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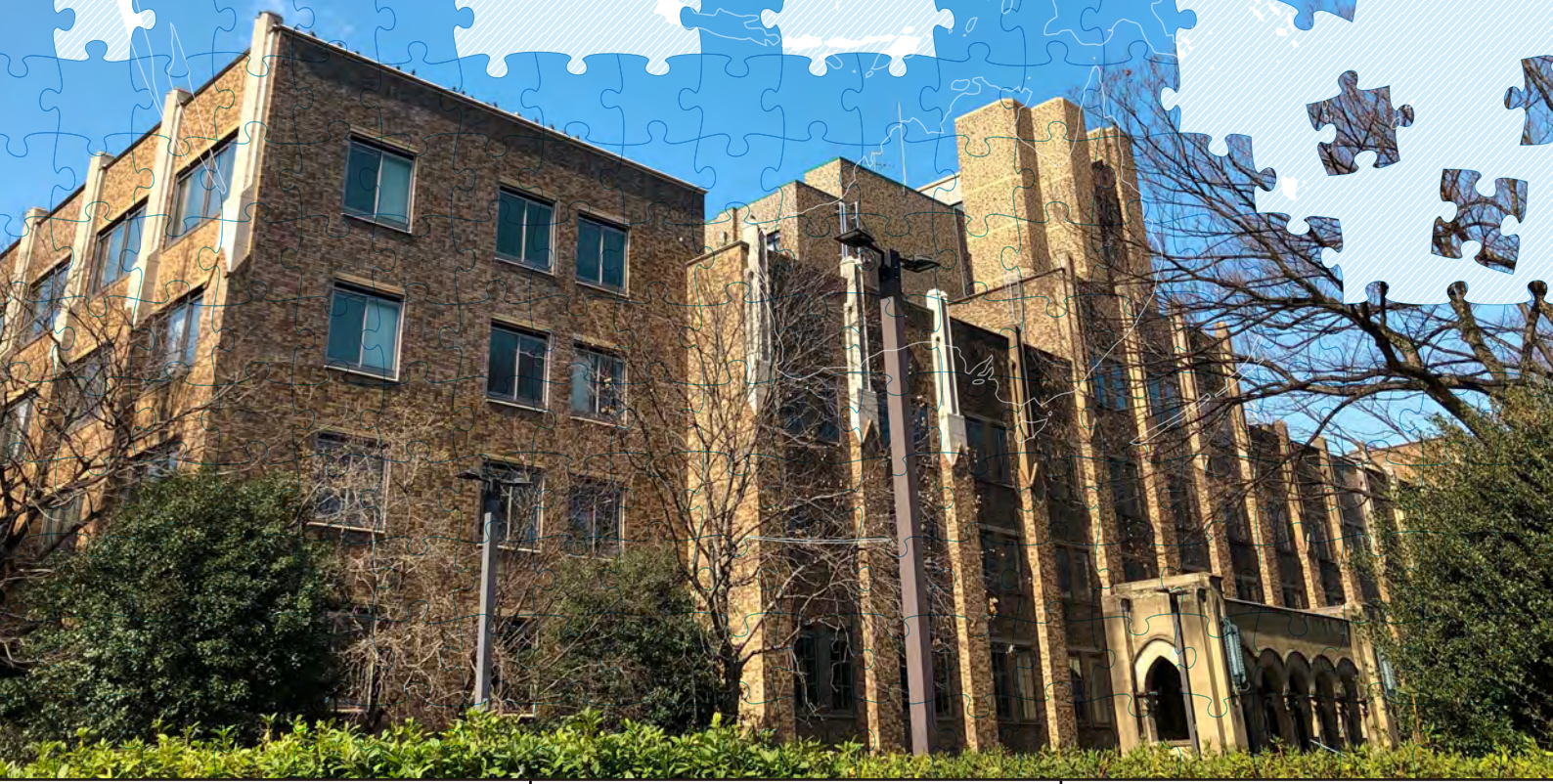
A Serious Challenge for China: A Comparative Study of Women's Educational Attainment and Fertility Behaviors in China and Japan



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A Serious Challenge for China: A Comparative Study of Women's Educational Attainment and Fertility Behaviors in China and Japan

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Abstract

East Asian countries have experienced rapid demographic changes. Thus far, declining fertility rates and the expansion of higher education for women have been reported in the literature, with contrasting solutions for different policy environments and societal contexts; therefore, nuanced knowledge is needed. We took a comparison approach to analyze cohort changes in the relationship between women's educational attainment and fertility behaviors in China and Japan, employing discrete-time event history models and difference-in-differences (DID) analysis. The results revealed divergent trends in the 2 countries: Japan showed a weakening negative association between higher educational attainment and fertility behaviors over time, whereas China exhibited a persistent trend influenced by historical population control policies. We argue that sociocultural contexts and policy environments play crucial roles in shaping women's fertility behaviors. To address the demographic challenges associated with unique social conditions, China needs to develop more nuanced policies rather than mirror Japan's policies. Additionally, this research demonstrates how ultralow fertility can emerge without significant shifts in family attitudes or rising individualism, contributing to the broader discourse on the second demographic transition in East Asia.

Keywords: Fertility behavior; Educational attainment; Cohort changes; China and Japan

1. Introduction

The proliferation of higher education has altered the educational composition of the female population of childbearing age, resulting in a significant increase in the number of highly educated women. Despite this shift, the debate surrounding the persisting negative association between women's education and fertility rates is ongoing. Researchers continue to explore the complex interplay of factors that contribute to this relationship, seeking to understand the underlying mechanisms and identify potential solutions.

This relationship has distinct mechanisms across fertility stages, historical periods, and nations. For example, over the past few decades, Western countries have experienced a second demographic transition, concomitant with the expansion of higher education for women. In this context, several studies have reported a negative relationship between women's educational attainment and completed fertility (Weinberger 1987; Martin 1995; Jejeebhoy 1995; Cleland 2002; Howe 2016). However, other studies have shown that welfare and social policies can mitigate these negative effects (Breierova and Duflo 2004; Monstad, Propper, and Salvanes 2008; McCrary and Royer 2011; Geruso and Royer 2018; Kan and Lee 2018; Kramarz, Rosenqvist, and Skans 2023) or that a positive association exists between women's educational attainment and fertility behaviors (Braakmann 2011; Fort, Schneeweis, and Winter-Ebmer 2016). Given the diverse findings across various contexts, examining heterogeneity across populations, societies, and cohorts is crucial for obtaining a detailed understanding of the relationship between women's educational attainment and fertility behaviors.

However, there is limited research on how this relationship has evolved over time (Lazzari, Mogi, and Canudas-Romo 2021).

Among the regions experiencing rapid demographic changes, Asia has shown the fastest decline in fertility rates. Many Asian countries have witnessed a significant drop in birth rates over the past few decades, often accompanied by an increase in women's educational attainment. This trend has led to growing concerns about the potential consequences of population aging and the sustainability of economic growth in these regions.

China and Japan are two particularly noteworthy cases within Asia. Both countries have experienced dramatic declines in fertility rates, with Japan being one of the first countries to enter the "ultralow fertility" category and China recently following suit. Moreover, these two countries have experienced rapid expansion of higher education, with women's tertiary enrollment rates surpassing 50% (China Ministry of Education 2021; Gender Equality Bureau 2020). Moreover, China and Japan represent two distinct paths of economic development and social change, with Japan experiencing a more gradual transition and China undergoing a more rapid transformation in recent decades. Comparing these two societies can offer valuable insights into the interplay among socioeconomic factors, educational attainment, and fertility outcomes in the Asian context. Analyzing fertility behaviors in relation to educational attainment and family planning among different cohorts is essential for obtaining a nuanced understanding of the impacts of declining birth rates and the advancement of women in society. Furthermore, the impact of the population control policy

implemented from the 1980s to 2015 on population composition and fertility behaviors in China, as well as the cohort changes it engendered, must be elucidated in comparison with Japan, where no such policy was implemented.

This study examined cohort changes in the relationship between women's educational attainment and fertility behaviors in China and Japan, contributing to our understanding of the low fertility rates in East Asia. This comparative analysis aimed to elucidate the nuanced challenges and contextual backgrounds in China and Japan, providing policymakers with insights into how seemingly similar issues in parity progression require contextualized approaches. By highlighting the distinct sociocultural and historical factors influencing fertility behaviors in these two East Asian countries, this study underscores the importance of tailored policy solutions that address each nation's unique demographic landscape. The significance is twofold. First, this study elucidates the education–fertility relationship across cohorts, considering the historical context, national policies, and social welfare systems, potentially refining previous theories. Second, this study provides evidence for identified challenges in parity progression and parenting caused by changing gender roles and family structures.

The structure of this study is as follows: Section 1 outlines the research objectives and questions. Section 2 reviews the theoretical underpinnings and previous studies concerning fertility behaviors. Section 3 provides an overview of the statistical methodologies, data, and empirical model used in this study. Section 4 describes the microdata from China and Japan used to analyze the influence of

women's educational attainment on fertility behaviors across different cohorts and discusses the effects of the repeal of China's population control policy via the difference-in-differences (DID) analytical method. Section 5 summarizes the findings, discusses their implications, and presents issues for future research.

2. Literature review

Becker's (1960) economic theory of fertility posits that higher opportunity costs of childbearing for more educated women lead to lower fertility rates. This relationship is moderated by policies supporting work–family balance, such as childcare services and parental leave (Del Boca, Pasqua, and Pronzato 2009; Kravdal and Rindfuss 2008). In countries with comprehensive support systems, such as Nordic nations, the negative association between women's educational attainment and fertility behaviors is weaker (Andersson et al. 2009; Kravdal and Rindfuss 2008). However, increased competition among highly educated women in the labor market may strengthen this negative correlation, especially in countries lacking adequate social policy support.

China and Japan exemplify contrasting policy approaches to low fertility rates. Japan has implemented various work–family balance policies, including expanded childcare services and the promotion of paternal involvement (Suzuki 2013). In contrast, China has focused primarily on abolishing population control policies without providing sufficient social welfare benefits for

childbearing (W. Chen 2021). This disparity in policy support may lead to differing impacts on the relationship between women's education and fertility behaviors in these countries.

Given these distinct policy environments and societal contexts, this study analyzed cohort changes in the relationship between women's educational attainment and fertility behaviors in China and Japan separately. This approach allowed for a nuanced examination of how the relationship between these variables has evolved in response to each nation's unique socioeconomic context, policies, and societal factors influencing the opportunity costs of childbearing. By conducting separate analyses, this study aimed to provide insights into the specific mechanisms shaping the relationship between women's education and fertility behaviors in each country, considering their distinct trajectories and challenges in addressing low fertility rates.

2.1 The Chinese Context: Expansion of Higher Education, Population Policy Shifts and Lower Birth Rates

China has experienced a remarkable expansion of higher education since the late 1970s. After the Cultural Revolution, China implemented compulsory education policies in the 1970s and 1980s. The national college entrance examination system was reinstated in 1977, although the enrollment rate was initially only 1%, reflecting an elitist approach to higher education. Graduates were assigned positions in the government, public institutions, or state-owned enterprises. The enrollment rate gradually increased from 2.8% in 1985 to 8.4% in 1999. A significant shift occurred in 1999 with the

marketization of higher education policy, which led to a rapid increase in enrollment due to the introduction of tuition fees and university expansion (Yan and Xue 2019). The job assignment system for graduates was abolished in 2000, and by 2019, the enrollment rate exceeded 50%. This transition from an elitist to a mass and universal higher education system resulted in higher educational attainment among younger cohorts.

China's population dynamics have been shaped by enforced population control policies, notably the "One-Child Policy" initiated in 1980. The policy limited most couples to having one child, with some exceptions. During the "One-Child Policy" era, the limited number of children and decreased gender discrimination in single-child families led to increased educational attainment among women (Lu, Zou, and Zhang 2019). However, the policy also led to a skewed sex ratio at birth, with a preference for boys, and accelerated population aging. In response to these challenges, the Chinese government implemented a series of policy changes. In 2013, a transitional policy allowed couples in which one parent was an only child to have a second child. The "One-Child Policy" was abolished in 2015, permitting all couples to have two children, and in 2021, couples were allowed to have three children. These policies aimed to balance the population, maintain demographic dividends, and address issues related to population aging.

Despite the implementation of the "Universal Two-Child Policy" in 2016, which temporarily increased the number of births, the total number of births has declined. In 2022, the total number of births decreased to 9.56 million in China, with second- and third- or higher-order births accounting

for 38.9% and 15.0% of all births, respectively (CCTV News Client 2023). The total number of births remains below prepolicy levels, and the total fertility rate (TFR) has dropped below 1.3 children per woman, presenting a significant demographic challenge for China. While university-educated women, who are expected to have higher incomes, face higher opportunity costs, they are more likely to marry men with similar educational backgrounds (Dong and Xie 2023). This educational homogamy results in greater family resources and an easier ability to bear the costs associated with having a second child, benefiting from the income effect of the policy change.

However, China's policy measures to address the declining birth rate have been shown to be insufficient, with several key issues emerging. The short duration of maternity leave (three months) and lack of paternity leave make it difficult for women to balance work and childcare. Moreover, the scarcity of affordable and high-quality childcare facilities forces many families to rely on grandparents or hired help for childcare support. Before the economic reforms, the cost of childcare in urban areas was borne by the government's work unit (danwei) system. However, after the reforms, private enterprises did not have a work unit system, and individuals became responsible for the cost of childcare. The state ceased the provision of services for social reproduction and care, leaving women to bear the burdens of housework, childcare, and paid work (Ji et al. 2017). The traditional patriarchal gender discourse emphasizing gender role division aligns with market liberalism, which views women as being inferior and less productive workers (Wu 2009). This reliance on extended family or informal care arrangements may discourage some couples from

having additional children, as they may not have access to the necessary support systems to balance work and family responsibilities. This effectively places all childcare responsibilities on the family. However, not all families have sufficient resources and conditions to raise children, which also makes it difficult for women to balance work and family.

2.2 The Japanese Context: Expansion of Higher Education and Lower Birth Rates

Japan has experienced a significant expansion of its higher education system, providing equal access for both men and women. This expansion has occurred in several stages since the postwar period. Initially, the higher education system underwent rapid growth until the mid-1970s, with enrollment rates continuing to increase until the early 1980s, reaching 38.5% before stagnating (Kaneko 1994). However, from the 1990s onward, the deregulation of university establishment standards effectively removed restraints on higher education, leading to a rapid increase in enrollment rates (Toyonaga 2020). By 2005, the enrollment rate surpassed 50%, marking the onset of universal access to higher education in Japan (Utagawa 2022). As female enrollment rates increase, more women enter the labor force, with a gradual shift from the traditional "male breadwinner model," delaying family formation and increasing the proportion of women who continue working after marriage or childbirth. With the expansion of higher education for women and the increase in female labor force participation, women's economic independence has increased, enabling them to

postpone or forgo marriage to pursue personal development and career goals. This has led to an increase in lifetime unmarried rates. In 2020, the lifetime unmarried rate in Japan was 28.3% for men and 17.8% for women (National Institute of Population and Social Security Research 2022), which was significantly higher than the lifetime unmarried rate in China, which was 3.53% for men and 0.64% for women (YuWa Population Research 2022).

Concurrent with the expansion of higher education, Japan has been grappling with declining birth rates since the economic bubble burst in the 1990s, despite the absence of restrictive population policies. The country's postwar TFR has undergone three distinct stages of transition. Initially, there was a rapid decrease from over 4 to approximately 2 children per woman in the late 1950s, largely attributed to the widespread use of contraceptives. This was followed by a period of stability at the replacement level until the early 1970s. However, from the mid-1970s onward, the TFR fell below the replacement level and reached 1.50 children per woman in 1992, continuing its decline and entering the "lowest-low fertility" category (Atoh 2017). The consequences of this decline became apparent when the population started shrinking in 2008, with the number of births falling below 1 million in 2016, reaching 865,234 in 2019, and dropping under 800,000 in 2022.

To counter the low fertility rate, the Japanese government has implemented various policy measures since the 1990s, focusing primarily on "economic support for child-rearing" and "support for balancing work and child-rearing" (Atoh et al. 2011). These measures aim to mitigate the opportunity cost of childbearing for highly educated and regularly employed women. One such

policy is the parental leave system, which specifically targets working parents. For example, after giving birth, women can take one year of maternity leave and two years of childcare leave; additionally, women receive corresponding childcare allowances and wage subsidies. Indeed, studies have shown that regularly employed women are less likely to interrupt their work due to childbirth, indirectly validating the effectiveness of these measures (Mugiyama 2017).

However, the effectiveness of these policies in addressing the low-fertility rate remains questionable. Historically, Japan's long-term employment system provided a sense of job security and acted as a safety net for families (The Japan Institute for Labour Policy and Training, 2021). This stability enabled couples to plan for marriage and childrearing with a long-term outlook. The 1990s economic bubble burst led to a more unstable employment landscape and decreased men's income prospects, complicating financial stability for families. Additionally, the increase in women's educational attainment and labor force participation has led to an increase in their economic independence and expectations for partners, resulting in a more cautious approach to marriage and childbearing (Tsutsui 2015). These socioeconomic changes have contributed to the persistent low fertility rate in Japan, despite the government's efforts to support families through various policy measures.

2.3 Previous Research on Chinese and Japanese Societies

Research on the relationship between women's educational attainment and fertility behaviors has produced mixed results, with three main perspectives. The first suggests a negative relationship, as higher education and income increase the opportunity cost of childbearing for women, leading to delayed or forgone fertility. The second perspective proposes a positive relationship, with highly educated women having more resources to support larger families and exhibiting a greater propensity for childbearing. The third perspective, the U-shaped curve hypothesis, posits that women with higher and lower education levels have a greater desire for childbearing than those with secondary education.

In the Chinese context, these three perspectives have been examined in various studies. Some researchers have found evidence supporting the negative relationship between women's educational attainment and fertility behaviors (Shi and Yang 2019; Niu and Qi 2020), whereas others have reported a positive relationship, with highly educated women exhibiting a greater likelihood of having a second child (Chen and Duan 2019; Chen and Gu 2020). For example, Chen (2022) reported that each additional year of education for girls increases the number of children born by 0.14. Additionally, some studies provided evidence supporting the U-shaped curve hypothesis in China (Fang and Chen 2016; Zhao 2019).

Similarly, in Japan, the relationship between women's educational attainment and fertility behaviors has undergone significant changes. Previously, highly educated women were found to

have lower fertility than less educated women did (Yoda 2021). However, recent studies indicated that highly educated women are now more likely to marry (Fukuda et al. 2020), and the fertility rate has recently increased among couples in which the wife is highly educated (Yoda and Iwasawa 2018). Moreover, research suggests that the negative relationship between higher educational attainment and lower fertility, which can be attributed to the higher opportunity costs faced by educated women, is weakening in the more recent cohorts (Ghaznavi et al. 2022; Sakamoto 2023).

Despite these findings, several limitations exist in previous research on both China and Japan. First, the lack of consensus among studies is partly due to the failure to account for cohort changes, as each cohort experiences different population policies, educational circumstances, and labor market conditions that affect the opportunity costs of childbearing. Few studies have focused on cohort changes, and those that have (e.g., Piotrowski and Tong 2016; Ghaznavi et al. 2022) did not examine the behavior of the more recent cohorts. Second, the use of birth numbers can result in data truncation, ignoring the future possibility of childbearing. Third, research often fails to distinguish first births from subsequent births, neglecting cohort changes in birth order and the potentially varying impact of opportunity costs across births.

Given the recent changes in population policies, the expansion of higher education, and the evolving labor market dynamics in both China and Japan, the relationship between women's educational attainment and fertility behaviors across cohorts requires further verification through the lens of Becker's opportunity cost theory. Moreover, owing to the long-term implementation of the

One-Child Policy in China and the strong link between marriage and childbirth in Japan, it is necessary to analyze the relationship between women's educational attainment and fertility behaviors by distinguishing between first and subsequent births, not just the total number of births. Re-examining how the relationship between women's educational attainment and fertility behavior evolves within cohorts and differs across parities in both societies is crucial for understanding the complex interplay of factors shaping fertility trends in East Asia.

2.4 Hypothesis

This study posits the following hypotheses, focusing on the effect of women's educational attainment on the timing of childbirth by cohort:

Hypothesis 1a: In China, the negative relationship between women's educational attainment and the timing of first birth persists across cohorts.

Hypothesis 1b: In China, the negative relationship between women's educational attainment and the likelihood of having a second child persists across cohorts.

Despite the abolition of population control policies in China, the slow development of child-rearing support measures and the persistence of traditional gender roles continue to influence women's reproductive decisions. Highly educated women, in particular, often prioritize their careers and are concerned about the potential negative impact of childbirth on their job opportunities and

career advancement. Additionally, gender discrimination in the job market, such as employers' preferences for male employees or the perception that women are less committed to their careers after having children, may indirectly affect women's decisions to have children. These factors interact with each other, leading to the expectation that the negative relationship between women's educational attainment and fertility behavior persists across cohorts, both for the timing of first birth and the likelihood of having a second child.

Hypothesis 2a: In Japan, the negative relationship between women's educational attainment and the timing of first birth has weakened in recent cohorts.

Hypothesis 2b: In Japan, the negative relationship between women's educational attainment and the likelihood of having a second child has weakened in recent cohorts.

In recent years, Japan has increased its support measures for balancing work and child-rearing, making it easier for women, particularly those with higher education, to combine their careers with family responsibilities. These policies have helped reduce the barriers to having children for highly educated women, thereby weakening the negative impact of educational attainment on their reproductive behavior. However, importantly, the increase in women's labor force participation and educational attainment in Japan may not be solely attributed to these support measures. Other factors, such as changes in societal norms, economic conditions, and women's aspirations, have also played a role in shaping these trends. Nonetheless, the improved support for work–family balance is expected to have contributed to the attenuation of the negative relationship between women's educational

attainment and fertility behaviors in recent cohorts, both in terms of the timing of first birth and the likelihood of having a second child.

3. Data and Methods

3.1 Analytical Framework

This study employed an empirical approach to investigate the factors influencing women's fertility behaviors. The analytical framework was structured as follows: First, a descriptive analysis was performed to examine the temporal progression from marriage to first birth and first to second birth, stratified by women's education levels, providing an overview of childbearing patterns across educational groups. Second, a discrete-time event history model was used to analyze the relationship between women's educational attainment and childbearing events ('marriage to first birth' and 'first to second birth') by birth cohort, assessing the impact of education on parity transitions while accounting for cohort effects. Third, a DID approach was used to estimate the impact of the abolition of China's population control policy on fertility, comparing the outcomes of affected (treatment) and unaffected (control) women before and after the policy shift and identifying its causal effect while controlling for confounding factors. Finally, by synthesizing the results comparatively, the study elucidates the similarities and differences in fertility behaviors between China and Japan, considering

their distinct socioeconomic, cultural, and policy contexts, and provides insights into the factors shaping childbearing decisions in East Asian societies.

3.2 Data Source and Key Measures

3.2.1 Chinese Data

Data from waves 1 to 6 of the China Family Panel Studies (CFPS) (from 2010 to 2020) were used for the analysis of the Chinese societal context. The CFPS is a longitudinal survey conducted biennially by Peking University since 2010, with samples drawn through stratified multistage random sampling in 25 provinces. The number of recovered samples was 42,590, with a household response rate of 81.3% and an individual response rate of 84.1% (Xie and Lu 2015).

This study analyzed both the transition to marriage and the transition to first and second births. For the marriage analysis, the sample included unmarried women aged 16 years and older. The analysis began by determining the time from the age of 16 years to marriage, creating person–year data until the event of marriage or censoring if marriage did not occur by 2020.

For the fertility analysis, this study focused on first-married couples, excluding those who had children before marriage or with missing childbearing age values, resulting in 14,992 analyzed couples. The risk starting point for the first birth was the time of marriage, and observations continued until the first birth, creating person-year data, which were censored if childbirth did not occur by 2020 or if the wife reached the age of 50 years. The period from first to second birth was

similarly analyzed and censored. A total of 14,446 couples had one child, and 9,057 had two children.

3.2.2 Japanese Data

Data from 29 surveys of the "Panel Survey of Consumer Life" (JPSC) conducted by Keio University from 1993 to 2021 were used for the analysis of the Japanese societal context. The JPSC started in 1993, targeting 1,500 women aged 24 to 34 years, with younger respondents added approximately every five years to avoid age gaps. By 2018, the target age group had expanded to include women aged 29 to 59 years. Sampling is conducted nationally via a stratified two-stage random sampling method. The average recovery rate for each survey throughout the study period is 95%, maintaining a high level of data reliability and consistency (Keio University Panel Data Research Center, 2022).

This study analyzed both the transition to marriage and the transition to first and second births. For the marriage analysis, the sample included unmarried women aged 16 years and older. The analysis began by determining the time from the age of 16 years to marriage, creating person–year data until the event of marriage or censoring if marriage did not occur by 2021.

For the fertility analysis, this study focused on first-married couples, excluding those who had children before marriage or with missing childbearing age values, resulting in 2,455 analyzed

couples. The main analysis targeted married women, treating the year a single woman was married as the year of marriage. The period from marriage to first birth was analyzed in this study, creating person-year data, which was censored if childbirth did not occur by 2021 or if the wife reached the age of 50 years. The period from first to second birth was similarly analyzed and censored. A total of 2,122 couples had one child, and 1,602 had two children.

Although the survey years for the Japanese and Chinese data did not perfectly align, this inconsistency did not affect the results of the analysis. As a discrete-time logit model was employed, the data were transformed into a person-year format, covering the period from the age of 16 years to marriage, from the year of marriage to the birth of the first child, and from the birth of the first child to the birth of the second child. This data restructuring ensured that the differences in survey years between the two countries did not impact the comparative analysis.

3.2.3 Key Measures

The dependent variables in the analysis were the occurrences of the following events: "from the age of 16 years to marriage," "from marriage to first birth," and "from first birth to second birth." The key independent variable was women's educational attainment, which was categorized into five groups in the Chinese data: "primary school," "lower secondary," "upper secondary," "college (3 years)," and "university graduate." In the Japanese data, the categories were "lower secondary,"

"upper secondary," "college (2-year degree)," and "university graduate," as no participants completed only primary school.

This study analyzed temporal changes in the impact of women's educational attainment on fertility behaviors across birth cohorts. The Chinese birth cohorts were divided into "before the 1960s," "1960s," "1970s," and "1980s and later." The Japanese birth cohorts were divided into "1960s," "1970s," and "1980s and later." In the Chinese data, the pre-1960s cohort allowed us to understand the impact of educational attainment on fertility behaviors before the One-Child Policy; however, the Japanese analysis focused on cohorts born in the 1960s and later due to data scarcity. Other control variables include the number of houses owned by the family, urban or rural status, wife's age at marriage, sex of the first child, wife's age at first birth, and year of marriage.

3.3 Analytical Method

To analyze the relationship between women's educational attainment and fertility behaviors, this study employed a discrete-time event history analysis model. This model was used to track the likelihood of childbirth over time and analyze how specific factors influence fertility. The basic form of the model is as follows:

$$\log\left(\frac{prob(T=t)}{1-prob(T=t)}\right) = \alpha_t + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k$$

where $prob(T=t)$ is the probability of childbirth at time t and where α_t represents the baseline hazard rate at time t.

$X_1, X_2, \ldots X_k$are explanatory variables, including women's educational attainment and other control variables. β_1, $\beta_2, \ldots \beta_k$ are parameters representing the effects of each explanatory variable (Allison, 2014).

In this model, a positive parameter value indicates that an event (in this case, the birth of a second child) is more likely to occur, whereas a negative value suggests that it is less likely. Furthermore, the study employed the DID analysis method to examine the effect of the 2015 abolition of the One-Child Policy on the second parity progression of women born in the 1980s in China. The DID method compares the changes in outcomes over time between a treatment group (women affected by the policy change) and a control group (women unaffected by the policy change). This approach allowed for the estimation of the causal effect of the policy change on the likelihood of having a second child while controlling for other factors that may influence fertility behaviors.

4. Results

4.1 Descriptive Analysis

Tables A1 and A2 present the descriptive statistics of the variables used in the analysis for China and Japan, respectively. These tables provide an overview of the characteristics of the sample, including the distributions of women's educational attainment, birth cohorts, and other relevant variables. Table A3 presents a crosstabulation of women's educational attainment and birth cohorts at

the time of marriage for both countries. This table shows the changes in educational attainment across cohorts. Notably, for cohorts born after 1980, both in China and Japan, the proportion of women with a college education increased significantly, reflecting the expansion of higher education in these societies.

Figures 1A, 1B, and 1C present Kaplan–Meier survival curves for life events among Chinese women, whereas Figures 1D, 1E, and 1F show the corresponding results for Japanese women.

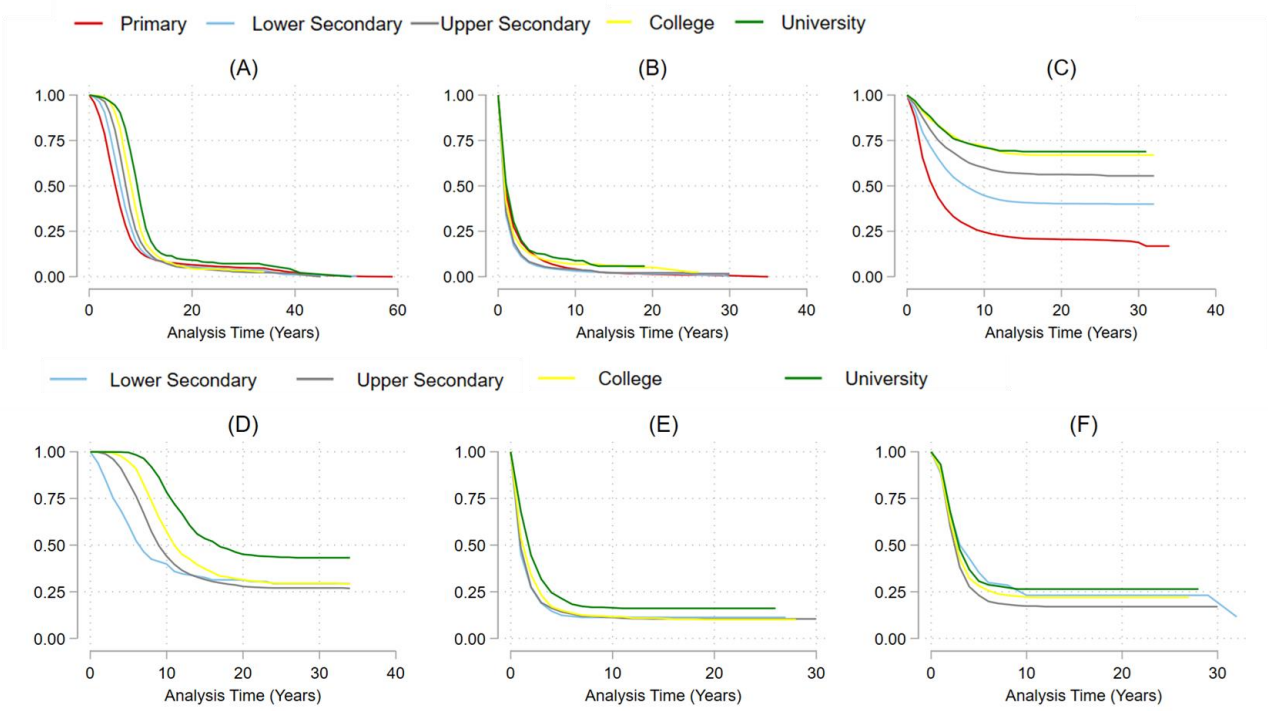

Figure 1. Kaplan–Meier Curve for Women's Marriage and Births

4.1.1 Kaplan–Meier Curve for Chinese Women's Life Events

Figure 1A shows Kaplan–Meier survival curves from the age of 16 years to marriage in China. Chinese women with higher education tended to marry later, but most eventually married. Despite

the trend toward later marriages, the low lifelong unmarried rate suggests that Chinese society remains a universal marriage society (Zhai and Liu 2020).

Figure 1B shows that most couples in China progressed to the birth of a first child after marriage. Log-rank and Wilcoxon tests ($p < 0.001$) indicate significant differences in survival functions (duration until first birth) among groups with different educational levels, with more highly educated women experiencing longer durations until first birth than their less educated counterparts did.

Figure 1C depicts Kaplan–Meier survival curves from first to second birth in China. The wife's educational attainment influenced the likelihood of having a second child, with higher education levels correlating with a lower probability of having a second child. The log-rank and Wilcoxon tests ($p < 0.001$) revealed statistically significant differences among the educational groups. A higher level of education correlated with a lower probability of progressing to a second birth, whereas a lower level of education indicated a greater tendency toward higher parity.

4.1.2 Kaplan–Meier Curve for Japanese Women's Life Events

Figure 1D shows the Kaplan–Meier survival curve for Japanese women from the age of 16 years to the year of marriage, illustrating the relationship between educational attainment and the timing of marriage. Similar to Chinese women, Japanese women with higher education levels tended to delay

marriage. However, Japan faces more severe unmarried rates than China does, with approximately 25% of women with lower secondary education remaining unmarried throughout their lives.

Figure 1E reveals that among married women, those with higher educational attainment—except for those with a bachelor's degree—showed no substantial difference in the progression to first birth than those with lower educational attainment, despite the statistically significant results of the log-rank and Wilcoxon tests ($P < 0.001$). These tests indicated a statistically significant difference in survival function (time until first birth) among groups with different educational levels. However, the actual differences in the survival curves were relatively small, suggesting that the effect of educational attainment on the timing of first birth is less pronounced in Japan than in China.

Figure 1F displays the Kaplan–Meier survival curve for the interval between first and second births among Japanese women. The log-rank and Wilcoxon tests ($P < 0.001$) suggest statistically significant differences in the likelihood of having a second child based on the wife's educational background. However, disparities in the progression to a second birth among Japanese women were less pronounced than those among Chinese women, as shown in Figure 1C. This finding indicates that while educational attainment influences the likelihood of having a second child in both countries, the effect is weaker in Japan than in China.

4.2 Temporal Variation in the Education–Fertility Link

4.2.1 Discrete-Time Model Analysis Results for Chinese Women

Table A4 presents the discrete-time event history analysis results for the transitions to marriage, first birth, and second birth across the four birth cohorts in China. Figures 2A-2C were drawn on the basis of Table A4, which shows the changes in the predicted probabilities.

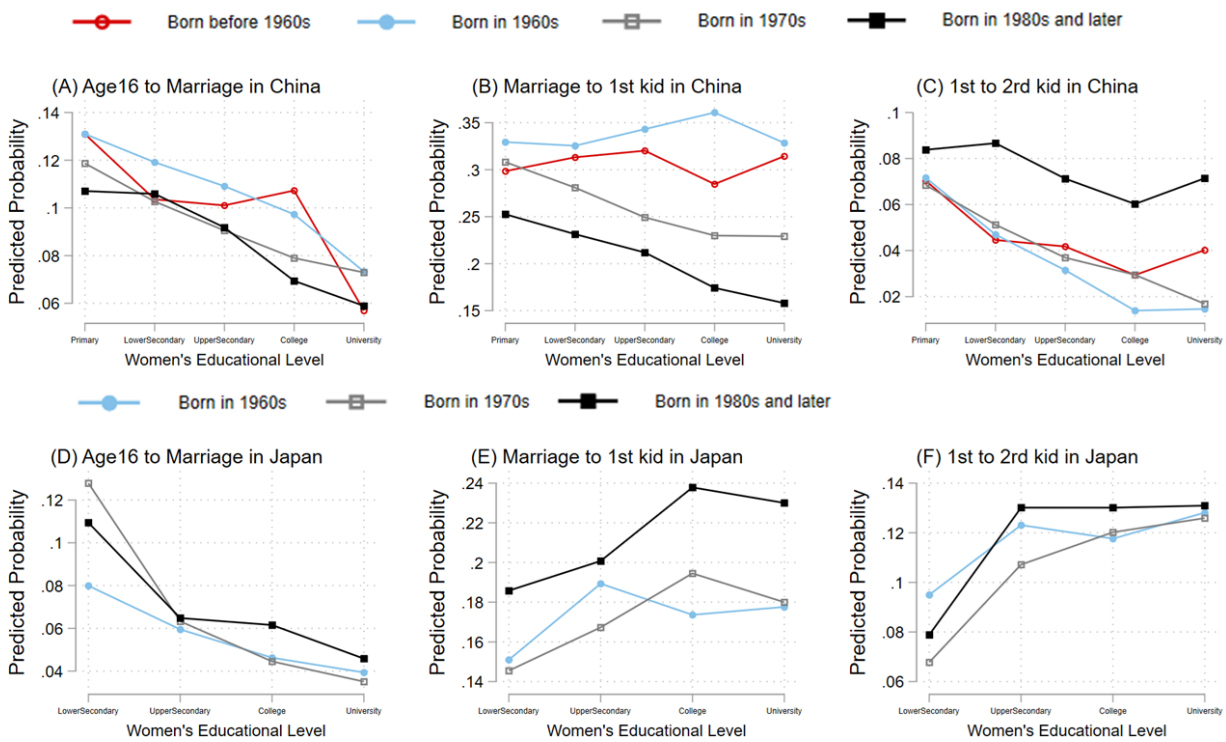

Figure 2. Predicted Probability Plot of the Influence of Women's Education on Marriage and the Number of Births

Figure 2A shows that higher educational attainment was associated with delayed entry into marriage across all cohorts. This reflects the prevalent notion of "establishing a career before starting a family" in Chinese society, where individuals consider marriage after completing their education

and securing stable employment and income. With the extension of years spent in education, the age at marriage continues to increase for highly educated individuals.

Figure 2B indicates that for cohorts born before the 1960s and in the 1960s, women's educational attainment did not significantly influence the timing of first birth. During this period, China was in an era of a planned economy, and compulsory education had not yet been widely implemented, resulting in low educational attainment for most people. In this social context, fertility behaviors were influenced primarily by traditional beliefs and family planning policies, with women's education levels having a limited impact on the timing of childbirth. In the cohort born in the 1970s, women began to delay the birth of their first child due to higher educational attainment, but no significant difference was observed between college and university graduates. This period marked the beginning of China's reform and opening-up, with a modest expansion of higher education but still limited to a relatively small population. Influenced by traditional beliefs, many women chose to marry and have children soon after completing their education, and the postponement of childbearing among highly educated women was not widespread. The 1980s cohort showed a persistent negative association between women's educational attainment and age at first birth, with university graduates exhibiting a greater propensity to delay childbearing. This reflects the comprehensive implementation of compulsory education and the massification of higher education in China during the 1980s, which led to a more equitable distribution of educational resources, enabling women to access higher education more equally. Highly educated women are more deeply influenced by

modern ideas about marriage and childbearing, and they commonly postpone childbirth. Moreover, as educational attainment increases, women face greater pressure to develop their careers, making it difficult to balance work and family, which also contributes to delays in childbearing.

Figure 2C presents the predicted probabilities for the timing of a second birth on the basis of women's educational attainment. For the cohorts born before 1960, in the 1960s, and in the 1970s, higher educational attainment was associated with delayed progression to second birth. However, the cohort born in the 1980s exhibited a distinct pattern, with a generally greater probability of having a second child than earlier cohorts. This can be attributed to the implementation of the "Universal Two-Child" policy in 2016, which coincided with the childbearing years of the cohort born in the 1980s. Interestingly, women with university, high school, primary school, and junior high school educations were more likely to have a second child, whereas those with college degrees had the lowest probability. This suggests that in the era of higher education expansion, college-educated women may face greater challenges in balancing their career and family responsibilities, leading to a lower likelihood of having a second child. The effectiveness of population control policies, particularly the second-child policy, in shaping fertility behaviors will be examined further in Section 4.2.2.

4.2.2 DID Analysis of the Abolition of the One-Child Policy

The DID method was employed to analyze the impact of the abolition of the One-Child Policy on the fertility behaviors of women born in the 1980s and later. The treatment group comprised women who resided in regions implementing the One-Child Policy or the conditional Two-Child Policy (for ethnic minorities, rural areas with a firstborn daughter, etc.) in 2010 and had not had a second child by 2015. The control group consisted of women from regions allowing couples to have two or more children. The "Universal Two-Child" policy was announced in October 2015 and implemented in 2016, making 2015 the reference year for the analysis.

Table A6 presents the results of the DID analysis, and Figure 3 is based on these results, illustrating the predicted probability of having a second child by women's education level. The primary finding was that the implementation of the "Universal Two-Child Policy" increased a couple's likelihood of having a second child. However, the magnitude of this stimulative effect varied by the wife's educational attainment. Although a stimulative effect was observed for all women, it was least pronounced among college-educated women. The stimulative effect was significant for women with primary, lower secondary, and university education levels. In other words, during the period of higher education expansion, women with lower or higher educational attainment exhibited a greater likelihood of having a second child than those with college degrees did. The abolition of the One-Child Policy reduced the opportunity cost of childbearing for less educated women, whereas more

highly educated women had greater financial flexibility, increasing the likelihood of having a second child.

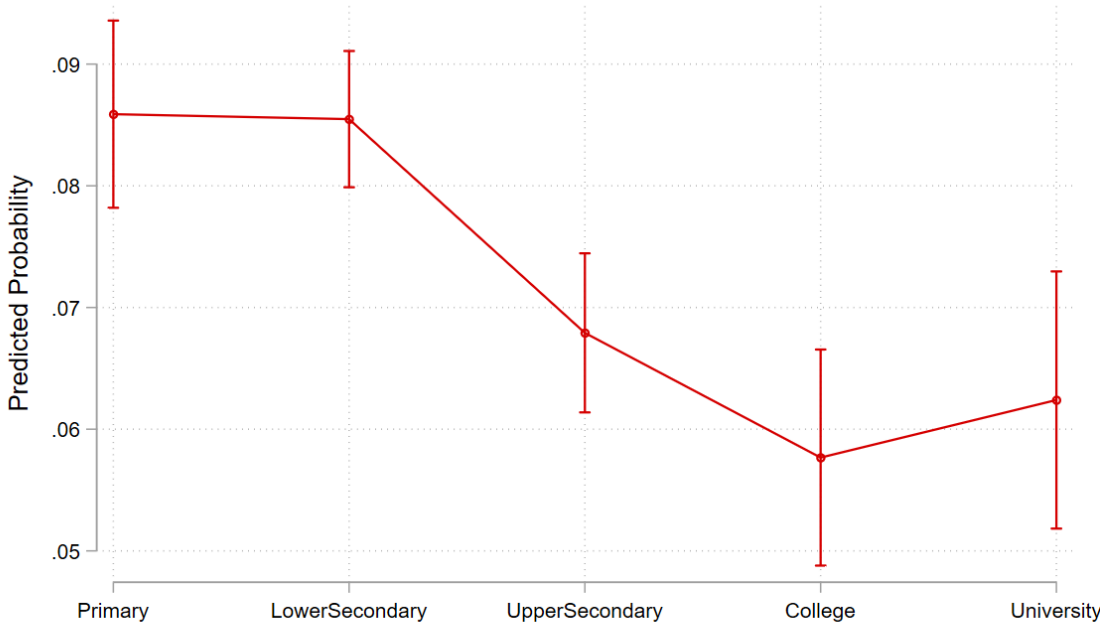

Figure 3. DID Analysis Results of the Abolition of the One-Child Policy

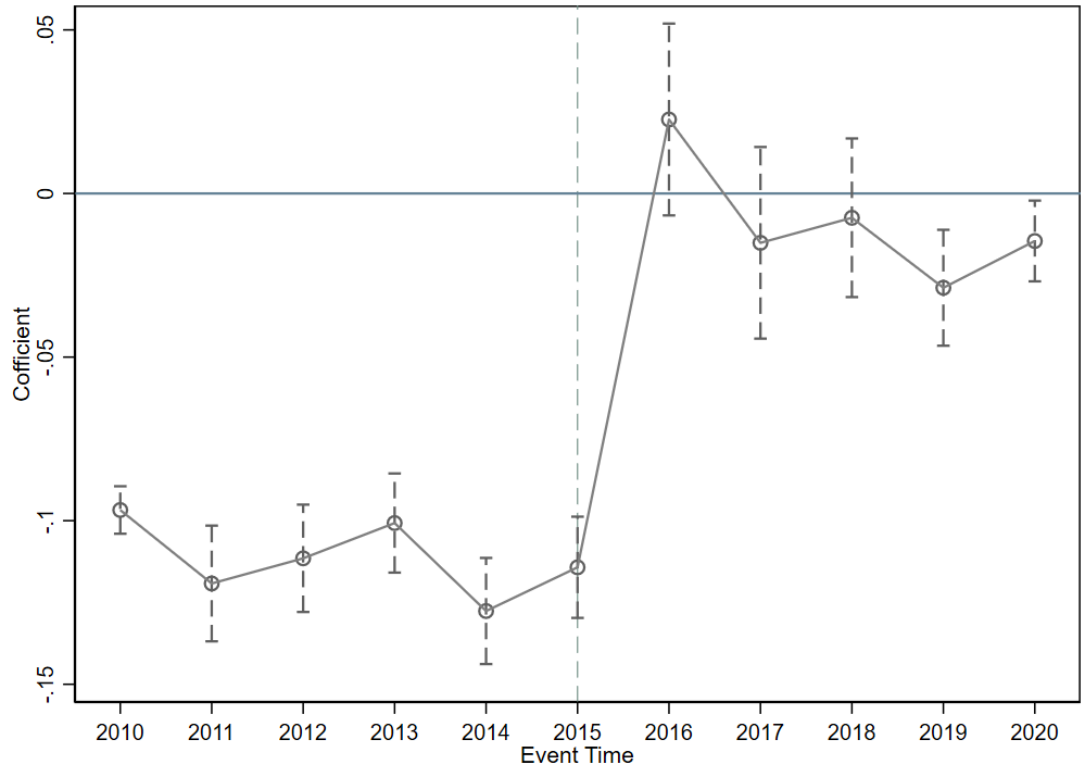

Figure 4. A Parallel Trend Test on the Effects of the Abolition of the One-Child Policy

The robustness check shown in Figure 4 was performed to examine parallel trends. Before 2015, the One-Child Policy had a negative effect on the likelihood of having a second child. After the abolition of the policy in 2015, this negative effect disappeared. However, negative impacts reemerged after 2019. The "Universal Two-Child Policy" had a transitory stimulative effect, which gradually diminished over time. This finding is corroborated by Chinese census data, which show an increased number of births in 2016, 2017, and 2018, followed by a decline after 2019 (W. Chen 2021). In summary, China's Universal Two-Child Policy had a temporary stimulative effect,

particularly on women with lower and higher education levels, but this effect dissipated after 3 to 4 years.

4.2.3 Discrete-Time Model Analysis Results for Japanese Women

Table A5 presents the discrete-time event history model results for the transitions to marriage, first birth, and second birth across the three birth cohorts in Japan. Figure 2D-2F was drawn on the basis of Table A5 and shows the predicted probabilities of women's education levels.

Figure 2D shows that Japanese women across all cohorts tended to delay marriage as their educational attainment increased, similar to the trend observed in China. In Figure 2E, when considering women born in the 1960s, 1970s, and 1980s, it was found that women born in the 1980s had the fastest and earliest timing of first birth after marriage. For the cohort born in the 1960s, women with upper secondary education had the highest proportion (as evidenced in Table A4) and earliest timing of first birth. For the cohort born in the 1970s, women with college degrees constituted the highest proportion and had the fastest progression to first birth. For the cohort born in the 1980s, despite the expansion of universities and the highest percentage of university-educated women, college graduates remained the group with the earliest timing of first birth. The timing difference between women with lower and upper secondary educations diminished, and the propensity for university graduates to delay first birth compared with college graduates became less

pronounced. This suggests that as higher education has expanded in Japan, the impact of education level on the timing of first birth has decreased between women with lower and upper secondary educations and between college and university graduates.

Figure 2F shows that women born in the 1980s, except those with lower secondary education, had the fastest timing of second birth after having their first child. For the cohort born in the 1960s, the association between higher educational attainment and earlier timing of second birth was less evident. However, for the cohort born in the 1970s, higher educational attainment was associated with faster progression to second birth, with university-educated women having the highest probability of having a second child. This finding indicates that women with lower educational levels tend to delay progression to higher parities. Among women born in the 1980s and later, there was no significant difference in the timing of second birth among high school, college, and university graduates. This suggests that the universalization of higher education in Japan has particularly narrowed the time gap between first and second births for university-educated women.

4.3 Comparison between China and Japan

In China, the negative association between higher educational attainment in women and childlessness has emerged in recent cohorts, partially supporting Hypothesis 1a. For cohorts born before and during the 1960s, there was no clear negative correlation between women's educational

attainment and the timing of first birth. However, for women born in the 1970s and 1980s, the negative correlation became more pronounced, with highly educated women exhibiting a lower propensity for first birth.

The decision to have a second child varies among families, with higher educational attainment consistently associated with delayed second birth across most cohorts, partially supporting Hypothesis 1b. However, the negative correlation between women's educational attainment and second birth behavior diminished in the 1980s, which was likely influenced by the abolition of the One-Child Policy in 2015. Some highly educated women in this cohort benefited from the policy change and had relatively more family resources, thus choosing to have a second child. Nevertheless, the positive effects of the policy were transitory, dissipating after three years.

The growing proportion of highly educated women in Chinese society has led to a decreased birth rate, aligning with Becker's theory of fertility opportunity costs, which suggests that increased educational attainment leads to higher opportunity costs of childbearing and, consequently, lower fertility. As women's educational attainment continues to increase, the negative association between women’s educational attainment and fertility behaviors is expected to persist, posing challenges for China's future population growth and age structure.

In Japan, the relationship between higher educational attainment in women and a lower propensity for childbearing has weakened due to the increasing proportion of highly educated women, supporting Hypothesis 2a. In the 1960s, higher educational attainment hindered the progression to

first birth, but this relationship reversed in the 1970s and 1980s. The cohort born in the 1970s showed a positive association between women's educational attainment and the timing of first birth, particularly among college graduates with the earliest timing. This relationship persisted in the cohort born in the 1980s, but the differences between lower and upper secondary graduates and between college and university graduates diminished.

Hypothesis 2b was also supported, as the negative association between higher educational attainment in women and progression to second birth was attenuated. In the 1970s, higher educational attainment among women was associated with earlier progression to second birth. However, among women born in the 1980s, no discernible difference in the timing of second birth was observed between upper secondary, college, and university graduates. The weakening association between women's educational attainment and fertility behaviors in Japan suggests that Becker's theory of fertility opportunity costs may not fully explain the observed patterns. The expansion of higher education and the implementation of policies supporting work-family balance have likely contributed to the attenuation of the negative relationship between women's educational attainment and fertility behaviors in Japan.

5. Conclusion

5.1 Low fertility in China

China, like Japan, faces the challenge of a low fertility rate but with distinct patterns and influencing factors. Despite recent increases in the unmarried rate, China remains characterized by near-universal marriage and childbearing among married couples (Zhai, Jin, and Zhang 2022). However, higher education among women is associated with delayed first births and a reduced propensity for second births due to increased opportunity costs. The evolution of China's higher education landscape has significantly impacted fertility patterns. While university-educated women born before the 1970s enjoyed relative gender equality, women in subsequent cohorts faced increased labor market discrimination, leading to delayed childbearing. The abolition of the One-Child Policy in 2015 had a differential effect across educational levels, with a more pronounced effect on women at the lower and higher ends of the educational spectrum. This study's findings suggest that higher educational attainment among women contributes to a shift toward delayed marriage, while a rise in the unmarried rate has also been observed. The decline in China's birth rate is attributed primarily to reduced marital fertility rather than nonmarriage. Current policies addressing declining birth rates in China remain focused on abolishing population control measures and lack comprehensive support for childrearing and work-family balance (Zhou and Kan 2019).

Drawing from Japan's experience, China should prioritize policies that support married couples in having a second child by implementing measures that facilitate work–family balance and provide

substantial child-rearing support. Such policies could mitigate the negative association between women's educational attainment and fertility behaviors, addressing China's unique demographic challenges within its socioeconomic context.

5.2 Low fertility in Japan

In Japan, the impact of nonmarriage on the low fertility rate is more pronounced than the decline in the fertility rate among married couples (Raymo et al. 2015). While higher educational attainment among women leads to delayed marriage, its relationship with fertility behaviors has weakened among married couples. This attenuation can be attributed to two factors: the mitigating effect of Japan's policy measures on the opportunity cost of childbearing for highly educated women and the selective nature of marriage in contemporary Japanese society. The expansion of higher education and increased female labor force participation have led to changes in gender roles and expectations, contributing to the rise in the unmarried rate and the decline in the fertility rate. According to Becker's theory of fertility, as women invest more in their human capital, the opportunity costs of childbearing increase, leading to lower fertility rates. In Japan, this effect is exacerbated by persistent gender inequalities in the workplace and inadequate work–life balance policies. The decrease in hypergamous marriages and increase in homogamous unions have made traditional family formation more challenging, further contributing to the nonmarriage phenomenon. Japan's policy measures against declining birth rates have focused primarily on supporting reproduction in families formed

through marriage. However, to address the declining birth rate problem effectively, proactive measures that not only support married individuals but also facilitate family formation among unmarried individuals are imperative.

Future policy initiatives should recognize and address the changing attitudes toward marriage and family formation among younger generations, as these shifts have significant implications for future fertility trends. Policymakers should consider initiatives that support alternative family structures and promote a more inclusive understanding of family formation while also addressing the persistent gender inequalities and work–life balance issues that contribute to low fertility rates in Japan.

5.3 Impending challenges for China

This comparative study of China and Japan reveals that while both countries face challenges related to low fertility, China's situation may become more severe in the future. The long-term impact of the One-Child Policy has not only reduced the likelihood of second births but also established a social norm for single-child families. Although China's unmarried rates remain relatively low compared with those of Japan, they are rising, potentially exacerbating the low fertility problem. The increase in women's educational attainment in China has increased the opportunity costs of childbearing, aligning with Becker's theory of fertility. Highly educated women from recent cohorts tend to delay both first and second births, a trend similar to that observed in Japan. However,

China faces the additional challenge of overcoming the ingrained one-child norm, even as couples consider two children to be the ideal number.

To address these issues, Chinese policymakers must develop a comprehensive framework that not only supports married couples but also facilitates family formation among unmarried individuals. These policies should consider the increased opportunity costs of childbearing and childrearing faced by highly educated women, creating an environment where women can balance their educational and career aspirations with their family goals.

Future research should employ rigorous causal inference frameworks to establish direct relationships between women’s educational attainment and fertility behaviors. Additionally, detailed international comparisons from the perspective of family policies and gender role divisions would provide valuable insights into the underlying mechanisms driving these demographic changes.

In conclusion, addressing China's impending low-fertility challenges requires a nuanced understanding of its unique social conditions, particularly the impact of women's educational attainment and the legacy of the One-Child Policy. Proactive policy adaptations are necessary to accommodate the changing social realities and mitigate the potential consequences of rapid population aging and labor force shrinkage.

References

Allison, Paul David. 2014. *Event History and Survival Analysis*. 2nd ed. Book, Whole. Los Angeles: SAGE. https://doi.org/10.4135/9781452270029.

Andersson, Gunnar, Trude Lappegård, Lisbeth B. Knudsen, Andres Vikat, Gerda Neyer, Kathrin Teschner, Marit Rønsen, and Kari Skrede. 2009. "Cohort Fertility Patterns in the Nordic Countries." *Demographic Research* 20 (14): 313–52. https://doi.org/10.4054/DemRes.2009.20.14.

Atoh, Makoto. 2017. "Thinking about Very Low Fertility in Japan, Based upon Its Demographic Analyses." *Iryo To Shakai* 27 (1): 5–20. https://doi.org/10.4091/iken.27.5.

Atoh, Makoto, Hachiro Nishioka, Noriko Tsuya, and Nobutaka Fukuda, eds. 2011. *Family Transformation in the Era of Declining Birthrates: Partnerships and Birth Behavior*. Tokyo: University of Tokyo Press.

Becker, Gary S. 1960. "An Economic Analysis of Fertility." In *Demographic and Economic Change in Developed Countries*, 209–40. Columbia University Press. http://www.nber.org/chapters/c2387.

Braakmann, Nils. 2011. "Female Education and Fertility – Evidence from Changes in British Compulsory Schooling Laws." In . Vol. 5. Newcastle Discussion Papers in Economics. https://api.semanticscholar.org/CorpusID:204824989.

Breierova, Lucia, and Esther Duflo. 2004. “The Impact of Education on Fertility and Child Mortality: Do Fathers Really Matter Less Than Mothers?” *National Bureau of Economic Research*, no. NBER Working Papers 10513. https://doi.org/10.3386/w10513.

CCTV News Client. 2023. “2022 Statistical Bulletin on the Development of Health and Health Services Released,” 2023. http://www.news.cn/health/20231012/0f3e55577ecc414fbb777a1e40678b53/c.html.

Chen, Rong, and Baochang Gu. 2020. “An Analysis of the Families Actually Having a Second Child: Based on the Survey in Shanghai.” *Chinese Journal of Population Science* 5:116–25.

Chen, Wei. 2021. “China’s Low Fertility Rate and the Three-Child Policy: An Analysis Based on the Seventh National Population Census Data.” *Population and Economics* 5:25–35.

Chen, Wei, and Yuanyuan Duan. 2019. “Recent Levels and Trends of Fertility in China.” *Population Research* 43 (1): 3–17.

Chen, Wei, and Fengfei Zhang. 2022. “Marriage Delay in China: Trends and Patterns.” *Population Research* 46 (4): 14–26.

China Ministry of Education. 2021. “Number of Female Students by School Type and Level.” Ministry of Education of the People’s Republic of China Website. 2021. http://www.moe.gov.cn/jyb_sjzl/moe_560/2020/quanguo/202108/t20210831_556360.html.

Cleland, John. 2002. “Education and Future Fertility Trends, with Special Reference to Mid-Transitional Countries.” In *Completing the Fertility Transition*. Population Bulletin of the United Nations.

Del Boca, D., S. Pasqua, and C. Pronzato. 2009. “Motherhood and Market Work Decisions in Institutional Context: A European Perspective.” *Oxford Economic Papers* 61 (Supplement 1): i147–71. https://doi.org/10.1093/oep/gpn046.

Dong, Hao, and Yu Xie. 2023. “Trends in Educational Assortative Marriage in China Over the Past Century.” *Demography* 60 (1): 123–45. https://doi.org/10.1215/00703370-10411058.

Fang, Changchun, and Youhua Chen. 2016. “Class Differences in Fertility Rates Will Shape an M-Shaped Society.” *Exploration and Free Views* 1:59–63.

Fort, Margherita, Nicole Schneeweis, and Rudolf Winter-Ebmer. 2016. “Is Education Always Reducing Fertility? Evidence from Compulsory Schooling Reforms.” *The Economic Journal* 126 (595): 1823–55. https://doi.org/10.1111/ecoj.12394.

Gender Equality Bureau. 2020. “Transition of Enrollment Rates by Type of School.” 2020. https://www.gender.go.jp/about_danjo/whitepaper/r02/zentai/html/zuhyo/zuhyo01-04-01.html.

Geruso, Michael, and Heather Royer. 2018. “The Impact of Education on Family Formation: Quasi-Experimental Evidence from the UK.” w24332. Cambridge, MA: National Bureau of Economic Research. https://doi.org/10.3386/w24332.

Howe, Elizabeth Teresa. 2016. *Education and Women in the Early Modern Hispanic World*. Book, Whole. London: Routledge. https://go.exlibris.link/1pwj7qZl.

Jejeebhoy, Shireen J. 1995. *Women's Education, Autonomy, and Reproductive Behaviour : Experience from Developing Countries*. Book, Whole. Oxford: Clarendon Press. https://doi.org/10.1093/oso/9780198290339.001.0001.

Ji, Yingchun, Xiaogang Wu, Shengwei Sun, and Guangye He. 2017. "Unequal Care, Unequal Work: Toward a More Comprehensive Understanding of Gender Inequality in Post-Reform Urban China." *Sex Roles* 77 (11–12): 765–78. https://doi.org/10.1007/s11199-017-0751-1.

Kan, Kamhon, and Myoung-Jae Lee. 2018. "The Effects of Education on Fertility: Evidence from Taiwan." *Economic Inquiry* 56 (1): 343–57. https://doi.org/10.1111/ecin.12492.

Kaneko, Motohisa. 1994. "Higher Education and Market Mechanisms." *The Journal of Educational Sociology* 55 (0): 23–36. https://doi.org/10.11151/eds1951.55.23.

Keio University Panel Data Research Center. 2022. "Women and Families Captured by the 'Panel Survey of Consumer Life.'"

Kramarz, Francis, Olof Rosenqvist, and Oskar Nordström Skans. 2023. "How Family Background Shapes the Relationship Between Human Capital and Fertility." *Journal of Population Economics* 36 (1): 235–62. https://doi.org/10.1007/s00148-021-00834-5.

Kravdal, Øystein, and Ronald R. Rindfuss. 2008. “Changing Relationships between Education and Fertility: A Study of Women and Men Born 1940 to 1964.” *American Sociological Review* 73 (5): 854–73. https://doi.org/10.1177/000312240807300508.

Lazzari, Ester, Ryohei Mogi, and Vladimir Canudas-Romo. 2021. “Educational Composition and Parity Contribution to Completed Cohort Fertility Change in Low-Fertility Settings.” *Population Studies* 75 (2): 153–67. https://doi.org/10.1080/00324728.2021.1895291.

Lu, Wanjun, Wei Zou, and Binbin Zhang. 2019. “Family Planning Policy, Fertility Decline and Gender Education Equality in China.” *South China Journal of Economics* 38 (9): 97–112. https://doi.org/10.19592/j.cnki.scje.360395.

Martin, Teresa Castro. 1995. “Women’s Education and Fertility: Results from 26 Demographic and Health Surveys.” *Studies in Family Planning* 26 (4): 187–202. https://doi.org/10.2307/2137845.

McCrary, Justin, and Heather Royer. 2011. “The Effect of Female Education on Fertility and Infant Health: Evidence from School Entry Policies Using Exact Date of Birth.” *American Economic Review* 101 (1): 158–95. https://doi.org/10.1257/aer.101.1.158.

Monstad, Karin, Carol Propper, and Kjell G. Salvanes. 2008. “Education and Fertility: Evidence from a Natural Experiment.” *The Scandinavian Journal of Economics* 110 (4): 827–52. https://doi.org/10.1111/j.1467-9442.2008.00563.x.

Mugiyama, Ryota. 2017. “Inequality Caused by Career Interruptions:” *Japanese Sociological Review* 68 (2): 248–64. https://doi.org/10.4057/jsr.68.248.

National Institute of Population and Social Security Research. 2022. “Table 6-23: Marital Status at Age 50 by Gender, Including Rates of Never Married, Currently Married, Widowed, and Divorced: 1920–2020.” *Population Statistics Data Collection 2022*. https://www.ipss.go.jp/syoushika/tohkei/Popular/Popular2022.asp?chap=6.

Niu, Jianlin, and Yaqiang Qi. 2020. “The Educational Differential in Fertility in Transitional China: Temporal and Regional Variation.” *Demographic Research* 42 (Journal Article): 657–88. https://doi.org/10.4054/DEMRES.2020.42.22.

Raymo, James M., Hyunjoon Park, Yu Xie, and Wei-jun Jean Yeung. 2015. “Marriage and Family in East Asia: Continuity and Change.” *Annual Review of Sociology* 41 (1): 471–92. https://doi.org/10.1146/annurev-soc-073014-112428.

Shi, Zhilei, and Yuxuan Yang. 2019. “Women ’s Social Status and Fertility: A Literature Review.” *Population Journal* 41 (1): 31–44.

Suzuki, Tōru. 2013. *Low Fertility and Population Aging in Japan and Eastern Asia*. Book, Whole. Tokyo: Springer. https://doi.org/10.1007/978-4-431-54780-8.

Toyonaga, Kohei. 2020. “Educational Expansion and Inequality of Access to University: The Effects and Changes in the Effects of Social Class and Academic Achievement.” *The Annual Review of Sociology* 2020 (33): 61–72. https://doi.org/10.5690/kantoh.2020.61.

Tsutsui, Junya. 2015. *Work and Family: Why Is Japan Difficult to Work and Hard to Have Children In?* Chuko Shinsho.

Utagawa, Takuo. 2022. “Professional Development for Professors in the Age of Mass Higher Education.” *Kaetsu University Research Review* 65 (1): 1–17.

Weinberger, Mary Beth. 1987. “The Relationship Between Women’s Education and Fertility: Selected Findings From the World Fertility Surveys.” *International Family Planning Perspectives* 13 (2): 35–46. https://doi.org/10.2307/2947826.

Wu, Xiaogang. 2009. “Gender Discourse Transformation in the Background of Marketization.” *Social Sciences in China* 2:163–76.

Yan, Shanping, and Jinjun Xue. 2019. “Expansion of Adult Higher Education and Its Effects on Increasing Employee’s Earnings in China: A Comparative Analysis with Regular Higher Education.” *Ajia Keizai* 60 (1): 2–36. https://doi.org/10.24765/ajiakeizai.60.1_2.

Yoda, Shohei. 2021. “Fertility and Educational Reproduction.” In *The Stratification Structure of Early Life: Series on the Stratification Structure of an Aging Society with Fewer Children*, edited by Takayasu Nakamura, Satoshi Miwa, and Hiroshi Ishida, 235–50. Tokyo: University of Tokyo Press.

Yoda, Shohei, and Miho Iwasawa. 2018. “Trends in Total Marital Fertility Rates: An Explanation by Socioeconomic Developments, Gender Regime, and Reproductive Technology.” *Journal of Population Problems* 74:205–23.

YuWa Population Research. 2022. “China Marriage and Family Report 2022 Edition.” https://file.c-ctrip.com/files/6/yuwa/0R71o120009dwkxcgE938.pdf.

Zhai, Zhenwu, Guangzhao Jin, and Yiyang Zhang. 2022. “Reassessment of China’s Fertility Level: An Analysis of the 7th Population Census Data.” *Population Research* 46 (4): 3–13.

Zhao, Menghan. 2019. “The Impact of Women’s Educational Level and Marriage Patterns on the Willingness to Have a Second Child.” *Population Journal* 41 (3): 16–27.

Zhou, Muzhi, and Man-Yee Kan. 2019. “A New Family Equilibrium? Changing Dynamics Between the Gender Division of Labor and Fertility in Great Britain, 1991–2017.” *Demographic Research* 40 (June):1455–1500. https://doi.org/10.4054/DemRes.2019.40.50.

Appendix

Table A1. Descriptive statistics of variables for China

	From Age16 to Marriage	From Marriage to First Child	From First to Second Child		From Age16 to Marriage	From Marriage to First Child	From First to Second Child
The event did not occur= 0	790 (4.7%)	547 (3.6%)	5321 (37.0%)	**Husband's Income**			
The event occurs = 1	15984 (95.3%)	14446 (96.4%)	9057 (63.0%)	Low Income	4293 (25.6%)	3680 (24.5%)	3532 (24.6%)
Wife's Educational Level				Lower Middle Income	3121 (18.6%)	2826 (18.8%)	2744 (19.1%)
Primary	8407 (50.1%)	7473 (49.8%)	7307 (50.8%)	Upper Middle Income	3386 (20.2%)	3075 (20.5%)	2952 (20.5%)
Lower Secondary	4479 (26.7%)	3998 (26.7%)	3854 (26.8%)	High Income	5974 (35.6%)	5412 (36.1%)	5150 (35.8%)
Upper Secondary	2116 (12.6%)	1927 (12.9%)	1830 (12.7%)	**Wife's Birth Cohort**			
College (3-year)	911 (5.4%)	833 (5.6%)	738 (5.1%)	Before 1960s	4693 (28.0%)	4174 (27.8%)	4019 (28.0%)
University	861 (5.1%)	762 (5.1%)	649 (4.5%)	1960s	3826 (22.8%)	3470 (23.1%)	3452 (24.0%)
Husband's Educational Level				1970s	3495 (20.8%)	3157 (21.1%)	3131 (21.8%)
Primary	6483 (38.6%)	5683 (37.9%)	5539 (38.5%)	1980s and later	4760 (28.4%)	4191 (28.0%)	3775 (26.3%)
Lower Secondary	5529 (33.0%)	4975 (33.2%)	4825 (33.6%)	**Number of Owned Houses**	0.3 (0.6)	0.3 (0.6)	0.3 (0.6)
Upper Secondary	2752 (16.4%)	2506 (16.7%)	2387 (16.6%)	**Wife's Age at Marriage**		22.4(3.4)	
College (3-year)	1041 (6.2%)	962 (6.4%)	878 (6.1%)	**Wife's Age in 2020**	51.0 (14.8)	51.0 (10.3)	51.4 (14.4)
University	969 (5.8%)	867 (5.8%)	749 (5.2%)	**Wife's Age at First Childbirth**			33.3 (9.8)
Regional Division				**First Child's Gender (boy)**			
Rural	9349 (56.1%)	8289 (55.5%)	7982 (55.8%)	Girl			6724 (46.9%)
Urban	7326 (43.9%)	6634 (44.5%)	6334 (44.2%)	Boy			7627 (53.1%)
Wife's Income							
Low Income	4029 (24.0%)	3533 (23.6%)	3423 (23.8%)				
Lower Middle Income	3711 (22.1%)	3235 (21.6%)	3104 (21.6%)				
Upper Middle Income	3413 (20.3%)	3076 (20.5%)	2983 (20.7%)	N of obs.	16,774	14,993	14,378
High Income	5621 (33.5%)	5149 (34.3%)	4868 (33.9%)	N of person-year	148,559	51,876	154,952

*Note: Categorical variables are the number and percentage of observations.
The values for the number of houses and ages are means, with standard deviations in parentheses.

Table A2. Descriptive statistics of variables for Japan

	From Age16 to Marriage	From Marriage to First Child	From First to Second Child		From Age16 to Marriage	From Marriage to First Child	From First to Second Child
The event did not occur= 0	1209 (32.8%)	333 (13.6%)	520 (24.5%)	Upper Middle Income	1019 (27.6%)	577 (23.5%)	494 (23.3%)
The event occurs = 1	2478 (67.2%)	2122 (86.4%)	1602 (75.5%)	High Income	1099 (29.8%)	508 (20.7%)	390 (18.4%)
Wife's Educational Level				**Wife's Birth Cohort**			
Lower Secondary	156 (4.2%)	100 (4.1%)	87 (4.1%)	1960s	1293 (35.1%)	1043 (42.5%)	918 (43.2%)
Upper Secondary	1279 (34.7%)	918 (37.4%)	804 (37.9%)	1970s	1199 (32.5%)	750 (30.5%)	636 (30.0%)
College (2-year)	1355 (36.8%)	946 (38.5%)	833 (39.3%)	1980s and later	1195 (32.4%)	662 (27.0%)	568 (26.8%)
University	897 (24.3%)	491 (20.0%)	398 (18.8%)	**Number of Owned Houses**	0.7 (0.5)	0.7 (0.5)	0.8 (0.5)
Husband's Educational Level				**Wife's Age at Marriage**		25.7 (4.1)	
Lower Secondary	201 (7.9%)	185 (7.5%)	164 (7.7%)	**Wife's Age in 2021**	46.9(8.8)	48.5 (8.8)	48.6 (8.9)
Upper Secondary	940 (36.9%)	918 (37.4%)	800 (37.7%)	**Wife's Age at First Childbirth**			27.2 (4.3)
College (2-year)	412 (16.2%)	400 (16.3%)	349 (16.4%)	**First Child's Gender (boy)**			
University	991 (39.0%)	952 (38.8%)	809 (38.1%)	Girl			1138 (53.8%)
Wife's Income				Boy			979 (46.2%)
Low Income	738 (20.0%)	713 (29.0%)	590 (27.8%)				
Lower Middle Income	730 (19.8%)	698 (28.4%)	604 (28.5%)				
Upper Middle Income	827 (22.4%)	812 (33.1%)	733 (34.5%)				
High Income	1392 (37.8%)	232 (9.5%)	195 (9.2%)				
Husband's Income							
Low Income	714 (19.4%)	645 (26.3%)	594 (28.0%)	N of obs.	3,687	2,455	2,122
Lower Middle Income	855 (23.2%)	725 (29.5%)	644 (30.3%)	N of person-year	47,703	11,299	14,071

*Note: Categorical variables are the number and percentage of observations.
The values for the number of houses and ages are means, with standard deviations in parentheses.

TableA3. Crosstab of women's education and birth cohorts at the time of marriage

	China						Japan			
	Before 1960s	1960s	1970s	1980s and later	Total		1960s	1970s	1980s and later	Total
Primary	3,090	2,013	1,562	808	7,473					
	74.0%	58.0%	49.5%	19.3%	49.8%					
Lower Secondary	637	910	938	1,513	3,998	Lower Secondary	40	32	28	100
	15.3%	26.2%	29.7%	36.1%	26.7%		3.8%	4.3%	4.2%	4.1%
Upper Secondary	359	426	344	798	1,927	Upper Secondary	482	267	169	918
	8.6%	12.3%	10.9%	19.0%	12.9%		46.2%	35.6%	25.5%	37.4%
College (3-year)	53	81	174	525	833	College	401	312	233	946
	1.3%	2.3%	5.5%	12.5%	5.6%		38.4%	41.6%	35.2%	38.5%
University	35	40	139	547	761	University	120	139	232	491
	0.84%	1.2%	4.4%	13.1%	5.1%		11.5%	18.5%	35.0%	20.0%
Total	4,174	3,470	3,157	4,191	14,992	Total	1,043	750	662	2,455
	100	100	100	100	100		100	100	100	100

Note: the first row is frequency,the second row is column percentage.

Table A4. the Temporal changes in wife's educational level and their childbearing behavior in China

	Model 1	Model 2	Model 3
	Age16 to Marriage	Marriage to 1st kid	1st kid to 2rd kid
Time	0.0359***	-0.0610***	-0.0936***
Wife's Educational Level			
Primary	0.268***	-0.0725	0.501***
Lower Secondary	0	0	0
Upper Secondary	-0.0279	0.0340	-0.0704
College (3-year)	0.0398	-0.142	-0.445+
University	-0.654***	0.00560	-0.111
Wife's Birth Cohort			
Before 1960s	0	0	0
1960s	0.159**	0.0592	0.0560
1970s	-0.00965	-0.161*	0.151+
1980s and later	0.0251	-0.432***	0.738***
Primary#Before 1960s	0	0	0
Primary#1960s	-0.159**	0.0911	-0.0354
Primary#1970s	-0.104+	0.209**	-0.182*
Primary#1980s	-0.256***	0.192**	-0.540***
Lower Secondary#Before 1960s	0	0	0
Lower Secondary#1960s	0	0	0
Lower Secondary#1970s	0	0	0
Lower Secondary#1980s	0	0	0
Upper Secondary#Before 1960s	0	0	0
Upper Secondary#1960s	-0.0725	0.0490	-0.357**
Upper Secondary#1970s	-0.113	-0.203+	-0.282*
Upper Secondary#1980s	-0.132	-0.151	-0.153
College#Before 1960s	0	0	0
College#1960s	-0.269	0.307	-0.829*
College#1970s	-0.331+	-0.137	-0.147
College#1980s	-0.506**	-0.225	0.0340
University#Before 1960s	0	0	0
University#1960s	0.113	0.00871	-1.110**
University#1970s	0.276	-0.290	-1.060**
University#1980s	0.0118	-0.493*	-0.109
Regional Division (urban=1)	-0.0916***	-0.0248	-0.488***
Wife's Age in 2020	-0.0110***	-0.0183***	0.0214***
Wife's Income			
Low Income	0	0	0
Lower Middle Income	0.0687**	-0.0334	-0.0193
Upper Middle Income	0.0957***	0.0133	-0.0254
High Income	0.231***	0.231***	-0.114***
Husband's Educational Level			
Primary		-0.0113	0.0709**
Lower Secondary		0	0
Upper Secondary		-0.0908**	0.0156
College (3-year)		-0.165**	-0.179**
University		-0.236***	-0.218**
Husband's Income			
Low Income		0	0
Lower Middle Income		-0.386***	-0.0886**
Upper Middle Income		-0.251***	-0.121***
High Income		-0.00263	-0.0509
Number of Owned Houses	0.0807***	0.0486*	0.0290
Wife's Age at Marriage		0.0221***	
Wife's Age at First Childbirth			-0.0566***
First Child's Gender (boy=1)			-0.456***
_cons	-1.967***	0.00881	-1.609***
N of obs.	16774	14993	14378
N of person-year	148559	51876	154952

$^{+}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A5. the Temporal changes in wife's educational level and their childbearing behavior in Japan

	Model 5 Age16 to Marriage	Model 6 Marriage to 1st kid	Model 7 1st kid to 2rd kid
Time	0.158***	-0.175***	-0.121***
Wife's Educational Level			
Lower Secondary	0.363+	-0.303	-0.304
Upper Secondary	0	0	0
College	-0.660***	-0.119	-0.0542
University	-0.847***	-0.0879	0.0481
Wife's Birth Cohort			
1960s	0	0	0
1970s	0.0745	-0.168	-0.164
1980s and later	0.104	0.0819	0.0670
Lower Secondary#1960s	0	0	0
Lower Secondary#1970s	0	0.121	-0.215
Lower Secondary#1980s and later	0	0.196	-0.278
Upper Secondary#1960s	0	0	0
Upper Secondary#1970s	-0.548*	0	0
Upper Secondary#1980s and later	-0.305	0	0
College#1960s	0	0	0
College#1970s	-0.667*	0.324*	0.190
College#1980s and later	-0.0701	0.366*	0.0541
University#1960s	0	0	0
University#1970s	-0.754*	0.187	0.143
University#1980s and later	-0.233	0.286	-0.0406
Wife's Age in 2021	0.0157*	0.00378	0.00233
Wife's Income			
Low Income	0	0	0
Lower Middle Income	0.0805	0.0528	0.123+
Upper Middle Income	-0.121+	0.00138	0.160*
High Income	-4.443***	-0.201	-0.235
Husband's Educational Level			
Lower Secondary		0.230*	0.130
Upper Secondary		0	0
College		0.0530	0.111
University		-0.0677	-0.00210
Husband's Income			
Low Income		0	0
Lower Middle Income		-0.507***	-0.252***
Upper Middle Income		-0.786***	-0.370***
High Income		-0.939***	-0.468***
Number of Owned Houses		0.155**	0.205***
Wife's Age at Marriage		-0.0335***	
Wife's Age at First Childbirth			-0.0733***
First Child's Gender (boy=1)			-0.0170
_cons	-3.823***	0.397	0.506
N of obs.	3687	2455	2122
N of person-year	47703	11299	14071

$^{+}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A6. DID analysis after the implementation of the universa

	Model 7
	DID
0.treat	0
1.treat	-0.106***
0.after	0
1.after	-0.0296***
0.treat#0.after	0
0.treat#1.after	0
1.treat#0.after	0
1.treat#1.after	0.0912***
Wife's Educational Level	
Primary	0.000407
Lower Secondary	0
Upper Secondary	-0.0176***
College (3-year)	-0.0278***
University	-0.0231***
Husband's Educational Level	
Primary	0
Lower Secondary	-0.0141**
Upper Secondary	-0.0242***
College (3-year)	-0.0357***
University	-0.0384***
Regional Division (urban=1)	-0.0310***
Wife's Age in 2020	-0.000906+
Number of Owned Houses	0.00470+
Wife's Income	
Low Income	0
Lower Middle Income	-0.00680
Upper Middle Income	0.000592
High Income	-0.00312
Husband's Income	
Low Income	0
Lower Middle Income	-0.0128*
Upper Middle Income	-0.0114*
High Income	0.00688
First Child's Gender (boy=1)	-0.0217***
Wife's Age at First Childbirth	-0.000456
_cons	0.198***51
N	26804

$^{+}\ p < 0.1$, $^{*}\ p < 0.05$, $^{**}\ p < 0.01$, $^{***}\ p < 0.001$