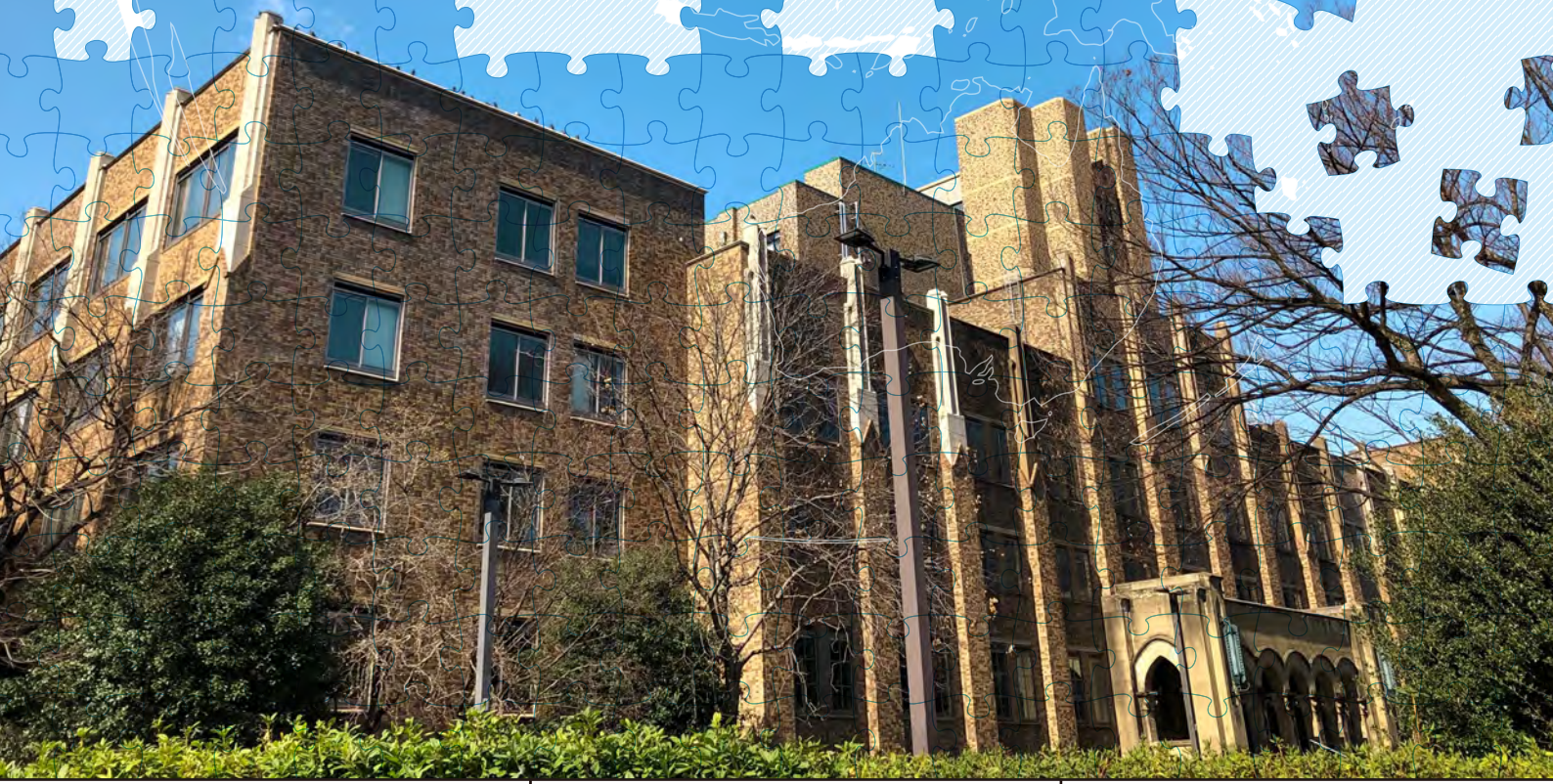
CSRDA
Center for Social Research and Data Archives, Institute of Social Science, The University of Tokyo
SUSTAINABLE DEVELOPMENT GOALS
CSRDA supports the Sustainable Development Goals

CSRDA Discussion Paper

The Increasing Importance of Changes in Nuptiality: Policy Mismatch and Fertility Decline in Low-Fertility East Asian Societies



No. 98

Date September.2024

SDGs 5 GENDER EQUALITY, 10 REDUCED INEQUALITIES

Name Jolene Tan, Qi Cui, Fumiya Uchikoshi

The Increasing Importance of Changes in Nuptiality: Policy Mismatch and Fertility Decline in Low-Fertility East Asian Societies

Jolene Tan[a], Qi Cui[b], and Fumiya Uchikoshi[c]*

[a] Office of Population Research, Princeton University, Princeton, New Jersey, United States

[b] Department of Methodology, London School of Economics and Political Science, London, United Kingdom

[c] Harvard Academy for International and Area Studies, Weatherhead Center for International Affairs, Harvard University, Cambridge, MA, United States

*Email: *uchikoshi@fas.harvard.edu*

Address: Harvard Academy for International and Area Studies, Weatherhead Center for International Affairs, Harvard University, 1727 Cambridge Street, Cambridge, MA 02138

Declaration of interests: None to declare.

The Increasing Importance of Changes in Nuptiality: Policy Mismatch and Fertility Decline in Low-Fertility East Asian Societies

Abstract

Despite the strong relationship between marriage and childbearing, existing policies aimed at supporting parenthood often prioritize parity progression within married couples while overlooking a concurrent yet increasingly significant trend: the rising prevalence of delayed marriage and nonmarriage. This study focuses on four low-fertility East Asian societies: South Korea, Japan, Taiwan, and Singapore. In these societies, changes in nuptiality play an important role in fertility change, and a variety of population policies have been implemented in response to the "lowest-low" fertility rates of these societies. Against this background, we first review existing policy efforts to mitigate declining fertility, arguing that these pronatalist policies are mistargeted. We then examine the extent to which the decrease in fertility is attributable to changes in marital fertility versus shifts in nuptiality. We conduct a decomposition analysis of fertility trends in these four low-fertility societies using data from the United Nations Population Division. We find that while the decline in marital fertility played a dominant role during the initial stages of the fertility transition, contemporary patterns highlight nuptiality as the primary driver of declining fertility rates. These findings underscore the importance of the rising prevalence of singlehood and the potential, albeit modest, increase in diverse family forms, both of which have received scant attention in policy discourse.

Keywords: marriage, nuptiality, low fertility, decomposition analysis, East Asia

Introduction

Over the past three decades, subreplacement fertility has emerged as a global phenomenon (Sobotka et al. 2019). Currently, half of the world's population resides in countries where the total fertility rate (TFR) is less than 2.1 births per woman. In response, many nations with low fertility rates have introduced policies to increase fertility. Pronatalist policies have been a particular focus in East Asian[1] societies such as South Korea, Japan, Taiwan, and Singapore, which face some of the lowest fertility rates in the world (Jones 2019). As early as the 1990s, governments in East Asia began implementing policy measures to address concerns surrounding the socioeconomic impacts of rapid population aging, potential population stagnation and decline, and shifts in family values from traditional attitudes toward more liberal attitudes (Frejka et al. 2010; Gietel-Basten 2022). These policy measures have focused primarily on financial barriers to childbearing and the challenges of reconciling work and family life (Chen et al. 2020; Gauthier 2016; McDonald 2002, 2006; Tan 2023); they include initiatives such as additional cash bonuses, expanded parental leave schemes, and increased access to affordable health and childcare services. Although the assumption underlying these measures is that fertility rates might stabilize or increase by alleviating financial and work–life burdens, empirical evidence suggests that their potential positive effects are typically modest (Bergsvik et al. 2021; Gauthier 2007; Sobotka et al. 2019; Thévenon and Gauthier 2011).

Moreover, while East Asia has been at the forefront of efforts to address declining fertility, an increasing number of studies have highlighted potential misalignments in the focus of its policies (Chen et al. 2020; Gauthier 2016; Lee 2009). A critical but perhaps less

[1] Although Singapore is geographically located in Southeast Asia, in this study, it was categorized with East Asian societies due to its parallel trends in fertility and marriage rates, as well as its cultural similarities with East Asia.

carefully considered factor in policy discourse is the close link between marriage and childbearing—the latter is less likely to occur without the former in Japan, South Korea, Taiwan, and Singapore, where nonmarital births constitute only approximately 2–4% of all births (Jones 2007; Raymo et al. 2015). For example, Chen et al.'s (2018) study on parity-specific pronatalist policies (e.g., cash transfers, childcare subsidies, and tax relief) suggests that policies designed to support marriage and the transition to parenthood would likely be more effective, given the strong connection between marital status and childbearing. However, few policies have been designed to promote marriages. Previous research has suggested that, given the increasing prevalence of singlehood and the ongoing association between marriage and childbearing, declining marriage rates could greatly contribute to the overall decline in fertility (Koh 2011; Raymo et al. 2021).

The preceding context informs this study's research question: To what extent do changes in nuptiality contribute to declining fertility rates in low-fertility East Asian societies? Is the role of changes in nuptiality uniform across these societies or over time? By empirically answering these questions, we aim to provide critical policy implications for the relationship between marriage trends and current policy efforts that aim to support childbearing. We focus on four East Asian societies with persistently low fertility rates—South Korea, Japan, Taiwan, and Singapore—as these societies are characterized by increasingly delayed and fewer marriages, negligible levels of nonmarital childbearing, and relatively similar cultural values and have been the most proactive in implementing population policies. In the first part of this paper, we critically review their policies to support childbearing and discuss how they may not reflect the ongoing reality of fertility changes in these societies. In the second part of this paper, we focus on quantifying and exemplifying the importance of marriage to childbearing. While recognizing that factors such as gender equity and work–family balance are also crucial, we analyze how trends in marital fertility and

nuptiality have influenced fertility changes over time using a decomposition analysis of birth rates from 1970 to 2020. Through this approach, we aim to highlight the importance of marriage in understanding declining fertility and suggest that family policies should consider supporting marriage as well as other diverse forms of families (e.g., unmarried couples and same-sex couples).

Literature review

Low-fertility policies tend to focus on specific milestones that occur before and throughout childbearing and parenthood and can be broadly categorized into six areas: (1) facilitating conception, (2) supporting healthcare and medical expenses related to pregnancy and childbirth, (3) providing parental leave, (4) offering financial support, (5) ensuring accessible and affordable childcare services, and (6) creating more family-friendly work environments (Jones and Hamid 2015; Lee and Choi 2015; Lee and Lin 2016; Tsuya 2015). These policies address a range of barriers to childbearing and parenting and are informed by the economic, social, and interpersonal considerations that influence marital fertility. The following subsections address each of these categories of strategic approaches.

Healthcare and assisted conception services

Reproductive behavior is intrinsically motivated and related to an individual's desire for close, enduring relationships (Miller et al. 2013); however, while intrinsic motivation is a strong facilitator of parenthood, individuals and couples may face health, economic, and social constraints that deter them from becoming parents. With respect to health constraints, appropriate policy measures (i.e., those seen as aiding individuals or couples in achieving their intended number of children) have been shown to support people's intrinsic motivation for childbearing (Botev 2015). Healthcare access and assisted conception services, for

example, have recently received considerable attention in low-fertility societies in light of the risks of increasingly advanced parental age.

To this end, the government of Japan provides a Childbirth and Childcare Lump-sum Grant of 500,000 yen (USD 3,200) to cover childbirth expenses for each baby, whereas South Korea provides medical allowances to mothers and newborns, including 500,000 won (USD 365) for pregnancy-related medical bills. The Singaporean government's MediSave maternity package allows for withdrawals from national medical savings schemes for predelivery services, delivery expenses, and postchildbirth hospital stays (Made for Families 2024). Finally, Taiwan offers a maternity benefit equivalent to salary earnings for 60 days on the basis of the mother's average monthly insurance salary over the last six months (Taiwanese Ministry of Labor 2022).

In addition to providing financial assistance for pregnancy and childbirth and maternity benefits, providing financial aid or subsidies for assisted conception services, such as in vitro fertilization and egg freezing, is another critical aspect of health-related policies to support childbearing (Lee and Choi 2015; Singapore Ministry of Health 2023). For example, the government of Japan reimburses 70 percent of in vitro fertilization costs through public health insurance (Yokoyama and Lee 2024). In a different approach, the South Korean government offers partial allowances for artificial insemination and in vitro fertilization, regardless of income (Korean Ministry of Health and Welfare 2024). In 2021, Taiwan expanded eligibility for its in vitro fertilization subsidy program from only low-income families to all couples (Taiwanese Department of Information Services 2023). Finally, Singapore provides up to 75 percent of co-funding for couples undergoing assisted conception procedures in public fertility centers (Made for Families 2024). With more people having children in their 30s and 40s and experiencing infertility, subsidizing reproductive

treatments constitutes a promising measure for increasing birth rates among individuals who wish to have children (Bergsvik et al. 2021).

Although statistics quantifying the success of these services are not yet available and cannot capture the physical and emotional toll of fertility challenges, government support for couples attempting to conceive a child and childless individuals is clearly integral for comprehensive fertility policies (Leridon and Slama 2008). Government support addresses not only the immediate need for medical interventions but also the broader societal need for a supportive environment for all families.

Parental leave schemes

Parent–child bonding is important for perinatal mental health and infant development. However, entrenched gender norms and precedent policy signals create an expectation that mothers should be the primary caregivers of children, whereas men should prioritize paid work. Policies have been implemented to pave the way for the second stage of what some scholars have called the gender revolution (Esping-Andersen and Billari 2015; Goldscheider et al. 2015), which is predicted to increase men's involvement in children and caregiving responsibilities.

Expanding parental leave schemes is key to this move toward gender equity. Most governments provide paid parental leave to care for a newborn child, a recently adopted child, or a child needing parental care. In Singapore, women can take 16 weeks of government-paid maternity leave, and in 2024, government-paid paternity leave was increased from two weeks to four weeks for working fathers (Made for Families 2024). Similarly, the South Korean government provides 90 days of paid maternity leave, with a minimum of 45 days taken after birth, and mandates that all of this leave be taken (Kim et al.

2023). Moreover, both parents in South Korea can now take parental leave simultaneously, a measure intended to encourage the use of paternity leave (Kim and Lundqvist 2023).

Similar policies are also in place in other low-fertility nations. These policies support working parents by helping them maintain their jobs while starting families and encouraging fathers to spend time with their newborns (Sobotka et al. 2019). These policies are suggested to increase fertility rates and job security for parents, ensure the physical and mental well-being of parents and children, promote gender equality in the workplace, and facilitate high job satisfaction (Haar et al. 2014; McDonald 2006).

Financial support

According to rational choice theory, individuals make calculated decisions to have children on the basis of the assessment that the benefits of having an additional child outweigh the costs (McDonald 2002). The theory thus indicates that financial incentives may provide a direct approach to lowering the economic costs of parenthood. To this end, a well-established and popular policy focuses on providing financial support to parents before, during, and after birth.

For example, in South Korea, families with children receive tax exemptions and can take out means-tested loans to rent or purchase a house (Lee and Choi 2015). Previous research has estimated that Korean parents with a child receive a sum ranging from 35 million won (USD 25,000) to 50 million won (USD 36,000) through various incentives and support programs from the birth of their child until the child reaches the age of seven (Song 2024). Taiwan also offers childbirth and parenting benefits. Recently, the government started providing an additional payment of NT$20,000 (USD 653) per child born in Taipei city on top of existing childbirth bonuses, along with introducing new tax deductions for parents with preschool-aged children (Lee and Lin 2016; Thomson 2023). The Japanese and Singaporean

governments provide similar child allowances to alleviate the financial burden of childbearing by removing income thresholds for eligibility, increasing allowances, and extending coverage for children until they reach older ages (Made for Families 2024). However, compared with work-life initiatives (i.e., policies that help parents better manage and balance their work and family life), financial incentives and one-off cash transfers (e.g., baby bonuses) typically have a shorter-term impact than what would be needed to have a potential effect on increasing the quantum of childbearing (Thévenon and Gauthier 2011). Moreover, as these allowances cover only a small proportion of the overall costs of raising children, they tend to have a limited impact on completed family size (Boydell et al. 2023).

Childcare services

In line with various theories on gender equity (e.g., second gender revolution theory) and economic costs (e.g., rational choice theory), the provision of accessible and affordable childcare helps working parents manage their work and childcare responsibilities, especially working mothers who remain in the workforce after having a child. As high childcare costs may be untenable for families, steps to reduce people's financial strain may make it more feasible for them to have children or larger families.

As such, the governments of South Korea, Japan, Taiwan, and Singapore have implemented policies to enhance access to high-quality and affordable preschools and childcare (Jones and Hamid 2015; Lee and Choi 2015; Lee and Lin 2016; Tsuya 2015). Japan's initiatives, such as the Angel Plans of 1994 and 1999, the Plus-One Plan of 2002, the Basic Law to Address Low Fertility of 2003, the Strategy to Assist Children and Families of 2007, the Vision for Children and Childcare of 2008, and the 2013 Plans to Accelerate the Reduction of Preschool Children on Waiting Lists, have substantially increased the availability of daycare slots and the enrollment of children in daycare centers (Frejka et al.

2010; Tsuya 2015). Similarly, through its universal childcare system of 2013, South Korea provides access to free childcare and an age-graded home care allowance for childcare at home (Korean Ministry of Health and Welfare 2024). In 2018, Taiwan amended the Early Childhood Education and Care Act to diversify service models for childhood education and care and expedite the addition of slots at public preschools and childcare facilities (Taiwanese Department of Information Services 2023). The Taiwanese government also provides subsidized private daycare center or home babysitting services, with additional childcare subsidies for parents with two or more children and those from low- or lower-middle-income families (Chen 2020). Finally, Singapore provides monthly subsidies for center-based childcare programs, infant care programs, and kindergarten fees (Made for Families 2024).

With many households relying on dual incomes, accessible and reliable childcare options help reduce the stress of balancing work and family life for parents (Frejka et al. 2010). Childcare programs enable parents to maintain their careers, setting families on a path toward financial stability. In previous research, policies that improve family life without sacrificing work life, including comprehensive childcare services, had positive associations with fertility rates (Bergsvik et al. 2021; Luci-Greulich and Thévenon 2013; Sobotka et al. 2019).

Family-friendly work environments

Family-friendly labor policies can mitigate the opportunity costs of childrearing by reducing the trade-offs between work and family life. By creating more accommodating work environments through, for example, the promotion of flexible work arrangements, policies may be able to foster a more equitable division of paid and unpaid labor among couples and alleviate the burden of childrearing, which is primarily placed on women. This shift makes it

possible for fathers to engage more actively with their families and encourages the development of an atmosphere that supports childbearing.

In a trend accentuated by the COVID-19 pandemic, which underscored the viability and benefits of widespread telecommuting and flexible work arrangements for families, governments and employers, greater emphasis is being placed on workplace flexibility in Japan, South Korea, Taiwan, and Singapore. The Japanese government initiated policies and institutional reforms to increase flexible working hours for employees with children (Lowenson et al. 2019), whereas the South Korean government launched educational campaigns promoting gender equality within families and society at large alongside incentives for companies to adopt family-friendly practices (e.g., reducing work hours) (Kim et al. 2023; Lee and Choi 2015; Yun et al. 2022). Similarly, in Singapore, organizations have been increasingly encouraged to embrace flexible work arrangements, enabling parents to manage work and family responsibilities more effectively. In this context, Singapore's forthcoming Tripartite Guidelines (slated to take effect in December 2024) are intended to delineate how employees can request flexible work arrangements and how employers and supervisors should handle such requests to enable employees to achieve better work–life harmony while giving employers a competitive advantage in talent attraction and retention (Singapore Ministry of Manpower 2024). Finally, the Taiwanese government revised its labor regulations to cap weekly work hours at 40 hours and allow greater flexibility in start and end times, with arrangements tailored to workers' needs or family requirements (Hsiao 2015).

Given the global postpandemic shift in workplace dynamics, the promotion of family-friendly work environments and flexible arrangements is dually intended to reduce work–family conflict and enhance employee retention (Laß and Wooden 2023).

Existing critiques of pronatalist policies

Given the assumption that alleviating financial or work–life burdens on families will encourage people to have (more) children, current policies in East Asia largely focus on (marital) fertility behavior. However, existing studies have raised concerns about whether these pronatalist policies in East Asia may be mistargeted (Chen et al. 2020; Matsuda 2015; Tsutsui 2023). Unlike in Europe, where policies are less marriage-specific and nonmarital fertility rates are relatively higher, East Asian societies face a distinctive cultural context in which marriage has remained a precursor to childbearing, whereas the rate of nonmarital childbearing is still low and nonmarital childbearing is often socially stigmatized (Hertog 2009). Moreover, some policies may (unintentionally) discriminate against single parents. In Singapore, for example, unmarried parents with children are less entitled to public housing, tax relief, and Baby Bonus cash gifts, all of which are prioritized for married parents (Association of Women for Action and Research 2021). This highlights the need to integrate (non)marriage considerations into fertility policies. In this context, existing discussions of Japan's population policies indicate the misalignment of these policies with the primary drivers of fertility decline, such as delayed and reduced marriage rates (Atoh et al. 2004; Iwasawa 2002, 2015; Raymo et al. 2015; Tsuya and Mason 1995). Similar discussions extend beyond Japan to other societies in the region (Chen et al. 2018; Fukuda 2020; Gauthier 2016).

Few studies, such as that of Chen et al. (2020), have examined the importance of changes in nuptiality and its link to existing policy measures. To address this gap, we conducted a comparative analysis of data from an extended period to isolate the impact of nuptiality, assess whether policy mismatches exist, and determine whether changes in marriage patterns or marital fertility rates are the primary drivers of fertility decline. Given the explicit focus of policies on increasing the number of children born within marriages, this

analysis acknowledges the cultural and social contexts that influence fertility behaviors. Our analysis thus contributes to the empirical evidence quantifying the effects of different factors (e.g., marriage and marital fertility) on overall fertility trends. In turn, our results identify which factors have a more substantial impact on fertility decline. More specifically, a decomposition analysis can uncover whether a tailored and potentially context-specific policy is required to address and comprehend the varying levels of marriage and fertility decline by isolating the specific contributions of changes in nuptiality and marital fertility. For example, if fertility decline is driven primarily by changes in marriage formation, policies focused solely on supporting marital fertility might be less effective. By identifying shifts in the relative importance of different factors over time (i.e., whether the impact of nuptiality has increased or decreased over time) as well as differences across societies that may be useful for more effective and targeted policy interventions, our study aim to provide comparative baseline evidence to help inform policymakers.

Changes in fertility and nuptiality

The Second Demographic Transition (SDT) framework proposes that societies with fertility postponement and increased childlessness will experience sustained subreplacement fertility, develop new forms of living arrangements, and experience a shift from family-centric values to individualistic values (Lesthaeghe 2010). In line with this framework, East Asia's demographic transition has been marked by a substantial decline in fertility rates to well below the replacement level of 2.1 births per woman (Figure 1). Although changes such as the decoupling of marriage and childbearing have been slower to manifest in East Asian societies than in Western societies, they are still occurring, albeit in different ways and at different rates (Cheng 2020).

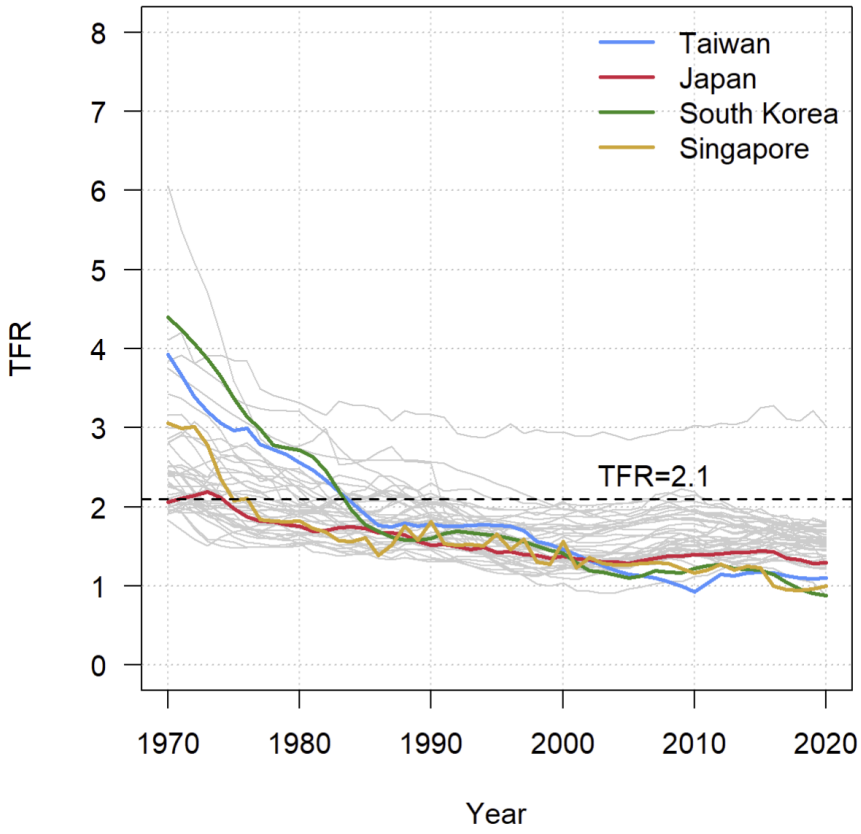


Figure 1. Period total fertility rate, selected countries and territories, 1970–2020.

Notes: The gray lines represent data from 38 countries, the majority of which are European countries. A detailed list of these countries and territories can be found in Appendix A1.

Source: Authors' illustration on the basis of fertility data from the United Nations Population Division (UNPD 2022).

The current policy landscape in East Asian societies actively targets marital fertility but often overlooks the complex sociocultural factors that shape fertility over an individual's life course. Specifically, existing studies point to the well-established pattern that marriage typically precedes childbearing in East Asia and suggest that shifts in marriage patterns have played a more important role in recent fertility declines in East Asia than in other low-fertility settings (Jones 2007; Jones and Yeung 2014). Figure 2 illustrates trends in the proportions of married women aged 15–49 from 1970 to 2020, where we can see that

marriage rates have steadily declined in East Asia. The proportion of married women fell by 14 percentage points in Japan, 9 percentage points in South Korea, and 9 percentage points in Taiwan, with corresponding increases in singlehood. The exception is Singapore, where the propotion of married women declined only by 1 percentage point. These changes in nuptiality raise important questions about the increase in singlehood and the extent to which this trend is driven by choice or circumstance.

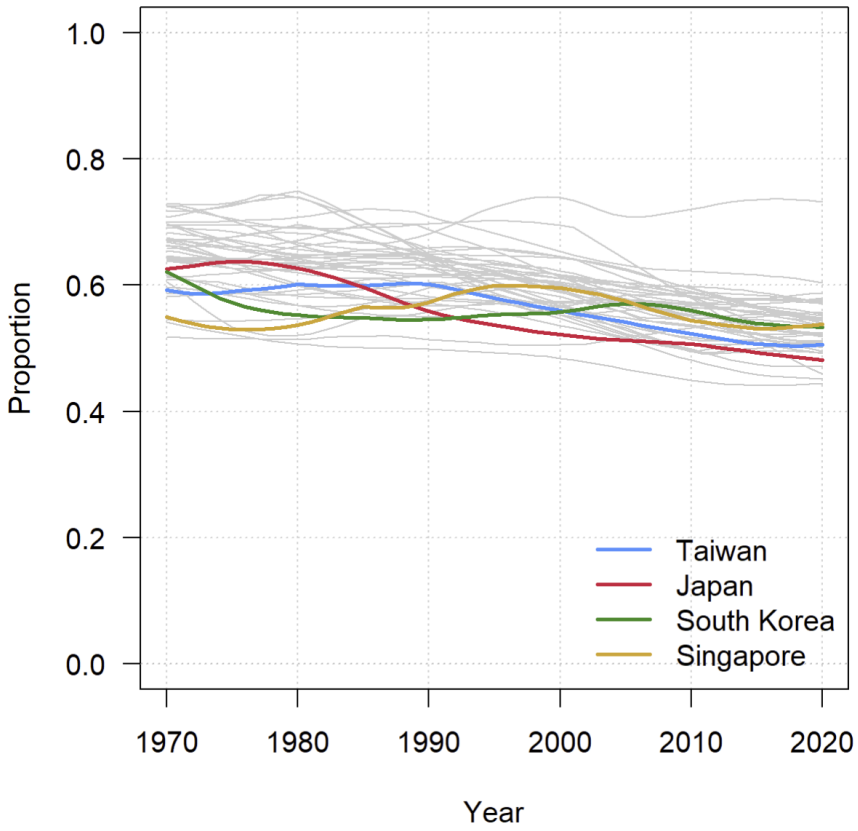


Figure 2. Proportions of married women aged 15–49, 1970–2020.

Source: Authors' illustration based on marriage estimates from the UNPD (2020).

Data

We compiled data on the age-specific fertility rate and the proportion of married women in each society (Japan, South Korea, Taiwan, and Singapore) from 1970 to 2020. The fertility data were sourced from the United Nations Population Division (UNPD 2022). The UNPD

has been gathering, compiling, and disseminating official demographic and social statistics from over 230 national statistical offices since 1950. UNPD data are thus consistent, comparable, and comprehensive and cover a lengthy period. The proportions of married (or in union) women were extracted from the UNPD database (2020). This database, covering the years from 1970 to 2020, offers a comparable and update-to-date set of data on the marital status of the population by age for 232 countries and territories. Information are sourced from censuses, sample surveys, and national estimates based on population register data or estimation methods using census data. For both datasets, we focused on the available five-year age groups: 15–19, 20–24, 25–29, 30–34, 35–39, 40–44, and 45-49.

Method

To isolate the impact of marriage age composition on the TFR, we defined the age-specific fertility rate (ASFR) at age x and time t, $ASFR(x,t)$, as follows:

$$\begin{aligned} ASFR(x,t) &= \frac{Births\ from\ women\ in\ age\ group\ x}{Women\ in\ age\ group\ x} \\ &= \frac{Births\ from\ women\ in\ age\ group\ x}{Married\ women\ in\ age\ group\ x} \times \frac{Married\ women\ in\ age\ group\ x}{Women\ in\ age\ group\ x} \\ &= MFR(x,t)MP(x,t) \end{aligned} \quad (1)$$

where $MFR(x,t)$ represents the marital fertility ratio,[2] which is the ratio between the number of births and married women in a specific age group, and where $MP(x,t)$ is the proportion of women who are married.

[2] Notably, the definition of the age-specific marital fertility rate in the study by Jiang et al. (2019) differs from the traditional definition. As detailed in studies by Cho and Retherford (1973) and Nishikido et al. (2022), these traditional methods involve calculating the numerator based only on births from married women within a specific age group. Our study defined this using a ratio, aligning with the definitions of rate and ratio provided by Preston et al. (2001, p. 3). When no nonmarital births occur, the marital fertility ratio is equivalent to the age-specific marital fertility rate.

The TFR at a given time t, $TFR(t)$, was then calculated as follows:

$$TFR(t) = \sum_{x=\alpha}^{\beta} ASFR(x,t) = \sum_{x=\alpha}^{\beta} MFR(x,t)MP(x,t), \quad (2)$$

where α and β represent the minimum and maximum reproductive ages, respectively.

Next, we applied the standard decomposition approach to split the effects of the marital fertility ratio and marriage age composition on the change in the TFR (Kitagawa 1955). The formulation is as follows:

$$\Delta TFR(t) = \sum_{x=\alpha}^{\beta} [\Delta MFR(x,t)\overline{MP}(x,t) + \overline{MFR}(x,t)\Delta MP(x,t)]. \quad (3)$$

where Δ and the overbar separately denote the difference and average between the two populations or time points. For example, in the case of one-year changes, $\Delta MFR(x,t) = MFR(x,t+1) - MFR(x,t)$, and $\overline{MP}(x,t) = \frac{MP(x,t+1)+MP(x,t)}{2}$.

On the basis of Eq. (3), the two effects can be defined as

$$\text{Marital fertility ratio effect} = \sum_{x=\alpha}^{\beta} \Delta MFR(x,t)\overline{MP}(x,t), \text{ and}$$

$$\text{Marital age composition effect} = \sum_{x=\alpha}^{\beta} \overline{MFR}(x,t)\Delta MP(x,t).$$

In cases where nonmarital births are negligible, the marital fertility ratio effect can be considered the marital fertility rate effect; similarly, the marital age composition effect can be viewed as the composition effect (a more detailed discussion and mathematical proofs are available in Appendix A2). In East Asian contexts (i.e., Japan, South Korea, Taiwan, and

Singapore), the marital fertility ratio effect and the marital age composition effect can be interpreted as changes in marital fertility and nuptiality, respectively. Our decomposition approach was similar to the total fertility decomposition approach developed by Nishikido et al. (2022). With detailed survey data, where the number of births can be distinguished between those within and outside marriage, the age-specific marital and nonmarital fertility rates can be constructed, and the proportion of women in marital and nonmarital unions can be calculated. However, the approach of Nishikido et al. may not be suitable for large-scale cross-national comparisons using limited survey data over extended periods, especially when there are inconsistencies in how marital status is measured (e.g., varying definitions of stable union, marriage, and cohabitation).

Results

The preceding section describes our analysis of the decline in fertility rates by decade to capture the decrease in the TFR across Japan, South Korea, Taiwan, and Singapore. We find that from 1970 to 2020, the TFR decreased from about 2.06 children per woman to 1.29 in Japan, from 4.39 to 0.88 in South Korea, from 3.92 to 1.10 in Taiwan, and from 3.06 to 1.00 in Singapore (UNPD 2022). Figures 3 to 6 show the changes in fertility rates decomposed into changes due to marital fertility and the proportion of married women according to each age group. In all societies, fertility decline was driven by changes in both, with more substantial changes due to the change in the proportion of married women in their 20s and 30s, particularly during the past two decades.

In Japan, changes in nuptiality had a more dominant impact on the change in the TFR (Figure 3). The change in the TFR by decade was -0.309 children (1970–1980), -0.242 children (1980–1990), -0.131 children (1990–2000), +0.012 children (2000–2010), and -

0.102 children (2010–2020). In periods in which the TFR declined, most of the decline was due to changes in nuptiality, particularly among the 20–24 and 25–29 age groups. These results are consistent with findings from earlier studies that declining fertility in Japan is largely the result of the trend toward later and fewer marriages (e.g., Atoh et al. 2004; Iwasawa 2002).

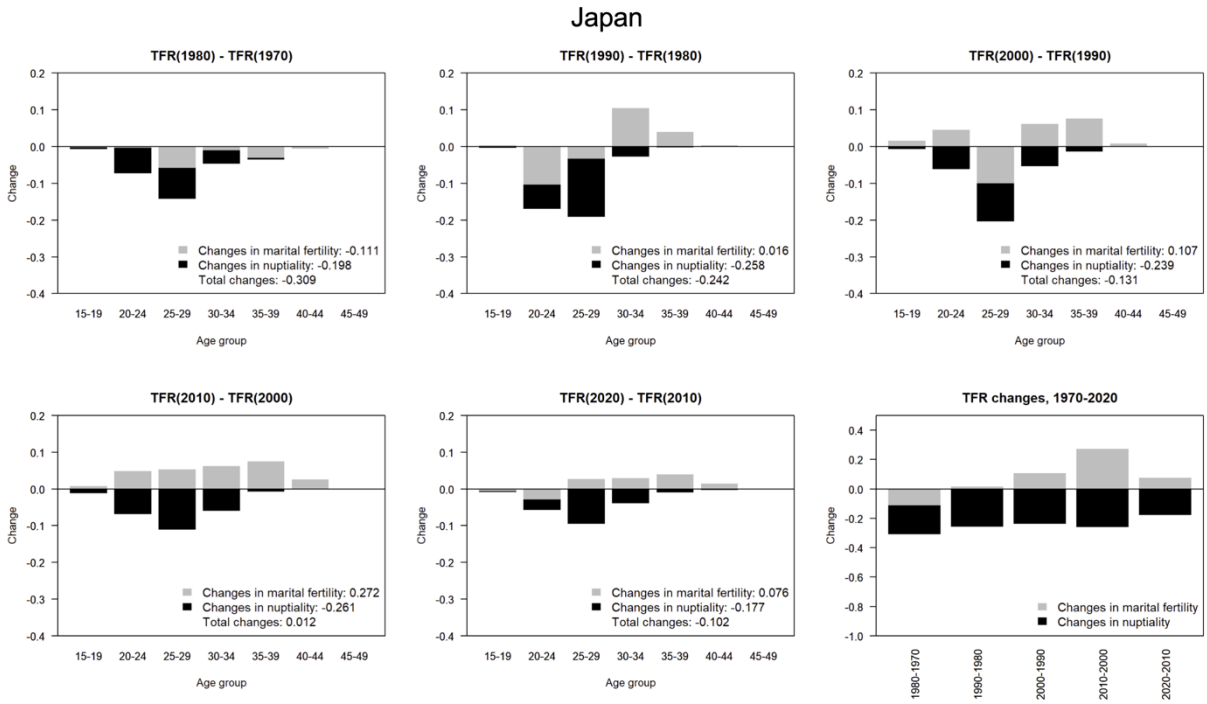


Figure 3. Decomposition of the change in the TFR in Japan, 1970–2020.

Source: Calculated by the authors using data from the UNPD fertility and marriage datasets (2020, 2022).

In South Korea, the decline in nuptiality consistently contributed to the decline in the TFR (Figure 4). The TFR declined by -1.681 children between 1970 and 1980, by -1.113 children between 1980 and 1990, by -0.185 children between 1990 and 2000, by -0.196 children between 2000 and 2010, and by -0.338 children between 2010 and 2020. During the transition from high to low fertility, the decline in fertility was initially driven largely by

changes in marital fertility from 1970 to 1990. However, after 1990, as the TFR approached the lowest-low levels, changes in nuptiality contributed more to the reductions in the TFR than did changes in marital fertility. Since 2000, the decline in nuptiality has had approximately twice as much of an effect as marital fertility, resulting in a decline in the TFR.

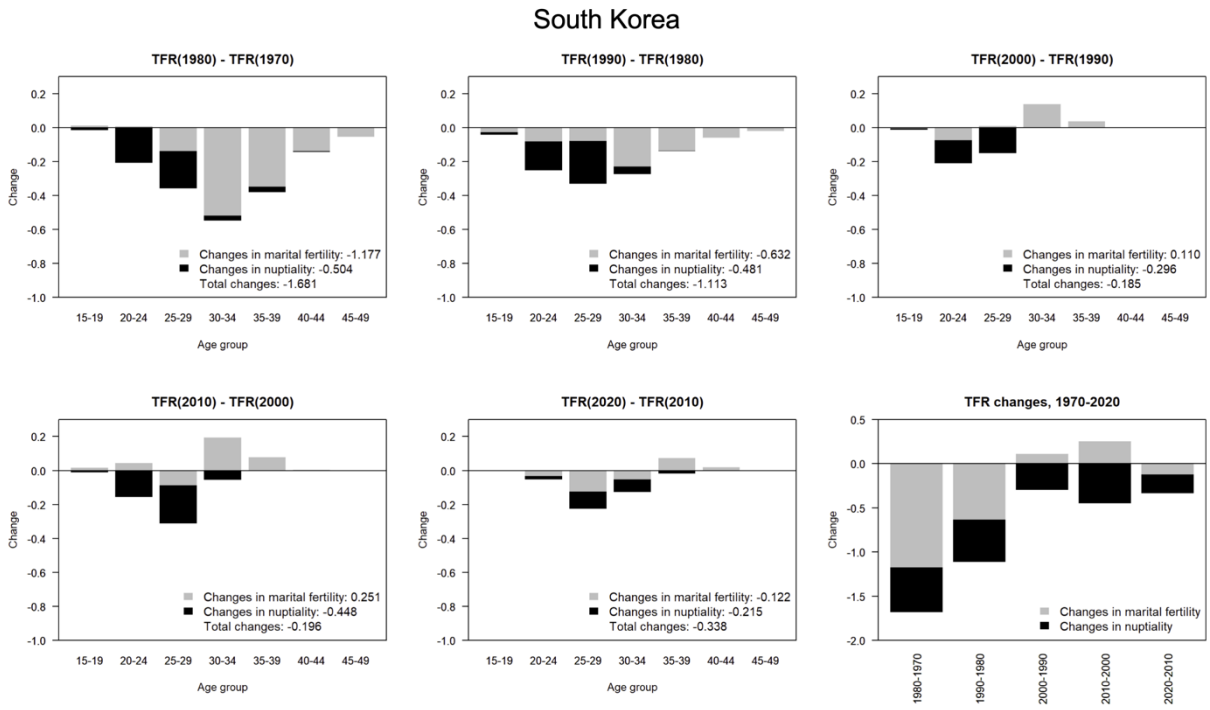


Figure 4. Decomposition of the change in the TFR in South Korea, 1970–2020.

Source: Same as in the previous figure.

In Taiwan, the decline in marital fertility played a major role in decreasing the TFR between 1970 and 1980, with nuptiality beginning to play a more significant role only later (Figure 5). The TFR declined by -1.366 children between 1970 and 1980, -0.774 children between 1980 and 1990, -0.326 children between 1990 and 2000, -0.536 children between 2000 and 2010, and +0.180 children between 2010 and 2020. Changes in the proportion of married women stand out as a major contributor to the decline in fertility, particularly from

1980 to 2010 and for the 20–24 and 25–29 age groups. Notably, the change in the TFR was approximately +0.180 children from 2010 to 2020—during this period, the positive contributions of marital fertility (+0.303) were offset by the negative contributions of nuptiality (-0.123). This finding indicates that despite policies aimed at increasing marital fertility, the TFR cannot fully increase if marriage continues to decline, thereby offsetting the increase in marital fertility.

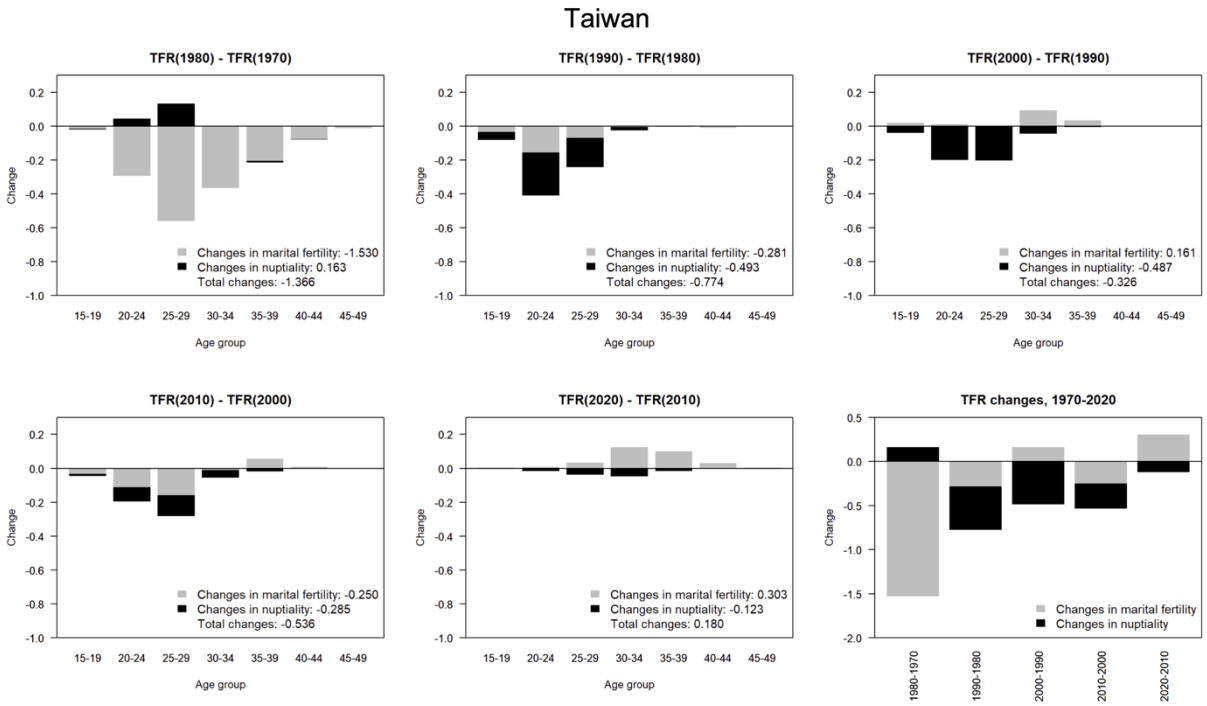


Figure 5. Decomposition of the change in the TFR in Taiwan, 1970–2020.

Source: Same as in the previous figure.

Similarly, the decline in Singapore's TFR was initially driven by changes in marital fertility, with nuptiality later driving more of the change (Figure 6). The TFR decreased by -1.237 children (1970–1980), -0.008 children (1980–1990), -0.251 children (1990–2000), -0.400 children (2000–2010), and -0.167 children (2010–2020). The decline in marital fertility and the proportion of married women played important roles in the decline in the TFR during

different periods. More specifically, marital fertility was the greatest contributor to the decline in the TFR from 1970 to 1980, yet the decline in the TFR after 1980 was mainly due to the decline in the proportion of married women, which contributed to a large negative effect on overall fertility.

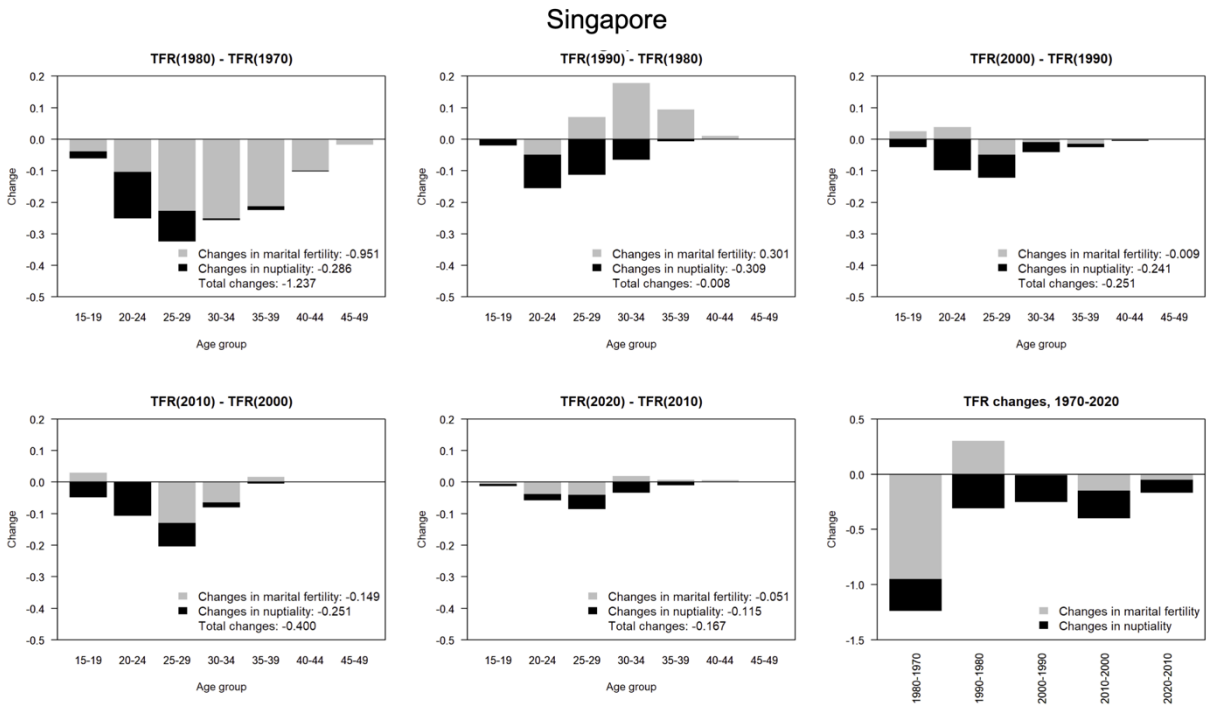


Figure 6. Decomposition of the change in the TFR in Singapore, 1970–2020.

Source: Same as in the previous figure.

Our findings highlight that declines in fertility are influenced by both marital fertility and the proportion of married women. Of these factors, we find that the latter has played a critical role in explaining the changes in the TFR throughout the periods, while it has become increasingly significant for the other three societies in the past two or three decades. Additionally, results show that changes in nuptiality are consistently negative. The major age-specific nuptiality contributions have gradually shifted toward higher age groups over the

past decades, suggesting that marriage is increasingly being delayed and forgone in these societies.

Discussion

This study examined the contributions of changes in nuptiality and marital fertility to the decline in the TFR in East Asian societies between 1970 and 2020. To empirically quantify these contributions, we conduct a decomposition analysis using data from the UNPD Fertility and Marriage Datasets in Japan, South Korea, Taiwan, and Singapore (all societies characterized by the lowest-low fertility at present). Through a comparative lens, we illustrate how fertility declines in these contexts are largely attributable to the recent decline in nuptiality. Here, our results highlight the importance of considering an alternative, more holistic, structural approach to improve the utility of existing family policies.

Our findings indicate that Japan was the first of these societies to undergo a transition in fertility, falling from approximately 4 children per woman in 1950 to below the replacement level by 1974, with rates continuing to trend slightly downward for the remainder of the period (Okazaki 1967). During the earlier estimation periods (1970–1980), South Korea, Taiwan, and Singapore experienced a fertility transition, with TFRs decreasing from a high of approximately three to four children per woman to below the replacement level. Most of this early decline appears to be attributable to reductions in marital fertility. On the basis of these findings, the rapid decline in the TFR during the fertility transition was due primarily to changes in marital fertility. Therefore, it is understandable that policymakers in these societies have predominantly aimed to increase marital fertility. Following Japan's lead, the other East Asian societies have adopted a broad range of policy measures focused on boosting postmarriage fertility rates, including financial support for families and initiatives

designed to reconcile work and family life in hopes of increasing within-marriage childbearing.

Despite these policies, fertility rates have not substantially increased; regarding potential reasons for their ineffectiveness, our results reveal that the primary challenge of increasing fertility within East Asian societies in recent decades has been declining marriage rates. Specifically, we find that changes in nuptiality have contributed negatively to changes in the TFR in all four societies over the past few decades (1990–2020). Drawing on a comparative approach, our results demonstrate that changes in nuptiality play an important role in understanding recent changes in the TFR from low to lowest-low rates across all four East Asian societies. The norm of universal marriage appears to be gradually diminishing, with a trend toward delayed marriage or nonmarriage throughout the lifespan. These societies have undergone significant economic, social, and attitudinal changes since the 1970s—a period described as one of "compressed modernity" (Chang 1999). Based on these findings, we propose that the rapid changes in these past decades may have promoted what Lesthaeghe (2010) identified as the postmodern attitudes associated with the SDT (e.g., individuality, self-actualization) and the traditional Confucian family values that Cheng (2020) noted as influencing family formation trends (also see Choi and Qian 2023 for a similar argument to the case of South Korea). The commonality in these societies suggests that economic costs are not the only deterrent against marriage and childbearing for women: Married women in highly patriarchal societies are often expected to assume caregiving roles despite government efforts to encourage more involvement from men. When considering economic and cultural factors, Jones et al. (2012) reported that the high cost of living, the demanding work culture, and stagnant economy and wages contribute to fewer people choosing to date or marry. On the basis of this evidence, fewer marriages lead to lower overall fertility.

To address the low marriage rate and delayed marriage, some governments have attempted to promote marriage among single individuals. In this regard, the Singaporean government established the Social Development Unit in 1984; it later evolved into the Social Development Network and aimed to encourage social interaction among single graduates and nongraduates as a means of promoting marriage. Housing support policies in South Korea and Singapore have also been introduced to help couples purchase homes earlier than they would otherwise. Despite these policy measures, which may have prevented an even greater proportion of single individuals and lower fertility rates, significant structural barriers and cultural constraints remain to be addressed.

In addressing low fertility, drawing on lessons from low-fertility European societies that have experienced improvement in fertility rates and focusing on broader issues (e.g., gender equity and improving family and children's well-being) appears to be beneficial (Sobotka et al. 2019). In contrast to the standard of 40–44 work hours per week in many countries, the French family support system includes a standard 35-hour work week (Letablier 2003). Notably, up to 12 hours of overtime work is common in low-fertility Asian societies (Kim and Min 2023; Singapore Ministry of Manpower 2023). Adjusting working hours may enhance work–family balance by supporting full-time labor force participation among men and women alike, encouraging them to spend time with their families and potential partners. Other previously implemented policies that could be implemented in East Asia address obstacles and barriers faced by specific population groups, such as unmarried couples, single parents, and same-sex couples (Sobotka et al. 2019). Most East Asian societies are less accepting of legalizing same-sex marriage, parenting, and adoption, making it far more challenging for nonheteronormative citizens to become parents. Crucially, the stigmatization of less conventional family forms may adversely impact these groups' reproductive rights as well as any of their possible contributions to fertility. Modern family

policies should thus better reflect the diversity of family forms and support individuals' reproductive decisions.

In addition to its implications for policy, this study contributes to the advancement of decomposition analysis in fertility research on the basis of foundational methods (Cho and Retherford 1973; Retherford and Ogawa 1978; Jiang et al. 2019; Nishikido et al. 2022). We discussed two methods for calculating the ASFR, with each leading to different but related approaches for decomposing changes in the TFR. The first method, used by Cho and Retherford (1973), Retherford and Ogawa (1978), and Nishikido et al. (2022), comes from a weighted mean: ASFR = ASMFR * MP + ASNMFR * NMP, with MP and NMP as weights (see Appendix A2). The second method, employed in our study and by Jiang et al. (2019), calculates the ASFR using the marital fertility ratio multiplied by the MP (details in the Methods section). Both methods are valid yet require careful interpretation when the results are analyzed. Nishikido et al. (2022, p. 9) explained that the rate effect summarizes the impact of age- and partnership-specific fertility rates on TFR differentials, whereas the composition effect reflects the influence of age-specific partnership composition. Although mathematically precise, these interpretations combine the distinctions between marital and nonmarital fertility rates and composition effects, making it more complex to untangle them. Typically, policies focus on the effects of marital fertility and nuptiality rather than combined effects, leading to potential discrepancies between policy intent and measurement outcomes. In contexts with negligible nonmarital births, the rate effect is driven primarily by the marital fertility rate, and the composition effect is influenced mainly by marital age composition; however, to our knowledge, this is the first study to discuss these details in depth.

Ultimately, we conclude that a multipronged approach to population policies may be pivotal in addressing the contemporary demographic reality faced by many low-fertility

Asian societies. While current policies assist citizens who seek to start and grow their families, more can be done to improve the inclusivity of these policies to embrace more diverse families. Reorienting public expenditure, welfare, health, and social care systems is thus necessary to address population aging. To this end, policies should include investments in lifelong learning, gerontechnology, and active aging and focus on closing the digital divide, reducing inequalities, increasing community engagement, and supporting and training carers, potentially offsetting some challenges of aging and population decline (Gietel-Basten 2022). In tandem with existing policies, more inclusive measures and aging-related preparations may aid in addressing imminent demographic challenges.

References

Association of Women for Action and Research. 2021. “Reimagining Equality: End Discrimination Against Single Parents.” Accessed June 27, 2024. https://www.aware.org.sg/wp-content/uploads/AWARE-Reimagining-Equality-2021-Community-Policy-Wishlist-Single-Parents.pdf

Atoh, M., V. Kandiah, and S. Ivanov. 2004. “The Second Demographic Transition in Asia? Comparative Analysis of the Low Fertility Situation in East and South-East Asian Countries.” *The Japanese Journal of Population* 2 (1): 42–75.

Bergsvik, J., A. Fauske, and R. K. Hart. 2021. “Can Policies Stall the Fertility Fall? A Systematic Review of the (Quasi-) Experimental Literature.” *Population and Development Review* 47 (4): 913–964.

Botev, N. 2015. “Could Pronatalist Policies Discourage Childbearing?” *Population and Development Review* 41 (2): 301–314.

Boydell, V., R. Mori, S. Shahrook, and S. Gietel-Basten. 2023. “Low Fertility and Fertility Policies in the Asia-Pacific Region.” *Global Health & Medicine* 5 (5): 271–277.

Chang, K. -S. 1999. “Compressed Modernity and Its Discontents: South Korean Society in Transition." *Economy and Society* 28 (1): 30–55.

Chen, M., S. Gietel-Basten, and P. S. F. Yip. 2020. “Targeting and Mistargeting of Family Policies in High-Income Pacific Asian Societies: A Review of Financial Incentives.” *Population Research and Policy Review* 39 (3): 389–413.

Chen, M., P. S. F. Yip, and M. T. Yap. 2018. “Identifying the Most Influential Groups in Determining Singapore’s Fertility.” *Journal of Social Policy* 47 (1): 139–160.

Cheng, Y. -H. Alice. 2020. “Ultra-Low Fertility in East Asia: Confucianism and Its Discontents." *Vienna Yearbook of Population Research* 18: 83–120.

Cho, L.-J., and R. D. Retherford. 1973. “Comparative Analysis of Recent Fertility Trends in East Asia.” International Population Conference, Liege, Belgium.

Choi, K. H., and Qian, Y. 2023. The rise of the childless single in South Korea. *Journal of Family Theory & Review*, 15 (3), 526–541.

Esping-Andersen, G., and F. C. Billari. 2015. “Re-Theorizing Family Demographics.” *Population and Development Review* 41 (1): 1–31.

Frejka, T., G. W. Jones, and J. -P. Sardon. 2010. “East Asian Childbearing Patterns and Policy Developments.” *Population and Development Review* 36 (3): 579–606.

Fukuda, S. 2020. “Marriage Will (Continue To) Be the Key to the Future of Fertility in Japan and East Asia.” *Vienna Yearbook of Population Research* 18: 71–80.

Gauthier, A. H. 2007. “The Impact of Family Policies on Fertility in Industrialized Countries: A Review of the Literature.” *Population Research and Policy Review* 26 (3): 323–346.

Gauthier, A. H. 2016. “Governmental Support for Families and Obstacles to Fertility in East Asia and Other Industrialized Regions.” In *Low Fertility, Institutions, and Their Policies: Variations Across Industrialized Countries*, edited by R. R. Rindfuss and M. K. Choe, 283–303. Cham: Springer International Publishing.

Gietel-Basten, S. 2022. “Demographic and Social Anxieties: The Second Demographic Transition in Asia.” *China Population and Development Studies* 6 (3): 338–349.

Goldscheider, Frances, Eva Bernhardt, and Trude Lappegård. 2015. “The Gender Revolution: A Framework for Understanding Changing Family and Demographic Behavior.” *Population and Development Review* 41 (2): 207–239.

Haar, J. M., M. Russo, A. Suñe, and A. Ollier-Malaterre. 2014. “Outcomes of Work–Life Balance on Job Satisfaction, Life Satisfaction and Mental Health: A Study Across Seven Cultures.” *Journal of Vocational Behavior* 85 (3): 361–373.

Hertog, E. 2009. *Tough Choices: Bearing an Illegitimate Child in Japan*. Stanford, CA: Stanford University Press.

Hsiao, A. 2015. "Labor Regulations Amended to Cap 40-Hour Work Week." *Taipei Times*, May 16, 2015. https://www.taipeitimes.com/News/front/archives/2015/05/16/2003618394

INE (Instituto Nacional de Estadística). 2019. "2018 Spanish Fertility Survey (2018 SFS)." Accessed June 27, 2024. https://www.ine.es/dyngs/INEbase/en/operacion.htm?c=Estadistica_C&cid=1254736177006&menu=resultados&idp=1254735573002#!tabs-1254736195425.

Iwasawa, M. 2002. "On the Contribution of the Changes in First Marriage Behavior and Couples' Reproductive Behavior to the Recent Change in Total Fertility Rates of Japan." *Journal of Population Problems (Jinko Mondai Kenkyu)* 58 (3): 15–44.

Jiang, Q., S. Yang, S. Li, and M. W. Feldman. 2019. "The Decline in China's Fertility Level: A Decomposition Analysis." *Journal of Biosocial Science* 51 (6): 785–798.

Jones, G. W. 2007. "Delayed Marriage and Very Low Fertility in Pacific Asia." *Population and Development Review* 33 (3): 453–478.

Jones, G. W. 2019. "Ultra-Low Fertility in East Asia: Policy Responses and Challenges." *Asian Population Studies* 15 (2): 131–149.

Jones, G. W., and W. Hamid. 2015. "Singapore's Pro-natalist Policies: To What Extent Have They Worked?" In *Low and Lower Fertility*, edited by R. R. Rindfuss and M. K. Choe, 33–61. Cham: Springer International Publishing.

Jones, G. W., and W. -J. J. Yeung. 2014. "Marriage in Asia." *Journal of Family Issues* 35 (12): 1567–1583.

Jones, G. W., Y. Zhang, and P. P. Z. Chia. 2012. "Understanding High Levels of Singlehood in Singapore." *Journal of Comparative Family Studies* 43 (5): 731–750.

Kim, H., J. Kim, S. Lee, and E. Shin. 2023. “Korea Country Note.” In *International Review of Leave Policies and Research 2023*, edited by S. Blum, I. Dobrotić, G. Kaufman, A. Koslowski and P. Moss, 354–365. https://www.leavenetwork.org/fileadmin/user_upload/k_leavenetwork/annual_reviews/2023/Korea2023.pdf

Kim, I., and J. Min. 2023. “Working Hours and the Regulations in Korea.” *Annual Occupational and Environmental Medicine* 35: e18.

Kim, Y., and Å. Lundqvist. 2023. “Parental Leave Reforms in South Korea, 1995–2021: Policy Translation and Institutional Legacies.” *Social Politics: International Studies in Gender, State & Society* 30 (4): 1113–1136.

Kitagawa, E. M. 1955. “Components of a Difference Between Two Rates.” *Journal of the American Statistical Association* 50 (272): 1168–1194.

Koh, E. C. 2011. “The State of Marriage in Singapore.” In *Changing Marriage Patterns in Southeast Asia: Economic and Socio-Cultural Dimensions*, edited by G. W. Jones, T. H. Hull and M. Mohamad, 218–233. Abingdon, UK: Taylor & Francis Group.

Korean Ministry of Health and Welfare. 2024. “Individualized Care.” Ministry of Health and Welfare. Accessed June 27, 2024. https://www.mohw.go.kr/menu.es?mid=a20202000000

Laß, I., and M. Wooden. 2023. “Working from Home and Work–Family Conflict.” *Work, Employment and Society 37* (1): 176–195.

Lee, M. 2009. “Transition to Below Replacement Fertility and Policy Response in Taiwan.” *The Japanese Journal of Population* 7 (1): 71–86.

Lee, S., and H. Choi. 2015. “Lowest-Low Fertility and Policy Responses in South Korea.” In *Low and Lower Fertility: Variations across Developed Countries*, edited by R. R. Rindfuss and M. K. Choe, 107–123. Cham: Springer International Publishing.

Lee, M., and Y.-H. Lin. 2016. “Transition from Anti-natalist to Pro-natalist Policies in Taiwan.” In *Low Fertility, Institutions, and their Policies: Variations Across Industrialized Countries*, edited by R. R. Rindfuss and M. K. Choe, 259–281. Cham: Springer International Publishing.

Leridon, H., and R. Slama. 2008. “The Impact of a Decline in Fecundity and of Pregnancy Postponement on Final Number of Children and Demand for Assisted Reproduction Technology.” *Human Reproduction* 23 (6): 1312–1319.

Lesthaeghe, R. 2010. “The Unfolding Story of the Second Demographic Transition.” *Population and Development Review* 36 (2): 211–251.

Letablier, M. -T. 2003. “Fertility and Family Policies in France.” *Journal of Population and Social Security* Supplement to Volume 1: 245–261.

Lowenson, R., M. Masotya, and R. Mori. 2019. “Japan Case Study: Changing Policies on the Work-Life Balance in Response to Demographic Challenges.” Accessed June 27, 2024. https://www.tarsc.org/publications/documents/FCH%20Japan%20case%20study%202019.pdf.

Luci-Greulich, A., and O. Thévenon. 2013. “The Impact of Family Policies on Fertility Trends in Developed Countries.” *European Journal of Population* 29 (4): 387–416.

Made for Families. 2024. “Support measures.” National Population and Talent Division, Strategy Group, Prime Minister’s Office. Accessed June 27, 2024. https://www.madeforfamilies.gov.sg/support-measures/managing-work-and-family-life/family-friendly-workplaces.

Matsuda, S. 2015. “Contributions of Family Sociology to Measures for Preventing the Declining Birthrate.” *Japanese Sociological Review* 66 (2): 260–277. (In Japanese).

McDonald, P. 2002. “Sustaining Fertility through Public Policy: The Range of Options." *Population* 57 (3): 417–446.

McDonald, P. 2006. “Low Fertility and the State: The Efficacy of Policy.” *Population and Development Review* 32 (3): 485–510.

Miller, L. C., J. L. Christensen, W. C. Pedersen, A. Putcha-Bhagavatula, and P. R. Appleby. 2013. “Attachment Fertility Theory: Complex Systems of Mechanisms Simplify Sex, Mating, and Sexual Risks.” *Psychological Inquiry* 24 (3): 211–220.

Nishikido, M., Q. Cui, and A. Esteve. 2022. “Partnership Dynamics and the Fertility Gap Between Sweden and Spain.” *Genus* 78 (1): 26.

Okazaki, Y. 1967. “An Analysis of Decline of Birth Rate in Japan.” Institute of Population Problems, Ministry of Health and Welfare. Accessed June 27, 2024. https://www.ipss.go.jp/history/EnglishPamphletSeries/pdf/J000008753.pdf.

Preston, S. H., P. Heuveline, and M. Guillot. 2001. *Demography: Measuring and Modeling Population Processes*. Oxford, UK: Blackwell Publishers.

Raymo, J. M., H. Park, Y. Xie, and W. -J. J. Yeung. 2015. “Marriage and Family in East Asia: Continuity and Change.” *Annual Review of Sociology* 41 (1): 471–492.

Raymo, J. M., F. Uchikoshi, and S. Yoda. 2021. “Marriage Intentions, Desires, and Pathways to Later and Less Marriage in Japan.” *Demographic Research* 44: 67–98.

Retherford, R.D. and N. Ogawa. 1978. “Decomposition of the Change in the Total Fertility Rate in the Republic of Korea, 1966–1970.” *Social Biology* 25 (2): 115–127.

Singapore Ministry of Health. 2023. “Raising of Age Limit from 35 to 37 Years for Egg Donors and Elective Egg Freezing.” Ministry of Health. Accessed June 27, 2024. https://www.moh.gov.sg/news-highlights/details/raising-of-age-limit-from-35-to-37-years-for-egg-donors-and-elective-egg-freezing.

Singapore Ministry of Manpower. 2023. “Hours of Work, Overtime and Rest day.” Ministry of Manpower. Accessed June 27, 2024. https://www.mom.gov.sg/employment-practices/hours-of-work-overtime-and-rest-days.

Singapore Ministry of Manpower. 2024. “Tripartite Guidelines that Shape the Right Norms and Expectations Around Flexible Work Arrangements to Come into Effect on 1 Dec 2024.” Ministry of Manpower. Accessed June 27, 2024. https://www.mom.gov.sg/newsroom/press-releases/2024/0416-launch-of-tripartite-guidelines-on-fwa-requests-and-tripartite-workgroup-report

Sobotka, T., A. Matysiak, and Z. Brzozowska. 2019. *Policy Responses to Low Fertility: How Effective areTthey?* https://www.unfpa.org/sites/default/files/pub-pdf/Policy_responses_low_fertility_UNFPA_WP_Final_corrections_7Feb2020_CLEAN.pdf.

Song, S. -H. 2024. “Seoul Studies W100m Cash Incentive for Each Child Born.” *The Korea Herald*, April 23, 2024. https://www.koreaherald.com/view.php?ud=20240423050513

Taiwanese Department of Information Services 2023. “National Child Care Policy for Ages 0–6.” Department of Information Services, Executive Yuan. Accessed June 27, 2024. https://english.ey.gov.tw/News3/9E5540D592A5FECD/7b033800-d295-4a7a-8fba-dfbf617142d6

Taiwanese Ministry of Labor. 2022. “Maternity Benefits.” Bureau of Labor Insurance, Ministry of Labor. Accessed June 27, 2024. https://www.bli.gov.tw/en/0011970.html

Tan, J. 2023. “Perceptions Towards Pronatalist Policies in Singapore.” *Journal of Population Research* 40 (3): 14.

Thévenon, O., and A. H. Gauthier. 2011. “Family Policies in Developed Countries: A ‘Fertility-Booster’ With Side-Effects.” *Community, Work & Family* 14 (2): 197–216.

Thomson, J. 2023. “Government to Offer Extra NT$20,000 Per Taipei City-Born Child.” *Taiwan News*, March 2, 2023. https://www.taiwannews.com.tw/news/4825533

Tsutsui, J. 2023. *Declining Marriage and Low Fertility: Why It is Difficult to Have Children in This Country.* Tokyo: PHP Publishers. (in Japanese).

Tsuya, N. O. 2015. “Below-Replacement Fertility in Japan: Patterns, Factors, and Policy Implications.” In *Low and Lower Fertility: Variations Across Developed Countries*, edited by R. R. Rindfuss and M. K. Choe, 87–106. Cham: Springer International Publishing.

Tsuya, N. O., and K. O. Mason. 1995. “Changing Gender Roles and Below Replacement Fertility in Japan.” In *Gender and Family Change in Industrialized Countries*, edited by K. O. Mason and A. -M. Jensen, 139–167. Oxford, UK: Clarendon Press.

UNPD (United Nation Population Division). 2020. “Estimates and Projections of Women of Reproductive Age Who Are Married or in a Union: 2020 Revision.” Accessed June 27, 2024. https://www.un.org/development/desa/pd/file/9053

UNPD (United Nation Population Division). 2022. “Age-Specific Fertility Rate (ASFR) by Five-year Age Groups.” Accessed June 27, 2024. https://population.un.org/wpp/Download/Standard/Fertility/

Yokoyama, M., and Lee, M. J. 2024. “Tokyo’s Fertility Program Is Overwhelmed by How Many Women Want to Freeze Their Eggs.” *Time*, January 19, 2024. https://time.com/6564312/japan-tokyo-egg-freezing-women-demand-fertility-subsidy/

Yun, J., C. Y. Kim, S. H. Son, C. W. Bae, Y. S. Choi, and S. H. Chung. 2022. “Birth Rate Transition in the Republic of Korea: Trends and Prospects.” *Journal of Korean Medical Science* 37 (42): e304

Appendix A1

The 38 countries and territories included in Figure 1 are as follows:

Australia, Austria, Belgium, Canada, Chile, China, Croatia, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hong Kong, Hungary, Iceland, Ireland, Israel, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, Romania, the Russian Federation, Slovakia, Slovenia, Spain, Sweden, Switzerland, the United Kingdom, Ukraine, and the United States of America.

Appendix A2

The use of the Kitagawa decomposition technique (1955) to investigate the impact of marriage age composition on the total fertility rate was pursued by Cho and Retherford (1973) and recently revisited by Nishikido et al. (2022). The approach of Nishikido et al. (2022) can be reformulated as follows:

$$\Delta TFR(t) = \sum_{x=\alpha}^{\beta} [\Delta ASMFR(x,t)\overline{MP}(x,t) + \Delta ASNMFR(x,t)\overline{NMP}(x,t) + \overline{ASMFR}(x,t)\Delta MP(x,t) + \overline{ASNMFR}(x,t)\Delta NMP(x,t)] \quad \text{(A1)}$$

where $ASMFR(x,t)$ and $ASNMFR(x,t)$ represent the age-specific marital and nonmarital fertility rates, respectively. $MP(x,t)$ and $NMP(x,t)$ are the proportions of women in a marital union and those outside a marital union, respectively.

When nonmarital births are negligible, $ASNMFR(x,t) \approx 0$ and $\Delta ASNMFR(x,t) \approx 0$. Thus, we approximated:

$$ASMFR(x,t) = \frac{Births\ from\ married\ women\ in\ age\ group\ x}{Married\ women\ in\ age\ group\ x}$$

$$\approx \frac{Births\ from\ women\ in\ age\ group\ x}{Married\ women\ in\ age\ agroup\ x} = MFR(x,t)$$

Then, $ASMFR(x,t) \approx MFR(x,t)$, and $\Delta ASNMFR(x,t) \approx \Delta MFR(x,t)$. Consequently, Eq. (A1) simplifies to $\Delta TFR(t) = \sum_{x=\alpha}^{\beta}[\Delta MFR(x,t)\overline{MP}(x,t) + \overline{MFR}(x,t)\Delta MP(x,t)]$, as derived in Eq. (3).

To validate our approach—which requires fewer data than that of Nishikido et al. (2022)—we reconstructed the first-order marital and nonmarital fertility rates, as well as the proportions of women inside and outside marital unions, using the 2018 Spanish Fertility

Data (INE 2019). These calculations utilized two distinct yet interconnected decomposition approaches. As Figure A1 illustrates, the marital fertility ratio effect and marital age composition effect from our approach exhibited similar age schedules to the rate (especially the marital fertility rate effect) and composition effects (particularly the marital composition effect) derived from Nishikido et al. (2022). Additionally, at younger ages, for which births outside marital unions are relatively more common than at older ages, notable disparities emerged between the approaches. However, the magnitude of these differences was not substantial.

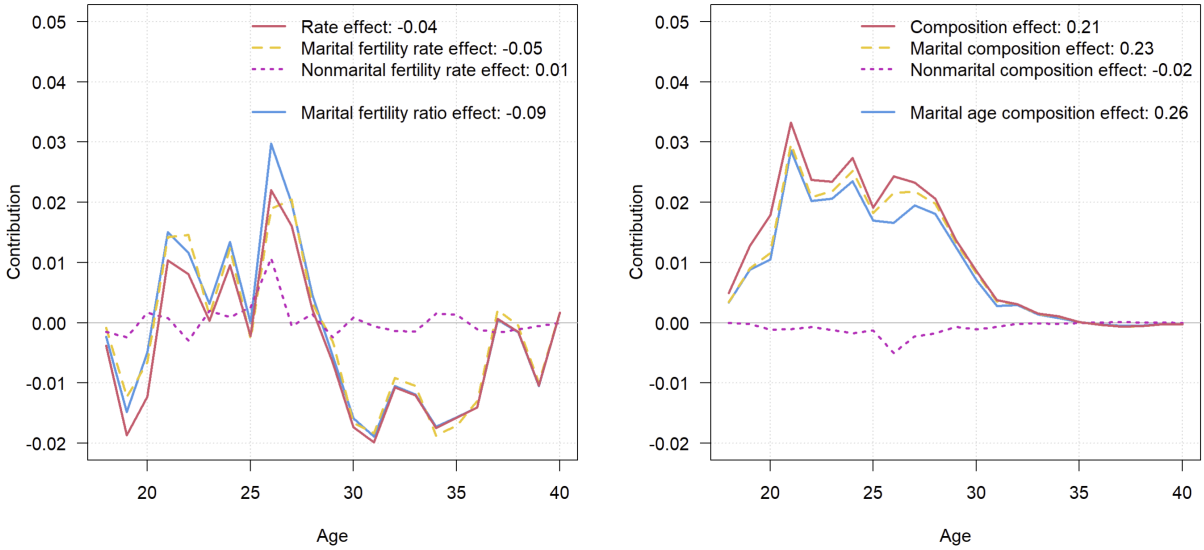


Figure A1. Contribution of the partnership-specific first-birth rate and composition to the first-birth differential by age group (1965–1969) using the two decomposition approaches.

Notes: $Rate\ effect\ =\ marital\ fertility\ rate\ effect\ +\ nonmarital\ fertility\ effect$ and $Composition\ effect\ =\ marital\ composition\ effect\ +\ nonmarital\ composition\ effect$. The rate and composition effects were calculated using the method of Nishikido et al. (2022). The effects of the marital fertility ratio and marital composition were calculated using the approach outlined in this paper.

Source: Calculated by the authors using the 2018 Spanish Fertility Survey (INE 2019).