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Research Article

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Albert Esteve

Ridhi Kashyap

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Albert Esteve[1]

Ridhi Kashyap[2]

Joan Garcia Roman[3]

Yen-hsin Alice Cheng[4]

Setsuya Fukuda

Wanli Nie[5]

Hyun-ok Lee[6]

Abstract

BACKGROUND
Marriage is a central institution for social reproduction in East Asia. Until the 1970s and 1980s, marriage across much of East Asia was early and universal. In recent decades, though, this pattern has begun shifting to one of later and less marriage.

OBJECTIVE
We explore the long-term implications for universal marriage patterns of future demographic change in marriage markets in the context of prevailing marriage norms by projecting trends in late singlehood (ages 45 to 49) in four East Asian societies (China, South Korea, Taiwan, and Japan).

METHODS
We estimate forces of attraction to characterize marriage matching norms by age and education across these different societies by drawing on large-scale population data. Next, we develop counterfactual scenarios in which we apply contemporary norms to future population structures in these societies, as well as scenarios based on more gender-

[1] Centre d'Estudis Demogràfics (CED), Spain. Email: aesteve@ced.uab.es.
[2] University of Oxford, UK.
[3] Centre d'Estudis Demogràfics (CED), Spain.
[4] Academia Sinica, Taiwan.
[5] Université catholique de Louvain, Belgium.
[6] Yonsei University, Seoul, South Korea.

symmetrical matching norms to examine how populations who have never been married by ages 45 to 49 would evolve.

RESULTS

Our projections indicate that in the coming decades there will be a substantial increase in late singlehood across all these societies relative to their 2010 levels. These increases in singlehood are driven by forthcoming demographic changes in the marriage market that intensify the effects of prevailing matching norms. These increases are notable in Taiwan and South Korea, where recent data indicate generalized weak propensities to marry in current norms. While a shift toward greater gender symmetry in matching norms would reverse gender gaps between men and women in nonmarriage, it would have little impact on the overall projected proportions of singles by ages 45 to 49.

CONCLUSIONS

If prevailing norms in each of these contexts continue, the universality of marriage will be substantially eroded in the coming decades, even if norms become more gender symmetrical. The extent to which nonmarital cohabitation and childbearing emerge in the future will determine how marriage will influence fertility trends, population growth, aging, and social reproduction.

CONTRIBUTION

For the first time, we project the implications for universal marriage of recent shifts in marriage norms and demographic change in East Asian countries.

1. Introduction

Marriage is a central institution for social reproduction in East Asia, and in most of Asia as well. It has profound implications for fertility trends and population growth, as it continues to be the sole context in which childbearing takes place[7] and also shapes access to family support at older ages (Raymo et al. 2015). Until the 1970s and 1980s, marriage across much of East Asia was nearly universal, with fewer than 5% of women and men who remained never married by their late forties (Jones 2010). Marriage also occurred fairly early and within a concentrated range of ages, especially for women, who generally married in their early twenties with husbands who were older than they were. Since the 1970s and the 1980s, this early and universal marriage regime began shifting to one of later and less marriage, particularly in Japan, South Korea, and Taiwan. More recently, signs of similar changes have begun to emerge in postreform urban China (Lesthaeghe

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[7] According to OECD, the share of births outside of marriage in 2016 was 1.9% in South Korea and 2.3% in Japan.

2010; Yu and Xie 2015; Jones 2010). The long-term implications of these changes for universal marriage have yet to be examined for a region where more than one fifth of the world population resides and, unlike in Western countries, the postponement of marriage has been accompanied neither by dramatic increases in unmarried cohabitation (Raymo et al. 2015) nor by significant changes in gender norms (Kan, Hertog, and Kolpashnikova 2019).

The aim of this paper is twofold: First, we characterize prevailing marriage matching norms by age and educational attainment across four East Asian countries using large-scale population data. Second, we explore potential future cohort trends in singlehood by ages 45 to 49 (also referred to as *late singlehood*) in these societies in the context of prevailing matching norms and shifting demographic composition of their marriage markets. We focus on the percentage of the single population or those who have never been married at ages 45 to 49. These ages correspond to the end of the reproduction period for women (and many men as well), and were also chosen because of the relatively low occurrence of first marriages or partnerships after them.

We focus our analyses and projections on China, South Korea, Taiwan, and Japan, four East Asian countries that have long-standing cultural, political, and historical ties. They also share a common past of early, gender-asymmetric, and universal marriage while facing similar social (e.g., rapid educational expansion, in particular among women) and demographic shifts (e.g., fertility declines and, with the exception of Japan, skewed sex ratios at birth) in their respective marriage markets. Drawing on best-available data from censuses, vital registration, and surveys, we start by describing recent first-marriage patterns in each of these four populations in terms of the prevalence of marriage by age, sex, and educational attainment. We then characterize matching norms across these different populations by estimating a force of attraction parameter (Schoen 1988) that captures propensities to marry between men and women by age and educational attainment. The analysis is restricted to registered first marriages involving at least one native-born partner. Thus, we include cross-national marriages, which are particularly important in Taiwan and South Korea. Next, we evaluate the implications of forthcoming demographic change for late singlehood in each of these populations from 2010 to 2050. We draw on most recent population projections by sex, age, and educational attainment for China, South Korea, Japan (Lutz, Butz, and KC 2014), and Taiwan (Cheng and Loichinger 2017). We generate several sets of counterfactual projections of marriage for each population by applying contemporary matching norms to future population projections disaggregated first by age and sex and second by age, sex, and educational attainment. Finally, we generate a set of counterfactual scenarios to assess the implications of shifts in the gender distribution of matching norms. We compare in each country the observed scenario, which reflects traditional age and educational hypergamous norms (i.e., women are more likely to marry older men who

have higher levels of educational attainment), with two additional scenarios. The first one assumes perfect gender symmetry in matching norms, and the second one reverses the pattern from hypergamous to hypogamous (i.e., men are now more likely to marry older women who have higher levels of educational attainment). This latter trend is consistent with the global reversal of the gender gap in education and the end of hypergamy (Esteve, García-Román, and Permanyer 2012; Esteve et al. 2016; Raymo and Park 2020).

Throughout the text, we shall refer to the propensities to marry across sex, age, and educational groups as either matching norms or marriage norms. By shifts in demographic composition, we refer to three key trends that will affect the age, sex, and educational composition of the populations at risk of marriage ('marriage market') in the future. First, the cohorts that will enter the marriage markets in the coming decades will be progressively less numerous because prior fertility declines have reduced and continue to reduce the number of births in these societies (Myrskylä, Goldstein, and Cheng 2013). Second, with the exception of Japan, the East Asian countries under consideration have witnessed sex ratio at birth distortions since the 1980s and 1990s due to son preference and the practice of sex-selective abortion. These cohorts have, as a result, disproportionately more males than females than what would be the case under non-distorted conditions (Guilmoto 2009). Third, cohorts with substantially higher levels of education, particularly among women, will enter the marriage market. Although the societies examined here are at various levels of educational expansion, recent cohorts have either witnessed faster rates of improvement in postsecondary education for women relative to men in Japan, Taiwan, and South Korea or will do so in coming decades in China (Lutz, Butz, and KC 2014; Hannum et al. 2019).

2. Characterizing marriage regimes and future demographic change

2.1 Marriage characteristics by sex and educational attainment

Table 1 succinctly characterizes marriage regimes in China, South Korea, Taiwan, and Japan by showing the proportion of never-married men and women at the ages of 20–24 and 45–49 years old by educational attainment. The former age groups provide an indirect measure of the timing or age at marriage, whereas the latter group is an indicator of the quantum or universality of marriage. Across all societies, women marry younger than men and, for both men and women, the high-educated groups marry later than the low-educated ones. Chinese men and women marry the earliest, as indicated by the lower percentages of never-married women (67.5%) and men (82.4%) at ages 20–24 compared to those in South Korea, Taiwan, and Japan, which were above 90% for both men and women.

Table 1:   Description of marriage regimes in four East Asian societies

	China 2005		South Korea 2010		Taiwan 2010		Japan 2010	
	F	M	F	M	F	M	F	M
% Never married 20–24								
Total	67.5	82.4	94.0	98.5	94.4	98.1	90.2	94.3
Less primary	42.2	78.3	59.1	100.0	-	-	-	-
Primary	42.1	72.2	45.9	93.3	75.4	93.0	68.7	81.2
Secondary	68.5	82.5	94.8	98.8	95.4	98.6	82.2	90.5
Postsecondary	96.6	98.1	95.7	97.4	97.7	99.4	95.7	97.5
% Never married 45–49								
Total	0.4	3.1	3.3	8.1	9.9	12.0	11.7	21.0
Less primary	1.0	22.4	4.9	36.4	-	-	-	-
Primary	0.3	7.1	2.0	17.5	5.3	15.8	18.6	37.2
Secondary	0.4	1.7	2.8	8.1	9.2	11.3	10.3	23.1
University	1.4	0.9	5.4	4.3	17.5	8.8	12.3	16.8
Educational Mating (female perspective)								
Homogamous	67.8		79.3		62.2		63.4	
Hypergamous	21.9		10.4		19.1		15.2	
Hypogamous	10.3		10.3		18.8		21.4	

Sources: Population censuses from 2005 China, 2010 South Korea, 2010 Taiwan, and 2010 Japan.

Marriage in China was technically universal for people of the ages 45–49, except for Chinese men with primary or less education. At the other end, Japan shows the highest levels of late singlehood for the total population. Across all societies, women show lower percentages of those who have never been married than men. With the exception of Japan, postsecondary-educated women indicate the highest proportions who never married by age 45–49. Among men and across all societies, the highest proportions of singles are for the lowest educated and the lowest are for the postsecondary educated. Interestingly, in Japan both primary-educated women and men show the highest proportions never married.
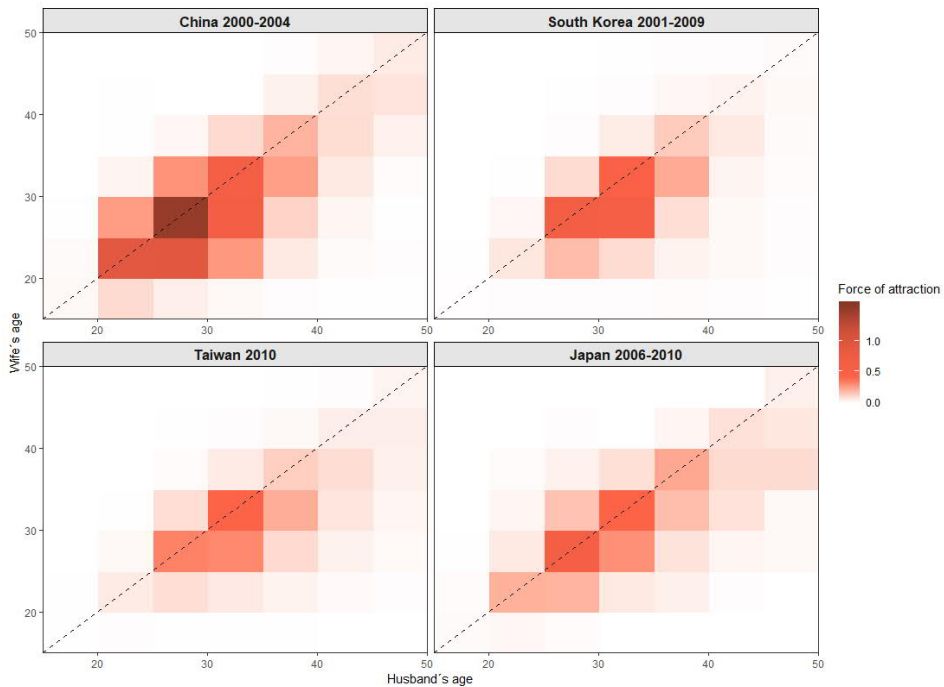
The marriage patterns described in Table 1 are the product of both marriage matching norms and the demographic composition of marriage markets. In the next section, we describe a measure to isolate matching norms by age, sex, and educational attainment from demographic composition.

2.2 Forces of attraction

The harmonic mean marriage function proposed by Schoen (1988) provides a simple, elegant function to link the numbers of marriages occurring to the population at risk of experiencing marriage and allows for the estimation of a parameter that captures the composition-independent propensity or likelihood of marriage (see Appendix 1 for details of data and method). This parameter captures the desirability of marriage and matching norms between men and women of specific age (i, j) and educational characteristics *(k, l)*. If men (M_{ik}) and women (W_{jl}) with given characteristics randomly encounter each other at equal rates, then higher propensities to marry (α_{ijkl}) indicate that higher rates of such encounters are likely to result in marriage (Qian and Preston 1993: 483).

Figure 1 presents forces of attraction parameters (α_{ij}) by age for men and women. Each cell denotes the matching propensity for men (husbands) of a particular age group i (indicated on the x-axis) with women (wives) of a particular age group j (indicated on the y-axis) within a country square. The cells that lie on the diagonal indicate age-homogamous unions, those below the diagonal indicate age hypergamy (husband is older than wife), and those above the diagonal indicate age hypogamy (wife is older than husband). China shows significantly higher forces of attraction, or in other words, stronger matching norms across all ages compared with the other three countries, as indicated by the darker colors across the grid of cells for these countries. As denoted by the darker cells at earlier ages and, in particular, below the diagonal, China shows earlier matching norms and stronger hypergamous norms than Japan, South Korea, and Taiwan.

Figure 1: **Forces of attraction (α_{ij}) between never-married men and women in the marriage market by age groups in four East Asian societies**

Figure 2 shows forces of attraction by age and education (α_{ijkl}) for China, South Korea, Taiwan, and Japan. A set of 4x4 squares are depicted for each population, in which each square shows all α_{ijkl} values corresponding to a combination of husband and wife's educational categories at different ages (represented by cells within the larger squares). In all cases, the figure shows that norms for educational homogamy are strongest, and especially so in the group when both partners have postsecondary education (topmost right square).

Figure 2: **Forces of attraction (α_{ijkl}) between never-married men and women by age groups and educational attainment in four East Asian societies**
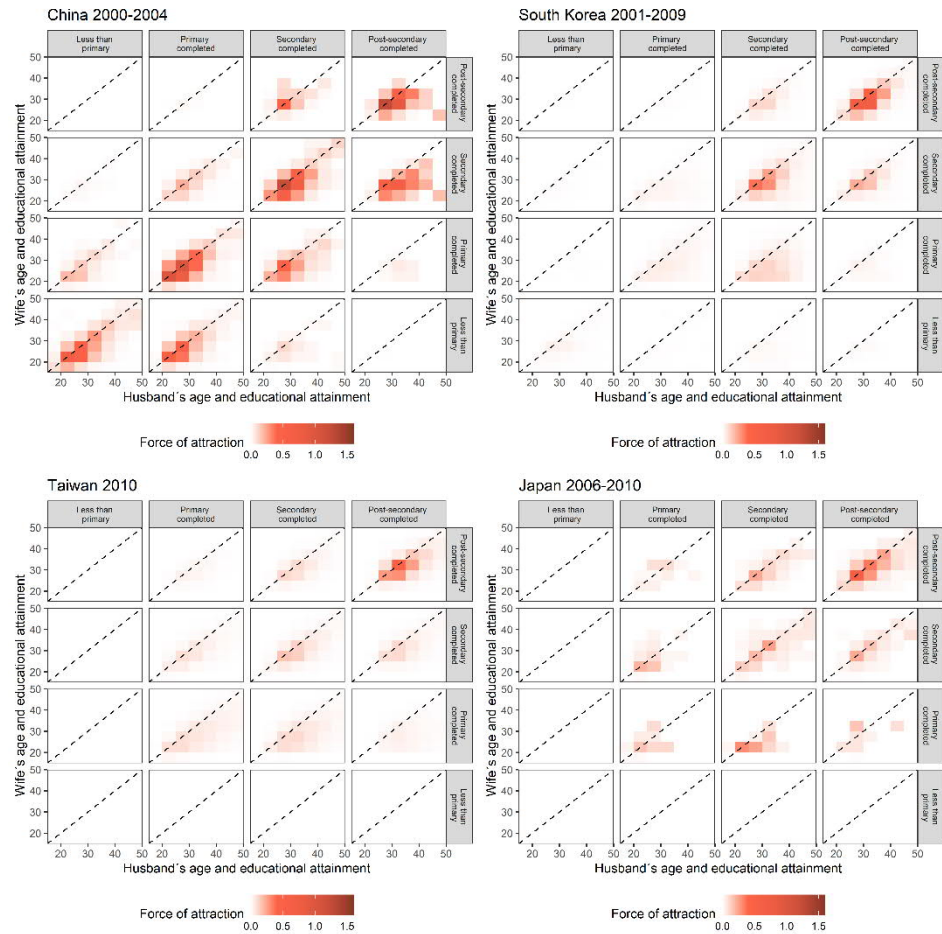
Source: Own elaboration based on China: 2000 census and 2005 1% population inter-census survey; South Korea: 2001–2009 vital statistics, 2001 and 2010 population census; Taiwan: 2010 vital statistics and 2010 population census; Japan: 2010 National Fertility Survey.

Table 2 summarizes key indicators linked to the strength of matching norms and propensities of matching by education for each of the societies based on the α_{ijkl} values. The sum of α_{ijkl} captures how strong matching norms are across all age–education combinations – higher values correspond to more universal marriage regimes. Table 2

also notes the extent to which homogamous, hypergamous, and hypogamous propensities by education account for all propensities, and how much matching propensities among the postsecondary-educated group account for all observed matching propensities.

Table 2:   Key indicators linked to the strength of matching norms across educational groups in four East Asian societies

	China 2000–2004	South Korea 2001–2009	Taiwan 2010	Japan 2000–2010
Sum of αijkl	30.7	9.1	7.4	9.6
All educational levels				
% homogamous	0.60	0.61	0.54	0.51
% hypogamous	0.11	0.11	0.18	0.23
% hypergamous	0.30	0.27	0.27	0.26
Tertiary education only				
% homogamous	0.14	0.33	0.29	0.29
% hypogamous	0.04	0.07	0.11	0.15
% hypergamous	0.12	0.13	0.14	0.16
ratio hyper / hypo	2.99	1.87	1.34	1.05

Source: Own elaboration based on China: 2000 census and 2005 1% population inter-census sample survey; South Korea: 2001–2009 vital statistics, 2001 and 2010 population census; Japan: 2010 National Fertility Survey and 2010 population census.

China in Figure 2 shows significantly darker intensities across different ages and educational categories as compared with the other East Asian societies depicted in Figure 2, and also shows higher values for the sum of α_{ijkl} in Table 2. These matching propensities indicate that marriage norms are universal and earlier. Propensities for educational hypergamy are stronger in China than the other three East Asian societies, as well. Although homogamous propensities by education are the highest, when unions are heterogamous by education, particularly in the postsecondary-educated groups, the ratio of hypergamous propensities relative to hypogamous propensities are higher than in the other societies.

In comparison with China, Japan, South Korea, and Taiwan have significantly lower total levels of forces of attraction. Particularly in Taiwan, but also in South Korea, the forces of attraction are faint across different groups, indicating weaker propensities to marry across the educational spectrum, even in comparison to Japan and South Korea. In Japan, hypergamous matching propensities are balanced by hypogamous matching propensities, and the ratio among hypergamous to hypogamous propensities among the postsecondary-educated group is 1.05. In contrast, in South Korea hypergamous norms appear to be stronger than those in Japan, and South Korea also exhibits a stronger pattern of educational homogamy among the postsecondary educated. Although at different levels, overall patterns of educational assortative mating still reflect traditional

hypergamous norms, indicating that men are more likely to marry down in the educational hierarchy than women.

The figures for South Korea and Taiwan suggest a marriage regime that is in a state of flux. These matching propensities depict a cross-sectional picture comprising the matching behaviors of different cohorts. The cohorts that are now in their late thirties and forties show weak matching propensities across the educational spectrum because they belong to cohorts that married at younger ages in their early or late twenties. In contrast, contemporary matching propensities at younger ages for Taiwan and South Korea are weak, but prevailing matching norms set no precedent for postponed marriage that is recuperated at later ages of the late thirties or forties. In comparison, matching propensities in Japan suggest a marriage regime with norms that allow for heterogamous unions by education, as well as more flexible age-matching norms that are also indicated by the darker cells within each square at later ages.

2.3 Demographic change and its implications for marriage

Population projections by age and educational attainment are used in our projection exercise. For China, Japan, and South Korea, we use the projections published by the Wittgenstein Centre (Lutz, Butz, and KC 2014), in which information on educational attainment is incorporated within the medium growth scenarios of United Nations population projections until 2050 (United Nations 2011). We use the projections published by Cheng and Loichinger (2017) for Taiwan. Key demographic trends in these four populations are going to impact on the composition of marriage markets in coming decades. Since those who will marry in the coming years until 2050 are already born, we expect these population projections to be reasonably accurate in capturing the size and composition of these societies for the period of interest. In Appendix 2, we show population pyramids for these societies in 2010 (observed) and 2050 (projected).

The first of these trends is that of declining birth cohort size as a result of falling or already low fertility levels. The four East Asian societies analyzed here already have fertility levels that are well below replacement. Successive birth cohort sizes in all countries are consequently smaller than older ones, which is likely to disfavor men if age norms are structured toward older men marrying younger women who come from smaller cohorts. This pattern of age hypergamy is still quite strong in China.

The second demographic trend that will impact on the composition of marriage markets for several of these populations is sex ratio at birth (SRB) distortions. First in South Korea in the 1980s, Taiwan after the mid-1980s, followed by China in the 1990s, excessively masculine birth cohorts were born as a result of the practice of sex-selective abortion arising from strong son preference in these societies (Guilmoto 2009; Sharygin,

Ebenstein, and Das Gupta 2013; Kashyap and Villavicencio 2016; Lee, Lindy, and Florio 2016). SRBs in South Korea began to show a turnaround toward normalization by the early 1990s, and similar trends have ensued in Taiwan since the 2010s. In China, although SRBs have started to level off since the mid- to late-2000s, levels remain distorted. In contrast, Japan did not experience any distortions in its SRBs.

Third, the expansion in female education, particularly in postsecondary education, that has occurred or is occurring in these societies is likely to impact on the future composition of marriage markets (Raymo and Iwasawa 2005). Figure 3 shows observed (1970–2010) and projected (2020–2050) population trends on a double axis: the proportion of the 25–34 population with postsecondary education (horizontal axis) and the female advantage in education (vertical axis). This latter indicator captures the relative likelihood of men and women holding a postsecondary degree. A value of 0.5 represents an equal likelihood of men and women holding a postsecondary degree, whereas a value of greater than 0.5 indicates a higher likelihood for women having postsecondary education relative to men (Esteve, García-Román, and Permanyer 2012; Esteve et al. 2016). This figure highlights how, as levels of postsecondary education have expanded, women have made faster improvements in postsecondary completion than men, thereby changing the availability of educated women relative to educated men in the marriage market. However, the timing of female educational expansion varies across these societies, with Japan showing the most significant increases in the 1980s. In contrast, in South Korea and Taiwan, the educational composition by sex is roughly over a decade behind Japan. The share of postsecondary educated women increased significantly in the 2000-2010 period in Taiwan. By 2010, women outnumbered men in postsecondary education in Japan, Taiwan, and South Korea. In China, men still outnumber women in postsecondary education, but due to faster rates of improvement for women relative to men, women are expected to be at par with men in 2050.

Figure 3: **Percentage of postsecondary completed (25–34) and female educational advantage, 1970–2050**
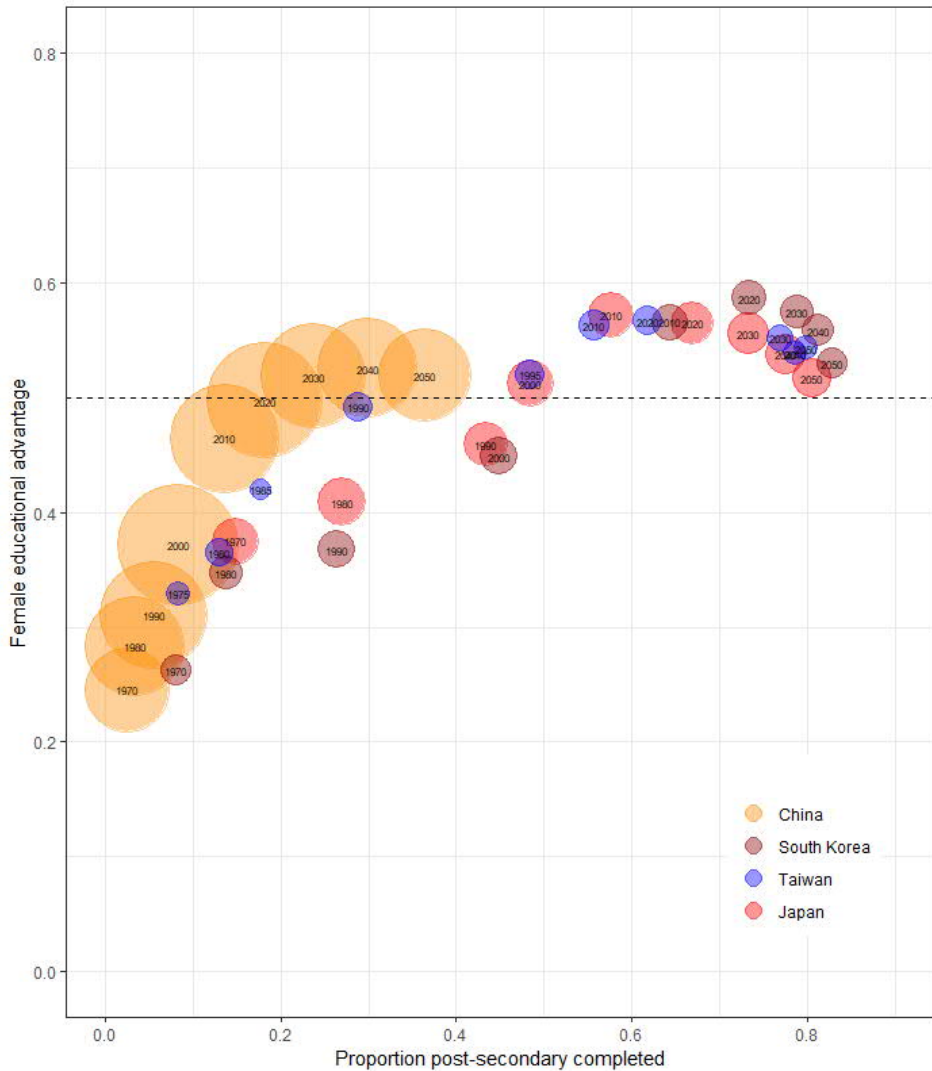
3. Projecting trends in late singlehood until 2050

How would late singlehood rates look in the face of forthcoming demographic change? In order to assess the implications of contemporary matching norms for future marriage patterns, we apply a projection method developed and described in detail in Kashyap, Esteve, and García-Román (2015). Briefly, we apply forces of attraction by age only and by age and education, computed for the most recent period for each country to population projections by age, and by age and education respectively. The forces of attraction can be applied to the age-specific or age- and education-specific population at risk of marriage to generate numbers of marriages occurring to men and women of a specific set of characteristics. These marriages can be related to an age-specific population at risk in a given period through an iterative, longitudinal cohort decrement process. The model assumes that at age 15 all men and women are never married and readjusts the populations at risk in successive periods by removing those that are married in each projection period through the decrement process (see Appendix 1).

3.1 Scenarios with constant forces of attraction by sex and educational attainment

In the first scenario, we apply contemporary forces of attraction by age only to population projections disaggregated by age and sex for each society. This projection scenario captures the effect of changing population structure by age and sex brought about by demographic changes that affect the age structure of the population, namely fertility decline and sex ratio imbalances, on marriage prevalence. In a second scenario, we apply prevailing forces of attraction by age and education to population projections disaggregated by age, sex, and educational attainment. This scenario also captures the effect of the shifting educational composition of the marriage market by sex. Figure 4 shows estimated proportions under both of these scenarios.

Figure 4:   **Estimated proportions of never-married people by age 45–49 from 2010 to 2050 by applying constant contemporary forces of attraction by age-only, α_{ij} (solid line), and by age and education, α_{ijkl} (dashed line), to population projections in four East Asian societies**
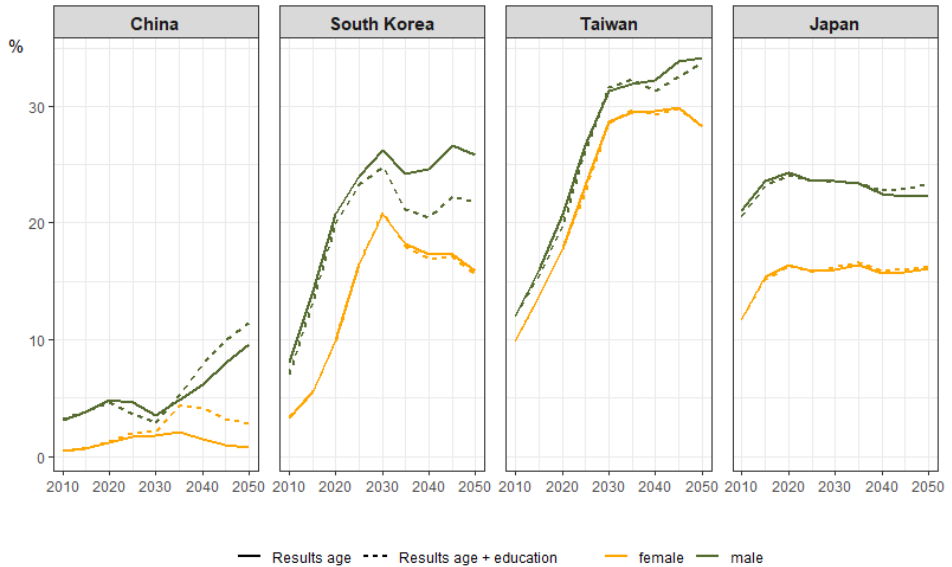
Source: Own elaborations.

In China, the age-only projections (denoted by the solid, green line) show increasing late singlehood among men, with the proportion never married going from under 5 to 10% between 2010 and 2050, which indicates the adverse impact of SRB distortions combined with declining birth cohort size due to fertility decline. The same period sees increasing marriage prevalence for women in China (yellow, solid line), as there are fewer women relative to men in the marriage market.

In the age-only projections, Japanese men and women show increases in singlehood initially, which then level off by 2015, when marriage patterns stabilize for women and show slight decreases in singlehood for men. In contrast, the initial rises in singlehood for South Korean and Taiwanese men are remarkable. If contemporary matching norms by age continue, the interaction between norms and the changing demographic composition of their marriage markets implies that these societies will experience levels of nonmarriage exceeding that of Japan in the decades after 2030. After 2030, South Korean men show an increase in singlehood, whereas women show a recuperation of

marriage prevalence. The divergence between male and female marriage prevalence in South Korea after 2030 reflects the effects of SRB distortions. Cohorts of 45–49 year olds in South Korea in 2030 are those that were born in 1980–1985, when SRBs became distorted in South Korea. A similar pattern, while less pronounced, is also suggested in the Taiwanese age–sex projections. The divergence is less pronounced between male and female marriage patterns in Taiwan, however, which reflects less distortion in Taiwanese SRBs compared with those in South Korea. Nevertheless, the rise in the share of those never married appears to be the starkest for men and women in Taiwan, reaching levels around and above 30% in 2040–2050.

The effect of changing educational composition of the marriage market for future marriage prevalence for the four societies is indicated by the dashed line in Figure 4. For China, proportions of never married are quite different under each of the two scenarios. This indicates that current matching norms by age and education are not well adapted to the patterns of gendered change in education that are anticipated in the marriage market. For China, singlehood is higher in the age-education scenario for both men and women after 2030 than in the age-only scenario. Women show recuperation of marriage after an initial increase in the mid-2020s, while men show steadily increasing singlehood after 2030. The increasing singlehood in the age-education scenario is driven by worsening prospects for the least-educated men and postsecondary-educated women, who are the most affected by the hypergamous tendencies of contemporary matching norms.

In Japan, Taiwan, and South Korea, accounting for the educational composition of future marriage markets does not significantly alter the trends in nonmarriage for women as compared to those predicted by the age-only scenario. In South Korea, men's marriage prospects are improved when the educational composition of future marriage markets are accounted for – and this pattern is also visible, albeit less pronounced, in Taiwan. This is likely due to the norms of educational homogamy in contemporary matching patterns in South Korea that enable men to draw on a larger pool of postsecondary-educated women, which offsets the otherwise adverse impact of the changing age and sex structure on marriage for South Korean men after the 2030s. The relative stability in singlehood levels in Japan, as well as the similarity between the age-only and age-education scenarios, suggests an adaptation of Japanese matching norms to the growing numbers of highly educated women in the marriage market – albeit at levels of singlehood hovering around 15% for women and 20–25% for men. In contrast to the divergence seen in South Korea and also Taiwan, male and female patterns of marriage show a similar trend, as Japan's population structure is the only one that is not affected by SRB distortions.

In 2010, singlehood levels in South Korea were 13% among men and 8% among women, and in Taiwan were 12% among men and 10% among women. By 2020, both South Korea and Taiwan show levels of late singlehood among men at 20% or higher. In contrast to Japan, where late singlehood levels stabilize, in South Korea and Taiwan the

persistence of prevailing norms amidst imminent demographic change point to even higher levels of singlehood among men, reaching levels of 25% in South Korea and 34% in Taiwan by 2050, and 15% in South Korea and 29% in Taiwan among women.

3.2 Projected trends in late singlehood by educational attainment, 2010–2050

Figure 5 shows projected trends in the proportion never married at ages 45–49 for 2010–2050, disaggregated by educational attainment for men (top panel) and women (bottom panel). The figure only shows those educational groups that account for at least 3% of the population in a given period. An educational gradient exists for all societies. Among men, this follows the classical patterning of traditional male-breadwinner societies, in which men with higher levels of education are more likely to marry than low-educated ones (Jones and Gubhaju 2009; Cheng 2014; Park and Lee 2016). In China, postsecondary-educated men will maintain their preeminence in the marriage market and will be unlikely to experience high degrees of singlehood. In contrast, the fastest increases in singlehood will occur among the growing group of men with only secondary education, whereas the projections show stability for those with primary or less. South Korea and Taiwan show the most significant increases in never-married populations without altering the educational gradient favoring men with higher levels of education, whereas Japan shows more stable trends.

Among women, the educational gradient follows the reverse pattern. For higher levels of education, the proportion of those who have never been married among women is higher, whereas women with low levels of education are always more likely to be married. This is clearly the case for China, where almost no changes are expected among women with primary or less education over this period. In South Korea, trends in populations never married increase across both the secondary- and postsecondary-educated groups. In Taiwan, never-married female populations indicate sharp increases in the next two or three decades for all groups, but more rapidly among postsecondary-educated populations and secondary-completed populations due to the shifting educational compositions of Taiwan's marriage markets. Notably, Japanese women show some signs of reversal of the gradient, with postsecondary-educated women showing a decline in nonmarriage, whereas secondary-educated women show increasing levels of nonmarriage midway through the projection period.

Figure 5: **Estimated proportions of never-married people at age 45–49 by educational attainment and sex from 2010 to 2050 by applying constant contemporary forces of attraction by age and education, α$_{ijkl}$, to population projections in four East Asian societies**


Source: Own elaborations. Only educational groups representing 3% or more of the total population are shown.

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3.3 Projected trends in late singlehood under alternative gender scenarios

The projection scenarios above, in which we vary the demographic composition of future marriage markets but hold contemporary norms constant, show significant increases in late singlehood, particularly among less educated men and highly educated women. Could adjustments in marriage norms toward greater age and gender symmetry, or even a reversal toward hypogamy, potentially stall these increases? In this section, we explore how trends in late singlehood would look under two scenarios that alter the age and educational distributions of matching norms by gender (Figure 6). Although to varying degrees, the observed distribution in all countries reflects traditional hypergamous norms (*Hypergamy* [observed] in Figure 6), the forces of attraction involving men with younger women and lower levels of education are systematically higher than the opposite combinations, as also shown in Figures 1 and 2. The first alternative scenario relaxes observed hypergamous norms and assumes a gender-symmetrical distribution of norms by age and educational attainment (*Symmetry*). We build this scenario by averaging forces of attraction across both sides of the diagonal, thereby equalizing hypergamous and hypogamous matching propensities while holding marriage intensity constant (i.e., without changing the sum of all marriage propensities). The second alternative scenario reverses completely the gender pattern, assuming that men and women interchange positions, and hypogamous propensities now exceed hypergamy in this scenario (*Hypogamy*). In both the Symmetry and Hypogamy scenarios, the total sum of forces of attraction remains the same, and thus we do not increase marriage intensities but only seek to redistribute them by gender. In setting up the alternative scenarios in this way, we can assess if increasing singlehood observed so far by applying contemporary norms to shifting demographic composition is a consequence of generalized weakened propensities to marry, or linked to the gender redistribution of marriage norms.

Figure 6 shows the results of this projection exercise. Each set of forces of attractions (identified by the title of each panel) is applied to projected age-sex-educational composition of the marriage market in each population. In Figure 6, we show the proportion of women and men born during the 2000–2005 period that will remain single by year 2050, when they will be between 45 and 49 years old. By following this specific cohort, which is 15–19 at the beginning of our projection period and first enters the population at risk for marriage, we are able to model the risk of marriage of this entire cohort across their life course with the same set of forces of attraction.

Figure 6: **Estimated proportions of people who have never been married at ages 45–49 by sex for cohorts born in 2000–2005, applying two alternative gender distributions of forces of attraction in each country in comparison with observed hypergamy: symmetry (hypergamy = hypogamy) and hypogamy (complete reversal of the observed pattern)**
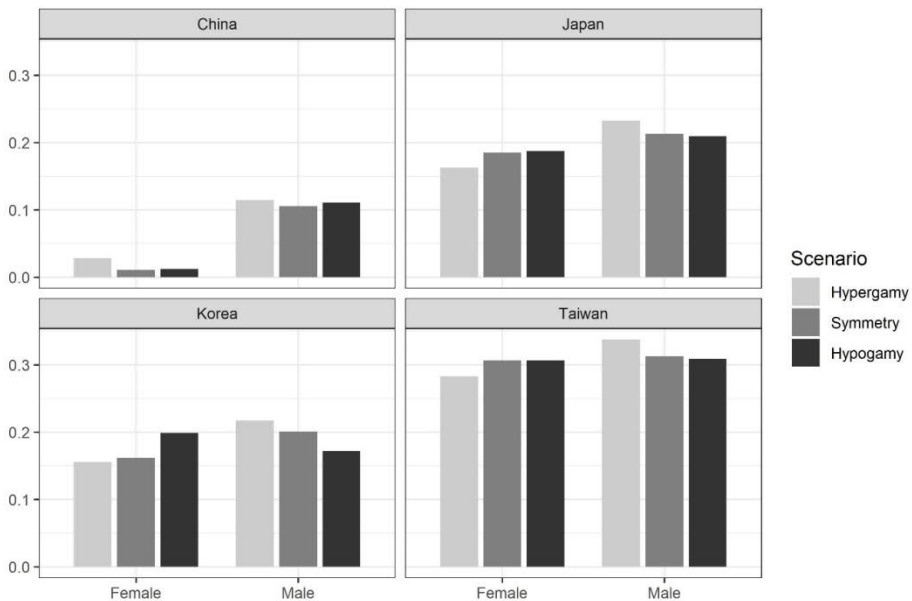
Source: Own elaborations.

Results from these projections show that the overall proportion of the single population will not experience significant changes in either of the two alternative scenarios compared with the observed hypergamy scenario, which suggests that relative shifts in gender matching norms without a modification of the overall intensity of marriage would presumably have little impact on singlehood levels. However, these scenarios suggest slight to modest variations in the proportion of singles by sex. For Japan, Korea, and Taiwan, the shift from the hypergamy to the symmetry and to the hypogamy scenarios implies an increase in singlehood levels for women and a decrease for men. In Japan and Taiwan, the hypogamy scenario yields similar proportions of single women and men. In South Korea, on the other hand, women are more likely to remain single than men, reversing the traditional order. In China, however, men experience little

change in the proportion of singles, but marriage prospects for women improve. Trends by educational attainment (results shown in the Appendix 3) show that there are neither large differences across scenarios nor consistent trends in such differences across countries. In Japan, Korea, and Taiwan, the marriage prospects of postsecondary-educated men increase slightly under the 'symmetry' and 'hypogamy' scenarios, whereas postsecondary-educated women are less likely to marry. In China, the transition from hypergamy to hypogamy yields higher proportions of singles among postsecondary-educated men and reduces the percentage of women with postsecondary education that remain single, due to the strength of hypergamy in contemporary norms that disfavor postsecondary-educated women.

4. Conclusions

This paper has made a twofold contribution. First, we have characterized marriage matching norms by age and education in four East Asian societies. Second, we have examined the potential implications of these prevailing norms in the context of forthcoming demographic change in the marriage market in each of these societies for marriage universality, as measured by late singlehood. These societies represent marriage regimes at different stages of the transition to later and lesser marriage, but share a common past of earlier, universal, and gender-asymmetrical marriage. Our marriage projections suggest that, if prevailing norms in each of these contexts were to continue, the universality of marriage would be substantially eroded in the coming decades, as indicated by increasing proportions of singles (who remain married by ages 45–49). This change is already evident in Japan, where late singles in 2010 were 20% for men and 12% for women, and appear to stabilize at levels of 23% for men and 16% for women by 2050 in our projections. Similar patterns may also appear in South Korea and Taiwan, where late singlehood levels in 2010 were still around 10% but will more than double by 2050. In our projections, these changes arise purely as a consequence of shifting demographic composition in the marriage market, signaling the important interaction between marriage norms and demographic changes in shaping observed marriage patterns at the population level. In China, our projections suggest substantial increases in levels of singlehood compared to their starting levels in 2010, but lower than those observed in South Korea, Taiwan, and Japan by 2050. Shifting educational composition in the marriage market will further increase singlehood levels for men in China. Although existing literature has signaled the forthcoming impact of sex ratio at birth imbalances for increasing singlehood among men in China (Guilmoto 2012; Sharygin, Ebenstein, and Das Gupta 2013), our projections have shown that female educational expansion will also play a significant role for concurrent increases in singlehood among women.

When disaggregating singlehood by educational groups and keeping contemporary matching norms constant, we see a clear continuation of the educational gradient in marriage among men, with the biggest increases in late singlehood among the lower-educated groups and with postsecondary-educated groups experiencing either decreasing late singlehood in China, stability in Japan, or less steep increases in South Korea and Taiwan. For women, the educational pattern in late singlehood is the opposite as that found among men. Postsecondary-educated women face greater levels of late singlehood. The only exception is Japan, where we see a reversal in 2030 with postsecondary-educated women experiencing declines in late singlehood. This finding is consistent with a recent study on Japanese marriage which shows turnover of the negative educational gradient in women's total first marriage rates after 2009 (Fukuda, Raymo, and Yoda 2020). Reversal of the negative educational gradient in women's marriage in Japan is paralleled with increasing valuation of women's earning capacity and emergence of positive relationship between women's earnings and marriage in the 2000s in Japan (Fukuda 2013).

The abovementioned scenarios have assumed that current matching norms remain constant, but this assumption shows – particularly in the case of South Korea and Taiwan, where we see sharp increases in late singlehood relative to their 2010 levels – how prevailing matching norms are maladjusted to forthcoming demographic change in the marriage markets of these populations. In the case of Taiwan and South Korea, current forces of attraction observed in recent marriages may be capturing a period of rapid change in marriage norms across cohorts, where older cohorts were married under a different set of matching norms than those of younger cohorts. The older cohorts in these contexts married early, and their marriage behavior does not set a precedent for the younger cohorts to follow. In contrast, if contemporary norms continue in Japan, increases in singlehood will be less steep compared with South Korea and Taiwan. The fact that female educational expansion has a longer history in Japan compared with South Korea and Taiwan suggests a gradual adaptation of Japanese matching norms to the shifting demographic composition of the marriage market has already emerged. Although the share of these more gender-symmetrical tendencies has increased, this has occurred alongside a generalized weakening of marriage propensities overall, as indicated by weaker forces of attraction.

In counterfactual scenarios, we applied two alternative sets of gender matching norms across societies whilst holding contemporary propensities to marry constant overall. These scenarios enabled us to assess if the increasing singlehood arising from the interaction of demographic changes with contemporary norms was driven more by the gender distribution of norms (i.e., hypergamy by age and education) or more by the generalized weakening of propensities to marry that have emerged in the marriage market of these societies. With these further counterfactual scenarios, we have shown how

moving toward more gender-symmetrical matching norms (homogamous) or toward hypogamous patterns would have modest effects on the overall levels of singlehood, but would have implications for the gender gradients in marriage formation. In China, an uptake of hypogamous norms would increase marriage prevalence for women, in particular those with high education, while depressing marriage prospects of men. In contrast, in Japan, Korea, and Taiwan, a shift from hypergamous to hypogamous norms signals an improvement in marriage prospects for men, especially among those who are postsecondary educated, and a reduction in marriage for women, resulting in a narrowing of the differences between men's and women's singlehood rates. These scenarios thus suggest that even considerable redistribution in the forces of attraction in these societies would have a modest impact on singlehood, given generalized weakened marriage norms that have emerged.

We acknowledge several limitations of this study. First, our marriage projections take population projections by age, sex, and educational attainment as inputs. These population projections make certain assumptions about future patterns of change, which if erroneous have implications for our own results. We have tried to limit some of the uncertainty by projecting until 2050 and focusing largely on cohorts that are already born and subject to prevailing educational transition rates, with our youngest cohorts born in 2000–2005. Furthermore, our projections focus on national-level populations, which mask significant regional heterogeneities, particularly in large, diverse societies such as China. This was due to the limited availability of population projections by age and education at subnational levels. We have also assumed nationally bounded marriage markets when considering the population at risk for marriage. Marriage migration has been noted as social development in recent years in South Korea and Taiwan, and these trends will also affect how marriage patterns develop in these societies (Lee, Lindy, and Florio 2016; Raymo and Park 2020). While we have accounted for transnational marriages when estimating forces of attraction, it is difficult to delimit a potential population at risk for marriage when accounting for the possibility of marriage migration. As a result, our projections underestimate the impact of marriage migration, which may serve to lessen the projected increases in singlehood. We also considered age and education as two dimensions of stratification in our analyses. Several other dimensions of stratification, for example ethnicity, are also salient for marriage markets. Moreover, our focus here has been comparative, and as our analyses has shown, education is an important dimension of socioeconomic stratification across each of these marriage markets. Nevertheless, we acknowledge that the educational systems are quite different in each of these countries, and while our grouping facilitates comparison, it may also mask important heterogeneity within educational categories. For example, in our postsecondary-educated group, vocational schools, junior colleges and four-year postsecondary degrees are included. These capture different types of educational

qualifications, which have implications for patterns of assortative mating, but are difficult to operationalize in the context of our cross-national research combining multiple sources of data and in light of the fact that our analyses are constrained by the educational classification used in the underlying population projections. Alongside educational expansion, we also note that the meaning of education has changed over time in each of these countries, but especially in Japan and South Korea, where the proportions with less than secondary education are now very small as a proportion of the population. The meaning associated with these qualifications has implications for how they are perceived in the marriage market. For example, while marriage propensities among lower-educated groups remain comparatively high in China, these patterns may change as this group becomes smaller and higher education becomes more widespread. We hope future work will address several of these limitations and assess if and how norms respond to the shifting demographic composition in these societies.

In any case, our projections results suggest a plausible reduction in the prevalence of marriage in the future decades in these four societies that arises from the interaction between weakened propensities to marry and forthcoming demographic changes in East Asian societies. Our analyses highlight the importance of considering demographic changes in the composition of marriage markets While our projections are a conterfactual exercise based on assumptions, they illustrate how the unfolding of ongoing demographic changes in the context of prevailing norms will result in these societies witnessing levels of singlehood that are unprecedented. In absolute numbers, and according to our projections that hold contemporary norms constant, late singles among 45 to 49 years old would increase from 1.78 million in 2010 to 6.09 in 2050 in China. In South Korea and Taiwan, the number of singles among the same ages would double between 2010 and 2050 from 0.21 to 0.44 million in South Korea and from 0.21 to 0.38 in Taiwan. In contrast, singles would slightly decrease in Japan from 1.28 to 1.16 million between 2010 and 2050. Even when some of these propensities are redistributed, as in our alternative gender scenarios, singlehood would increase in three out of four countries, suggesting that unless a generalized increase in propensities to marry take place, universal marriage will be eroded in East Asia. The potential implications of such trends are broad, not just for the institution of marriage itself but for fertility and social reproduction, as well as the broader family context of old-age support in these societies. Marriages, as unions formed between two families, lay the foundation for social solidarity in collectivist settings like Asia. Changes in marriage regimes can thus have profound impact on the social fabric of these East Asian societies, particularly when marriage remains the normative type of union commonly recognized and considered as the ideal context for childbearing. As shown in the case of Japan, fertility – and in particular childlessness – is closely tied to marriage, and childlessness has been the main driver of the decline in fertility in Japan over recent decades (Raymo et al. 2015). Unlike in Western societies, the postponement

of marriage in Asia has not been accompanied by a substantial increase in cohabitation and childbearing out of wedlock (Lesthaeghe 2010). The extent to which nonmarital cohabitation and childbearing emerge in the future will very much determine how marriage will influence fertility trends, population growth, aging, and social reproduction.

References

Cheng, Y.H.A. (2014). Changing partner choice and marriage propensities by education in post-industrial Taiwan, 2000–2010. *Demographic Research* 31(33): 1007–1042. doi:10.4054/DemRes.2014.31.33.

Cheng, Y.H.A. and Loichinger, E. (2017). The future labor force of an aging Taiwan: The importance of education and female labor supply. *Population Research and Policy Review* 36: 441–466. doi:10.1007/s11113-016-9423-z.

Esteve, A., Schwartz, C.R., Van Bavel, J., Permanyer, I., Klesment, M., and García-Roman, J. (2016). The end of hypergamy: Global trends and implications. *Population and Development Review* 42(4): 615–625. doi:10.1111/padr.12012.

Esteve, A., García-Román, J., and Permanyer, I. (2012). The gender-gap reversal in education and its effect on union formation: The end of hypergamy? *Population and Development Review* 38(3): 535–546. doi:10.1111/j.1728-4457.2012.00515.x.

Fukuda, S. (2013). The changing role of women's earnings in marriage formation in Japan. *The Annals of the American Academy of Political and Social Science* 646(1): 107–128. doi:10.1177/0002716212464472.

Fukuda, S., Raymo, J.M., and Yoda, S. (2020). Revisiting the educational gradient in marriage in Japan. *Journal of Marriage and Family*. 82(4):1378–1396. doi:10.1111/jomf.12648.

Guilmoto, C.Z. (2009). The sex ratio transition in Asia. *Population and Development Review* 35(3): 519–549. doi:10.1111/j.1728-4457.2009.00295.x.

Guilmoto, C.Z. (2012) Skewed sex ratios at birth and future marriage squeeze in China and India, 2005–2100. *Demography* 49(1): 77–100. doi:10.1007/s13524-011-0083-7.

Hannum, E., Ishida, H., Park, H., and Tam, T. (2019). Education in East Asian societies: Potswar expansion and the evolution of inequaliy. *Annual Review of Sociology* 45: 625–647. doi:10.1146/annurev-soc-073018-022507.

Jones, G.W. (2010). Changing marriage patterns in Asia (Asia Research Institute Working Paper 131) Singapore: National University of Singapore. doi:10.2139/ssrn.1716533.

Jones, G.W. and Gubhaju, B. (2009). Factors influencing changes in mean age at first marriage and proportions never marrying in the low-fertility countries of East and Southeast Asia. *Asian Population Studies* 5(3): 237–265. doi:10.1080/17441 730903351487.

Kan, M.Y., Hertog, E., and Kolpashnikova, K. (2019). Housework share and fertility preference in four East Asian countries in 2006 and 2012. *Demographic Research* 41(35): 1021–1046. doi:10.4054/DemRes.2019.41.35.

Kashyap, R., Esteve, A., and García-Román, J. (2015). Potential (mis) match? Marriage markets amidst sociodemographic change in India, 2005–2050. *Demography* 52(1): 183–208. doi:10.1007/s13524-014-0366-x.

Kashyap, R. and Villavicencio, F. (2016). The dynamics of son preference, technology diffusion, and fertility decline underlying distorted sex ratios at birth: A simulation approach. *Demography* 53(5): 1261–1281. doi:10.1007/s13524-016-0500-z.

Lee, H., Lindy, W., and Florio, A. (2016). Adapting to marriage markets: International marriage migration from Vietnam to South Korea. *Journal of Comparative Family Studies* 47(2): 267–288. doi:10.3138/jcfs.47.2.267.

Lesthaeghe, R. (2010). The unfolding story of the second demographic transition. *Population and Development Review* 36(2): 211–251. doi:10.1111/j.1728-4457.2010.00328.x.

Lutz, W., Butz, W.P., and KC, S. (2014). *World population and human capital in the twenty-first century*. Oxford: Oxford University Press. doi:10.1093/acprof:oso/9780198703167.001.0001.

Myrskylä, M., Goldstein, J.R., and Cheng, Y.H.A. (2013). New cohort fertility forecasts for the developed world: rises, falls, and reversals. *Population and Development Review* 39(1): 31–56. doi:10.1111/j.1728-4457.2013.00572.x.

Park, H. and Lee, J.K. (2016). Growing educational differentials in the retreat from marriage among Korean men. *Social Science Research* 66: 187–200. doi:10.1016/j.ssresearch.2016.10.003.

Qian, Z. and Preston, S.H. (1993). Changes in American marriage, 1972 to 1987: Availability and forces of attraction by age and education. *American Sociological Review* 58(4): 482–495. doi:10.2307/2096072.

Raymo, J.M., Park, H., Xie, Y., and Yeung, W.J. (2015). Marriage and family in East Asia: Continuity and change. *Annual Review of Sociology* 41: 471–492. doi:10.1146/annurev-soc-073014-112428.

Raymo, J.M. and Iwasawa, M. (2005). Marriage market mismatches in Japan: An alternative view of the relationship between women's education and marriage. *American Sociological Review* 70(5): 801–822. doi:10.1177/00031224 0507000504.

Raymo, J.M. and Park, H. (2020). Marriage decline in Korea: Changing composition of the domestic marriage market and growth in international marriage. *Demography* 57(1): 171–194. doi:10.1007/s13524-019-00844-9.

Schoen, R. (1988). *Modeling multigroup populations*. New York: Plenum Press. doi:10.1007/978-1-4899-2055-3.

Sharygin, E., Ebenstein, A., and Das Gupta, M. (2013). Implications of China's future bride shortage for the geographical distribution and social protection needs of never-married men. *Population Studies* 67(1): 39–59. doi:10.1080/00324728. 2012.723893.

United Nations, Division of Economic and Social Affairs (2011). *World population prospects: The 2010 revision.* New York: United Nations.

Yu, J. and Xie, Y. (2015). Changes in the determinants of marriage entry in post-reform urban China. *Demography* 52(6): 1869–1892. doi:10.1007/s13524-015-0432-z.

Appendix 1: Detailed description of the method and data used in the marriage projections

Marriage outcomes are shaped by both preferences or norms about whom to marry as well as the availability of potential partners. The harmonic mean marriage function proposed by Schoen (1988) provides a simple, elegant function to link the numbers of marriages occurring to the population at risk of experiencing marriage and allows for the estimation of a parameter that captures the composition-independent propensity or likelihood of marriage. The model relates the number of marriages occurring between men of type *i* to women of type *j* to the eligible (unmarried) men and women of those classes.

$$N_{ij} = \alpha_{ij} \frac{M_i F_j}{nM_i + mF_j}$$

(1).

In equation (1), N_{ij} is the number of marriages between men aged *i* and women aged *j* in some time period; M_i is the number of unmarried men aged *i* in the middle of that time period; F_j is the number of eligible women aged *j* in the middle of that time period; m, n is the length of the *ith* and *jth* age intervals respectively (in years), and α_{ij} is the 'force of attraction' between men aged *i* and women aged *j*.

As we are interested in examining pairing patterns across both age and educational attainment, the number of marriages as well as the risk population can be simultaneously identified across two categories – age and educational level. The model applied to this case is:

$$N_{ijkl} = \alpha_{ijkl} \frac{M_{ik} F_{jl}}{nM_{ik} + mF_{jl}}$$

(2).

Here N_{ijkl} is the number of marriages between men aged *i* with educational level *k* and women aged *j* with educational level *l* in some time period; M_{ik} is the number of unmarried men aged *i* with educational level *k* in the middle of that time period; F_{jl} is the number of eligible women aged *j* with educational level *l* in the middle of that time period; m, n is the length of the *ith* and *jth* age intervals respectively (in years), and α_{ijkl}

is the force of attraction between men aged *i* with educational level *k* and women aged *j* with educational level *l*.

By relating the number of marriages actually occurring with the population at risk of marriage for both sexes, the force of attraction α_{ijkl} captures the composition-independent propensity to marry between men and women belonging to a group of specific age (*i, j*) and educational attainment level (*k, l*). This parameter can be thought to capture the desirability of marriage and matching norms between men and women of specific age and educational characteristics. If men (M_{ik}) and women (W_{jl}) with given characteristics randomly encounter each other at equal rates, then higher propensities to marry (α_{ijkl}) indicate that higher rates of such encounters are likely to result in marriage (Qian and Preston 1993: 483). The analysis is restricted to registered first marriages involving one native-born partner.

To compute forces of attraction, data on marriages cross-tabulated by spousal characteristics, in this case age and age by educational attainment, and data for the population at risk of experiencing these marriages are needed. The population at risk of first marriage is the single (never-married) population. The latest published marriage data in each society were used, but this does not always coincide with the latest registered data. Hence, reference periods and statistical sources vary by country. Marriage data come from censuses (China), surveys (Japan), and vital statistics (South Korea and Taiwan). Marriages in China refer to the 2000–2004 period and come from the 2005 Chinese population micro-census. The question on year of first marriage was used to select respondents who were married between 2000 and 2004, and information on relationship to the household head was then applied to identify spouses. In Japan, marriages refer to the 2006–2010 period and are registered in the 2010 National Fertility Survey. Finally, information on marriages for Taiwan and South Korea was obtained from vital statistics. In the case of Taiwan, they refer to 2010, and in South Korea, to the period between 2001 and 2009.

The populations at risk of getting married correspond to the single (never-married) population by sex, age, and educational attainment. When the marriages that occur refer to periods of more than one year, the middle of the period is taken to identify populations at risk. For China, we averaged the 2000 and 2005 populations obtained from the censuses taken at those years. For Japan, we used the 2010 census, in South Korea the 2001 and 2010 population censuses, and in Taiwan the 2010 census.

Age at marriage was grouped into five-year intervals from 15 to 49 years of age, except for the first and second age groups (15, 16–19). Educational attainment was harmonized across societies into four groups: 'Less than primary' (ISCED 0), 'Primary completed' (ISCED 1), 'Secondary completed' (ISCED 2 and 3), and 'Postsecondary completed' (ISCED 4 and above). 'Less than primary' in Japan and Taiwan was excluded or combined with 'Primary completed' because of their very small sample size.

Appendix 2: Population pyramids by age and educational composition in four East Asian societies, 2010–2050
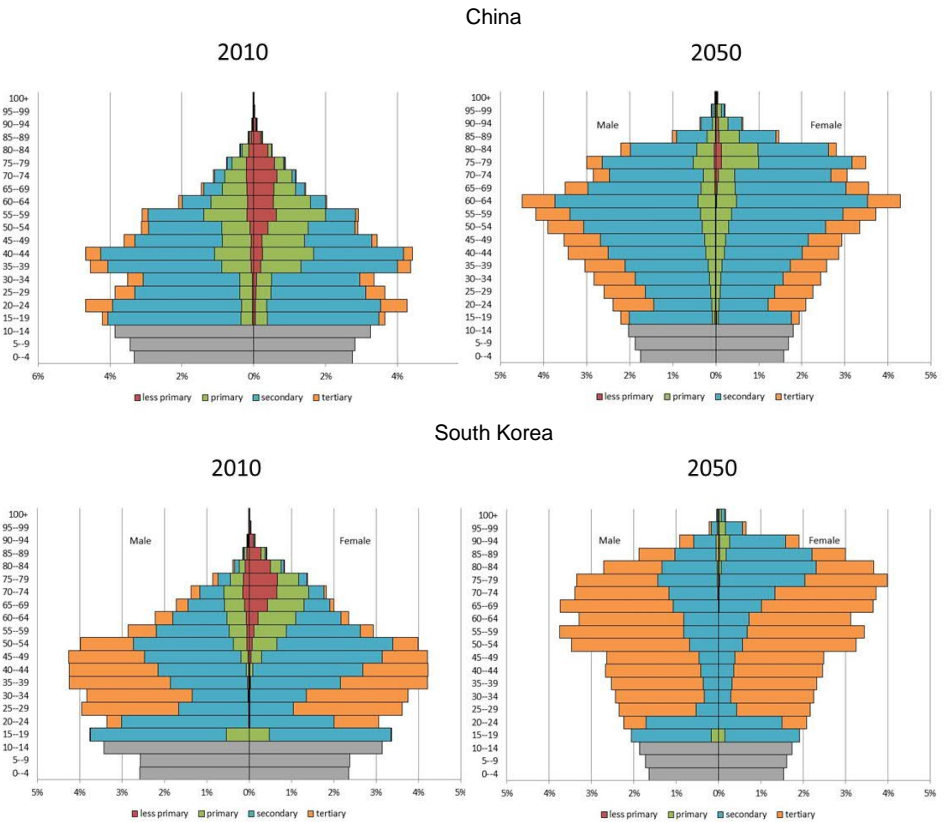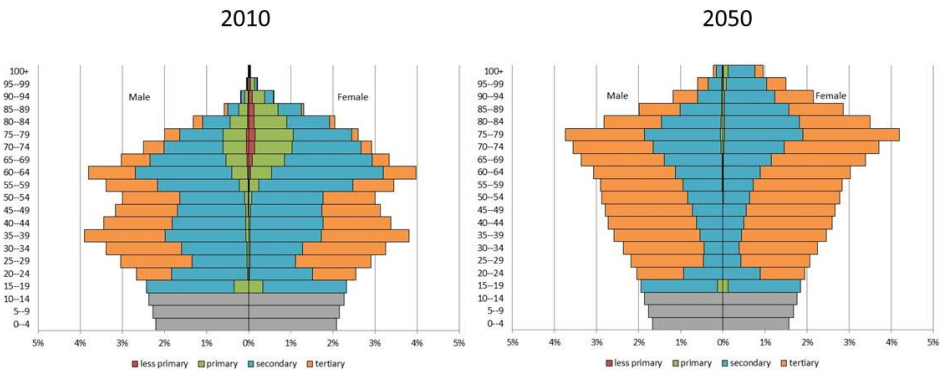

China

South Korea

Appendix 2: Population pyramids by age and educational composition in four Asian societies, 2010–2050 (continuation)
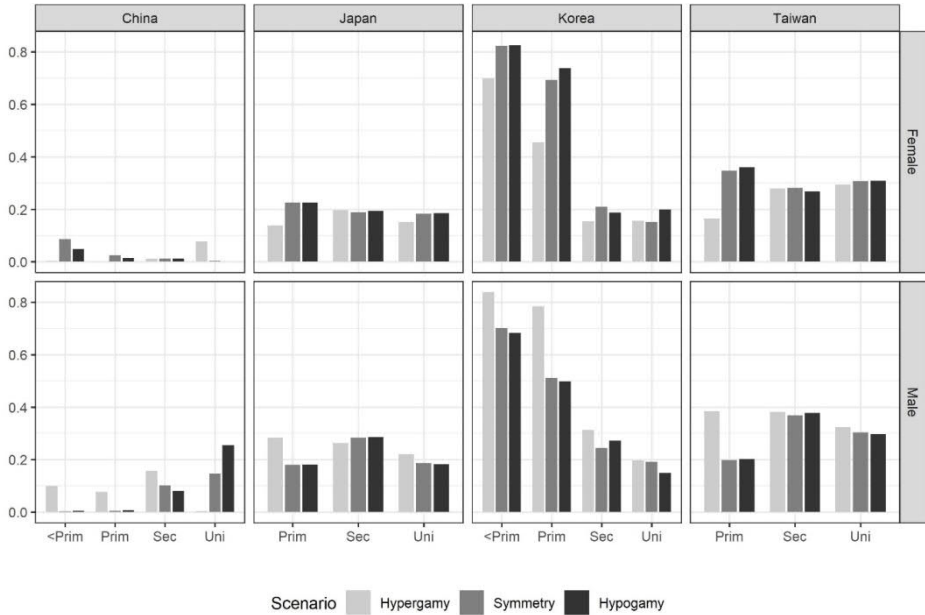
Taiwan
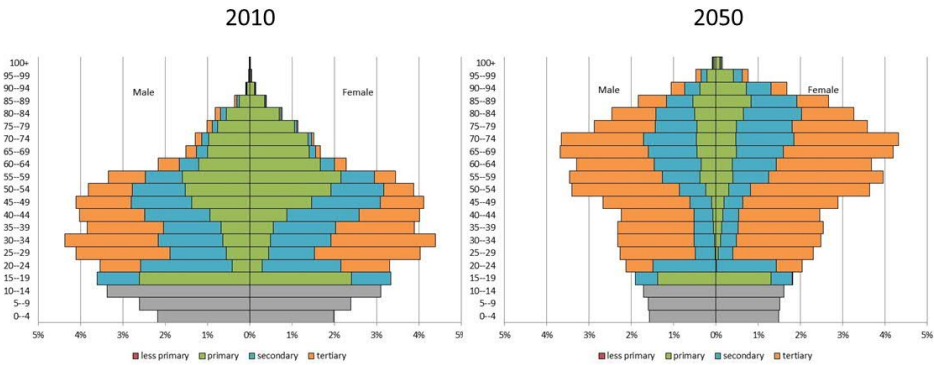
Japan

Source: Own elaboration based on population projections from Lutz, Butz, and K.C. (2014) for China, South Korea, and Japan; and from Cheng and Loichinger (2017) for Taiwan.

Appendix 3: Estimated proportions of never married people at ages 45–49 by sex and educational attainment for cohorts born in 2000–2005 applying three alternative gender distributions of forces of attraction in each country: observed hypergamy; symmetry (hypergamy = hypogamy); and hypogamy (complete reversal of the observed pattern)

Source: Own elaborations.