

Low fertility: A review of the determinants

Working Paper No. 2

July 2019



Technical Division

Working Paper Series

Population & Development Branch

Elizabeth Wilkins

Consultant, UNFPA Population and Development Branch

Complete draft updated and revised, July 2019

1. Introduction

Classic demographic transition theory assumed that fertility would decline from high levels and stabilize at the replacement level of around 2.1 children per woman. Yet nearly half of the global population now lives in a country with a period total fertility rate (TFR) below 2.1 children per woman (United Nations, 2019)¹. Meanwhile, in many countries in Eastern Asia, Southern Europe, and parts of Central, Eastern and South-eastern Europe, fertility is even lower, with period TFR at 1.0-1.4 and completed family size at 1.4-1.6 births per woman born in the mid-1970s. Traditional development and geographic boundaries have been blurred with all major world regions, except sub-Saharan Africa, now firmly set on a decline towards low fertility. By 2050, more than two-thirds of the global population is projected to live in a country with fertility below a period TFR of 2.1 children per woman² (United Nations, 2019).

Low fertility, particularly at very low levels, is seen by some governments as a source of concern (Hakkert, 2014; Poston et al., 2018). In particular, policymakers note concerns about the accelerated pace of population ageing and associated pressure on the labor market, healthcare and social security systems, which are largely supported by contributions from the working age population (Rindfuss & Choe, 2015). Another set of concerns relates to eventual population decline and its attendant threats to economic growth, military power and national pride (Rindfuss & Choe, 2015). In 2015, two-thirds of governments in more developed countries considered fertility to be too low and were pursuing policies to boost it (United Nations, 2015, cited in UNFPA, 2018: 95).

At the individual level, low fertility is a manifestation of couples' increased ability to prevent pregnancies and space births, yet it also reflects the challenges faced by women and men in starting a family or planning for another child. The International Conference on Population and Development Programme of Action, endorsed by 179 countries in 1994, stated that "all couples and individuals have the basic right to decide freely and responsibly the number and spacing of their children and to have the information, education and means to do so". Yet in many low fertility countries, individuals report that they are not having as many children as they aspire to have, indicating their inability to realize their full reproductive rights.

Against this background, this report aims to review the theoretical and empirical evidence of the determinants of low fertility. First, it presents an overview of the main trends and patterns of low fertility, followed by a discussion of the role of fertility postponement and the associated tempo effect. Subsequently, it explores three broad sets of distal social, cultural and economic determinants: 1) ideational change and the Second Demographic Transition, 2) economic constraints, including labor market uncertainty and the direct costs of raising children, and 3) constraints affecting women's ability to combine paid work and childbearing, namely gender

¹ In 2019, 47% of the global population lived in a country with TFR<2.1 (United Nations, 2019).

² United Nations medium variant projections.

(in)equity in the domestic sphere, workplace conditions, and the availability of childcare services.

These social, cultural and economic factors are selected as determinants that are well studied and represented in the literature, but they are not the only determinants. This review does not cover in depth, for instance, the expansion of female higher education (see e.g. Mills et al., 2011; Ní Bhrolcháin & Beaujouan, 2012), which while an important factor behind fertility postponement and decline in almost all post-transitional countries, is not a determinant specific to the countries with very low fertility. Secondly, this review does not cover in detail the rise of family instability and the role of divorce and re-partnering (see e.g. Balbo et al., 2013; van Bavel et al., 2012), nor various determinants with relatively limited coverage in the literature, namely psychological factors such as insecurity, sense of control, and fashions related to parenthood and childlessness; geographical influences such as population density, climatic factors and settlement type; and the ideology of “quality” parenting found in many rich countries. Finally, given the focus on social, cultural and economic determinants, this report does not delve deeply into the substantial and growing literature on the biomedical determinants of low fertility among females and males (see e.g. Rossi et al., 2016; University of Rochester Medical Center, 2019).

Geographically, the review covers those countries that experienced early fertility declines to replacement fertility or below between the 1950s and 1980s. As noted by Sobotka (2017), these include most European countries (with the exceptions of Albania and Kosovo), several East Asian countries and administrative regions (Japan, the Republic of Korea, Taiwan Province of China, and China, Hong Kong Special Administrative Region), Singapore, the United States, Canada and Cuba, as well as Australia, New Zealand and some smaller territories in Oceania and elsewhere. However, the main focus is on those countries with very low fertility in East Asia, Southern, Central and Eastern Europe. This is not the first study to synthesize research on the determinants of low fertility. Related papers include those by: Balbo *et al.* (2013), Billari (2008), Basten *et al.* (2014), Morgan and Taylor (2006), Sobotka (2017) and Thévenon (2015), which readers are encouraged to review for alternative structural frameworks and substantive concentrations.

Box 1: Measuring fertility

The most widely used measure of fertility at the population level is the total fertility rate (TFR). This indicator represents the average number of children that a woman in the population would have if she were to experience the age-specific fertility rates of the current calendar year across her lifetime. For a given year, it is computed as the sum of the age-specific fertility rates at each age, or for each 5-year age group, between 15-49 years, and is expressed as the number of children per woman.

The key advantage of the TFR is its timeliness: the indicator can be computed as soon as the number of births in a given year are released by national statistical agencies (UNFPA, 2018). However, the disadvantage of this “period” measure is that it measures fertility at a particular point in time and does not represent the experience of any real group of women across their lifetimes (Rindfuss & Choe, 2015). This makes it vulnerable to distortion by shocks such as economic recessions, which can have a substantial short-term effect on the number of births at all ages, as well as changes in the timing of births. If women give birth at earlier ages than in previous years, the so-called “tempo effect” will result in an elevated TFR even if women are not having more births over their lifetimes. Conversely, if women delay births, the TFR will be depressed even if they are having the same number of births as before, since some births will be “shifted into the future” (Sobotka, 2017: 26). This makes the TFR unstable and potentially misleading.

An alternative indicator is the completed cohort fertility rate, which measures the average number of children women would have across their lifetimes based on the experience of real female cohorts. It is calculated as the sum of the age-specific fertility rates across the lifetimes of women, and in this way provides a clearer picture of actual fertility. The cohort fertility rate is not subject to tempo distortions and tends to be more stable than period fertility measures. However, its disadvantage is that it can only be calculated after the cohort of women analyzed reaches the end of their reproductive years. Hence, cohort measures cannot inform us about the fertility behavior of younger women in recent years (UNFPA, 2018).

1.1 Trends and patterns

Fertility decline began in many European countries in the 19th Century, closely followed by Australia and New Zealand, the United States and Canada, and subsequently Japan. By the 1970s, the fertility transition had taken place in Australia, Japan, and all highly developed countries in Europe and North America. In the 1970s, fertility in China declined dramatically following policies to promote later childbearing and smaller family sizes, including the notable introduction of the 1979 family planning policy, which generally restricted couples to a single child (UNFPA, 2018). During the 1980s and 1990s, countries such as Cuba, Thailand, China, and

the remaining East Asian “Little Dragons” (Republic of Korea, Taiwan Province of China and Hong Kong SAR) joined the growing list of countries with sub-replacement fertility. The transition was particularly rapid in these East Asian settings, which in the 1950s had had TFRs in the order of 5 to 7 children per woman (Frejka, Jones & Sardon, 2010).

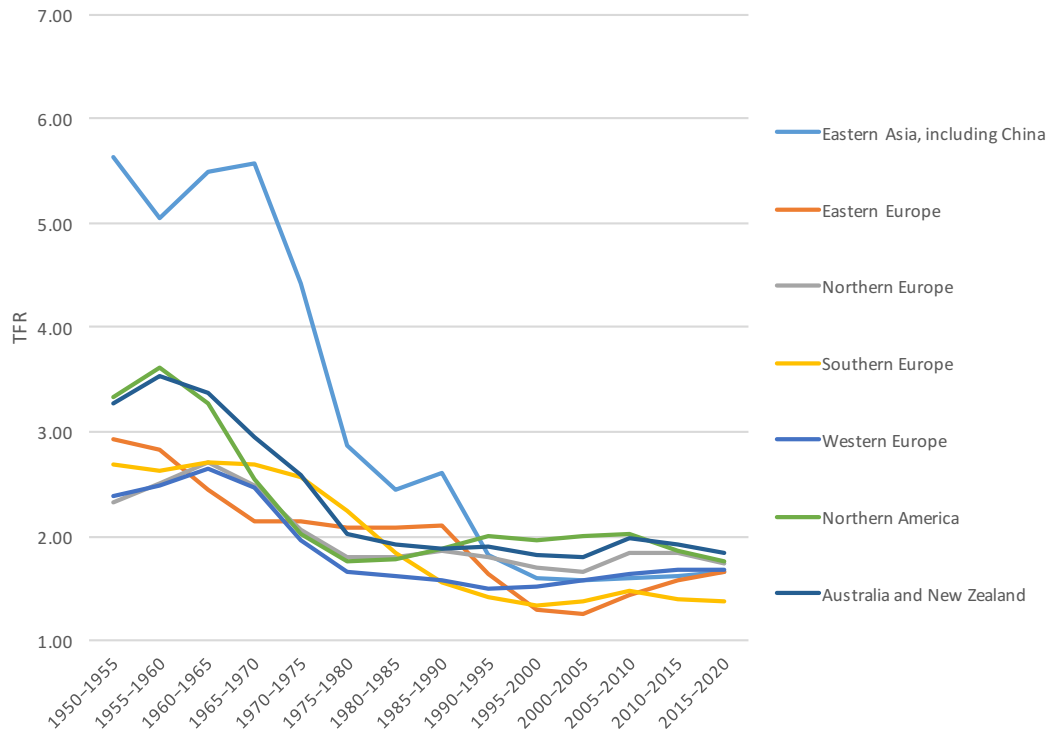
In the early 1990s, low fertility countries in Southern, Eastern and Central Europe experienced further decreases in their TFR, sometimes to as low as 1.3 children per woman and below, where they remained for decades. This marked the emergence of so-called “lowest-low fertility” (Kohler, Billari & Ortega, 2002)³; by 2002, more than half of the European population lived in countries with a lowest-low period TFR (Goldstein et al, 2009). Soon thereafter, similar “ultra-low fertility”⁴ emerged in Japan, the Republic of Korea, Singapore, Taiwan Province of China and Hong Kong SAR (Jones, Straughan & Chan, 2009). By the mid to late 2000s, these East Asian countries had the lowest period fertility globally (Frejka, 2010), recording TFRs in the range of 1.04 to 1.34 children per woman between 2005 and 2010 (United Nations, 2017).

Beginning around 2000, declines in period fertility stalled, and a concerted increase took place across many low-fertility settings, with the notable exceptions of East Asia and some European countries such as Germany, Austria and Switzerland (Goldstein et al, 2009; Hoorens et al., 2011). This upturn was mainly a result of the weakening pace of fertility postponement and the related tempo effect (Bongaarts & Sobotka, 2012) (**Box 1**). In many countries, the rise in the period TFR was modest, in the order of 0.2 births per woman or less in absolute terms. However, several countries experienced greater TFR increases of 0.3 to 0.6, or around 20-40% in relative terms (Goldstein et al, 2009). This fertility recuperation lasted until around 2008 and the start of the global economic recession. Following this, fertility stabilized in several countries (e.g. Germany, Austria and Switzerland), increased in a few Eastern European countries, possibly connected with the recently implemented pronatalist policies, and reversed in several others (e.g. Bulgaria, Cyprus, Greece, Iceland and Spain) (Sobotka, 2013; Thévenon, 2015) (**Figure 1**).

³ The term “lowest-low fertility” was coined by Kohler and colleagues (2002) to distinguish those countries with the lowest period fertility rates from those with below-replacement fertility. As noted by the authors, the cut-off of TFR = 1.3 is somewhat arbitrary; it is not intended to refer to the lowest attainable fertility level.

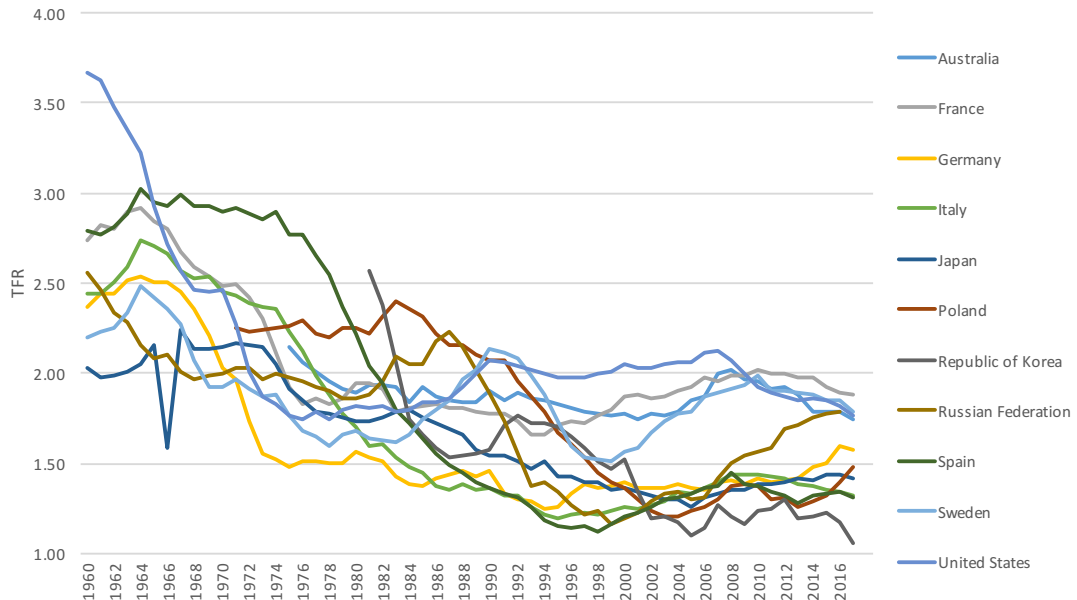
⁴ The term “ultra-low fertility” also refers to fertility below TFR=1.3. It was first introduced by Day (1988), though has been used more recently by Asian demographers (e.g. Jones et al., 2008) to differentiate Asian fertility declines from the European country experiences, and not to exclude the possibility of a further decline to even lower levels (Yoo & Sobotka, 2018).

Figure 1a. Total fertility rate in low fertility world regions, 1950-55 to 2015-20



Source: United Nations (2019).

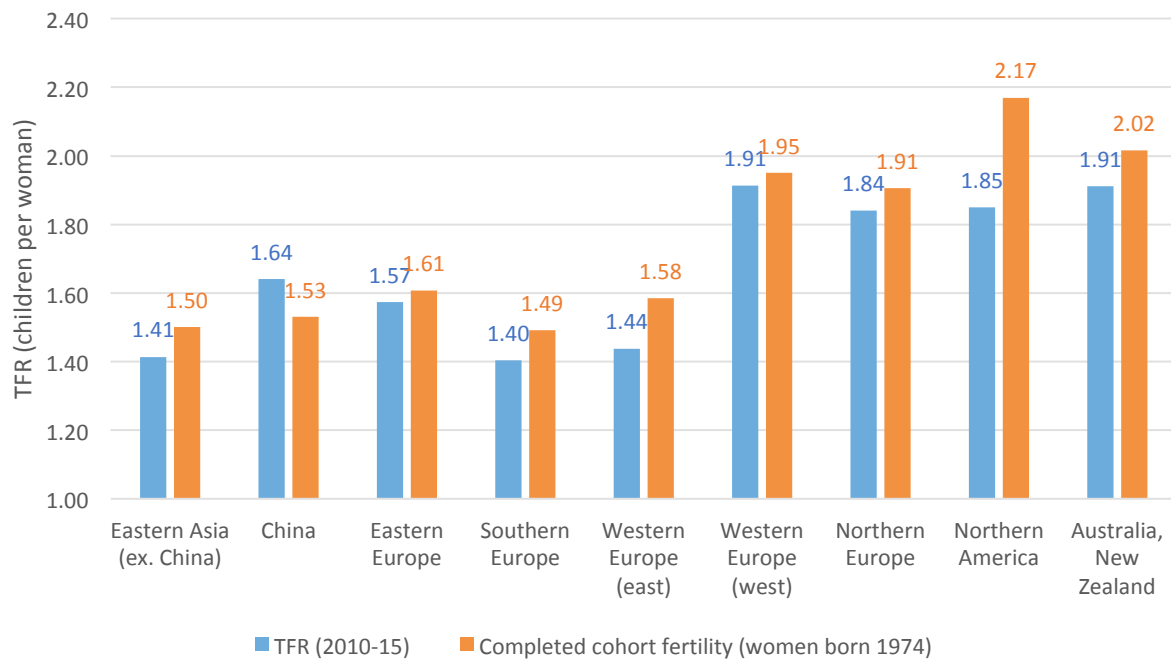
Figure 1b. Total fertility rate in selected countries, 1960-2017



Source: Human Fertility Database (2019); Eurostat (2018); and national statistical offices.

Despite the broad global convergence towards replacement fertility, there exists marked variation among low fertility countries today, with some scholars suggesting a long-term “great divergence” in fertility among more developed countries (Billari, 2018: 15; McDonald, 2006; Rindfuss et al., 2016). **Figure 2** illustrates the contrast between regions and countries with *moderately low* fertility in the region of 1.7 to 2.2 children per woman and *very low* fertility of 1.6 or fewer children per woman (McDonald, 2006; Rindfuss et al., 2016; Billari, 2018)⁵.

Figure 2. Total fertility rate in 2010-15 and completed cohort fertility rate among women born in 1974



Sources: United Nations (2019); Human Fertility Database (2018); Yoo & Sobotka (2018); Wittgenstein Centre (2016).

Notes: Western Europe (east) includes Austria, Germany and Switzerland; Western Europe (west) includes Belgium, France, Luxembourg and the Netherlands; Eastern Asia ex. China excludes China; Hong Kong SAR; and China, Macau SAR.

Moderately low fertility is typical of countries in Northern Europe, Western Europe and Anglophone countries such as the United States, Canada, Australia and New Zealand, whereas very low fertility is concentrated in Southern, Central and Eastern Europe, the German-speaking countries, and South-East and East Asia. These latter two regions represent a particular hotspot for low fertility. At the extreme, the lowest TFR worldwide, estimated at 1.05, was reached in the Republic of Korea in 2017. In 2017, Taiwan Province of China, Hong Kong SAR and Singapore had a TFR of between 1.13 and 1.16, and Southern European countries had a TFR of 1.3-1.4 (European Demographic Datasheet, 2018; Human Fertility Database, 2019; national

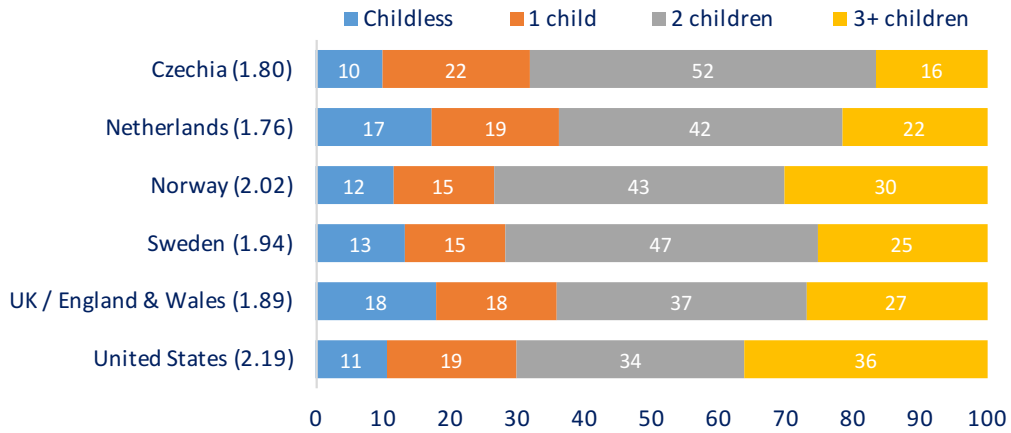
⁵ The divergence is more stark when measured by the period fertility indicator and less stark when measured by the cohort indicator, although it is evident for both measures.

statistical offices). Within several cities, fertility is even lower: for example, Seoul recorded a TFR of 0.84 in 2017 (KOSIS, 2019), while the TFR reached as low as 0.8 during the 1990s and 2000s in the largest cities in China (Guo and Gu, 2014).

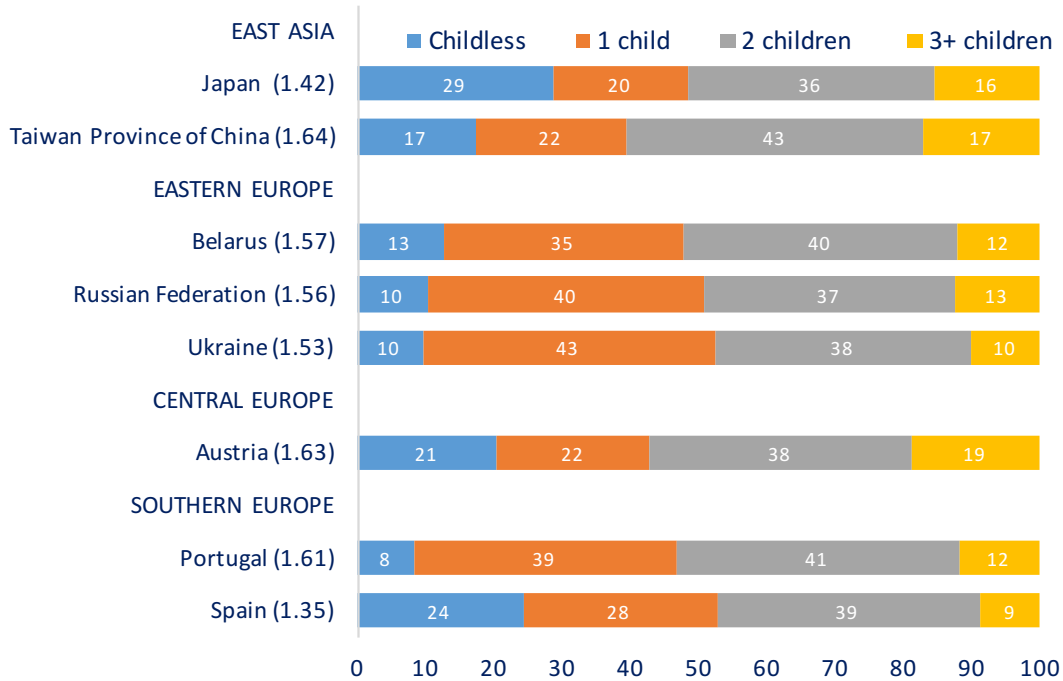
Alongside aggregate measures of population fertility, it is important to consider data on the actual number of children born to individual men and women. **Figure 3** shows that in almost all countries (with the exception of the United States), women are most likely to have 2 children during their lifetime. However, there is considerable cross-national heterogeneity in the proportion of women with 3 or more children and the proportion remaining childless. Most of the countries with moderately low fertility have a relatively high proportion of women with 3 or more children, although several (e.g. the Netherlands, and the United Kingdom) also have a high prevalence of childlessness. By contrast, very low fertility settings tend to have a small share of women with 3 or more children. More specifically, in Eastern Europe and the Republic of Korea (not shown), there is a high share of women with only one child but the proportion of childless women is low. In Southern Europe, Central Europe and Japan, the proportion of women with only one child *and* the proportion who remain childless are relatively high. Japan has the highest prevalence of childlessness in the world, with 29% of all women having no children by age 42 years.

Figure 3. Women by number of children ever born (territories (women born in 1971-75)

a) Countries with moderately low fertility



b) Countries with very low fertility



Notes: The data show the number of children born to women by age 42 (45 in the UK/England and Wales). Numbers in brackets show the completed cohort fertility at age 42. Data relate to women born in the following years: 1971 for Ukraine; 1972 for Taiwan Province of China, the Russian Federation, Norway, England and Wales; 1973 for Portugal; 1974 for Japan, Belarus, Spain, Czechia, the Netherlands, Sweden and the United States; and 1975 for Austria. For the UK data pertain to England and Wales only.

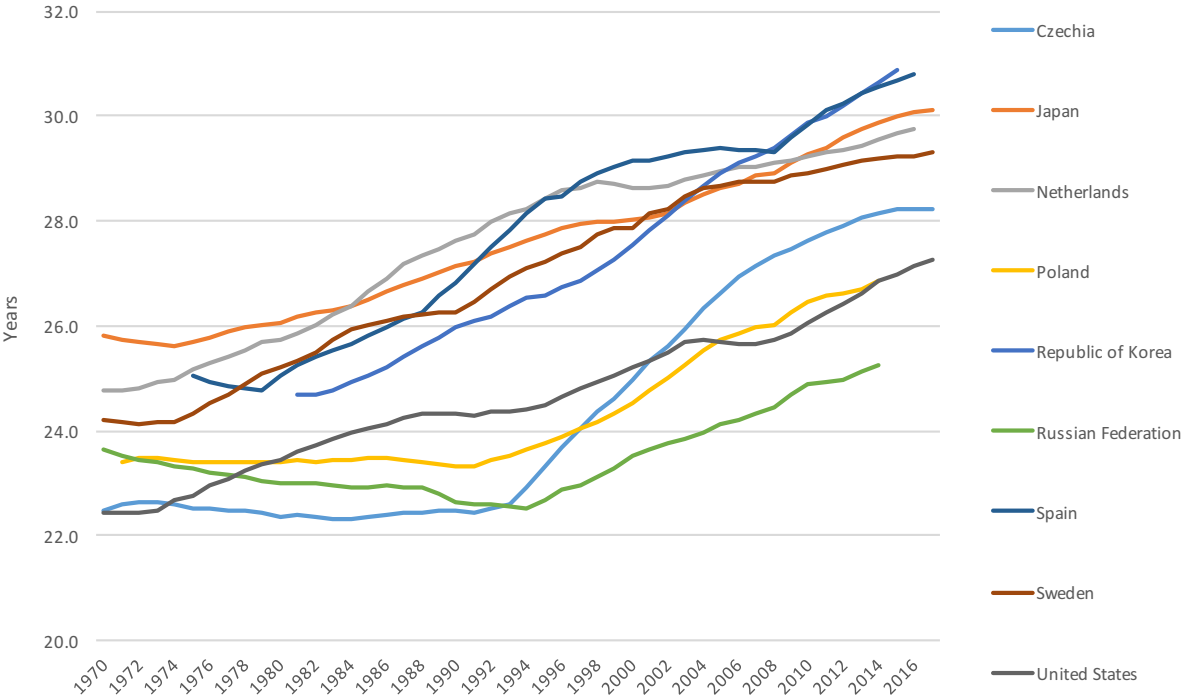
Sources: Sobotka, Matysiak and Brzozowska (2019). Data from: Human Fertility Database (2019), national statistical offices (2018).

Overall, countries with very low fertility make up almost 30% of the world’s population (UNFPA, 2018). The review that follows concentrates mainly on the factors underlying such very low fertility.

2. Postponement of childbearing

There is almost universal agreement among demographers that the postponement of childbearing has, without exception, played a key role in the decline of fertility to low levels (Kohler, Billari & Ortega, 2002; Lutz, O’Neill & Scherbov, 2003; Morgan, 2003; Sobotka, 2004, Billari, 2008; Sobotka, 2017). Kohler, Billari and Ortega (2002: 642) coined the term “postponement transition” to describe the shift from an early to late pattern of first birth in developed countries, which they argue reflects a rational response to greater economic uncertainty among youth and the related expansion of higher education. Indeed, the mean age of women at first birth has increased considerably in developed countries from around 22-26 years in the 1970s to 26-30 years in most countries today, and has exceeded 30 years in several countries such as Italy, Spain, Switzerland, Japan and the Republic of Korea (VID, 2018) (Figure 4).

Figure 4: Mean age of woman at first birth, selected countries, 1970-2017



Sources: Human Fertility Database (2019); Yoo and Sobotka (2018).

One way in which the postponement of childbearing contributes to contemporary low fertility is through its artificial depressing effect on the period TFR (**Box 1**). This so-called “tempo effect” is proportional to the pace of increase in the average age of childbearing and can be considerable (Bongaarts & Feeney, 1998). In an analysis of European countries recording a TFR of 1.3 or below during the 1990s and early 2000s, Sobotka (2004) used Bongaarts and Feeney’s (1998) tempo-adjusted TFR to demonstrate that up to one-third of the TFR deficit relative to replacement level could be explained by the shift in fertility timing towards births at older ages (see also Goldstein et al., 2009 and Bongaarts & Sobotka, 2012). More recent estimates using tempo- and parity-adjusted measures indicate that in the absence of changes in the timing of births, period fertility in 2014 in the European Union (EU) would have been 1.75 rather than 1.57 (VID, 2016; VID, 2018). In other words, postponement of childbearing has depressed the TFR by 0.18 births per woman on average, although there is variation in the estimated size of this effect across individual countries (VID, 2018). Outside of Europe, Yoo and Sobotka (2018) show that the tempo effect has also contributed to the fertility decline to low levels in the Republic of Korea since the early 1980s. Specifically, they estimate that delayed childbearing reduced the TFR in this country by 0.33 between 1981 and 2015 on average.

However, these studies also reveal that even when measurement bias is removed, the actual number of births (or quantum fertility) is also well-below replacement level in many countries. Therefore, the tempo effect cannot account entirely for low fertility. In fact, fertility postponement may also influence quantum fertility via biological mechanisms. Evidence from “natural fertility” populations, where contraception is not practised, shows that female fecundity begins to decrease from around age 25 and this decrease accelerates from around age 35 (Bongaarts, 1975; Leridon, 1977; Wood, 1989, reported in Mills et al., 2011: 849). In addition, males’ age has been highlighted as an independent risk factor for infertility (Dunson et al, 2004). To quote Morgan and Taylor (2006: 380), “in the aggregate, fertility postponed implies some fertility foregone”.

2.1. Diffusion of modern contraception

A key factor facilitating the “postponement transition” has been the diffusion of reliable methods of contraception, particularly the pill, but also of condoms and post-coital emergency contraception. Such technologies, by giving women a high degree of control over the timing of pregnancy, have allowed them to invest in education without the high cost of abstinence or postponement of unions that was the norm before the pill (Goldin & Katz, 2000). In the case of the United States, Goldin and Katz (2002) showed how the spread of the pill in the late 1960s led to an almost immediate postponement of the age of first marriage for college-educated women, who could now invest in education and longer-term careers while being sexually active. At the same time, the widespread availability of efficient contraception has reduced the rates of unwanted and unplanned pregnancies and births, which had previously “boosted” fertility rates.

The spread of modern contraception has played a key role in fertility declines to low levels in the United States, Northern and Western Europe since the 1960s, and Central and Eastern Europe in the 1990s (Sobotka, 2011). However, low fertility is also a feature of some countries (e.g. Italy and Japan) where a considerable proportion of women continue to use traditional contraceptive methods or no contraception at all. This indicates the importance of other more distal social, cultural and economic factors to which we now turn.

These distal determinants include: changes in family values and preferences encompassed under the “Second Demographic Transition”; economic constraints, including economic and employment uncertainty as well as the direct costs of children; and constraints relating to work-family compatibility, specifically gender inequity in the home, workplace conditions, and the availability of accessible childcare. Notably, these distal factors operate through their effects on the postponement of first births (tempo), and through their effects on reduced transition to second and higher-order births and increased childlessness (quantum). The distal factors are not mutually exclusive and do not operate in isolation, but rather constitute a broader set of institutional conditions that make it challenging for individuals and couples to realize their reproductive desires (Rindfuss & Choe, 2015, 2016).

3. Ideational change and the Second Demographic Transition

One of the earliest overarching narratives for the emergence of sub-replacement fertility is the Second Demographic Transition (SDT) theory (van de Kaa, 1987, 1994; Lesthaeghe, 1995, 2010). This theory links various changes in fertility, partnership and living arrangements that first emerged in Northern and Western Europe with a dramatic transition in value orientations. Drawing on the work of Maslow (1956) and Inglehart (2003), the authors emphasize the shift from traditional norms, duties and ideologies associated with the family to new so-called “post-materialist values” encompassing the dismissal of institutional control, individual self-fulfillment, the importance of lifestyle and personal freedom. Similar themes are also identified in the sociological literature on the “individualization” of life courses (Beck and Beck-Gernsheim, 2001).

This ideational change, it is argued, fueled a package of behaviors including: the delay of marriage, its displacement by cohabitation, increased union instability and a rise in extra-marital births, plus the emergence of sub-replacement fertility preferences, the postponement of childbearing, an increase in voluntary childlessness, and sustained fertility decline to low levels. Importantly, the authors acknowledged the contribution of economic development and structural changes (e.g. the increase in higher education and gender equity) to this ideological shift (Surkyn & Lesthaeghe, 2004), but it is cultural change that lies at the heart of the theory.

According to the SDT, at the macro level, those countries most advanced in terms of ideational change should also be the most advanced in terms of SDT behaviors. Empirically, value change does seem to be linked with some family behaviors. For example, there is a positive correlation

between postmaterialism (measured by the Inglehart postmaterialism index⁶) and the mean age at first marriage, cohabitation, and total divorce rate, and a negative correlation with the total first marriage rate (van de Kaa, 2001). Similarly, there is a strong association between Sobotka's composite index of SDT values and attitudes⁷ and fertility postponement, measured by the mean age of women at first birth (positive correlation), fertility rates under age 25 (negative correlation), as well as the pace of postponement, measured by the calendar year when the mean age of birth among females rose by 2 years since the start of first birth postponement (Sobotka, 2008a).

However, in contrast to predictions of the SDT, those European countries that made the greatest advances in terms of SDT values (e.g. the Nordic countries, the Netherlands and France) did not experience fertility declines to very low levels; rather they have fertility rates close to replacement level, linked to a pattern of strong recuperation of births at older ages (Sobotka, 2008a; Sobotka, 2017). One must exercise caution in interpreting such bivariate macro-level correlations, which could be influenced by ecological fallacy, confounding by unobserved factors, and country-specific temporal trajectories (Sobotka, 2008b). It is possible that the relatively high level of gender equity in the most advanced SDT countries could explain the association: gender equity is closely linked to both SDT values and more moderate fertility (see Section 5.1). Secondly, the more permissive attitude to extra-marital fertility in many moderately low fertility countries might offer greater opportunities for family formation, compensating for the decline in marital fertility (Sobotka, 2017)⁸. Indeed, TFR is also positively correlated with the share of extra-marital births at the national level. However, this too is contrary to the predictions of the SDT, which assumes that ideational change leads to both a rise in non-marital fertility and fertility decline to low levels, such that the correlation between TFR and extra-marital fertility would be expected to be negative. Overall, these cross-national studies offer limited support for the SDT as a determinant of low fertility.

Further critique of the SDT comes from studies of fertility preferences. Despite evidence of changing motivations for parenthood in Europe and the increasing importance of lifestyle factors in fertility-decision-making (Sobotka, 2008b), desire for children remains relatively high and remarkably stable over time. In a recent systematic analysis of multi-country values survey

⁶ Inglehart's postmaterialist index (Inglehart, 1997) measures the extent to which individuals hold "postmaterialist" values (individual self-expression and quality of life) as opposed to "materialist" values (economic and physical security). Materialist and post materialist value orientations are measured using a survey instrument that asks respondents to select their first and second priority from four items: 1. Maintaining order in the nation; 2. giving people more say in important government decisions; 3. fighting rising prices; and 4. protecting freedom of speech. Effectively, respondents selecting 1 and 3 as priorities are classed as materialists while those selecting 2 and 4 as priorities are classed as postmaterialists.

⁷ The index was based on 8 questions from the 1999-2000 rounds of the European Values Surveys (EVS) for 29 countries. Specifically, it relates to areas such as secularization, importance of children and leisure, gender equity, sense of individual freedom and choice, marriage as an institution, and ethics (See Sobotka, 2008a).

⁸ Interestingly, in recent years, following increases since the 1960s and 1970s, the proportion of extra-marital births has shown signs of stabilization and even decline in several settings, including the Nordic countries and the United States (UNFPA, 2018). It will be interesting to explore the consequences of these trends for future fertility.

data in Europe from 1979-2012, Sobotka and Beaujouan (2014) found that six out of ten women regard two children as ideal. This proportion is largely consistent across sub-regions. A dominant two-child ideal is also found in the United States (Hagewen & Morgan, 2005; Livingstone & Cohn, 2010), Canada and Australia (ISSP and WVS data reported in Sobotka & Beaujouan, 2014), as well as in the Republic of Korea (2001 WVS), Japan (1995-2005 WVS and repeated waves of the Japanese National Fertility Survey), and Taiwan Province of China (Chang, 2006, cited in Sobotka & Beaujouan, 2014).

One must note the perceived limitations of such preference survey data, namely that the concept of ideal family size is ambiguous, open to different interpretations (Philipov & Bernardi, 2011), and might not include preferences for childlessness (Blake, 1974). Moreover, individuals' responses are likely to be biased by their current family size (Hauser, 1967). However, overall, the SDT prediction of widespread sub-replacement fertility preferences does not seem to be borne out in practice: there is a gap between desired and actual fertility in most countries, implying constraints to couples' ability to realize their preferences. China represents an exception to the dominant two-child ideal, with many women in urban settings reporting a desire for only one child (Basten & Gu, 2013). However, this preference for small families in China seems less likely to reflect SDT-related ideological change than the operation of substantial constraints on childbearing (Basten, 2015). The following two sections explore two broad sets of constraints facing couples that are proposed to explain low fertility. The first broad set of constraints relates to economic challenges and encompasses economic and labor market uncertainty as well as direct costs associated with raising children. The second broad set of constraints relates to the challenge of combining childbearing and childrearing with building a career, particularly for women.

4. Economic constraints

4.1 Economic and labor market uncertainty

In many high-income countries today, young people face significant economic insecurity (Billari, 2008; Sobotka, 2017; UNFPA, 2018). Over the past four decades, youth unemployment rates have increased, linked in part with the expansion of tertiary education, but also with rapid globalization and technological change, which have reduced many job opportunities previously filled by young people (Adserà, 2018). At the same time, with increasing economic liberalization, jobs that in the past had long-term security have been substituted for short-term, insecure contract work, which is often poorly paid. Across developed countries, the real incomes of those in their 20s and early 30s have stagnated or declined compared to previous generations (Rahman & Tomlinson, 2018), and young people are “[failing] to thrive” (Sanderson et al., 2013). This deterioration in economic position has been especially stark among the lower- and middle-educated youth, leading to widening social inequality (Adserà, 2017), with the possibility of steeper fertility declines among these lower- and middle-educated groups in the future.

Geographically, the economic position of youth is particularly precarious in Southern Europe, which has seen high unemployment rates since the 1980s. In 2016, the proportion of 15-29 year olds not in employment, education or training (NEETs) exceeded 20% in Spain (21.7%), Greece (23.5%) and Italy (26.0%) – compared to the OECD average of 13.2% (OECD, 2018a). East Asian countries have also seen a proliferation of temporary employment following the implementation of neoliberal government policies designed to increase the flexibility of the labor market after the 1997 economic crisis (Ma, 2014). Tsuya (2015) notes for Japan, a dramatic increase in *keijaku* (fixed-term employment with limited social insurance provision), *haken* (contract work in which workers are sent by an agency to an organization for a fixed period), and *freeta* (young people without stable employment who jump from one temporary job to another). Similar increases in economic uncertainty following the crisis are highlighted by Lee and Choi (2015) for the Republic of Korea.

From a theoretical perspective, economic and labor market uncertainty encourages couples to defer long-term irreversible commitments, which include having children (see Balbo et al., 2013; Blossfeld, 2005). Easterlin's (1976) model of economic deprivation demonstrates that, throughout history, in times of economic uncertainty and increasing unemployment, individuals' propensity to marry and have children decreases; similarly, Rindfuss and Vandenheuvel (1990) stress the so-called "affordability clause" to having a child. The social norm of securing employment prior to starting a family is argued to further aggravate the effect of labor market instability on fertility postponement (Thévenon, 2015; Brinton et al., 2018).

Several empirical studies support these theoretical perspectives. Fahlen and Oláh (2018) showed that societal and perceived economic uncertainty is negatively associated with first birth intentions, particularly among men. In a macro-level analysis of 23 OECD countries, Adserà (2004) found that high levels of unemployment and a high share of self-employment and fixed-term (unstable) contracts, common in Southern Europe, had a downward effect on fertility, especially among younger age groups. Consistent with this, Mills and colleagues (2005) found in a comparison of 14 countries that experience of temporary contractual work, job instability or youth unemployment increased the likelihood of postponement of first births. Meanwhile, analyzing 12 European Union countries, Adserà (2011) showed that postponement of second births was more likely among women in countries with high unemployment and who were themselves unemployed (particularly if less educated) or on a temporary contract.

Importantly, the impact of economic uncertainty on fertility seems to be conditioned by national-level institutional factors, including the nature of welfare systems and gender systems. In countries with strong social welfare protection such as Norway and Sweden, economic uncertainty had a weaker impact on first birth postponement compared to Southern Europe (Mills et al., 2005; Adserà, 2004). Secondly, women facing uncertain employment conditions in male-breadwinner countries such as Germany, the Netherlands and Spain showed a greater (rather than reduced) tendency to have children, perhaps reflecting a lack of career opportunities for women in these settings (Mills et al., 2005). Furthermore, Kreyenfeld (2010)

identified differential responses to economic uncertainty in Germany depending on women's education level: lower educated women tended to respond to economic uncertainty by having children, whereas highly educated women responded by delaying childbearing. These differential responses were seen for both objective (unemployment) and subjective (fear of economic context and job insecurity) measures of uncertainty.

Compounding the long-term shift towards greater economic insecurity is the impact of economic recessions and other shocks. Most studies have identified a pro-cyclical relationship between economic trends and fertility in post-transitional countries (Sobotka et al., 2011; Currie & Schwandt, 2014; Comolli, 2017). For example, the unprecedented economic, social and political transformation that occurred with the collapse of the state-socialist system in Central and Eastern Europe in 1989-1991 led to a massive fertility decline that continued throughout the 1990s (Sobotka, 2011) (**Box 2**). In East Asia, Kim and Yoo (2016) showed that the 1997 economic crisis contributed to a decline in cohort fertility in Korea, mediated by a delay in marriage. In European countries and the United States, evidence suggests that the 2008 recession was associated with a stalling of the fertility increase in several countries (e.g. France, UK, Italy, the Russian Federation), and a reversal in the previous trend of rising fertility in others (e.g. USA, Romania and Spain, and to a lesser extent Australia and Canada) (Basten et al., 2015). Notably, the fertility decline during this recession was particularly steep among young women under 25 years (Lanzieri, 2013; Goldstein et al., 2013), implying an effect on the postponement of births rather than a reduction in lifetime quantum fertility (Sobotka, 2017).

Box 2: The collapse of state-socialism in Central and Eastern Europe and fertility

The collapse of the state-socialist system and transition to a market economy in Central and Eastern Europe in 1989-1991 constituted a major economic, social and political transformation, with huge implications for fertility and family behavior across the region. There had already been a gradual decrease in fertility rates in many Central and Eastern European countries during the 1980s, but the change in political regime around 1990 precipitated a massive, widespread fall in period fertility, accompanied by (and partly caused by) the postponement of childbearing (Sobotka, 2011).

The transition to a market economy was associated with marked economic downturns; high inflation; a rapid rise in unemployment, particularly among women; the loss of previously guaranteed employment and income rights; considerable cuts in social spending; and a rise in poverty as well as increasing inequality in the income distribution (Hakkert, 2014). These changes served to make childbearing less affordable for much of the population. At the same time, several institutions, including the system of preferential housing distribution, low competition in the labor market, and many family policies – all of which had supported the previous pattern of early and universal marriage and reproduction – collapsed (Sobotka, 2011). There were also changes in tertiary education with a rapid increase in university enrolment rates, linked to the rise in employment uncertainty (higher education being seen as a rational alternative to employment), and an increase in returns to education in terms of employment prospects (Kogan & Unt, 2005). This expansion of tertiary education was a significant driver of the postponement of partnership formation, marriage, and births (e.g. Kantorová, 2004 for Czechia, cited in Sobotka, 2011).

In addition to these economic and institutional changes, the general societal upheaval was associated with rapid changes in norms and values, including an increase in “normlessness”, anomie, and “disorientation” among some people (Philipov, 2002). Specifically, Perelli-Harris (2008: 1163) has argued that uncertainty and anomie, coupled with a desire to have “high quality” children may account for the increase in one-child families in Ukraine, because people “[felt] that they [had] lost control over their environment.”

Importantly, despite the similarities in economic, social and fertility trends across the region, Sobotka (2011) identified important differences in fertility patterns between countries and social groups. On the one hand, economic transformation seems to have contributed to the maintenance of an early childbearing pattern with limited fertility postponement in countries that experienced the most pronounced fall in real wages, the greatest uncertainty, and the lowest level of social security, such as Lithuania, the Republic of Moldova, the Russian Federation and Ukraine (Sobotka, 2003b, Billingsley, 2010). On the other hand, in countries with a more successful economic and social transition in the 1990s, typical of Central Europe, widespread postponement of childbearing took place, and this constituted a major driver of the decline in period fertility (Sobotka, 2011).

It is also worth noting, that the very low period fertility rates seen across the whole region of post-communist Europe during the 1990s, have subsequently recovered somewhat, owing to a combination of a decrease in the tempo effect, strong economic conditions prior to the recent

4.2 Direct economic costs of raising children

Alongside contextual economic uncertainty, the direct costs associated with raising children, and the increase in these costs since the 1970s, play a role in explaining the shift towards very low fertility (Thévenon, 2015; UNFPA, 2018; Rindfuss & Choe, 2015, 2016). Reviews of the literature indicate that a child represents around 15-30% of the budget of a childless couple (OECD, 2011; Thévenon & Luci, 2012, reported in Thévenon, 2015: 100). These costs include food, clothing, childcare, transport and leisure among others. This review focuses on two particularly significant costs: housing and children's education.

4.2.1 Housing

In most high-income countries, access to one's own appropriate dwelling is considered a precondition for starting a family. Therefore, other things being equal, where it is difficult to obtain a home, couples may delay or avoid childbearing (Rindfuss & Brauner-Otto, 2008; Rindfuss & Choe, 2015, 2016). Affordability of housing is a particular issue in several East Asian countries. In a survey of 360 cities, Holliday (2014, cited in Basten, 2015: 72) showed that average property prices in Hong Kong SAR were 14.9 times the gross annual median household income, making it the most unaffordable city globally to buy a home. Meanwhile, in a commercial survey of middle-class 30- to 40-year olds in Hong Kong SAR, of the single participants, 53% stated that they would delay marriage to increase time for saving, with property purchase being the primary reason for savings (Chen, 2013, reported in Basten in Rindfuss & Choe, 2015: 73). These findings are consistent with Yi and Zhang's (2010) economic analysis of housing in Hong Kong SAR in which a 1% increase in house prices was significantly associated with a 0.45% reduction in TFR, suggesting that around 65% of the fertility decline in Hong Kong SAR from 1971 to 2005 could plausibly be attributed to high house price inflation.

In the Republic of Korea, not only are house prices high but the unique property rental system, known as *jeonse*, makes it expensive to rent as well. Under this system, dwellers make a substantial down-payment, the interest from which serves as a substitute for monthly rent; the down-payment is then returned to the renters when they leave (Lee & Choi, 2015). Consequently, even when renting, the majority of young people need to secure a mortgage – a factor noted by Lee and Choi (2015) as contributing to low fertility in the country. In addition to direct expense, the limited size of available housing has been identified as a low fertility determinant in Hong Kong SAR (Basten, 2015). Here, the average size of new homes is just 45m², equivalent to around 15m² of residential space per capita on average (Wilson, 2013, cited in Basten, 2015).

Meanwhile in Southern Europe, the share of rental and social housing is low and obtaining a mortgage is difficult, owing in part to the limited regulation of the rental and credit markets (Tanturri, 2016). Mulder (2006) notes that mortgage lenders in Italy require down-payments as high as 50%, making it difficult for young people to establish themselves, which in turn encourages the postponement of parenthood. Furthermore, lenders are often reluctant to lend

to individuals who are not in secure work, irrespective of their long-term earning potential (Tanturri, 2016). In this way, the housing market and the aforementioned economic uncertainty seem to interact as determinants of low fertility in Southern Europe. Compounding the problem is the strong social norm of home ownership in the region, which as Mulder and Billari (2010) observe, is associated with low fertility at the country level. This lies in contrast to North-Western European countries where renting is more socially acceptable (Mulder & Billari: 2010). Overall, despite theoretical work, high quality empirical analysis of the role of housing in low fertility is currently limited. Future research should address this area.

The difficult home ownership regime in Southern Europe, combined with the precarious economic situation of youth and their extended time in education, has led to a situation where a high proportion of young adults still live with their parents, often well into their 30s (Iacovou, 2010; Mencarini & Tanturri, 2006). Indeed, Tanturri (2016) estimates that more than 44% of 25-35 year-old Italians still live in the parental home. While comparable demographic analysis of home-leaving is lacking in East Asian low fertility countries, Suzuki (2008: 37) observes, in relation to Korea, the emergence of the “kangaroo-jok” as a description for single adults who delay marriage as well as leaving their parental home.

According to Dalla Zuanna (2001), such delayed home-leaving contributes to lower fertility directly by reducing the interval available for childbearing. It also contributes indirectly by reducing young adults’ exposure to risk (arguably useful for childbearing), and since young men fail to gain experience in housework, which in turn creates a double-burden of work for their female partners when they eventually do leave home (*see Section 5.1*). Reinforcing the structural drivers of this extended intergenerational co-residence is the strong familist culture in Southern Europe. Dalla Zuanna (2001) notes that the tight intergenerational links and high level of comfort provided in the parents’ home discourage children from leaving. The outcome is a paradoxical situation whereby very low fertility tends to be found in countries with the strongest emphasis on the family (Dalla Zuanna, 2001; Dalla Zuanna & Micheli, 2004; Livi-Bacci; 2001; Reher, 1998), summarized by Livi-Bacci as “too few children and too much family”.

4.2.2 Education

The perceived and actual cost of children’s education represents a second factor underlying very low fertility, particularly in the East Asian context. According to evidence cited by Anderson and Kohler (2013), these societies are characterized by strong Confucian values that put an emphasis on education as a means of social mobility. This, combined with cultural influence from the West, posits Sorensen (1994), has produced a strong national dedication to mass education. At the same time, Tan and colleagues (2016) draw attention to the highly selective university admissions, strict university hierarchy and strong labor market discrimination based on the prestige of one’s university in East Asian countries. This makes educational attainment, even from very young ages, important (Tan *et al*, 2016).

All this, argue Anderson and Kohler (2013), has stimulated intense pressure and competition among parents for their children to succeed. This “education arms race” (Jones & Hamid, 2015: 36) or “education fever” (Anderson & Kohler, 2013: 196), and the associated need to invest heavily in one’s children’s education, makes raising children very expensive. Over 75% of children in the Republic of Korea participated in some sort of private education in 2009 (Korea National Statistical Office, 2009, cited in Anderson & Kohler, 2013). These include English-speaking kindergartens and cram schools (*hagwon* in Korea, *juku* in Japan) to prepare for key exams (Anderson & Kohler, 2013; Tsuya, 2015). Seemingly, it has become socially normative to send one’s children to such after-school activities in the Republic of Korea, and parents who do not risk being labelled as irresponsible (Lee, 2011; Anderson and Kohler, 2013). Aside from financial costs, intense investment in children’s education represents an opportunity cost in terms of time for women, since it is almost exclusively mothers who take responsibility for their children’s educational development. The result is a quality-quantity trade-off with parents prepared to have fewer children than they would have liked to ensure that those they do have are more successful (Anderson and Kohler, 2013).

In qualitative research in Japan, mothers most frequently cite paying for their children’s education, particularly after-school activities, as the reason for their employment (Tsuya & Choe, reported in Tsuya, 2015). Meanwhile, in the 2012 Korean National Survey on Fertility, Family Health and Welfare, just over half of married women respondents reported economic reasons such as unstable employment, low income and the cost of children’s education as reason for not wanting more children (Kim *et al* 2012, cited in Lee & Choi, 2015: 116). In quantitative research at the macro level, Anderson & Kohler (2013) found a negative relationship across Korean provinces between household spending on education and fertility rates. Likewise, Ogawa and colleagues (2009) revealed a negative association between direct public and private spending on children and fertility in Korea, Japan, Taiwan Province of China and Thailand, although admittedly, neither of these macro-level correlations can be interpreted as causal.

Educational costs may also contribute to delayed and low fertility indirectly through the high cost of tertiary education and associated student debt, particularly in the United States. According to the most recent estimates, total student debt in this country stood at \$1.49 trillion in Q1 of 2019, a figure equivalent to nearly 11% of all outstanding household debt, and the second largest source of personal indebtedness after mortgages (\$9.2 trillion) (Federal Reserve Bank of New York, 2018). Several authors have linked the rapid rise in student debt with the recent increase in “boomeranging”, or returning to the parental home, among young people (Bleemer et al., 2014; Davidson, 2014), which in turn delays the start of adult life transition such as living with a partner and having a child (*see Section 4.2.2*). Using data from the National Longitudinal Survey of Youth 1997 cohort for the United States, Addo (2014) found that women with educational loan debt were more likely to delay marriage and the transition to cohabitation than those without such debt, and Nau and colleagues (2015) found that student loans tend to delay fertility for women, especially at very high levels of debt. Currently,

quantitative studies of the link between student debt and fertility are limited, making further research into this and the contribution of educational expenditure to low fertility in East Asian contexts, a high priority moving forwards.

5. Combining work and childbearing

A second set of constraints identified as important determinants relate to the challenge of combining childbearing and childrearing with paid work, particularly for women. These constraints emphasize the indirect or opportunity cost of having children in contemporary societies. Over the past five decades, female labor force participation has increased considerably and has largely converged among developed countries. In 2017, the average female labor force participation rate⁹ among 25-34 year olds in OECD member states was 72.4%, up from 44.5% in 1970 (OECD, 2019). Employment has become an expected part of women's life courses (Goldin, 2006); having one's own source of income serves as a source of financial security for women (Rosenbluth, 2007); and with rising consumerism, there is an increasing perceived need among couples for two incomes (Frejka *et al.*, 2010).

In the Nordic, and to some extent, the English-speaking OECD countries, this increase in women's employment has been accompanied by social and institutional reforms that facilitate the combination of work and childbearing. However, in many Southern, Central and Eastern European and East Asian countries, traditional institutional arrangements and cultural norms persist. The result is a work-family conflict for women, and couples respond by having fewer children than they might otherwise have liked.

Across developed countries, the cross-national relationship between female labor force participation and TFR has changed over time. In the 1970s, the association was negative (countries with higher female labor force participation had lower TFR), but during the 1980s and 1990s, this relationship reversed (Brewster & Rindfuss, 2000; Ahn & Mira, 2002; Kögel, 2004)¹⁰. The highest TFRs are now found in countries with higher female labor force participation, where social and institutional reforms have made work and childbearing most compatible.

The following discussion focuses on three specific cultural and institutional constraints that contribute to low fertility via their effect on the compatibility of work and family: 1) gender (in)equity in the domestic sphere, 2) workplace conditions, and 3) the availability of childcare.

5.1 Gender inequity in the domestic sphere

⁹ For a given age and sex group, the labor force participation rate is calculated as the labor force divided by the population size of that age group. The labor force participation rate is available for age groups within the working age population of 15 to 64 years (OECD, 2019).

¹⁰ It should be noted that this reversal has not been replicated at the individual level (Engelhardt & Prskawetz., 2004), although for several countries there is evidence of an attenuation of the negative correlation over time (Kögel, 2004).

In a widely cited series of papers, McDonald (2000a, 2000b, 2006) argues that low fertility at the national level results from an asymmetry of gender equity¹¹ in the public and private spheres. In the public sphere, there has been a massive expansion of opportunities for females. Across developed OECD member states, there are now more women aged 25-35 years than men attaining higher education (OECD, 2017). In addition, the absolute gap between male and female labor force participation rates has narrowed: in 1970, the labor force participation rate among 15-64 year olds was 85.8% for males and 47.6% for females; in 2017, the rates were 86.2% and 64.0% respectively (OECD, 2017).

However, in Southern, Central and Eastern Europe as well as East Asia, gender equity in the domestic sphere typically remains low. These societies tend to be characterized by traditional patriarchal gender norms, with women taking on the bulk of the responsibility for domestic chores, childrearing and care for older relatives (Rindfuss & Choe, 2015, 2016). In Japan and Korea, for instance, women on average spend over two hours per day on housework and childcare compared to men's contribution of 45 minutes or less (OECD, 2018c). Tanturri (2016) notes in the case of Italy that the "working mother" is still viewed negatively, with three-quarters of Italians reporting a belief that a pre-school child suffers to some extent if his/her mother works according to European Social Survey (2008) data. Such gender-unequal attitudes are reinforced by structural factors, with the school day typically much shorter than normal working hours, for example (Tanturri, 2016).

This public/private asymmetry has led to what Esping-Andersen (2009) has termed the "incomplete gender revolution". The outcome is a double-burden or "second shift" (Hochschild & Machung, 1989) for women who wish to work, and an increased opportunity cost of childbearing. By contrast, the higher domestic gender equity observed in the Nordic countries, for instance, reduces the indirect cost of children and actual fertility is closer to desired, near-replacement levels¹². According to Esping-Andersen and Billari (2015) and Goldscheider *et al.* (2016), this shift towards greater gender equality and the increased involvement of men in the domestic sphere is a precondition for achieving higher fertility.

Interestingly, Goldschieder and colleagues (2015) also posit that the emergence of several behaviors characteristic of the aforementioned SDT, namely low rates of union formation, high rates of union dissolution (as well as very low fertility), can in fact be explained by an incomplete gender revolution without needing to invoke ideational change. Specifically, they propose that women's increased education and entry into the workplace without accompanying increases in domestic gender equity (the first half of the gender revolution) has

¹¹ McDonald (2013: 983) employs the term "gender equity" rather than "gender equality" to indicate "perceptions of fairness" as opposed to "strict equality of outcome".

¹² Interestingly, recent years have witnessed declines in the period TFR in the UK, USA, and some Nordic countries (e.g. Finland and Norway) despite generous policies to promote gender equity and work-life balance (Gietel-Basten, 2019). It is as yet unclear as to whether these lower period TFRs will lead to declines in cohort fertility, but examining the future progression of these trends will be important.

placed stresses on the traditional family. For instance, the growth in women's independence has likely contributed to a reduced need to get married or remain in an undesirable marriage, while, as mentioned above, the double burden faced by working women increases the opportunity cost of having children, contributing to lower fertility. Crucially, however, they argue that the rise in the domestic role of men (the "second half" of the gender revolution), now underway in the Nordic countries and increasingly other Western European countries, may strengthen families: more egalitarian male roles can lead to greater relationship satisfaction among couples, reducing the likelihood of divorce, while fathers' increased participation in household tasks can reduce the opportunity cost of childbearing and hence support fertility.

Myrskylä *et al* (2011) demonstrate that the positive effect of development (measured by health, income and education) on fertility in highly developed countries is contingent on high levels of societal gender equality: countries in which high human development is combined with low levels of gender equality (measured by the Gender Gap Index¹³) tend to experience very low and declining fertility. However, other authors have questioned the strength of the reversal when more recent post-2015 data are used (Sobotka, 2018).

In support of gender equity theory, several household-level longitudinal studies across diverse settings show that a more equal gender division of household labor increases the probability of second birth. Oláh (2003) found that fathers' contribution to household work is associated with an increased likelihood of second birth in both Sweden, which has a dual-earner/dual-carer model, and Hungary, which has a more unequal division of domestic labor. This is consistent with further evidence from Nordic countries indicating that the involvement of fathers in caring for the first child advances the birth of the second child (Duvander & Anderssen, 2006; Duvander *et al*, 2008; Lappegard, 2009). Meanwhile, in Germany, Cooke (2004) showed that an increase in husbands' share of childcare time increased the likelihood of a second birth, although this did not entirely outweigh the depressing effect of women's long working hours: indeed, male-breadwinner couples were around twice as likely to have a second birth three years after the first birth compared to dual-earner couples in this study.

Analyzing data for the United States and Italy respectively, Torr and Short (2004) and Cooke (2009) demonstrated a positive influence of more egalitarian housework sharing on the probability of a second birth when the wife was working. However, a 2015 study by Miettinen and colleagues in Finland revealed more nuanced findings: while fewer hours spent on housework by women increased the probability of a subsequent birth, men's increased contribution to housework had no impact on fertility (although male participation in childcare did increase the probability of a subsequent birth). They speculated that the negligible effect of

¹³ The Global Gender Gap Index, produced by the World Bank, examines the gap between men and women in four fundamental categories (subindexes) and 14 different indicators that compose them. The subindexes are Economic Participation and Opportunity, Educational Attainment, Health and Survival and Political Empowerment. The highest possible score is 1 (equality) and the lowest possible score is 0 (inequality) (World Bank, 2019).

men's housework participation on fertility may result from women spending less time on housework in households where men contribute more (Miettinen *et al.*, 2015).

In East Asia, Kim (2017) and Yoon (2017) revealed for the Republic of Korea that increased husbands' time spent on domestic labor increases the likelihood of second birth, although Yoon (2017) found that this positive effect is only present above a high threshold contribution of three hours per day. In Japan, Nagase and Brinton (2017) concluded that husbands' increased contribution to household work is an important predictor of second birth among dual-earner couples, although the effect was not significant for male-breadwinner couples.

Further support for gender equity theory comes from recent qualitative studies, which add nuances complementary to the quantitative research. In 32 qualitative interviews with parents in Taipei, Taiwan Province of China, Freeman *et al* (2017) found that women were responsible for the majority of the hands-on childcare; this skewed responsibility, and the concomitant tiredness, social isolation and restrictions on living the life they wanted, was the clearest predictor of the intention to limit further childbearing among women with one child.

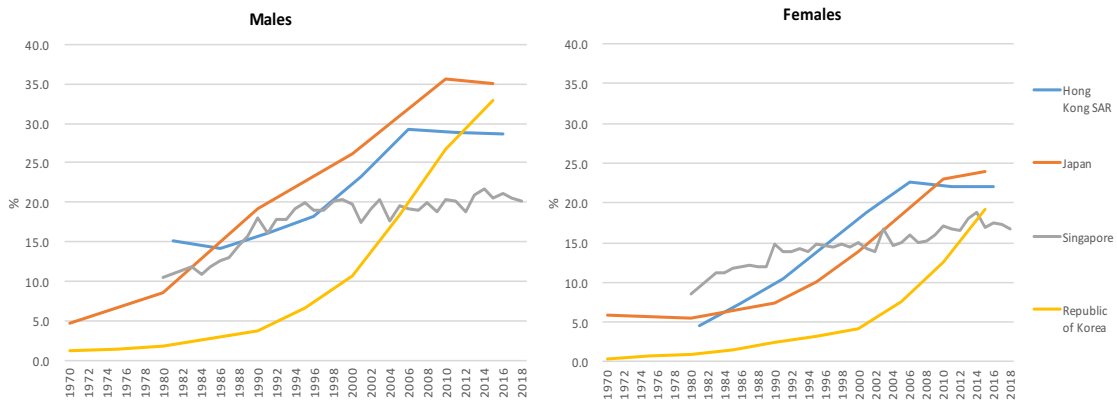
Brinton and colleagues' (2018) comparative analysis using in-depth interviews of highly educated young adults in two moderately low fertility countries (Sweden and United States) and two very low fertility countries (Japan and Spain), found that work-family conflict was a very significant constraint on fertility in Japan but was little expressed since gender specialization in the home was "taken for granted" (p. 303). Furthermore, the analysis revealed the "distinctiveness" (p. 304) of the two very low fertility settings, with gender inequity in the home being an important factor in Japan but less so in Spain, where reported attitudes were more progressive: most interviewees from Spain said that both women and men should invest in their careers and work experience to prevent against future unemployment and job insecurity, and Spanish males, in contrast to those from Japan, reported that the couple might consider having more children if they as male partners were to invest more time in household tasks. Economic and labor market insecurity was a more important explanation offered by respondents for the gap between fertility ideals and intentions in this country.

Box 3: The marriage-childbearing link

A key proximate factor contributing to low fertility in the East Asian context specifically is the strong link between marriage and childbearing. The persistence of traditional Confucian norms means that childbearing outside of marriage remains strongly disapproved of in these societies. In addition, structural factors may reinforce these socio-cultural norms in several settings. As Bumpass (2009) notes, children born outside of marriage in Japan are still labeled as illegitimate (*hi-chakushutsu-shi*) in vital statistics and qualify for only half of the inheritance rights awarded to children born within marriage (Taeuber, 1958, Tsuya & Choe, 1991, cited in Bumpass *et al.*, 2009: 218). Correspondingly, despite a small increase in recent years, the proportion of non-marital births remains low, at around 2% in Japan and the Republic of Korea and 5% in Hong Kong SAR. By contrast, the share in 2016 exceeded 50% in several European and English-speaking countries, including: France, Iceland, the Netherlands, Norway, Portugal, Slovenia and Sweden, with rates particularly high in Iceland (70%) (OECD, 2018d).

Marriage in East Asian societies is effectively the “gatekeeper” to fertility, with factors that encourage the postponement or rejection of marriage in turn tending to delay and depress fertility (Frejka *et al.*, 2010: 596). Indeed, since the 1970s and 1980s, there has been substantial postponement and avoidance of marriage in East Asian countries, coinciding with rapid fertility decline. From 1980-81 to 2015-18, the proportion of women never married at age 35-39 years increased from 4.5% to 22.0% in Hong Kong SAR, 5.5% to 23.9% in Japan, 1.0% to 19.2% in the Republic of Korea, and 8.5% to 16.7% in Singapore. Among men, the increases were generally even greater, from 15.2% to 28.7% in Hong Kong SAR, 8.5% to 35.0% in Japan, 1.7% to 33.0% in the Republic of Korea, and 10.5% to 20.2% in Singapore (Figure 5). Research by Kim (2018) using decomposition analysis reveals that a reduction in the proportion of women married has been the principal factor driving the decline in fertility in the Republic of Korea between 2000 and 2017. Specifically, the author estimated that more than 50% of the fertility decline over the period was attributable to a reduction in marriage, compared to a reduction in the female population size or a reduction in marital fertility, which explained around 30% and 16% of the fertility decline respectively.

Figure 5: Proportion single males and females age 35-39 in selected East Asian countries. 1970-2018



Sources: For Hong Kong SAR, Census and Statistics Department 2007, 2017; for Japan, Statistics Japan 2017; for Republic

Box 3: The marriage-childbearing link (*continued*)

Two main factors are thought to underlie the delay and increased avoidance of marriage in East Asian settings. First, is the rejection of the so-called “marriage package” – the bundle of inter-related domestic roles (including household chores, care for the elderly and children and their educational development) that largely fall on women within marriage. Tsuya (2015) highlights the change in women’s lives upon marriage using data from the 1994, 2000 and 2009 National Family Surveys in Japan: whereas two-thirds of unmarried women perform less than 10 hours of housework per week, 40-60% of currently married women perform 30 hours or more per week. In comparison, regardless of their marital status, men perform around 2-4 hours of housework per week. With the aforementioned expansion of educational and employment opportunities, and the exposure to new values plus the time demands that this brings, it seems that marriage has become a less attractive life choice for women (Bumpass *et al.*, 2009).

The second factor concerns the squeeze in marriage markets. East Asian societies tend to be characterized by a persistent system of hypergamy, whereby women marry older and better educated men (Jones & Gubhaju, 2009; Raymo *et al.*, 2015). Yet with expanding education and employment opportunities for women, better educated women (and lower educated men) are squeezed out of the marriage market. According to Raymo and Iwasawa (2005), changing mate availability can account for up to one-third of the decrease in age-specific proportions of highly educated women who have married in Japan. Furthermore, the squeeze among lower educated men has been identified as a key driver of the increase in cross-border marriages in East Asia (So, 2003; Jones & Shen, 2008).

Finally, Raymo *et al* (2015) note that long working hours and sex-segregated workplaces make it difficult to meet partners in East Asia. In this way, the strong cultural norm of childbearing within marriage seems to interact with workplace factors discussed in the next section.

5.2 Workplace conditions and policies

Persistent gender inequity within the domestic sphere makes it difficult for women to combine work and childbearing. This challenge is further reinforced by diverse aspects of workplace conditions, which also operate to constrain fertility choices. As noted in *Section 4.1*, high levels of unemployment, self-employment and insecure contractual positions tend to depress fertility (Adserà, 2004, 2005, 2011), and this is a key contributor to very low fertility in Southern Europe.

Meanwhile, Rosenbluth (2007) highlights the contribution of direct discrimination by employers against hiring female workers in jobs with benefits and opportunities for career progression, or in re-hiring them following career breaks for childbearing. Rather than encouraging women to

give up on a career, she argues, these obstacles to females' labor force participation motivate them to strive harder to succeed, and fertility may suffer as a consequence.

Such discrimination has been identified as a particular issue in Japan (Rosenbluth, 2007; Rindfuss & Choe, 2015) and Italy. In Italy, it is known that some employers will make women of reproductive age sign an undated resignation letter to be used should they become pregnant (Rindfuss & Choe, 2016). Moreover, in relation to the Republic of Korea, Ma (2014) notes that that mothers returning to employment after childbirth in the decade following the 1997 economic crisis experienced substantial downward labor market mobility, often taking lower status jobs after their return.

According to Estévez-Abe (2007), the likelihood of discrimination, and hence the cost of career interruption to women, is linked to the extent to which national economies are based on firm- or industry-specific skills as opposed to general skills; this in turn tends to be a product of long-standing political and historical factors. Consistent with this hypothesis, Rosenbluth (2007) highlights labor market differences between Japan and Germany (very low fertility) on the one hand and the United States and Sweden (moderately low fertility) on the other. In the former two countries, employees enter one firm (or industry) for which they are expected to build up specific skills over the course of their careers in return for long-term employment guarantees (Rosenbluth, 2007). Under these circumstances, the cost of employees' career interruption to employers and to the female employees themselves is high, and women generally respond by limiting their fertility to increase their chance of career success (Rosenbluth, 2007). By contrast, the United States has a more fluid labor market, where general rather than specific skills are valued. Ironically, under these circumstances where both female *and* male employees are insecure, career interruption by females becomes relatively less disadvantageous than in firm- or industry-specific economies, and fertility is arguably less constrained. Fertility also tends to be higher in countries, such as Sweden, with a high share of secure public jobs that are disproportionately filled by women, and serves to reduce the cost of female career interruption, facilitating the combination of work and family (Rosenbluth, 2007, Adserà, 2004, 2005).

Alongside direct discrimination by employers, indirect discrimination in the form of long, inflexible working hours and practices have been proposed as factors behind delayed and depressed fertility (Kim, 2018; Rindfuss & Choe, 2015, 2016; Thévenon, 2015). Long working hours and working weeks is an issue largely specific to East Asian countries, where economic growth has been driven by labor-intensive industries (Lee & Choi, 2015; Tsuya, 2015; Kim, 2018). It is the expectation among both employers and co-workers that employees be present for long hours; there is often little appreciation for the family responsibilities of workers, and long commuting times further increase the time burden of employment (Rindfuss & Choe, 2015). According to OECD data, in the Republic of Korea in 2014 around 18% of employed women worked more than 54 hours per week (OECD, 2017, cited in UNFPA, 2018: 109).

Limited options for flexible arrangements make it difficult for women and men to juggle work and family commitments (Thévenon, 2015). Meanwhile, Nagase and Brinton (2017) demonstrate that long working hours among males are a significant predictor of husbands' low share of household work in Japan, which in turn tends to reduce transition to second births among dual earner couples. Interestingly, this study revealed that working hours are a more significant predictor of men's contribution to domestic work than the progressiveness of gender role attitudes. Further empirical support for the impact of working hours on fertility comes from a study by Baizán and colleagues (2016) of 25 European Union Countries plus Norway. These authors showed that long working hours of men have a depressing effect on completed fertility of medium and highly educated couples. This was especially true for highly educated women, for whom completed fertility was estimated at 1.8 in countries where men work 38 hours per week on average, compared to approximately 1.45 in countries where men work 45 hours per week on average. Currently, empirical research on the contribution of working hours is in its infancy, and future studies would be well placed to address this gap (Kim, 2018).

Several East Asian countries with very low fertility have already enacted legal restrictions on the number of working hours per week. In 2018, for instance, Korea passed a law to limit the working week to 40 hours with maximum 12 hours' overtime (UNFPA, 2018). However, governments need to enhance enforcement efforts to incentivize employers to take action. As observed by Kim (2018), inadequate governmental action is partly a consequence of the limited systematic knowledge about the impact of long working hours on childbearing decisions, making this a priority area for further research.

The limited availability of high-quality part-time work and flexible working arrangements, which is a feature of several East Asian and Southern European countries, may also constrain the compatibility of work and family, and in turn fertility choices (Rindfuss & Choe, 2016). A number of studies demonstrate a positive effect of part-time employment on fertility, particularly among highly-educated women (Baizán *et al.*, 2016; D'Addio & d'Ercole, 2005). However, this positive effect depends on the type and quality of part-time work: where part-time employment is of worse quality than full-time work in respect to job protection, social benefits and pro rata wages, it is unlikely to promote childbearing (Del Boca & Pasqua, 2005; McDonald & Belanger, 2016). The Netherlands, where fertility is close to replacement, represents an example of a country from which others could learn: here women and men have a legally-protected right to work part-time for equal wage and benefits (including healthcare and pensions) as their full-time counterparts.

5.2.1 Parental leave policies

One specific aspect of workplace policies is that of post-childbirth parental leave. Reviews of the impact of parental leave on fertility also reveal mixed findings (Thévenon & Gauthier, 2011). In cross-national studies, the duration of leave is generally estimated to have a negative or non-

significant effect. Evidence for an impact of payment associated with leave is stronger (D’Addio & Mira D’Ercole, 2005; Luci & Thévenon, 2011, cited in Thévenon & Gauthier, 2011), although the effect may operate principally on advancing the timing of births (Kalwij, 2010). This is consistent with the results of national studies, particularly in Scandinavian countries (Hoem, 1993; Ronsen, 2004; Ronsen & Skrede, 2008). For instance, Andersson & Neyer (2008, reported in Thévenon & Gauthier, 2011) find that the policy of a premium on paid parental leave awarded in Sweden when the second child is born soon after the first appears to have resulted in more closely spaced births, although the impact on completed family size is uncertain. In an analysis of panel data in 18 OECD countries, Luci-Greulich & Thévenon (2013) found that paid leave had a positive effect on fertility on average, although the effect was less than that for cash benefits following the year of birth, and childcare services for children under three years. These findings remained after controlling for birth postponement, endogeneity, lagged fertility reactions and for female labor force participation, unemployment labor market protection, and the share of children born out of marriage.

In several countries, parental leave policies are now designed to incentivize fathers to care for their children. Such “use it or lose it” schemes, pioneered in the Nordic countries in the mid-1990s involve non-transferable parental leave rights for each parent, and as intended have resulted in increased leave uptake by fathers. While empirical evidence on the impact of these schemes on fertility is still limited, and the duration of leave used by fathers still likely too short to have a large influence, research from Nordic countries has demonstrated that fathers who take parental leave have greater involvement in childcare following their return to work (Duvander & Jans, 2008; Haas & Hwang, 2008), and for couples who share parental leave there is a greater probability of having a second child, or having it sooner (Duvander & Andersson, 2006; Duvander, et al., 2010). It is important to note, however, the potential for a selection effect whereby those fathers who took the leave may be more family oriented in the first place; in this case, the impact of shared leave use in these studies may be overestimated.

In addition to the availability of parental leave entitlements, awareness of their availability is important. Yoon (2017) notes for the Republic of Korea that despite currently providing the most generous period of paternal leave among OECD countries, close to half of the 526 respondents were not very familiar with the policy, while one-fifth of them had no knowledge of it at all. Furthermore, several authors observe that even where parental leave is available, many employees in East Asian countries do not make use of it owing to negative pressure from co-workers (linked to the redistribution of leave-takers’ workload to peers), or fear of missing out on promotion opportunities (Frejka et al., 2010; Jones, 2012; Kim, 2018).

5.3 Availability of childcare services

A third institutional constraint thought to play a role in low fertility in several countries is the limited availability of high-quality childcare services, particularly for children below three years of age. In theory, where affordable childcare support is lacking, parents (typically mothers) face challenges in returning to the workplace after childbirth, thereby increasing the opportunity

cost of children (UNFPA, 2018). In many countries, grandparents (particularly grandmothers) provide informal childcare support of varying degrees (Bordone & Arpino, 2018; Bordone et al., 2017; Hank & Buber, 2009), and studies have demonstrated that this availability of grandparents is linked with higher fertility (intentions and behaviors), as well as increased labor participation of their daughters (Arpino et al., 2014; Tanskanen & Rotkirch, 2014). However, formal childcare is also important, given that not everyone has access to grandparental support, as well as the potential negative consequences of childcare provision on grandmothers' employment (Lumsdaine & Vermeer, 2015).

Within the OECD, government-subsidized childcare is particularly low in several Eastern and Central European states. In Bulgaria, Poland, Czechia, and Slovakia (as well as Greece), fewer than 15% of 0-2 year olds are enrolled in childhood education and care services, compared to an OECD average of 34% (OECD, 2018e). Limited institution-based childcare and other child-friendly services are also highlighted as contributors to low fertility in Taiwan Province of China (Lee & Lin, 2016, cited in Rindfuss & Choe, 2016: 268) and Hong Kong SAR (Basten, 2015, cited in Rindfuss & Choe, 2015: 72). By contrast, in the Nordic and Benelux countries, where fertility is close to replacement, public childcare facilities are widely available, and (with the exception of Finland) more than 50% of 0-2 year olds are enrolled (OECD, 2018e). The Republic of Korea and Japan have implemented public childcare services more recently. For example, in the Republic of Korea the government provides either fees for daycare and nursery school or an allowance for childcare at home as well as a free after-school education program (Lee & Choi, 2015). Yet in many countries, coverage remains limited and waiting lists are long (Tsuya, 2017), indicating a need for scale-up of service provision.

Empirically, Luci-Greulich and Thévenon (2013, cited in Thévenon, 2015), identify a positive influence of childcare services on average when analyzing fertility trends in 18 OECD countries from 1980 to 2007. Similarly, d'Addio and Mira d'Ercole (2005, cited in Thévenon & Gauthier, 2011: 209) find a positive causal relationship between childcare coverage and fertility rates among OECD Member States, while Kalwij (2010, cited in Thévenon & Gauthier, 2011: 209) establishes a strong link between national spending on childcare and the timing of births in Western European countries.

Research using individual-level data produce more mixed results. As noted by Thévenon & Gauthier (2007), several studies in Scandinavia reveal an insignificant effect of the availability and cost of childcare on fertility (Andersson, et al., 2004; Ronsen, 2004). However, as the authors observe, the absence of an impact seems likely to be due to the relatively small variations in quality, quantity and price of childcare in these countries, where childcare is relatively abundant, high-quality and affordable. Rindfuss et al. (2007), in contrast, reveal a strong positive effect of childcare availability for young children on the birth of the first child in Norway, controlling for local potential confounding factors. Meanwhile, in Sweden, Mörk *et al.*, (2009) conclude that the cost of childcare has an impact on fertility, even in a country where childcare coverage is nearly universal and the cost is heavily subsidized (cited in Thévenon &

Gauthier, 2011: 209). Similarly, Kim (2017) show for the Republic of Korea, that receiving formal childcare assistance has a positive effect on the realization of intended second birth, but only when its costs are not high.

However, availability of affordable childcare is only part of the puzzle: use of such childcare must also be acceptable to parents. According to Aassave and colleagues (2016), the degree of social trust (i.e. the willingness of individuals to trust others outside of their family and close friend networks) can influence parents' utilization of childcare services, which in turn plays an important role in explaining cross-national fertility differences. Specifically, where social trust is low (e.g. in Southern and Eastern Europe), they argue that couples are less likely to outsource childcare, which means that women, who then assume the bulk of the childcare responsibilities face a greater trade-off between work and childbearing, with lower fertility as a consequence. By contrast, where social trust is higher (e.g. in the Nordic countries), outsourcing childcare is common, the work/family conflict is reduced, and fertility is less constrained.

This hypothesis is supported by multilevel statistical analyses demonstrating that national-level social trust interacts with cohort-level female education to explain individual-level completed fertility (Aassave *et al.*, 2016; similar results are shown by Yamamura & Antonio). Crucially though, the effect of social trust is only significant through its interaction with rising female education. Where female education (and by extension female employment) is low, demand for combining work and family life is also low. However, as opportunities for women in education and employment increase, the need for childcare as a means to reconcile work and family obligations rises; social trust (which affects the uptake of childcare) then becomes an important factor in explaining low fertility. It is worth noting, however, a few limitations: namely that the authors used only a binary measure of social trust, and that data for the former Soviet countries before 1989 were not available. Moreover, there were outliers in the trust-fertility relationship, namely Japan and the Republic of Korea, which have very low fertility and intermediate levels of social trust, as well as France, where fertility is close to replacement level but social trust is moderate. Clearly other country-specific factors are also important.

6. Discussion

6.1 Summary

In contrast to the predictions of classic demographic transition theory, low fertility has become a widespread phenomenon. In almost all countries in Europe, North America, Oceania, and East Asia, average fertility (both period and cohort) stands below the replacement level of around 2.1 children per woman. Increasingly, low fertility is emerging in middle-income countries in Asia, Latin America and the Caribbean, and North Africa, blurring traditional geographic and development boundaries. Yet despite this convergence, among developed countries today, there exists a market regional divide in cohort fertility: fertility in Northern and Western Europe, as well as the English-speaking countries in North America and Oceania, is *moderately low*, standing in the region of 1.7 to 2.2 children per woman, whereas the countries

of Southern, Central and Eastern Europe, the German-speaking countries, and South-East and East Asia have *very low fertility* around 1.6 children per woman or below.

This review has aimed to explore the determinants of low fertility, with a particular focus on those countries with very low fertility. It has shown that fertility postponement and the associated tempo effect is a key feature of almost all fertility declines to low levels, and continues to operate in many countries. Yet at the same time, reduced progression to second order births and rising childlessness mean that fertility quantum is also low. In terms of more distal determinants, ideational change as outlined in the Second Demographic Transition theory, is not a convincing explanation. Contrary to the predictions of the theory, those countries most advanced in SDT values generally have fertility close to replacement level, while fertility tends to be very low in those less advanced in SDT values. Furthermore, studies of fertility preferences reveal a remarkable stability across time and space of an ideal family size of two children per woman.

Rather, it seems that low fertility is largely a response to constraints faced by couples, especially women, in realizing their fertility ideals. Two broad sets of constraints have been identified as significant. First, economic constraints, which encompass an environment of economic and employment insecurity faced by young people in particular, as well as the direct economic costs associated with housing and children's education. These economic constraints are compounded by obstacles to women's ability to combine paid work and childbearing, specifically gender inequity within the home, various workplace conditions, such as long working hours and inflexible working practices, and limited availability of childcare. As substantial structural changes have opened up opportunities for women in higher education and employment, the relative stability of traditional sociocultural norms and institutions in very low fertility countries have acted to increase the indirect opportunity cost of children.

There is no unique formula for low fertility. The relevance of specific determinants varies across countries and regions. Economic and employment insecurity, as well as low social trust are most prominent in Southern Europe, while the cultural emphasis on educational "success", the disapproval of non-marital fertility, and long and inflexible working hours are features largely specific to East Asian contexts. Furthermore, multiple factors across the economic, structural, institutional and socio-cultural domains interact to produce low fertility. For example, employment insecurity, structural difficulties in obtaining a mortgage, and the socio-cultural norm of home ownership together make it difficult for couples to set up an appropriate dwelling for childbearing. Meanwhile, long male working hours interact with patriarchal socio-cultural norms to increase the domestic labor burden facing women, which in turn increases the opportunity cost of childbearing. In addition, the socio-cultural emphasis on educational attainment operates in conjunction with the rigid education and labor market systems, while the availability of affordable childcare services interacts with the degree of social trust to affect their utilization.

6.2 Is low fertility necessarily a problem?

Despite the emphasis in the literature on the negative implications of low fertility, it is important to ask whether low fertility is necessarily such a major cause for concern (Vobecká et al., 2013). Many environmentalists note potential benefits in terms of reduced resource consumption and pollution. Moreover, having fewer children in theory enables parents to invest more time and resources in the health and skills of each child. As Lee and Mason (2010) point out, such investment, by increasing the average human capital of the population, has the potential to boost economic growth in the long-run. Furthermore, we must acknowledge that low fertility is a reflection of women, men, and couples' increased capacity to prevent unwanted pregnancies and space births, and that several structural changes that contribute to fertility decline to sub-replacement levels, particularly the rise in women's educational attainment and labor force participation, have empowered women to become economically independent – an undoubtedly positive development.

It is also important to unpick the concerns of governments surrounding low fertility as a driver of population decline and accelerated population ageing. In several countries, low fertility receives attention in national debates as a key driver of population decline, but outmigration is often a far more significant factor driving population decline and a more significant factor to address for an effective response. This is particularly true in many Central and Eastern European countries. Furthermore, while fertility declines to low levels are associated with accelerated population ageing, population ageing *per se* is not a problem; in fact, with proactive, holistic and evidence-based reforms of pension, health and long-term care systems, population ageing can represent an opportunity for countries.

Clearly, low fertility in itself is not a problem. That said, the gap between desired and actual fertility at the micro level implies the need for policies to help individuals realize their fertility preferences and reproductive rights. The International Conference on Population and Development Programme of Action, endorsed by 179 countries in 1994, affirmed that all couples and individuals must have the basic right to decide freely the number and timing of children, and the knowledge and means to do so. This includes not only the right for people to *limit* the number and timing of children, but to have the number of children they *desire*.

6.3 Policy implications

Several governments have in recent years adopted explicitly pronatalist policies. These include restrictions on family-planning programs (Basten *et al.*, 2013; McDonald *et al.*, 2015) (Basten, 2013: 8; see also citation of McDonald et al, 2015, reported in Sobotka, 2017: 38), plus implementing openly pronatalist family policy interventions and political rhetoric. A number of countries in Eastern Europe have adopted so-called “demographic security” policies, which implicitly or explicitly recognize low fertility and population decline as a threat to national security and stability. These policies, while varied in content, generally focus on bringing birth rates back to replacement levels and promoting population growth through generating demand for more children, strengthening the institution of the family, and promoting “traditional” values, including around motherhood.

Such pronatalist policies risk a regressive step in terms of women's reproductive rights and societal roles. Effective policies must instead tackle the broader structural, institutional and socio-cultural impediments discussed above, with a focus on individual rights and choices, without coercion. Here, we outline several ideas for policy action, but note that policies should be designed specifically for each country, taking into consideration the uniqueness of each demographic, economic, institutional and sociocultural context.

To address a key economic constraint on childbearing, governments, particularly in Southern Europe, should focus on developing more equitable and inclusive employment options for young people. This might take place alongside investments in measures to boost skills for youth to increase their chances of securing decent work. To be most effective, these initiatives should adopt a multi-sectoral approach, bringing together private sector employers, educators, labor unions and other social actors. At the same time, investing in health and pension benefits, as is common in the Nordic countries, will be important to cushion against the precarious nature of short-term contracts. Billari (2008) advocates for policies that strengthen the position of youth more generally in societies that have been characterized by a long-standing pro-elderly bias. For example, through reducing the minimum age for election to the Senate (40 years in Italy) as a signal of youth empowerment. Overall, such policies it is hoped could reduce pressure to postpone childbearing.

Secondly, addressing structural constraints in the housing market will be important. In relation to Southern Europe, these might include increased investment in social housing, and greater regulation of the rental and credit markets to facilitate access to mortgages among youth. For example, in Italy the development of companies that monitor individuals' credit ratings could prove helpful since bankers' reluctance to loan money is often linked to their lack of key information about mortgage applicants (Tanturri, 2016). Addressing the space constraints and prohibitively high house prices that prevail in Hong Kong SAR could prove more challenging, although governments might consider implementing means-tested loans for purchasing or renting a house as has been adopted in the Republic of Korea (Lee & Choi, 2015).

As for the direct costs associated with children's education, simply increasing public spending on education is unlikely to have a significant impact. One of the drivers of such high investment in children's education seems to be competition *between* parents *within* the society, so enhancing education across the board would be unlikely to tackle the root of the issue. Moreover, as noted by Kim and Lee (2004, cited in Tan *et al.*, 2016), in the Republic of Korea, household spending on private tutoring increased in the 1990s despite significant increases in public education spending. Tan (2016) suggests as an alternative so-called "reverse one-child" policies aimed to discriminate positively against children from larger families in public university admissions. They highlight the relatively low fiscal requirements of such measures as well as the likely implication of discouraging firms from using university ranking as the sole indicator of employee quality.

Many countries have introduced direct financial transfers to support childbearing. But while there is strong evidence that these policies advance the timing of births, their impact on overall cohort fertility is less decisive (Thévenon & Gauthier, 2011). As noted by Thévenon and Gauthier (2011), such financial transfers are typically insufficient to cover the real costs of having a child, and fail to address the structural obstacles to combining work and family, limiting their effectiveness in supporting fertility choices.

Policies to address the direct economic costs of childbearing must also be combined with those focusing on the indirect or opportunity costs. Key here will be efforts to challenge and shift gender norms concerning the domestic division of labor (Goldscheider *et al.*, 2015). Education and publicity initiatives to increase gender equity within families could be useful, as could the introduction and expansion of non-transferable parental leave rights to encourage fathers to participate in childcare. Tackling engrained socio-cultural norms is likely to be challenging, although one encouraging sign of change is the shift of the Republic of Korea's sex ratio at birth down to near-normal levels after its increase to levels around 115 males for every 100 females in the early 1990s. Key in this transformation was strong government dedication to penalize gender-biased sex selection and the enhancement of women's social status in Korea following advances in education and employment (Guilmoto, 2009, cited in Frejka *et al.*, 2010: 602). Armenia, Azerbaijan and Georgia have also made significant progress in reducing son preference through strong government commitment and prevention campaigns.

However, efforts to increase males' involvement in the home are unlikely to be effective without complementary structural changes to address long and inflexible working hours, particularly in East Asian countries. This might include the introduction of legislation limiting working hours, as well as the effective enforcement of existing legal restrictions on working hours. In addition, efforts to increase options for high-quality part-time and flexible working hours will play an important role in enabling women and men to reconcile paid work and childbearing.

While many countries have parental leave policies, this leave is often limited in compensation and coverage, excluding from coverage smaller companies or the informal sector, for example. Addressing these deficiencies could improve work/family reconciliation. Moreover, governments should monitor employers more closely to prevent them from penalizing workers who take leave, while employers themselves might consider banning redistribution of a leave-taker's workload in an effort to reduce the peer pressure against taking leave. Increasing public awareness of parental leave and other policies through effective marketing campaigns is also recommended.

Furthermore, governments must do more to prevent employers discriminating against future parents when making recruitment decisions. Sweden's system of providing extensive employment opportunities for women in the public sector, where jobs are more stable and better protected, might serve as inspiration. However, measures to increase the fluidity of the labor market as in the United States should be treated with caution: such initiatives might have

a counterproductive effect of encouraging delayed fertility through increased employment uncertainty.

Finally, the provision of universal, accessible, affordable, publicly-funded childcare services is critical. A number of low fertility countries have already implemented childcare programs. Yet in many countries, coverage remains limited and waiting lists are long (Tsuya, 2017), indicating a need for scale-up of service provision. In areas where social trust is low, strong quality control of care services could help to promote their utilization, as could permitting foreign domestic workers to supplement caregiving at home – a widespread practice in Singapore and Hong Kong SAR (Kim, 2018). Overall, despite the potential benefits of family policies such as childcare and parental leave, governments should exercise caution about making such policies dependent on employment status. This should help to reduce the sensitivity of fertility behavior to the labor market situation and general economic cycle.

More generally, to maximize their effectiveness, family policies relating to childcare and parental leave must be stable and predictable (Thévenon & Gauthier, 2011). Furthermore, it is important that all of these policies, covering education, housing, the labor market, economy and social welfare are considered holistically to maximize compatibility across the different domains. Most importantly, all approaches to address low fertility should be rights-based, people-centered, and evidenced-based; sexual and reproductive health should never be compromised in efforts to shape fertility trends.

In addition to addressing the drivers of low fertility, governments must continue to develop policies to adapt to the social and economic challenges of population ageing. There is a degree of overlap here, since policies facilitating the combination of work and family are also likely to increase the economically active population, with associated positive fiscal benefits in an ageing society. However, these initiatives should be complemented by efforts to promote the income security, health and wellbeing of the old-age population. Such policies might include: provision of diverse post-retirement employment opportunities and training to start a new business, strengthening pension systems, investing in preventative healthcare, improving medical insurance coverage, investing in long-term care including support for family-based care, and enhancing social infrastructure for the elderly such as transportation and housing.

6.4 Limitations and directions for further research

While this report has endeavored to provide a comprehensive overview of the key determinants of low fertility, it has limitations. It has focused primarily on fertility determinants, from a female perspective, yet the slowly expanding literature on male fertility determinants, levels and patterns remains unexplored. Further research should evaluate male fertility determinants in conjunction with those of females, as well as the joint fertility decision-making of couples (Basten *et al.*, 2013).

Secondly, with the focus on distal socio-cultural, economic and institutional determinants, little attention has been paid to the role of biomedical factors in individual fecundity. To date, there

has been limited research into trends in infertility, and the evidence of an infertility problem that does exist indicates that the issue pertains more to males than females. Levine et al (2007) identified a steady decrease in sperm quality and quantity of sperm in high-income, low fertility countries, although this has been disputed by other authors (te Velde *et al.*, 2017, cited in UNFPA, 2018: 114). As for female infertility, Mascarenhas and colleagues (2012) identified no strong shifts between 1990 and 2010 for the world as a whole or in high-income countries, while repeated surveys in the United States reveal a slight decrease in infertility among married, reproductive-age women (Chandra *et al.*, 2013). However, with continued postponement of childbearing to later reproductive ages, the incidence of infertility among both women and men is likely to rise (UNFPA, 2018), and further research into infertility and its trends, risk factors and consequences is a priority.

Other substantive areas remain unexplored owing to their limited coverage in the current literature and/or the limited evidence of their significance as determinants. These neglected factors include the emphasis on higher parenthood and child *quality*, especially in East Asia. Sobotka (2008b) notes that parents today need to sacrifice considerable amounts of human and financial resources to raise children in accordance with strong norms of responsible parenthood; further research should explore the influence of these factors in more depth, perhaps through high-quality qualitative research. Furthermore, we have not discussed the ways in which fashions related to childlessness or children, plus increasing public awareness of climate change and the environment influence fertility decisions.

Further research into sex lives and dating behavior would also be valuable. Emerging research suggests that young people born since the mid-1990s are starting sex later, are less likely to be in a relationship, and are less likely to prioritize marriage and family compared to earlier cohorts (Twenge, 2017). Complementary evidence on changing sex lives comes from the 2015 National Fertility Survey for Japan (NIPSSR, 2015). However, investment in a global, recurrent survey on lifestyle and sex lives would enable highly informative, systematic, cross-national analysis. Such a survey could also incorporate questions on gender roles and time spent on housework compared to paid work to improve understanding of these determinants. Moreover, building on the work of Twenge (2017), future research should explore the role of technological changes, particularly the rise of smartphones and social media, in changing sex and dating behavior.

From a methodological standpoint, alongside developing internationally-comparable micro-level datasets, there is a need for more credible empirical tests of macro-level determinants. A substantial proportion of the research cited here relies on simple bivariate cross-national associations conducted at a single time point. Such studies suffer from potential endogeneity, making causation difficult to establish (Balbo *et al.*, 2013). Moreover, quantitative research should be complemented by high-quality qualitative studies to explore couples' reasoning for fertility decisions. In recent years, we have seen several qualitative studies examining the impact of domestic gender equity on fertility intentions, but there is now a need for longer-

term follow-up studies to examine the extent to which intentions are translated into outcomes. In addition, most research to date has employed period measures of fertility, such as the TFR. Noting the aforementioned vulnerability of such measures to distortion by changes in the timing of births, future studies should consider using cohort measures as well.

More generally, there is a need for further analysis of the links between fertility determinants at different levels. Balbo and colleagues (2013) provide a highly comprehensive review of various micro-, meso-, and macro-level determinants; an enhanced understanding of how these various determinants interact would be valuable. Such analysis will profit from interdisciplinary research, bringing together scholars from demographic, education, sociology, and family policy backgrounds among others to build bridges across traditionally siloed fields.

Finally, while this review has focused primarily on the determinants of low fertility in the developed world, there is a pressing need to explore the nascent “postponement transitions” (Kohler *et al.*, 2002) and determinants of low fertility in many middle-income countries. Several of the factors underlying fertility decline to low levels in high-income countries are also becoming features in the developing world. For instance, the rapid expansion of higher education among females in several Asian countries including China, Malaysia, the Philippines and Sri Lanka (UNESCO, 2014, cited in Sobotka, 2017: 38), as well as increasing unemployment and economic uncertainty in the Middle East, North Africa and Latin America (Sobotka, 2017). Yet differences in education systems, policies, family patterns, culture, and of course economic development, imply that the transitions to low fertility will often deviate from the earlier experiences of Europe and East Asia. As low fertility becomes increasingly global, so too must research into its patterns and underlying determinants.

References

Aassave, A., Billari, F., and Pessin, L. (2016) “Trust and Fertility Dynamics”, *Social Forces*, **95**(2): 663-692.

Addo, R. (2014) “Debt, cohabitation, and marriage in young adulthood”, *Demography*, **51**(5): 1677-1701.

Adserà, A. (2004) “Changing fertility rates in developed countries. The impact of labor market institutions”, *Journal of Population Economics*, **17**: 17-43.

Adserà, A. (2011) “The interplay of employment uncertainty and education in explaining second births in Europe”, *Demographic Research*, **25**(16): 513-544.

Adserà, A. (2017) “Education and fertility in the context of rising inequality”, *Vienna Yearbook of Population Research*, **15**: 63–92.

- Adserà, A. (2018) "Education and fertility in the context of rising inequality", *Vienna Yearbook of Population Research*, 1(15): 63–94.
- Ahn, N. and Mira, P. (2002) "A note on the changing relationship between fertility and female employment rates in developed countries", *Journal of Population Economics*, **15**: 667-682.
- Anderson, T. and Kohler, H. (2013) "Education Fever and the East Asian Fertility Puzzle", *Asian Population Studies*, **9**(2): 196-215.
- Andersson, G. and Neyer, G. (2008) "Consequences of family policies on childbearing behavior: Effects or artifacts?", *Population and Development Review*, **34**(4): 699-724.
- Arpino, B. Pronzato, C. and Tavares, L. (2014) "The Effect of Grandparental Support on Mothers' Labour Market Participation: An Instrumental Variable Approach", *European Journal of Population*, **30**(4): 369-390.
- Baizán, P., Arpino, B., and Delclòs, C. (2016) "The Effect of Gender Policies on Fertility: The Moderating Role of Education and Normative Context", *European Journal of Population*, **32**(1): 1-30.
- Balbo, N., Billari, F., and Mills, M. (2013) "Fertility in Advanced Societies: A Review of Research", *European Journal of Population*, **29**: 1-38.
- Basten, S. and Gu, B. (2013) "National and regional trends in ideal family size in China", Paper presented at the IUSSP International Population Conference, Busan, Korea, 26-31 August 2013.
- Basten, S., Sobotka, T., and Zeman, K. (2014) "Future fertility in low-fertility countries", In: W. Lutz, W. Butz., and K. Samir (eds.), *World Population and Human Capital in the Twenty-First Century*, Oxford University Press: 39-146.
- Basten, S. (2016) "Understanding Ultra-Low Fertility in Hong Kong", In: R. Rindfuss and M. Choe (eds.), *Low and Lower Fertility*, Springer: 63-86.
- Gietel-Basten, S. (2019) *The "Population Problem" in Pacific Asia*, Oxford University Press: Oxford.
- Beck, U and Beck-Gernsheim, E., (2001) *Individualization*, London: Sage.
- Billari, F. (2008) "Lowest-low fertility in Europe: Exploring the causes and finding some surprises", *Japanese Journal of Population*, **6**(1): 2-18.
- Billari, F. (2018) "A "Great Divergence" in Fertility?", In: D. Poston, S. Lee and H. Kim (eds.) (2018) *Low Fertility Regimes and Demographic and Societal Change*, Cham: Springer, pp. 15-36.
- Billingsley, S. 2010. "The post-communist fertility puzzle", *Population Research and Policy Review*, **29**(2): 193-231.

- Blossfeld, H., Klijzing, E., Mills, M., and Kurz, K. (eds.) (2005) *Globalization, uncertainty and youth in society*, London: Routledge.
- Bordone, V., Arpino, B. and Aassave, A. (2017) "Patterns of Grandparental Child Care Across Europe: The Role of the Policy Context and Working Mothers' Need", *Ageing and Society*, **37**(4): 845-873.
- Bordone, V. and Arpino, B. (2018) "Grandparenthood and Female Employment", In: A. Gauthier, I. Kotowska, and D. Vono de Vilhena, *Gender (In)Equality over the Life Course: Evidence from the Generations & Gender Programme*. Population Europe, Discussion Paper No. 10.
- Brewster, K., and Rindfuss, R. (2000) "Fertility and Women's Employment in Industrialized Nations", *Annual Review of Sociology*, **26**: 271-296.
- Bongaarts, J. (1975) "A method for the estimation of fecundability", *Demography*, **12**: 645-660.
- Bongaarts, J. and Feeney, G. (1998) "On the quantum and tempo of fertility", *Population and Development Review*, **24**(2): 271-291.
- Bongaarts, J. and Sobotka, T. (2012) "A Demographic Explanation for the Recent Rise in European Fertility", *Population and Development Review*, **38**(1): 83-120.
- Brinton, M., Bueno, X., Oláh, L., and Hellum, M. (2018) "Postindustrial Fertility Ideals, Intensions, and Gender Inequality: A Comparative Qualitative Analysis", *Population and Development Review*, **44**(2): 281-309.
- Bumpass, L., Rindfuss, R., Choe, M. and Tsuya (2009) "The Institutional Context of Low Fertility", *Asian Population Studies*, **5**(3): 215-235.
- Census and Statistics Department, Government of the Hong Kong Special Administrative Region. (2007). Demographic Trends in Hong Kong 1981-2006. Available from: <https://www.statistics.gov.hk/pub/B1120017022007XXXXB0200.pdf>.
- Census and Statistics Department, Government of the Hong Kong Special Administrative Region. (2017). Demographic Trends in Hong Kong 1986-2017. Available from: <https://www.statistics.gov.hk/pub/B1120017042017XXXXB0100.pdf>.
- Chang, M. (2006) "Taiwan's transition from high fertility to lowest low levels", *Asian Journal of Health and Information Sciences*, **1**(1): 1-15.
- Chen, A. (2013, August 9th) "Hong Kong's middle class most burdened by high housing costs", *South China Morning Post*.
- Comolli, C. (2017). "The fertility response to the Great Recession in Europe and the United States: structural economic conditions and perceived economic uncertainty", *Demographic Research*, **36**(51): 1549-600

Cooke, L. (2004) "The gendered division of labor and family outcomes in Germany", *Journal of Marriage and Family*, **66**(5): 1243-1256.

Cooke, L. (2009) "Gender equity and fertility in Italy and Spain", *Journal of Social Policy*, **38**(1): 123-140.

Currie, J. and Schwandt, H. (2014) "Short- and long-term effects of unemployment on fertility", *PNAS*, **111**(41) 14734-14739.

Dalla Zuanna, G. (2001). "The banquet of Aeolus: A familistic interpretation of Italy's lowest low fertility", *Demographic Research*, 4: 133–162.

Dalla Zuanna, G., & Micheli, G. (2004) *Strong family and low fertility: A paradox?: New perspectives in interpreting contemporary family and reproductive behavior*, Dordrecht/London: Kluwer Academic.

D'Addio, A. and Mira d'Ercole, M. (2005) "Trends and Determinants of Fertility Trends: The Role of Policies", *Social, Employment and Migration Working Papers*, **27**, Paris: OECD.

De Laat, J. and Sevilla-Sanz, A. (2011) "The fertility and women's labor force participation puzzle in OECD countries: The role of men's home production", *Feminist Economics*, **17**(2): 87-119.

Del Boca, D. and Pasqua, S. (2005) "Labour Supply and Fertility in Europe and the US", In: T. Boeri, D., Del Beco and C. Pissarides (eds.) *Women at Work. An Economic Perspective*, A Report for the Rondazione Rodolfo Debenedetti (pp. 121-153). Oxford: Oxford University Press.

Del Boca, D. Pasqua, S. and Pronzato, C. (2009) "Market work and motherhood decisions in contexts", *Oxford Economic Papers*, **61**(1): 147-171.

Department of Statistics (2018). *Population Trends 2018*. Available from: <https://www.singstat.gov.sg/publications/population-trends>.

Dunson, D., Baird, D., and Colombo, B. (2004) "Increased Infertility with Age in Men and Women", *Obstetrics & Gynecology*, **103**(1): 51-56.

Duvander, A. and Andersson, G. (2006) "Gender Equality and Fertility in Sweden: A Study of the Impact of the Father's Uptake of Parental Leave on Continued Childbearing", *Marriage and Family Review*, **39**(1-2): 121-142.

Duvander, A., and Jans, A. (2008) *Consequences of Fathers' Parental Leave Use: Evidence from Sweden*, Stockholm Research Report in Demography (Vol. 2008: 6): Stockholm University, Dept of Sociology, Demography Unit (SUDA).

Duvander, A., Lappegard, T. and Andersson, G. (2010) "Family Policy and Fertility: A Comparative Study of the Impact of Fathers' and Mothers' Use of Parental Leave on Continued Childbearing in Norway and Sweden", *Journal of European Social Policy*, **20**(1): 45-57.

- Easterlin, R. (1976) "The conflict between aspirations and resources", *Population and Development Review*, **2**(3): 417-425.
- Engelhardt, H. and Prskawetz, A. (2004) "On the Changing Correlation between Fertility and Female Employment over Space and Time", *European Journal of Population*, **20**: 35-62.
- Esping-Andersen, G. (2009) *The Incomplete gender revolution: Adapting welfare states to women's new roles*, Cambridge: Polity Press.
- Esping-Andersen, G. and Billari, F. (2015) "Re-theorizing Family Demographics", *Population and Development Review*, **41**(1): 1-31.
- Estévez-Abe, M. (2007) "Gendering the Varieties of Capitalism: Gender Bias in Skills and Social Policies", In: F. Rosenbluth (ed.) *The Political Economy of Japan's Low Fertility*
- Fahlén, S. and Oláh, L. (2018) "Economic uncertainty and first-birth intentions in Europe", *Demographic Research*, **39**(28): 795-834.
- Federal Reserve Bank of New York, Research and Statistics Group (2019) *Quarterly Report on Household Debt and Credit*, 2019: Q1, New York.
- Feyrer, J., Sacerdote, B., and Stern, A. (2008) "Will the stork return to Europe and Japan? Understanding fertility within developed nations", *Journal of Economic Perspectives*, **22**(3): 3-22.
- Freeman, E., Xiaohong, M., Ping, Y., Wenshan, Y. and Gietel-Basten, S. (2017) "'I couldn't hold the whole thing': the role of gender individualization and risk in shaping fertility preferences in Taiwan", *Asian Population Studies*, **14**(1): 61-76.
- Frejka, T., Jones, G., and Sardon, J. (2010) "East Asian Childbearing Patterns and Policy Developments", *Population and Development Review*, **36**(3): 579-606.
- Gerber, T. and Cottrell, E. (2006) "Fertility in Russia, 1985-2001", Updated version, Paper presented at the Annual Meeting of the Population Association of America 2005, Philadelphia.
- Goldin, C. and Katz, L. (2000) "Career and marriage in the age of the pill", *American Economic Review*, **90**: 461-465.
- Goldin, C. and Katz, L. (2002) "The power of the pill: oral contraceptives and women's career and marriage decisions", *Journal of Political Economy*, **110**(4): 730-770.
- Goldin, C. (2006) "The quiet revolution that transformed women's employment, education and family", *American Economic Review*, **96**(2): 1-21.
- Goldscheider, F., Bernhardt, E., and Lappegard, T. (2015) "The Gender Revolution: A Framework for Understanding Changing Family and Demographic Behavior", *Population and Development Review*, **41**(2): 207-239.

- Goldstein, J., Sobotka, T., and Jasilioniene, A. (2009) "The end of lowest-low fertility?", *Population and Development Review*, **35**(4): 663-700.
- Goldstein, J., Kreyenfeld, M., Jasilioniene, A., Orsal., D. (2013) "Fertility reactions to the "Great Recession" in Europe", *Demographic Research*, **29**(4): 85–104.
- Guilmoto, C. (2009) "The sex ratio transition in Asia", *Population and Development Review*, **35**(3): 519-549.
- Guo, Z. and Gu, B. (2014) "China's low fertility: evidence from the 2010 Census", In: I. Attané and G. Baochang (eds.), *Analysing China's Population*, INED, Population Studies 3. Dordrecht: Springer Science+Business Media.
- Haas, L, and Hwang, C. (2008). "The Impact of Taking Parental Leave on Fathers' Participation In Childcare And Relationships With Children: Lessons from Sweden". *Community, Work & Family*, **11**(1), 85-104.
- Habbema, J., Dik, F., Collins, C., Leridon, H., Evers, J., and Lunefeld, B. (2004) "Towards Less Confusing Terminology in Reproductive Medicine: a Proposal", *Human Reproduction*, **19**(7): 1497-1501.
- Hagewen, K. and Morgan, S. (2005) "Intended and ideal family size in the United States", *Population and Development Review*, **22**(5-6): 479-496.
- Hakkert, R. (2014) *Population Policies in Low-Fertility Contexts: A Review of Practices and Options*, UNFPA.
- Hank, K. & Buber, I. (2009) "Grandparents Caring for their Grandchildren: Findings from the 2004 Survey of Health, Ageing, and Retirement in Europe", *Journal of Family Issues*, **30**(1): 53-73.
- Hauser, P. (1967) "Family planning and population programs", A book review article, *Demography*, **4**(1): 397-414.
- Hochschild, A. and Machung, A. (1989) *The Second Shift: Working Parents and the Revolution at Home*, United States: Viking Penguin.
- Hoem, J. (1993) "Public policy as the fuel of fertility: Effects of a policy reform on the pace of childbearing in Sweden in the 1980s", *Acta Sociologica*, **36**: 19-31.
- Holliday, K. (2014) "Hong Kong's housing market is "least affordable", Available from: <https://www.cnbc.com/2014/01/20/hong-kongs-housing-market-is-least-affordable-survey.html>.
- Hoorens, S., Clife, J., Staetsky, L., Janta, B., Diepeven, S., Morgan Jones, M. and Grant., J. (2011) *Low fertility in Europe: Is there still reason to worry?*, RAND Europe.

Human Fertility Database. (2018) Max Planck Institute for Demographic Research (Germany) and Vienna Institute of Demography (Austria). Available at www.humanfertility.org.

Human Fertility Database. (2019) Max Planck Institute for Demographic Research (Germany) and Vienna Institute of Demography (Austria). Available at www.humanfertility.org.

Iacovou, M. (2010) "Leaving home: independence, togetherness and income", *Advances in Life Course Research*, **15**(4): 147-160.

Igarashi, Y. (2009) "Hi-seiki-koyo no genjyo to kadai: Wakamono no mondai wo chushi-to-shite [Current situations of non-regular employment: Focusing on Young persons]", *Rippou to Chosa*, **288**: 183-188.

Inglehart, R. (1997) *Modernization and Postmodernization: Cultural, Economic and Political Change in 43 Societies*, Princeton: Princeton University Press.

Jones, G. (2012) "Population policy in a prosperous city-state: Dilemmas for Singapore", *Population and Development Review*, **38**(2): 311-336.

Jones, G. and Gubhaju, B. "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.

Jones, G. and Hamid, W. (2015) "Singapore's Pro-natalist Policies: To What Extent Have They Worked?", In: R. Rindfuss and M. Choe (eds.), *Low and Lower Fertility*, Springer: 33-62.

Jones, G. and Shen, H. (2008) "International marriage in East and Southeast Asia: Trends and research emphases", *Citizenship Studies*, **12**(1): 9-25.

Jones, G., Straughan, P., and Chan, A. (eds.) (2009) *Ultra-low Fertility in Pacific Asia: Trends, Causes and Policy Issues*, London: Routledge.

Kalwij, A. (2010) "The impact of family policy expenditures on fertility in Western Europe", *Demography*, **47**(2): 503-519.

Kim, E. (2017) "Division of domestic labour and lowest-low fertility in South Korea", *Demographic Research*, **37**(24): 743-768.

Kim, E. (2018) "Low fertility and gender inequity in developed Asian countries", *Asian Population Studies*, **14**(2): 113-115.

Kim, S., Kim, Y., Kim, H., Park, J., Son, C., Choi, Y., Kim, Y., Lee, G., and Yoon, A. (2012) *The 1012 national survey on fertility, family health, and welfare in Korea* [in Korean], Seoul: Korean Medical Association.

Kim, D., and Yoo, S. (2016). "Long-term effects of economic recession on fertility: the case of South Korea", *Paper presented at the European Population Conference 2016*, Mainz, Germany.

- Kim, S. (2018) "Determinants of Fertility Decline in Korea", *Paper presented at the International Seminar on Indicators and Policies of Low Fertility 2018*, Seoul, Korea.
- Kogan, I., and M. Unt. 2005. "Transition from school to work in transition economies", *European Societies*, **7**(2): 219-253.
- Kögel, T. (2004) "Did the association between fertility and female employment within OECD countries really change its sign?", *Journal of Population Economics*, **17**(45): 65.
- Kohara, M. (2010) "The response of Japanese wives' labor supply to husbands' job loss", *Journal of Population Economics*, **23**: 1133-1149.
- Kohler, H. Billari, F., Ortega, J. (2002) "The Emergence of Lowest-Low Fertility in Europe during the 1990s", *Population and Development Review*, **28**(4): 641-680.
- Korea Statistical Information Service (KOSIS) (2019) <http://kosis.kr/eng/>.
- Kotowska, I., Józwiak, J., Matysiak, A., and Baranowksa, A. (2008) "Poland: Fertility decline as a response to profound societal and labour market changes?", *Demographic Research*, **19**(22): 795-854.
- Kreyenfeld, M. (2010) "Uncertainties in female employment careers and the postponement of parenthood in Germany", *European Sociological Review*, **73**: 854-873.
- Lanzieri, G. (2013) "Towards a 'baby Recession' in Europe? Differential Fertility Trends During the Economic Crisis". Statistics in Focus 13. Statistics in Focus. Luxembourg: Eurostat. http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-SF13-013/EN/KS-SF-13-013-EN.PDF.
- Lappegard, T. (2009) "Family Policies and Fertility in Norway", *European Journal of Population*, **26**(1): 99-116.
- Lee, K. (2011) "Local perspectives of Korean shadow education", *Reconsidering Development*, **2**: 31-52.
- Lee, S. and Choi, H. (2015) "Lowest-low fertility and policy responses in South Korea", In: R. Rindfuss and M. Choe (eds.), *Low and Lower Fertility*, Springer: 107-123.
- Lee, R. and Mason, A. (2010) "Fertility, Human Capital, and Economic Growth over the Demographic Transition", *European Journal of Population*, **26**(2): 159-182.
- Leridon, H. (1977) *Human Fertility: The Basic Component*, Chicago: Chicago University Press.
- Leridon, H. (2008) "A New Estimate of Permanent Sterility by Age: Sterility Defined as the Inability to Conceive", *Population Studies*, **62**(1): 15-24.
- Lesthaeghe, R. (1995) "Second Demographic Transition in Western Countries: An Interpretation", In: K. Oppenheim Mason and A. Jensen, *Gender and Family Change in Industrialized Countries*, Oxford: Clarendon Press: 17-62.

- Lesthaeghe, R. (2010) "The Unfolding Story of the Second Demographic Transition", *Population and Development Review*, **36**(2): 211-251
- Levine, H., Jørgensen, N., Martino-Andrade, A., Mendiola, J., Weksler-Derri, D., Mindlis, I., Pinotti, R., and Swan, S. (2017) "Temporal trends in sperm count: a systematic review and meta-regression analysis", *Human Reproduction Update*, **23**(6): 646–659.
- Livi-Bacci, M. (2001) "Too few children and too much family", *Daedalus*, **130**: 139-156.
- Livingstone, G. and Cohn, D. (2010) *The New Demography of American Motherhood*, Pew Research Centre, *A Social and Demographic Trends Report*.
- Luci-Greulich, A. and Thévenon, O. (2014) "Does Economic Advancement 'Cause' a Re-increase in Fertility? An Empirical Analysis for OECD Countries (1960-2007)", *European Journal of Population*, **30**(2): 187-221.
- Lumsdaine, R. & Vermeer, S. (2015) "Retirement Timing of Women and the Role of Care Responsibilities for Grandchildren", *Demography*, **52**(2): 433-454.
- Lutz, W., O'Neill, B. and Scherbov, S. (2003) "Europe's population at a turning point", *Science*, **299**(5615): 1991-1992.
- Ma, L. (2014) "Economic crisis and women's labor force return after childbirth: evidence from South Korea", *Demographic Research*, **31**(18): 511-552.
- Mascarenhas, M., Flaxman, S., Boerma, T., Vanderpeol, S., and Stevens, G. (2012) "National, Regional, and Global Trends in Infertility Prevalence Since 1990: a Systematic Analysis of 277 Health Surveys", *PLoS Medicine*, **9**(12): e1101256.
- McDonald, P. (2000a) "Gender equity in theories of fertility transition", *Population and Development Review*, **26**(3): 427-429.
- McDonald, P. (2000b) "Gender equity, social institutions and the future of fertility", *Journal of Population Research*, **17**(1): 1-15.
- McDonald, P. (2006). "Low fertility and the state: the efficacy of policy", *Population and Development Review*, **32**(3): 485–510.
- McDonald, P. (2013) "Societal Foundations for Explaining Fertility: Gender Equity", *Demographic Research*, **28**: 981-994.
- McDonald, P., Hosseini-Chavoshi, M., Abbasi-Savazi, J., and Rashidian, A. (2015) "An assessment of recent Iranian fertility trends using parity progression ratios", *Demographic Research*, **32**(58): 1581-1602.
- McDonald, P. & Belanger, A. (2016) "A Comparison of Fertility in Canada and Australia, 1926-2011", *Canadian Studies in Population*, **43**(1-2): 5-22.

- Mencarini, L., and Tanturri, M. (2004) "Time use, family role-set, and childbearing among Italian working women", *Genus*, **60**(1): 111-137.
- Miettinen, A., Lainiala, L., and Rotkirch, a. (2015) "Women's housework decreases fertility: Evidence from a longitudinal study among Finnish couples", *Acta Sociologica*, **58**(2): 139-154.
- Mills, M., Blossfeld, H., Klijzing, E. (2005) "Becoming an adult in uncertain times: a 14-country comparison of the losers of globalization", In: Blossfeld, H. et al., (eds.), *Globalization, Uncertainty and Youth in Society*. London: Routledge: 343-411.
- Mills, M., Rindfuss, R., McDonald, P., and te Velde, E. (2011). "Why do people postpone parenthood? Reasons and social policy incentives", *Human Reproduction Update*, **17**(6): 848-860.
- Morgan, S. (2003) "Is low fertility a twenty-first century demographic crisis?", *Demography*, **40**(4): 589-603.
- Morgan, P. and Taylor, M. (2006) "Low Fertility at the Turn of the Twenty-First Century", *Annual Review of Sociology*, **32**: 375-399.
- Mulder, C. (2006) "Home-ownership and family formation", *Journal of Housing and the Built Environment*, **21**: 281-298.
- Mulder, C. and Billari, F. (2010) "Homeownership Regimes and Low Fertility", *Housing Studies*, **25**(4): 527-541.
- Myrskylä, M., Kohler, H., and Billari, F. (2011) "High development and fertility: fertility at older reproductive ages and gender equality explain the positive link", *PSC Working Papers Series*, 10-3-2011, *Population Studies Center*, University of Pennsylvania.
- Nagase, N. and Brinton, M. (2017) "The gender division of labor and second births: Labor market institutions and fertility in Japan", *Demographic Research*, **36**(11): 339-370.
- Nau, M., Dwyer, R., and Hodson, R. (2015) "Can't afford a baby? Debt and young Americans", *Research in Social Stratification and Mobility*, **42**: 113-122.
- Ní Bhrolcháin, M. and Beaujouan, É. (2012) "Fertility postponement is largely due to rising educational enrolment", *Population Studies*, **66**(3): 311-327.
- NIPSSR (National Institute of Population and Social Security Research) (2015) *The 15th Japanese National Fertility Survey*, Available from: http://www.ipss.go.jp/ps-doukou/e/doukou15/Nfs15_gaiyoEng.html.

OECD (Organisation for Economic Co-operation and Development) (2017) *The Pursuit of Gender Equality: An Uphill Battle*, Available from: <http://www.oecd.org/publications/the-pursuit-of-gender-equality-9789264281318-en.htm>.

OECD (Organisation for Economic Co-operation and Development) (2018a) OECD Database, *Youth not in employment, education or training (NEET)*. Available from: <https://data.oecd.org/youthinac/youth-not-in-employment-education-or-training-neet.htm>.

OECD (Organisation for Economic Co-operation and Development) (2018b) OECD Database, *Temporary Employment*. Available from: <https://data.oecd.org/emp/temporary-employment.htm>.

OECD (Organisation for Economic Co-operation and Development) (2018c) OECD Database, *Time spent in paid and unpaid work, by sex*. Available from: <https://stats.oecd.org/index.aspx?queryid=54757>.

OECD (Organisation for Economic Co-operation and Development) (2018d) OECD Family Database, *Share of births outside of marriage*. Available from: http://www.oecd.org/els/family/SF_2_4_Share_births_outside_marriage.pdf.

OECD (Organisation for Economic Co-operation and Development) (2018e) OECD Family Database, Table PF3.2: *Enrolment in childcare and preschool*. Available at <http://www.oecd.org/els/family/database.htm>.

ECD (Organisation for Economic Co-operation and Development) (2019) *Labour force participation rate* (indicator), doi: 10.1787/8a801325-en.

Ogawa, N., Mason, A., Chawla, A., Marsukura, R. and Tung, A. (2009) "Declining Fertility and the Rising Cost of Children", *Asian Population Studies*, **5**(3): 289-307.

Oláh, L. (2003) "Gendering fertility: Second births in Sweden and Hungary", *Population Research and Policy Review*, **22**(2): 171-200.

Pacelli, L., Villosio, C., and Pasqua, S. (2013) "Labor market penalties for mothers in Italy", *Journal of Labor Research*, **34**: 408–432.

Philipov, D. and Bernardi, L. (2011) "Reproductive decisions: concepts and measurement in Austria, Germany and Switzerland", *Comparative Population Studies*, **36**(2-3): 495-530.

Poston, D. Lee, S., and Kim, H. (2018) *Low Fertility Regimes and Demographic and Societal Change*, Springer.

Rahman, F. and Tomlinson, D. (2018) *Cross countries: international comparisons of intergenerational trends*, Resolution Foundation.

- Raymo, J. and Iwasawa, M. (2005) "Marriage market mismatches in Japan: an alternative view of the relationship between women's education and marriage", *American Sociological Review*, **79**: 801-822.
- Raymo, J., Park, H., Xie, Y., and Yeung, W. (2015) "Marriage and Family in East Asia: Continuity and Change", *Annual Review of Sociology*, **41**: 471-492.
- Reher, D. (1998) "Family ties in western Europe: Persistent contrasts. Population and Development Review", **24**: 203-234.
- Rindfuss, R. and Brauner-Otto, S. (2008) "Institutions and the transition to adulthood: implications for fertility tempo in low-fertility settings", *Vienna Yearbook of Population Research*, 57-87.
- Rindfuss, R. and Choe, M. (2015) "Diversity across Low-Fertility Countries: An Overview", In: R. Rindfuss and M. Choe (eds.) *Low and Lower Fertility: Variations across Developed Countries*, Honolulu: Springer, pp. 1-14.
- Rindfuss, R. and M. Choe. (2016) "Diverse Paths to Low and Lower Fertility: An Overview", In: R. Rindfuss and M. Choe (eds.) *Low Fertility Institutions, and their Policies: Variations Across Industrialized Countries*, Springer: 1-12.
- Rindfuss, R., Choe, M. and Brauner-Otto, S. (2016) "The emergence of two distinct fertility regimes in economically advanced countries", *Population Research and Policy Review*, **35**(3): 287-304.
- Rindfuss, R. and Vandenheuevel, A. (1990) "Cohabitation: A precursor to marriage or an alternative to being single?", *Population and Development Review*, **16**(4): 703-726.
- Ronsen, M. (2004) "Fertility and family policy in Norway – A reflection on trends and possible connections", *Demographic Research*, **10**(10): 265-286.
- Ronsen, M. & Skrede, K. (2008) "Fertility trends and differentials in the Nordic countries – Footprints of welfare policies and challenges on the road ahead", *Vienna Yearbook of Population Research*: 103-123.
- Rosenbluth, F. (2007) "The Political Economy of Low Fertility", In: F. Rosenbluth (ed.) *The Political Economy of Japan's Low Fertility*, Stanford: Stanford University Press: 3-36.
- Rossi, B., Abusief, M., and Missmer, S. (2016) "Modifiable Risk Factors and Infertility: What Are the Connections?", *American Journal of Lifestyle Medicine*, **10**(4): 220-231.
- Rotariu, T. (2006) "Romania and the Second Demographic Transition. The traditional value system and low fertility rates", *International Journal of Sociology*, **36**(1): 10-27.
- Sanderson, W., Skirbekk, V., and Stonawski, M. (2013) "Young adult failure to thrive syndrome", *Finnish Yearbook of Population Research*, **48**: 169-187.

Schneider, D. (2015) "The Great Recession, fertility, and uncertainty: evidence from the United States", *Journal of Marriage and Family*, **77**(5): 1144–56.

So, A. (2003) "Cross-border families in Hong Kong: The role of social class and politics", *Critical Asian Studies*, **35**(4): 515-534.

Sobotka, T. 2003. "Re-emerging diversity: Rapid fertility changes in Central and Eastern Europe after the collapse of the communist regimes", *Population-E* 2003, **58** (4-5): 451-486

Sobotka, T. (2004) "Is lowest-low fertility in Europe explained by the postponement of childbearing?", *Population and Development Review*, **30**(2): 195-220.

Sobotka, T. (2008a) "Does persistent low fertility threaten the future of European populations?", In: J. Surkyn et al. (eds.), *Demographic Challenges for the 21st Century*, Brussels: VUBPress: 27-90.

Sobotka, T. (2008b) "The diverse faces of the second demographic transition in Europe", *Demographic Research*, **19**(8): 171-224.

Sobotka, T. (2011) "Fertility in Central and Eastern Europe after 1989: collapse and gradual recovery", *Historical Social Research*, **36**(2): 246-296.

Sobotka, T. (2013) *Pathways to Low Fertility: European Perspectives*, Population Division Expert Paper No. 2013/8, New York: United Nations.

Sobotka, T. (2017) "Post-transitional Fertility: The Rise of Childbearing Postponement in Fuelling the Shift to Low and Unstable Fertility Levels", *Journal of Biosocial Science*, **49**(S1): S20–S45.

Sobotka, T. (2018) "Global low fertility: Key trends", *International Seminar on Indicators and Policies on Low Fertility*, KOSIS-UNFPA: Seoul.

Sobotka, T. and Beaujouan, É. (2014). "Two is best? The persistence of a two-child family ideal in Europe", *Population and Development Review*, **40**(3): 391–419.

Sorensen, C. (1994) "Success and Education in South Korea", *Comparative Education Review*, **38**(1): 10-35.

Statistics Japan (2017) *Population Statistics of Japan 2017*,s Statistics Bureau, Ministry of Internal Affairs and Communications, Population Census of Japan.

Surkyn, J. and Lesthaeghe, R. (2004) "Value orientations and the second demographic transition (SDT) in Northern, Western and Southern Europe: And update", *Demographic Research*, **SC3**: 45-75.

Suzuki, T. (2008) "Korea's Strong Familism and Lowest-Low Fertility", *International Journal of Japanese Sociology*, **17**: 30-41.

- Taeuber, I. (1958) *The Population of Japan*, Princeton: Princeton University Press.
- Tan, P., Morgan, S., and Zagheni, E. (2016) "A case for 'reverse one-child' policies in Japan and South Korea? Examining the link between education costs and lowest-low fertility", *Population Research and Policy Review*, **35**: 327-350.
- Tanskanen, A. and Rotkirch, A. (2014) "The Impact of Grandparental Investment on Mothers' Fertility Intentions in Four European Countries", *Demographic Research*, **31**(1): 1-26.
- Tanturri, M. (2016) "Aging Italy: Low Fertility and Societal Rigidities", In: R. Rindfuss and M. Choe (eds.) *Low Fertility Institutions, and their Policies: Variations Across Industrialized Countries*, Springer: 221-257.
- te Velde, E., Habbema, D., Leridon, H., and Eijkemans, M. (2012). "The effect of postponement of first motherhood on permanent involuntary childlessness and total fertility rate in six European countries since the 1970s", *Human Reproduction*, **27**(4): 1179–1183.
- Thévenon, O. (2015) "Decreasing Fertility in Europe: Is it a Policy Issue?", In: K. Matthijs, K. Neels, C. Timmerman, and J. Haers (eds.) *Population Change in Europe, the Middle-East and North Africa: Beyond the Demographic Divide*, London: Routledge, pp. 81-114.
- Thévenon, O. and Gauthier, A. (2011) "Family policies in developed countries: a 'fertility booster' with side-effects", *Community, Work & Family*, **14**(2): 197-216.
- Thévenon, O. and Luci, A. (2012) "Reconciling Work, Family and Child Outcomes: What Implications for Family Support Policies?", *Population Research and Policy Review*, **31**(6): 855-882.
- Torr, B. and Short, S. (2004) "Second births and the second shift: A research note on gender equity and fertility", *Population and Development Review*, **30**(1): 109-130.
- Tsuya, N. (2015) "Below-replacement fertility in Japan: patterns, factors and policy implications", In: R. Rindfuss and M. Choe (eds.), *Low and Lower Fertility*, Springer: 87-106.
- Tsuya, N. (2017) "Low Fertility in Japan – No End in Sight", *East West Center*, **131**: 1-4.
- Tsuya, N. and Choe, M (1991) "Changes in Intrafamilial Relationships and the Roles of Women in Japan and Korea", *NUPRI Research Paper Series 58*, Tokyo, Nihon University Population Research Center.
- Twenge, J. (2017) *iGen: Why Today's Super-Connected Kids are Growing up Less Rebellious, More Tolerant, Less Happy – and Completely Unprepared for Adulthood*, Atria Books.
- UNESCO (United Nations Educational, Scientific and Cultural Organization) (2014) *Higher Education in Asia: Expanding Out, Expanding Up*, UNESCO, Montreal: Institute for Statistics.

United Nations (2015), *World Population Policies Database*. Population Division of the Department of Economic and Social Affairs. Available from: https://esa.un.org/poppolicy/about_database.aspx.

United Nations (2019) *World Population Prospects 2019*, Population Division of the Department of Economic and Social Affairs, Available from: <https://population.un.org/wpp/>.

University of Rochester Medical Center (2019) *Infertility Risk Factors for Men and Women*, Rochester, NY. Available from: <https://www.urmc.rochester.edu/encyclopedia/content.aspx?ContentTypeID=85&ContentID=P01533>.

UNFPA (United Nations Population Fund) (2018) *State of the World Population 2018*, New York: UNFPA.

United Nations, Department of Economic and Social Affairs, Population Division (2019). *World Population Prospects*. Available from: <https://population.un.org/wpp/>.

Van Bavel, J., Jansen, M., and Wijckmans, B. (2012) “Has Divorce Become a Pro-Natal Force in Europe at the Turn of the 21st Century?”, *Population Research and Policy Review*, **31**(5): 751-775.

Van de Kaa, D. (1987) “Europe’s Second Demographic Transition”, *Population Bulletin*, **42**(1): 1-59.

Van de Kaa, D. (1994) “The Second Demographic Transition Revisited: Theories and Expectations”, In: G. Beets (ed.) *Population and Family in the Low Countries 1993: Late Fertility and Other Current Issues*, NIDI/CBGS Publication: 81-126.

Van de Kaa, D. (2001) “Postmodern Fertility Preferences: From Changing Value Orientation to New Behavior”, *Population and Development Review*, **27**: S290-S331.

VID (Vienna Institute of Demography) (2016) *European Demographic Data Sheet 2016*, Vienna Institute of Demography and IIASA/Wittgenstein Centre for Demography and Global Human Capital. Available from: http://pure.iiasa.ac.at/id/eprint/13776/1/VID_DataSheet2016_printfile.pdf.

VID (Vienna Institute of Demography) (2018) *European Demographic Data Sheet 2018*, Vienna Institute of Demography and IIASA/Wittgenstein Centre for Demography and Global Human Capital. Available from: <https://www.oeaw.ac.at/en/vid/data/demographic-data-sheets/european-demographic-data-sheet-2018/>.

Vobecká, J., Butz, W. and Reyes, G. (2013) *Population Trends and Policies in the UNECE Region: Outcomes, Policies and Possibilities*, UNFPA and IIASSA.

Wilson, L. (2013) "How big is a house? Average house size by country", Available from: <http://shrinkthatfootprint.com/how-big-is-a-house>.

Wittgenstein Centre (2015) *European fertility 2015*. Available from: <http://www.fertilitydatasheet.org>.

Wittgenstein Centre (2016) *European demographic data sheet 2016*. Available from:

Wood, J. (1989) "Fecundity and natural fertility in humans", In: S. Milligan (ed.), *Reviews of Reproductive Biology*, Oxford: Oxford University Press: 61-109.

World Bank (2019) *Global Gender Gap Index*, Available from: https://tcdata360.worldbank.org/indicators/af52ebe9?country=BRA&indicator=27962&viz=line_chart&years=2006,2018.

Yamamura, E. and Antonio, A. (2011) "Trust and Fertility: Evidence from OECD countries", *MPRA Paper, University Library of Munich, Germany*, Available from: <https://econpapers.repec.org/paper/pramprapa/29978.htm>.

Yi, J. and Zhang, Y. (2010) "The Effect of House Price on Fertility: Evidence from Hong Kong", *Economic Inquiry*, **48**(3): 635-650.

Yoon, S. "The influence of a supportive environment for families on women's fertility intentions and behavior in South Korea", *Demographic Research*, **36**(7): 227-254.

Yoo, S. and Sobotka, T. (2018) "Ultra-low fertility in South Korea: The role of the tempo effect", *Demographic Research*, **38**(22): 549-576.