

Beaujouan, Éva; Sobotka, Tomáš

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## Late Motherhood in Low-Fertility Countries: Reproductive Intentions, Trends and Consequences

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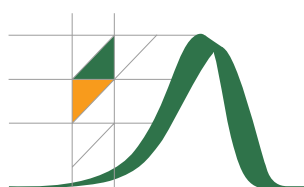
VIENNA INSTITUTE OF DEMOGRAPHY

# WORKING PAPERS

02/2017

## LATE MOTHERHOOD IN LOW-FERTILITY COUNTRIES: REPRODUCTIVE INTENTIONS, TRENDS AND CONSEQUENCES

ÉVA BEAUJOUAN AND TOMÁŠ SOBOTKA



**HUMAN FERTILITY DATABASE RESEARCH REPORT**

HFD RR-2017-002

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## Abstract

Delayed parenthood is a central feature of the massive transformation of family and reproduction in rich countries. We analyse the shift of motherhood towards later reproductive ages during the last four decades and review its consequences for children and their mothers in low-fertility countries in Europe, North America, Oceania and East Asia. First we analyse the trends in birth rates at advanced reproductive ages (35+), including trends at very high reproductive ages (50+) and detailing the rapid rise in first and second birth rates at that ages. We show that a relatively high share of childless women and of women with one child aged 35-44 still plan to have a(nother) child in the future. Subsequently, we discuss the limited success rates of assisted reproduction at advanced reproductive ages and its contribution to parenthood at later ages. Next we outline the key drivers of delayed parenthood and its demographic consequences. Finally, we briefly review the consequences of delayed motherhood for pregnancy outcomes, maternal and child health and highlight selected positive consequences of later parenthood for mothers and children. We argue that economic and social rationales for late reproduction clash with the biological and health rationales for having children earlier in life.

## Keywords

Advanced parental ages, higher reproductive ages, delayed childbearing, fertility intentions, reproductive aging, assisted reproduction, low-fertility countries, Europe, United States.

## Authors

Éva Beaujouan (corresponding author), Wittgenstein Centre for Demography and Global Human Capital (IIASA, VID/ÖAW, WU), Vienna Institute of Demography (Austrian Academy of Sciences), Vienna. Email: [eva.beaujouan@oeaw.ac.at](mailto:eva.beaujouan@oeaw.ac.at)

Tomáš Sobotka, Wittgenstein Centre for Demography and Global Human Capital (IIASA, VID/ÖAW, WU), Vienna Institute of Demography (Austrian Academy of Sciences), Vienna. Email: [tomas.sobotka@oeaw.ac.at](mailto:tomas.sobotka@oeaw.ac.at)

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# **Late Motherhood in Low-Fertility Countries: Reproductive Intentions, Trends and Consequences**

Éva Beaujouan and Tomáš Sobotka

## **1. Introduction**

Delayed parenthood is one of the defining features of the massive transformation of family and reproduction in rich countries (Lesthaeghe 2010). The “contraceptive revolution” that started in the late 1960s, together with relatively easy access to abortion in most countries, have given women and couples an effective control over their pregnancies and contributed to changing family and partnership relations (van de Kaa 2011). Young people in Western Europe today are sexually active for more than a decade before becoming parents. Policy concerns about high rates of teenage pregnancies, common in many Western countries a few decades ago (Jones et al. 1985), have gradually given way to heated debates about late motherhood and ticking biological clock (Heffner 2004, Twenge 2013). In the United Kingdom, The Royal College of Obstetricians and Gynaecologists (2009) declared later maternal age as an “emerging public health issue” that needs to be thoroughly studied.

Scientific and media debates on delayed motherhood take different angles, reflecting upon the advantages as well as drawbacks of this fast change. Some view late parenthood as an opportunity and a positive experience (La Liberté 2012). Older parents may provide children with higher living standards and more stable family arrangements, improving their future life chances (McLanahan 2004). Often, delayed parenthood is portrayed as risky, potentially endangering mother’s or children’s health or leading to involuntary childlessness and demographic decline (Selvaratnam 2014; Bewley et al. 2005). Discussions in popular press often blame women (and occasionally men) who wait for “too long,” presenting them as selfish, career-oriented, breaking the “natural order”, and irresponsible (Shaw and Gilles 2009; Budds et al 2013). These debates are also mirrored in discussions concerning age limits for the provision of Assisted Reproductive Technology (ART) and in policy initiatives seeking to inform women (and men) about reproductive aging and supporting them in having children earlier in life.

Some of these concerns are justified. It has been repeatedly shown that even well educated women are often poorly informed about female reproductive aging, infertility and the increased risk of pregnancy complications, and they often overestimate the chances of becoming pregnant at higher reproductive ages (Lampic et al. 2006, Tough et al. 2007, Bretherick et al. 2010, Daniluk et al. 2012). But the government campaigns can also create controversies, as did the officially promoted Italian “Fertility day” on 22 September 2016, during which the debates, images and materials distributed were considered sexist and

offensive by many (Coppolaro-Nowell 2016), as well as a government-initiated campaign in Singapore encouraging women to have a child before “it is too late” (Flora 2013).

In this study we analyse the shift to later parenthood and review its consequences for children and parents, especially mothers. First we analyse the trends in birth rates at advanced reproductive ages (35+), including trends at very high reproductive ages (50+), which were characterised by a rapid rise in first and second birth rates. We show that relatively high share of childless women and women with one child aged 35-44 still plan to have a child in the future. Subsequently, we review success rates of assisted reproduction at advanced reproductive ages and its role in fuelling the trend towards delayed motherhood. Next we discuss the key drivers of delayed parenthood and its demographic consequences. Finally, we briefly review the consequences of delayed motherhood for pregnancy outcomes, maternal and child health and highlight selected positive consequences of later parenthood for mothers and children, which provide economic and social rationale for late reproduction. Our focus is largely on developed countries in Europe, North America, Oceania and East Asia which have experienced a continuing shift to delayed reproduction in the last four decades.

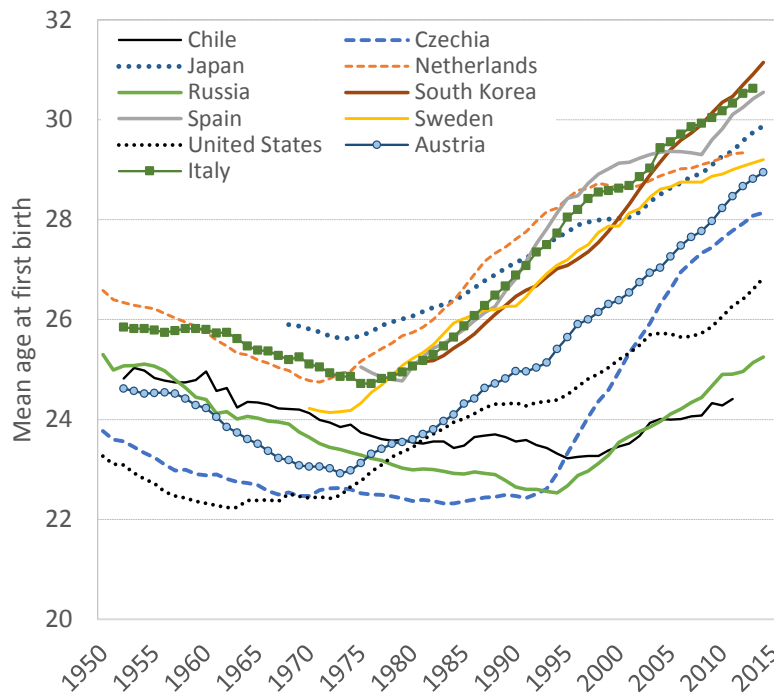
## **2. Shifting Childbearing to Advanced Reproductive Ages**

### **2.1. The long-term Trend towards Late Motherhood**

The trend to later motherhood first started in Western and Northern Europe, the United States, Canada, Australia and Japan in the early 1970s, reversing thus the shift towards earlier first births observed during the post-war baby boom era (Sobotka 2004). Other developed countries and regions followed during the 1980s and 1990s. Recently, the mean age at first birth among women has surpassed 30 in several European countries including Italy and Spain, and in South Korea where it reached 31.1 in 2014, the record-high among rich countries (Figure 1). In the most developed countries the age at starting a family among women has shifted from 22-25 in 1970 to 26-30 in 2014, without showing signs of weakening or reversing.

In most other world regions women still become mothers early in life, but even many of the less developed countries with high fertility have seen postponement of first marriage and first birth and a decline in adolescent births in the last two decades (United Nations 2013: 38). A gradual trend towards delayed motherhood has been reported for many middle-income countries with relatively low fertility, including China, Iran, and the countries of North Africa, and Latin America (including Chile, Figure 1) (Rosero-Bixby et al. 2009, Sobotka 2017a).

Figure 1: Mean age of women at first birth in selected low-fertility countries, period 1950-2014



Sources: Human Fertility Database (2016), Human Fertility Collection (2016). Data for Korea were kindly provided by Sam Hyun Yoo (Yoo and Sobotka 2016).

## 2.2. More Frequent Late First and Second Births

Historical data clearly show that childbearing at higher reproductive ages is not a new phenomenon. To the contrary, in the era of large families until the early 20<sup>th</sup> century, childbearing was common even among women past age 40. The natural reproductive capacity after that age can be estimated from the data on married Hutterite women, American high-fertility religious sect that did not practice birth control. After reaching age 40, these women gave birth to 1.43 children on average (Sheps 1965)—this number equals a complete family size of some contemporary low-fertility countries such as Japan, Italy, Spain, or Ukraine (VID 2016). Similarly, Leridon's (2008: Table 1) model estimated that women who become exposed to pregnancy at age 40, would give birth to 1.4 children on average; this would shrink to 0.3 birth for women starting pregnancy attempts at age 45. In contemporary populations fertility rates after age 40 are deep below this level. In Spain and Sweden, where the shift to late motherhood is well advanced, women gave birth to 0.08 children on average after age 40 in 2014: this amounts to less than 6% of their theoretical reproductive capacity above age 40. Late births are even less frequent in most other rich countries (Human Fertility Database 2016).

Table 1: Contribution of women aged 35+ and 40+ to total fertility rates (TFR), 1<sup>st</sup> birth rates (TFR1) and 2<sup>nd</sup> birth rates (TFR2) in selected developed countries, 1980-2014

		Age 35+			Age 40+		
		Total	1st births	2nd births	Total	1st births	2nd births
Western and Northern Europe	Austria						
	1984	7.4	2.1	5.1	1.3	0.3	0.6
	2000	10.9	5.6	10.4	1.7	0.7	1.4
	2014	20.6	13.7	22.5	3.6	2.2	3.3
	Germany						
	2013	22.4	14.5	26.0	3.7	2.2	3.8
	Netherlands						
	1980	6.5	2.1	4.2	1.2	0.3	0.5
	2000	16.1	8.6	17.4	2.0	0.9	1.8
	2014	19.7	12.0	21.6	2.8	1.7	2.5
	Sweden						
	1980	8.4	3.1	6.4	1.3	0.4	0.7
	2000	16.3	8.1	15.7	2.6	1.1	2.1
	2014	22.1	12.8	22.7	4.1	2.4	3.6
Switzerland							
2000	15.3	10.2	16.4	2.2	1.5	2.0	
2014	26.9	19.8	30.4	4.8	3.6	4.9	
Southern Europe	Italy						
	2004	22.8	15.2	28.2	3.9	2.6	4.4
	2012	27.3	20.9	32.4	5.7	4.3	6.4
	Spain						
	1980	14.0	4.6	7.8	3.7	1.4	1.4
	2000	20.2	11.2	25.8	2.8	1.5	2.6
	2014	30.3	22.3	38.3	6.1	4.5	6.9
Central & Eastern Europe	Czechia						
	1980	3.5	1.1	2.4	0.5	0.1	0.2
	2000	7.1	2.2	5.5	1.0	0.3	0.6
	2014	16.7	8.0	19.4	2.4	0.9	2.0
	Russia						
	1980	6.5	1.7	5.4	1.4	0.3	0.7
	2000	6.2	2.1	6.7	1.0	0.3	0.8
	2014	13.4	4.4	14.9	2.4	0.7	2.2
Non- European countries	Japan						
	1980	4.3	2.1	3.7	0.5	0.3	0.3
	2000	13.3	7.2	14.1	1.5	0.8	1.2
	2014	23.0	17.0	25.9	3.8	3.0	3.9
	Canada						
	1980	6.5	2.6	5.2	0.9	0.3	0.5
	2000	13.4	7.9	14.5	2.0	1.1	1.9
	2011	19.5	12.4	21.2	3.3	2.0	3.3
	United States						
	1980	6.4	1.9	3.9	1.1	0.2	0.4
	2000	11.8	6.4	11.5	2.0	1.1	1.7
2014	16.7	9.7	16.6	3.1	1.8	2.7	

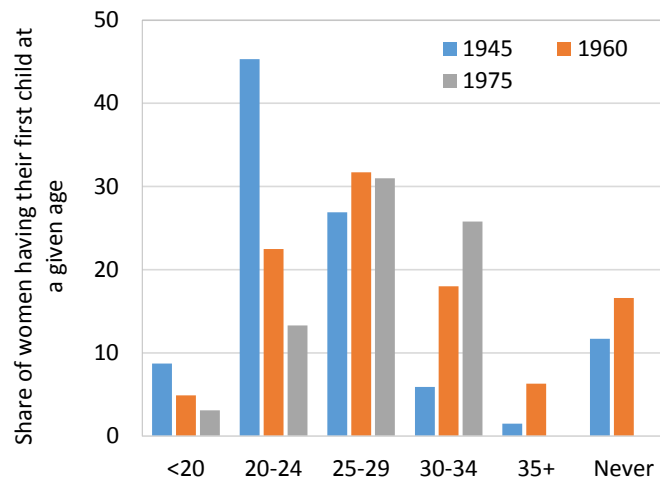
Source: Own computations from the Human Fertility Database (2016).



Late births have been historically much more common than today. However, the structure of late births has changed radically in the last decades. Many of the women who are now getting pregnant at higher reproductive ages have never had a child before. With the decline in family size, and a virtual disappearance of large families with more than four children, the historical pattern of having a fourth, fifth or sixth birth at late reproductive ages has been replaced with a new pattern of having a first or a second child later in life. This is especially the case in countries characterized by low fertility rates and a rapid shift to late motherhood, including Italy and Spain. In Spain, the number of births to women aged 40+ in 2014, slightly over 30 thousand, was not much different from that in 1975, when it was just below 28 thousand. But in 1975 most of these births, 61%, were fourth or higher-order births, which accounted for only 6% of births to mothers over 40 in 2014. In contrast, the contribution of the first and second births to births among women aged 40+ jumped from 19% in 1975 to 80% in 2014 (Human Fertility Database 2016, own computations). Across the rich low-fertility countries the share of births occurring at ages 35 and older has risen quickly since 1980 and this increase has been particularly steep for first and second births and at ages 40+ (Table 1). For instance, in Austria, the share of first birth rates that took place among women aged 35 and over jumped from 2% in 1984 to 14% in 2014 and the share of second birth rates at these ages jumped from 5% to 22%. At the same time the contribution of women aged 40 and over to total fertility in Japan went up from a low of 1.3% to 3.6% (Table 1). Late fertility has become even more common in Southern Europe, where around 6% of fertility rates now take place at ages 40% and around 30% of fertility is realised at ages 35+. Late childbearing remains less frequent in countries of Central and Eastern Europe, but its increase was particularly steep in this region.

The rich low-fertility countries have thus witnessed a radical change in the age when women and men become parents. Motherhood has become rare in teenage years, rather uncommon at ages 20-25—which was the most typical age at first birth in most developed countries in the past— and has increasingly shifted to ages 30 and higher. In tandem, childlessness has increased as well (Sobotka 2017b). This shift can be best captured by observing the change in age at first birth and in final childlessness between the generations of Dutch women born in 1945-1975 (Figure 2). There the share of all first births to women aged 20-24 fell from 45 to 13%, while their share at ages 30-34 went up from 6 to 26%.

Figure 2: Share of women having their first child at a given age, The Netherlands, women born in 1945, 1960 and 1975



Source: Own computations from the Human Fertility Database (2016).

Note: Data for women born in 1975 are shown up until age 35 only.

### 2.3. Childbearing at Very High Reproductive Ages

Advances in ART have partly eroded the conventional boundaries of female reproductive lifespan marked by follicular depletion and menopause. In vitro fertilization with donated oocytes, and, more recently also with women's own cryopreserved oocytes harvested at younger ages gives high pregnancy chances among women who are well past their menopause (e.g., Paulson et al. 2002, Salihu et al. 2003). These cases remain relatively rare, but such late births among celebrities or even ordinary women spending a fortune for becoming pregnant, generate media attention.

In the United States, the number of births to women aged 50+ tripled from 255 in 2000 to 743 in 2014 (Hamilton et al. 2015, Martin et al. 2002). In the European Union countries (including UK) the number of births to women aged 50+ in 2002-2014 jumped from 287 to 1019. (Eurostat 2016, own computations). Wikipedia (2016) provides an extensive list of women who gave birth at age 50 or older, with three oldest mothers reportedly being all from India and giving birth at age 70 between 2008 and 2016. The oldest mother with fully verified age is Maria del Carmen Bousada from Spain who gave birth to twin boys shortly before her 67<sup>th</sup> birthday, after receiving ART using donor oocytes in the United States.

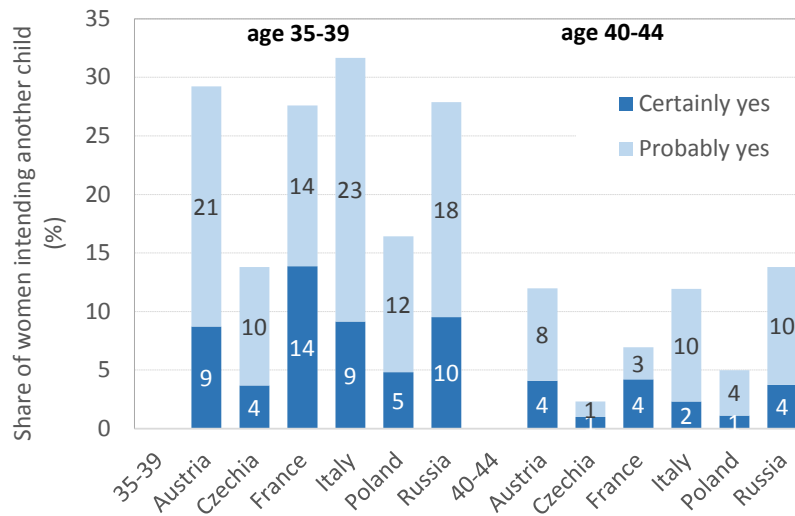
### 3. Childbearing Intentions and Their Realisation at Higher Reproductive Ages

#### 3.1. High Share of Childless Women Aged 35+ Intends to Have a Child

The *Generations and Gender Surveys* (GGS) for six European countries reveal that a high share of women still plan to have a child at an age when their reproductive capacity is declining (Beaujouan 2014). This is especially the case in Austria, France, Italy, and Russia where 28-32% of women aged 35-39 intend to have a(nother) child (Figure 3). Perhaps more surprising is that more than one in ten women aged 40-44 in Austria, Italy and Russia still intend to have a(nother) child in the future. These shares are considerably lower in Czechia and Poland, two post-communist countries where reproduction took place at relatively young ages until the 1990s. However, women at older reproductive ages also clearly express uncertainty about their plans: in each analysed country the share of women responding they “probably” intend to have a child outnumbers the share responding they are “certain” about their intention.

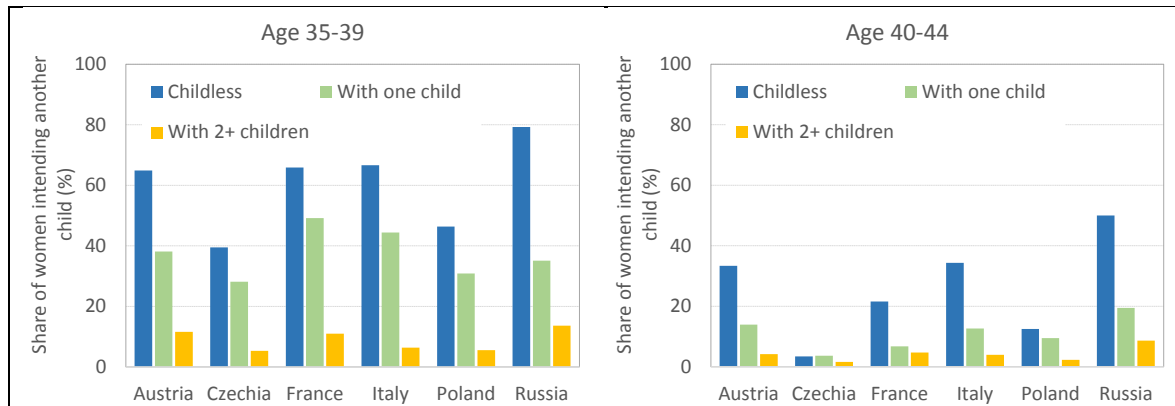
Another consistent finding is a strong family size gradient in reproductive intentions: the plan to have a child later in life is very common among childless women aged 35-39, with a majority of these women intending to become mothers in the future. Also many women with one child still plan to have a second child in the future. In contrast, only a few women having two or more children intend to have another child at later ages (Figure 4a). Very similar gradient is found also for women aged 40-44 (Figure 4b) and for men at advanced reproductive ages (not shown here). As men’s reproductive capacity is much less limited by age, a high share of childless men aged 40-44 still plan to become fathers in the future, especially in Italy (74%), Austria (54%), and Poland (44%; these shares include the “probably yes” answers).

Figure 3: Share of women aged 35-39 and 40-44 stating they intend to have a(nother) child in the future; six European countries, surveys organized in 2000s



Source: Own computations from the Generations and Gender Survey (GGS) data for Austria 2008-9, Czechia 2004-5, France 2005, Italy 2003-4, Poland 2010-11, Russia 2004 (see Beaujouan 2014 for questions asked and for more details about the data).

Figure 4a and 4b: Share of women aged 35-39 and 40-44 stating they intend to have a(nother) child in the future by the number of children they already have; 6 European countries.



Source: See Figure 3. Note: The graphs combine “probably yes” and “certainly yes” answers

### 3.2. Actual Fertility at Higher Reproductive Ages Corresponds More Closely to the Reproductive Intentions among Mothers than among Childless Women

How are intentions to have children later in life related to the actual fertility rates at higher reproductive ages? For three European countries, Austria, Italy, and the Netherlands, we compare survey data on reproductive intentions with the aggregate data on childbearing probabilities by age and parity included in the Human Fertility Database (2016) and Human

Fertility Collection (2016; data for Italy, own elaboration). We are not following up the women interviewed at the time of the survey, but we compare their plans with population-wide data on the likelihood of having a child by the end of their reproductive life among all women who were of the same age and had the same number of children in the year intention estimates were calculated.

Tables 2a and 2b illustrate this correspondence for Italy and Austria. In Italy, 37% of women aged 35-39 intended to have a child in the future (including “probably yes”) in the 2009 Multiscopo survey; this compares with the aggregate data showing that 22% of women of that age gave birth in the years following the survey. A similar correspondence is found for Austria (24% intended to have a child vs. 15% have had a child) and yet closer relationship is found for the Netherlands (20% vs. 16%) (data and detailed results not shown here). These comparisons indicate that women aged 35-39 wishing to have a child in the future still have a relatively good chance of achieving their goal, even if those who give birth to a child are not always those who intended to have one.

The gap between reproductive intentions and actual pregnancies becomes much wider at later ages, 40-44, when many women are infertile and the potential mothers often widely overestimate their chances of becoming pregnant (see data for Italy in Table 2a). In addition, childless women aged 35+ consistently show a larger gap between their reproductive intentions and subsequent childbearing. This gap is partly related to considerable uncertainty of reproductive plans reported by these women, but it is also due to unrealistic expectations and to adverse life circumstances (which often include not having a partner). In addition, selectivity plays a role as well as childless women at higher reproductive ages more often suffer health problems or are infertile.

Table 2a: Percentage of Italian women aged 35-39 and 40-44 intending to have a(nother) child (Multiscopo survey in 2009) and the share of women giving birth to a child in the following years (population-level statistics, in percent)

2009 Multiscopo survey					Population-level fertility data	
Intention to have a child, %				N	Share having a child (% of all women irrespective of their intention)	Share having a child related to the share intending
Yes	Probably yes	Total				
Age 35-39						
Childless	24	40	64	463	31	0.48
1 child	14	34	49	411	33	0.67
2+ children	2	10	12	764	9	0.75
Total	12	25	37	1638	22	0.59
Age 40-44						
Childless	7	27	34	362	7	0.20
1 child	3	14	17	436	6	0.33
2+ children	1	1	2	967	1	0.60
Total	3	10	13	1765	4	0.28

Source: Own computations from Multiscopo ISTAT – Family and Social Subjects (2009) survey and fertility tables in the Human Fertility Database (2016; fertility data).

Table 2b: Percentage of Austrian women aged 35-39 intending to have a(nother) child (Microcensus survey, 2012) and the share of women giving birth to a child in the following years (population-level statistics, in percent)

2012 Microcensus survey			Population-level fertility data	
Intention to have a child (%)		N	Share having a child (% of all women irrespective of their intention)	Share having a child related to the share intending
Childless	50	169	21	0.43
1 child	31	181	25	0.80
2 children	11	309	9	0.75
3 children	6	125	8	1.32
Total	24	784	15	0.63

Source: Own computations from 2012 Microcensus survey data and fertility tables in the Human Fertility Database (2016; fertility data).

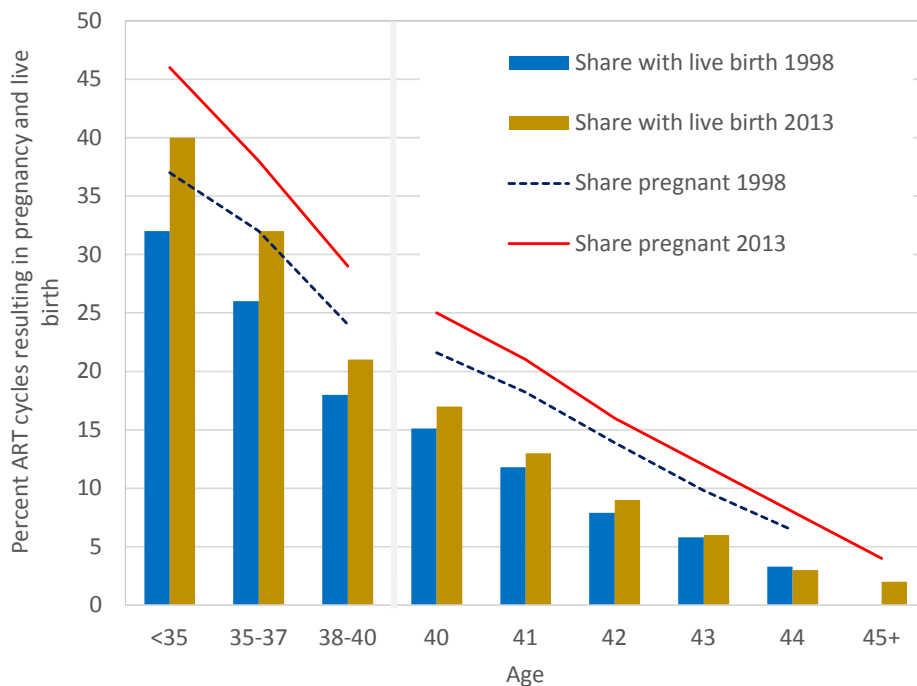
#### **4. Assisted Reproduction and Delayed Childbearing: Rising ART Use and Declining ART Success Rates at Higher Reproductive Ages**

Many women planning to have a child in their late 30s and early 40s are likely to face infertility and turn to ART treatment. This trend is partly fuelled by widespread misperceptions about the ability of ART to compensate for infertility at later reproductive ages (Wyndham et al. 2012), giving women an illusion of fertility control at higher reproductive ages (Szewczuk 2012; Mac Dougall et al 2012a). Despite many rich countries not subsidizing ART for women after a certain age threshold, the number of ART cycles is rising fastest at age 40 and higher. In the United States, 21% of all ART cycles in 2013 (i.e., 34 thousand cycles) were initiated by women aged 41+ (own computations from Centers for Disease Control and Prevention data (CDC 2015)).

In Europe, the incomplete data show that the number of registered ART cycles at ages 40+ increased much faster in 2002-12, by a factor of 3.1, than the number of cycles initiated by younger women, which increased by a factor of 1.8 (computations based on Calhaz-Jorge et al. 2016 and Nyboe Andersen et al. 2006). Especially steep rise was reported for ART using donor oocytes, which quadrupled in the same period. Overall, the share of ART cycles initiated by women aged 40+ jumped from 12% to 19% in 2002-12, contributing about 7% of all children born to women over age 40. This share would be considerably higher if in-vitro fertilisation with non-donor oocytes was more effective at these ages.

Success rates of non-donor assisted reproduction, measured especially by the percentage of ART cycles that result in pregnancies and live births or single-infant live births, decline rapidly with age among women past age 32 (CDC 2015, Figure 14). Over time, ART live birth rates have gradually improved, but these improvements were most pronounced among younger women up to age 40. Figure 5 illustrates this using the data for the United States. Among women undergoing non-donor ART in 2013, pregnancy rates per cycle reached 46% at ages below 35, 25% at age 40 and only 4% at ages 45+. Because of high rates of miscarriage at higher ages, the fall in the likelihood of live birth following ART cycle is even steeper with age: 40% of non-donor ART cycles initiated at ages <35 resulted in live birth in 2013, compared with 17% of the cycles initiated at age 40 and 2% at ages 45+ (Figure 5). The likelihood of live birth has improved only gradually among women past age 40. A majority of women do not achieve pregnancy leading to live birth after age 40 even after six or more ART cycles (Gnoth et al. 2011; Malizia et al. 2009).

Figure 5: Success rates of ART cycles with non-donor oocytes or embryos by age in the United States: Percentage of cycles resulting in pregnancies and live birth, 1998 and 2013



Source: CDC 2015 (Figures 15 and 17) and CDC 2000 (Figures 10 and 12). Note: Data for single years of age published only for ages 40-44

Conventional ART using non-donor oocytes therefore cannot offset age-related fertility decline and for many women it does not provide a realistic chance of having a child after age 40 (Leridon 2004; Wyndham et al. 2012; Ng and Ho 2007). Also the cost of ART treatments per live birth delivery rises steeply after age 40, making conventional non-donor ART use problematic, especially after age 45 Sullivan (2008).

In contrast, ART with donor oocytes shows remarkably stable success rate with age of women treated, with the percentage of ART cycles resulting in live births staying over 50% even for women in their 40s according to the US data for 2013 (CDC 2015: Figure 40). Therefore, despite higher costs and despite the fact that the live birth will not be genetically related to the mother, the use of donor oocytes increases rapidly. In the United States, donor oocytes accounted for 37% of ART cycles among women aged 41+ and around 78% of live births among ART users of that age; for Europe the corresponding estimates were 17% and 41%, respectively (own computations from CDC 2015 data and Calhaz-Jorge et al. 2016 data). In addition, the cryopreservation of oocytes and ovarian tissue has rapidly evolved and it reached the stage when it has become commercially available (Stoop et al. 2014). In the US, the number of oocyte or embryo banking cycles rose dramatically from around a thousand in 2006 to over 27 thousand in 2013 (CDC 2015). Surprisingly many of these freezing cycles, 30%, are taking place at ages 41+, i.e., at ages when the quality of oocytes



deteriorates rapidly, implying lower chances of successful pregnancy and delivery later in life.

## **5. Main Factors Contributing to Later Parenthood**

A review by Mills et al. (2011) identified the following key drivers of the shift towards later parenthood: expanding education, increased employment among women, economic uncertainty and precarious forms of employment, low availability and high costs of housing, delayed and more unstable partnerships, more individualized values including higher acceptance of childlessness, and lower levels of gender equality. These factors often reinforce each other and their importance differs by country and time period (Sobotka 2004). The shift towards later parenthood was supported by widely available efficient contraception, especially the pill (Goldin and Katz 2002; Bailey 2012) and, more recently, by the spread of “emergency contraception” that is used especially among young adult women (Daniels et al. 2013).

Being in education is commonly perceived as incompatible with parenthood (Blossfeld and Huinink 1991). The continuing expansion of higher education in the rich countries during the last four decades has been repeatedly identified as a central driver of delayed parenthood (Ní Bhrolcháin and Beaujouan 2012; Kalwij and Gustafsson 2006). However, in many countries including the United States, United Kingdom and Norway, highly educated women increasingly shifted childbearing well beyond the time of completing their education, often towards their mid- or late-thirties (Berrington et al. 2015; Lappegård and Rønsen 2005; Rindfuss et al. 1996). This leads to rising contrasts (“polarization”) in first birth timing by social status, especially in Southern Europe and in English-speaking countries (Rendall et al. 2010). Unemployment and unstable economic conditions have been documented as important factors especially in Southern Europe, where policies supporting family formation are weak and many young adults face precarious labour market situation (Adsera 2005). At an individual level, not having a suitable partner and, more generally, “not feeling ready” for motherhood are frequently cited as important reasons for delaying motherhood (Cooke et al. 2010; Gregory 2007).

## **6. Demographic Consequences of Delayed Childbearing**

The shift to later motherhood has important population-level consequences. It negatively affects period birth rates as some women who would otherwise have had a child in any given year shifted their childbearing plans towards the future. As a result, period total fertility rates are depressed and often decline well below the corresponding indicators of cohort family size (Bongaarts and Sobotka 2012; VID 2016). Delayed childbearing implies wider age distance between generations, which in turn means that women and men having children later in life are less likely to survive to see their grandchildren when compared

with younger parents or they might not remain in good health when becoming grandparents (Schmidt et al. 2012; Leopold and Skopek 2015). The stretched intergenerational interval also implies a slower pace of population decline when fertility rates are below the replacement-level threshold of around 2.07 children per woman in low-mortality countries (Goldstein et al. 2003).

Later motherhood can also result in higher childlessness and reduced family size in the population. Leridon and Slama (2008) simulated the impact of a postponement by 30 and 69 months of the first pregnancy attempt, initially starting at age 25 on average (based on the observed age pattern of pregnancies among French women born in 1968). The shift by 69 months would reduce the final number of children per woman by more than 10% (from 2.00 to 1.77) and would increase the share of childless couples from 11.7% to 17.7%. Te Velde et al. (2012) used similar micro-simulation models, estimating that first birth postponement in six European countries between 1970 and 2007 led to an increase in permanent childlessness in the range of 4% in Czechia to 7% in Spain.

Delayed childbearing is closely associated with higher frequency of multiple births. Their prevalence increases with age of the mother, attributable to higher multiple follicle growth with age (Beemsterboer et al. 2006) and to high rates of multiple births following ART. In the highly developed countries the frequency of twin deliveries has increased rapidly between 1970 and 2013, typically doubling, but in some cases (Greece, Hong Kong) tripling during that period (Pison et al. 2015). In the United States, the number of twin live births per thousand live births went up from 18.9 in 1980 to 33.9 in 2014, while triplet- and higher-order birth rate jumped from 0.4 to 1.9 between 1980 and 1998, and steadily declined thereafter to 1.1 in 2014 (Hamilton et al. 2015, table 27). Analysis by Pison et al. (2015) shows that in most countries ART use was the main reason for the rising frequency of twin births, contributing on average to three quarters of their observed rise between 1970 and 2005 across 32 countries, with huge cross-country variation. As single embryo transfers are increasingly preferred by health professionals and also guidelines regulating ART use, the frequency of twin deliveries peaked in 13 countries including Nordic countries, Australia, Japan, the Netherlands and Japan between 1998 and 2010 and then started declining (Pison et al. 2015; Cook et al. 2011; Källén et al. 2010; Umstad et al. 2013). The triplet and higher-order pregnancies fell even more strongly across most developed countries (Black and Bhattacharya 2010, Kulkarni et al. 2013).

## **7. Consequences of Delayed Motherhood for Pregnancy Outcomes, Maternal and Child Health**

Extensive medical literature documents the effects of pregnancy and childbearing at advanced reproductive ages on pregnancy outcomes, foetal development, and maternal and child health (e.g., Luke and Brown 2007; Balasch and Gratacos 2012, Schmidt et al. 2012; Delbaere et al. 2007; Jacobsson et al. 2004; Bianco et al. 1996). Many risks are related to

“natural pregnancies”, but some, including multiple deliveries are more typical for ART use. We give only brief highlights of the most important findings.

Pregnancy complications and foetal loss are more frequent at higher maternal ages. The frequency of miscarriages (spontaneous abortions), ectopic pregnancies as well as stillbirths increases rapidly with age among women in their late 30s and older (Nybo Andersen et al. 2000; Schmidt et al. 2012). Danish register-based study found that at age 42 and older, more than half of pregnancies intended to be carried to term (i.e. excluding induced abortions) resulted in foetal loss, compared with 13.5% of pregnancies across all ages (Nybo Andersen et al. 2000). Male partner’s age was also found to be an independent risk factor for miscarriage (de la Rochebrochard and Thonneau 2002). Interestingly, women using donor oocytes do not show a rise in pregnancy losses with age (Abdalla et al. 1993, Schieve et al. 2003), which again suggests that the age and quality of oocytes are the main factors determining reproductive success. A combination of rising infertility and more frequent pregnancy losses with age implies that women who have a strong childbearing desire and a preference for larger family should aim to have children relatively early in life. Habbema et al. (2015) showed that women planning only one child and willing to take a 50% risk that they do not succeed can start their pregnancy attempt at age 41 (or 42 if they are willing to use ART). Those planning three kids and wanting to have a 90% chance they succeed should start as early as at age 23.

Advanced maternal age has also been shown to be a risk factor in preterm births (Voigt et al. 2010; Joseph et al. 2005) and complications during pregnancy and delivery, including high rate of Caesarean delivery, excessive labour bleeding, and higher frequency of diabetes and chronic and pregnancy-induced hypertension among mothers (Luke and Brown 2007; Jacobsson et al. 2004; Bianco et al. 1996). Older mothers are also more likely to suffer from obesity, take medication or experience morbidity (see Heslehurst et al. 2007 for obesity). Multiple births, more common at later childbearing ages, constitute an additional risk factor associated with low birth weight of infants, pregnancy complications, maternal risks, and higher long-term morbidity (Pinborg 2005; Luke et al. 2004). Among children, advanced maternal age is often linked to higher incidence of congenital anomalies and chromosomal aberrations, of which most widely documented is the higher frequency of trisomy 13, 18 and 21 (Down Syndrome) (Hook 1981; Snijders et al. 1998).

## **8. Positive Consequences of Parenthood at Later Ages for Parents and Children**

### **8.1. The Economic Rationale of Parenthood at Later Ages**

Among higher educated women with better paid jobs and career prospects there is a strong economic rationale for delaying parenthood well beyond the period of completing education. It is based on a need for couples to accumulate resources before family

formation, to have enough resources to rear their children and support their education as they grow up, to qualify for paid maternity and parental leaves, and to minimize the income loss linked to childcare-related career break.

Achieving financial security is often cited by couples as one of the most important factors in their parenthood decisions (Tough et al., 2007). In many countries, especially in Southern and Eastern Europe, rental housing is scarce or too costly. Young couples may need to accumulate considerable savings and achieve high and stable income before purchasing their own flat or a house—which is often seen as a precondition to having children (Mulder 2006; Mulder and Billari 2010). Clark (2012) found that married couples living in US cities with highest rents and housing sales prices were having a first birth by 3-4 years later than the couples living in metropolitan areas with cheap housing. In addition, having children is costly, especially in countries where costs of childcare, healthcare and education shouldered by parents are high. In the US, the cost of raising a child from childbirth up to age 18 was estimated at 245,000 US Dollars for middle-income families, based on the 2013 computations by US Department of Agriculture (Lino 2014). This again motivates couples to put off childbearing until both partners achieve stable employment and steady income.

In countries which provide paid maternity and parental leave, their level is often linked to pre-leave income and a minimum period of uninterrupted employment before the leave. For instance, in Sweden each parent is entitled to up to 8 months of paid leave per child and for most of the leave period (13 months combined) parents receive 80% of the most recent income (during 240 days before the expected date of delivery) (Moss 2015). As this policy is focused on compensating parents their foregone earnings, it motivates prospective parents to get established on the labour market and achieve a stable full-time position before having a child, potentially delaying their parenthood (Björklund 2006). Finally, among mothers with higher socio-economic position, earning losses due to childcare leave are substantially lower at higher childbearing ages when they are more advanced in their careers, have more secure employment, and experience lower skill depreciation (Taniguchi 1999, Joshi 2002, Miller 2011). The US data analysed by Herr (2016) show that fertility delays are paying off especially for college graduates: for them, each year of delaying motherhood after their labour market entry implies a 2.9% increase in their wage after a 20-year period, accounting for 5.5% of their total wage growth. In the context of Italy, Bratti and Cavalli (2014) also show that delaying first birth increases mother's employment and working hours later in life.

## **8.2. Non-Economic Positive Consequences of Delayed Parenthood**

The positive consequences of delayed parenthood may extend beyond resource accumulation, more stable careers and lower income losses. However, the research in this area is relatively limited and the evidence so far is often based on small datasets or data pertaining to one country. Many papers do not address selection effects—the fact that older

mothers are also, on average, better educated and healthier, and therefore the possible effects of late motherhood reported below might be more closely associated with their education and health rather than age (Goisis and Sigle-Rushton 2014; Engelhardt and Schreyer 2016). Therefore, these findings do not imply causality and have to be interpreted with caution.

Later parenthood is linked with a lower likelihood for children to be born to a mother living without a partner (Schmidt et al. 2012) and a lower percentage of unintended pregnancies and births (Finer and Zolna 2012; Mosher et al. 2012). Children born to older parents experience less frequent parental separation (Musick and Micheltore 2015) and therefore they also experience less frequently living with a single mother or with stepparents before reaching adulthood. Myrskylä and Margolis (2014) found that parents at older ages (35+) show more positive happiness trajectory after the childbirth than the younger parents, while Kravdal et al. (2015) reported lower use of antidepressants among Norwegian women becoming mothers at higher ages. Garrison et al. (2007) reported that older parents (aged 35+) were more satisfied, less stressed, and reported better functioning than the parents having children earlier in life.

Barclay and Myrskylä (2016), working with Swedish data, demonstrated additional benefit of late motherhood for children. Children born to older mothers are also born in a later period, reaping the benefits of improving social conditions over time: they are taller, are more likely to attend university and perform better at standardised tests than their siblings born when their mothers were younger. Among mothers, late age at childbearing is associated with better health and longevity (Grundy and Kravdal 2008; Jaffe et al. 2015). These findings again suggest that some of the benefits of later motherhood might be explained by selectivity of mothers who are fertile (and presumably more healthy) at later ages.

## **9. Discussion: The Contrasting Biological and Social Rationales for and against Late Parenthood**

As longevity continues rising, life courses of men and women stretch and they experience many important transitions later in life (Lee and Goldstein 2003). They complete their education, move from parental home, enter the labour market, or retire at ever higher ages. From this perspective, the fast increase in the number of women who are childless past age 35 and plan to have a child in the future appears perfectly in line with this trend. With some simplification, children born to older parents are also born to more stable, happier and wealthier families. Many social and economic rationales speak for having children late in life. However, these rationales clash with “inconvenient biology” (Mac Dougall et al. 2012b) as there is also a clear biological and health rationale for having children much earlier in life (Daly and Bewley 2013; Bewley et al. 2005). The steep rise in the number of ART cycles

at later reproductive ages clearly illustrates the scale of infertility and unfulfilled pregnancy desires among women who arguably postponed parenthood for too long.

The rise of ART with donor oocytes and the advances in “social egg freezing” have gradually eroded the biological limits to fertility marked by follicular depletion and menopause. The number of post-menopausal women getting pregnant is increasing fast, although from very low numbers. At the same time, a vast majority of women still plan to get pregnant without the help of medically assisted reproduction. They are often caught between the conflicting motivations for and against having children soon and struggling with the ever more pertinent question of “How long can you wait to have a baby?” (Twenge 2013; Heffner 2004; Menken 1985). As Habbema et al. (2015) demonstrate, the answer clearly depends on family size preferences and the strength of these preferences.

## References

- Abdalla H.I., Burton G., Kirkland A., Johnson M.R., Leonard T., Brooks A.A. and Studd J.W. 1993. Pregnancy: Age, pregnancy and miscarriage: uterine versus ovarian factors. *Human Reproduction* 8(9): 1512-1517.
- Adsera A. 2005. Vanishing children: From high unemployment to low fertility in developed countries. *American Economic Review, Papers and Proceedings*, 95(2): 189-193.
- Bailey M.J., 2012. Reexamining the impact of family planning programs on US fertility: evidence from the War on Poverty and the early years of Title X. *American Economic Journal: Applied Economics* 4(2): 62-97.
- Balasch J. and Gratacós E., 2012. Delayed childbearing: effects on fertility and the outcome of pregnancy. *Current Opinion in Obstetrics and Gynecology* 24(3): 187-193.
- Barclay K. and Myrskylä M. 2016. Advanced maternal age and offspring outcomes: reproductive aging and counterbalancing period trends. *Population and Development Review* 42(1): 69-94.
- Beaujouan É. 2014. Counting how many children people want: The influence of question filters and pre-codes. *Demográfia, English edition* 2013 56(5): 35–61.
- Beemsterboer S.N., Homburg R., Gorter N.A., Schats R., Hompes P.G.A. and Lambalk C.B., 2006. The paradox of declining fertility but increasing twinning rates with advancing maternal age. *Human Reproduction* 21(6): 1531-1532.
- Berrington A., Stone J., and Beaujouan É. 2015. Educational differences in timing and quantum of childbearing in Britain: A study of cohorts born 1940-1969. *Demographic Research* 33 (Article 26): 733-764.
- Bewley S., Davies M. and Braude P.. 2005. Which career first? *BMJ* 331: 588-589.
- Bianco A., Stone J., Lynch L., Lapinski R., Berkowitz G. and Berkowitz R.L. 1996. Pregnancy outcome at age 40 and older. *Obstetrics & Gynecology* 87(6): 917-922.
- Björklund A. 2006. Does family policy affect fertility? *Journal of population economics* 19(1): 3-24.
- Black M. and Bhattacharya S. 2010. Epidemiology of multiple pregnancy and the effect of assisted conception. *Seminars in Fetal and Neonatal Medicine* 15 (6): 306-312.
- Blossfeld H.-P. and Huinink J. 1991. Human capital investments or norms of role transition? How women's schooling and career affect the process of family formation. *American Journal of Sociology* 97 (1): 143-168.
- Bongaarts J. and Sobotka T.. 2012. A demographic explanation for the recent rise in European fertility. *Population and Development Review* 38(1): 83-120.
- Bratti M. and Cavalli L.. 2014. Delayed first birth and new mothers' labor market outcomes: Evidence from biological fertility shocks. *European Journal of Population* 30(1): 35–63.
- Bretherick K.L., Fairbrother N., Avila L., Harbord S.H. and Robinson W.P., 2010. Fertility and aging: do reproductive-aged Canadian women know what they need to know? *Fertility and Sterility* 93(7): 2162-2168.
- Budds K., Locke A. and Burr V. 2013. Risky Business: Constructing the 'choice' to 'delay' motherhood in the British press. *Feminist Media Studies*, 13(1): 132-147.
- Calhaz-Jorge C., De Geyter C., Kupka M.S., De Mouzon J., Erb K., Mocanu E., Motrenko T., Scaravelli G., Wyns C., Goossens V. and Gliozheni O. 2016. Assisted reproductive

- technology in Europe, 2012: results generated from European registers by ESHRE. *Human Reproduction* 31(8): 1638-1652.
- CDC. 2000. *Assisted Reproductive Technology Success Rates. National Summary and Fertility Clinic Reports 1998*. Atlanta (GA), U.S. Department of Health and Human Services, Centers for Disease Control and Prevention
- CDC. 2015. *Assisted Reproductive Technology National Summary Report 2013*. Centers for Disease Control and Prevention, American Society for Reproductive Medicine, Society for Assisted Reproductive Technology. Atlanta (GA): US Dept of Health and Human Services.
- Clark W.A. 2012. Do women delay family formation in expensive housing markets? *Demographic Research* 27(1): 1-24.
- Cook J.L., Collins J., Buckett W., Racowsky C., Hughes E. and Jarvi K. 2011. Assisted reproductive technology-related multiple births: Canada in an international context. *Journal of Obstetrics and Gynaecology Canada* 33(2): 159-167.
- Cooke A., Mills T.A. and Lavender T., 2010. 'Informed and uninformed decision making' – Women's reasoning, experiences and perceptions with regard to advanced maternal age and delayed childbearing: A meta-synthesis. *International Journal of Nursing Studies* 47(10): 1317-1329.
- Coppolaro-Nowell A. 2016. Italy's fertility day posters aren't just sexist – they're echoes of a fascist past. *The Guardian* 5 September 2016. <https://www.theguardian.com/commentisfree/2016/sep/05/italys-fertility-day-posters-sexist-echoes-of-fascist-past>
- Daly I. and Bewley S. 2013. Reproductive ageing and conflicting clocks: King Midas' touch. *Reproductive Biomedicine Online* 27(6): 722-732.
- Daniluk J.C., Koert E. and Cheung, A. 2012. Childless women's knowledge of fertility and assisted human reproduction: identifying the gaps. *Fertility and sterility*, 97(2), pp.420-426.
- de La Rochebrochard E. and Thonneau P. 2002. Paternal age and maternal age are risk factors for miscarriage; results of a multicentre European study. *Human Reproduction* 17(6): 1649-1656.
- Delbaere I., Verstraelen H., Goetgeluk S., Martens G., De Backer G. and Temmerman M. 2007. Pregnancy outcome in primiparae of advanced maternal age. *European Journal of Obstetrics & Gynecology and Reproductive Biology* 135(1): 41-46.
- Engelhardt H. and Schreyer J. 2014. Timing of first birth and well-being in later life. *Zeitschrift für Familienforschung-Journal of Family Research* 26(3): 331-346.
- Eurostat. 2016. Data on births by age of mother and birth order in 2000-2014. Eurostat online database, theme "Population and Social Conditions". Accessed in October 2016 at <http://ec.europa.eu/eurostat/data/database>
- Finer L.B. and Zolna M.R. 2012. Unintended pregnancy in the United States: incidence and disparities, 2006. *Contraception* 84(5): 478-485.
- Flora L. 2013. 'Rusty and Old': Singaporean Government Tells Women to Get Pregnant Before It's Too Late. *The Atlantic*, 27 March 2013; <http://www.theatlantic.com/international/archive/2013/03/-rusty-and-old-singaporean-government-tells-women-to-get-pregnant-before-its-too-late/274405/>
- Garrison M.E., Blalock L.B., Zarski J.J. and Merritt P.B.. Delayed parenthood: An exploratory study of family functioning. *Family Relations* 46(3): 281-290.



- Gnoth C., Maxrath B., Skonieczny T., Friol K., Godehardt E. and Tigges J. 2011. Final ART success rates: a 10 years survey. *Human Reproduction* 26(8): 2239-2246.
- Goisis A. and Sigle-Rushton W. 2014. Childbearing postponement and child well-being: a complex and varied relationship? *Demography* 51(5): 1821-1841.
- Goldin C. and Katz L.F. 2002. The power of the pill: Oral contraceptives and women's career and marriage decisions. *The Journal of Political Economy* 110(4): 730-770.
- Goldstein J., Lutz W. and Scherbov S. 2003. Long-term population decline in Europe: The relative importance of tempo-effects and generational length. *Population and Development Review* 29(4): 699-707.
- Gregory E. 2007. *Ready: Why Women Are Embracing the New Later Motherhood*. New York: Basic Books
- Grundy E. and Kravdal Ø. 2008. Reproductive history and mortality in late middle age among Norwegian men and women. *American Journal of Epidemiology* 167(3): 271-279.
- Habbema J.D.F., Eijkemans M.J., Leridon H. and te Velde E.R. 2015. Realizing a desired family size: when should couples start? *Human Reproduction* 30(9): 2215-2221.
- Hamilton B.E., Martin J.A., Osterman M.J.K. et al. 2015. *Births: Final data for 2014*. National Vital Statistics Reports; Vol. 64 No 12. Hyattsville, MD: National Center for Health Statistics.
- Heffner L.J. 2004. Advanced maternal age—how old is too old? *New England Journal of Medicine*, 351(19): 1927-1929.
- Herr J.L. 2016. Measuring the effect of the timing of first birth on wages. *Journal of Population Economics* 29(1): 39-72.
- Heslehurst N., Ells L.J., Simpson H., Batterham A., Wilkinson J. and Summerbell C.D. 2007. Trends in maternal obesity incidence rates, demographic predictors, and health inequalities in 36 821 women over a 15-year period. *BJOG: An International Journal of Obstetrics & Gynaecology* 114(2): 187-194.
- Hook E.B. 1981. Rates of chromosome abnormalities at different maternal ages. *Obstetrics & Gynecology* 58(3): 282-285.
- Human Fertility Collection. 2016. Period age-specific fertility rates accessed at [www.fertilitydata.org](http://www.fertilitydata.org) (data downloaded 5 October 2016). Max Planck Institute for Demographic Research (Germany) and Vienna Institute of Demography (Austria).
- Human Fertility Database. 2016. Period and cohort fertility rates by age and birth order; data on mean age at first birth accessed at [www.humanfertility.org](http://www.humanfertility.org) (data downloaded 5 October 2016). Max Planck Institute for Demographic Research (Germany) and Vienna Institute of Demography (Austria).
- Jacobsson B., Ladfors L. and Milsom I. 2004. Advanced maternal age and adverse perinatal outcome. *Obstetrics & Gynecology* 104(4): 727-733.
- Jaffe D., Kogan L., Manor O., Gielchinsky Y., Dior U. and Laufer N. 2015. Influence of late-age births on maternal longevity. *Annals of Epidemiology* 25(6): 387-391.
- Jones E.F., Forrest J.D., Goldman N., Henshaw S.K., Lincoln R., Rosoff J.I., Westoff C.F. and Wulf D. 1985. Teenage pregnancy in developed countries: determinants and policy implications. *Family planning perspectives* 17(2): 53-63.
- Joseph K.S., Allen A.C., Dodds L., Turner L.A., Scott H. and Liston, R. 2005. The perinatal effects of delayed childbearing. *Obstetrics & Gynecology* 105(6): 1410-1418.

- Joshi H. 2002. Production, reproduction and education: Women, children and work in a British perspective. *Population and Development Review* 28 (3): 445-474.
- Källén B., Finnström O., Lindam A., Nilsson E., Nygren K.G. and Olausson P.O. 2010. Trends in delivery and neonatal outcome after in vitro fertilization in Sweden: data for 25 years. *Human Reproduction* 25 (4): 1026-1034
- Kalwij A. and Gustafsson S. (eds.) 2006. Education and postponement of maternity: economic analyses for industrialized countries. Dordrecht: Kluwer / Springer.
- Kravdal Ø., Grundy E. and Skirbekk V. 2015. Fertility history and use of antidepressant medication in late mid-life: a register-based analysis of Norwegian women and men. *Aging & Mental Health* 2015: 1-10.
- Kulkarni A.D., Jamieson D.J., Jones Jr H.W., Kissin D.M., Gallo M.F., Macaluso M. and Adashi E.Y. 2013. Fertility treatments and multiple births in the United States. *New England Journal of Medicine*, 369(23): 2218-2225.
- La Liberte A. 2012. Why Have A Child After 40?. Blog Post, accessed in October 2016 at <http://achildafter40.com/about-a-child-after-40/>.
- Lampic C., Svanberg A.S., Karlström P. and Tydén T. 2006. Fertility awareness, intentions concerning childbearing, and attitudes towards parenthood among female and male academics. *Human Reproduction* 21(2): 558-564.
- Lappegård T. and Rønsen M. 2005. The multifaceted impact of education on entry into motherhood. *European Journal of Population* 21(1): 31-49.
- Lee R.D and Goldstein J. 2003. Rescaling the life cycle. Longevity and proportionality In.: Carey J.R. and Tuljapurkar S. (eds.) Life span. Evolutionary, ecological and demographic perspectives. Supplement to *Population and Development Review*, 29: 183-207.
- Leopold T. and Skopek J. 2015. The delay of grandparenthood: A cohort comparison in East and West Germany. *Journal of Marriage and Family* 77(2): 441-460.
- Leridon H. 2004. Can assisted reproduction technology compensate for the natural decline in fertility with age? A model assessment. *Human Reproduction* 19(7): 1549-1554.
- Leridon H. 2008. A new estimate of permanent sterility by age: Sterility defined as the inability to conceive. *Population Studies* 62(1): 15 – 24.
- Leridon H. and Slama R. 2008. The impact of a decline in fecundity and of pregnancy postponement on final number of children and demand for assisted reproduction technology. *Human Reproduction* 23(6): 1312-1319.
- Lesthaeghe R. 2010. The unfolding story of the Second Demographic Transition. *Population and Development Review* 36(2): 211-251.
- Lino M. 2014. Expenditures on Children by Families, 2013. U.S. Department of Agriculture, [https://www.cnpp.usda.gov/sites/default/files/expenditures\\_on\\_children\\_by\\_families/crc2013.pdf](https://www.cnpp.usda.gov/sites/default/files/expenditures_on_children_by_families/crc2013.pdf)
- Luke B. and Brown M.B. 2007. "Contemporary risks of maternal morbidity and adverse outcomes with increasing maternal age and plurality." *Fertility and Sterility* 88(2): 283-293.
- Luke B., Brown M.B., Nugent C., Gonzalez-Quintero V.H., Witter F.R. and Newman R.B. 2004. Risk factors for adverse outcomes in spontaneous versus assisted conception twin pregnancies. *Fertility and sterility* 81(2): 315-319.

- Mac Dougall K., Beyene Y. and Nachtigall R.D. 2012a. Age shock: misperceptions of the impact of age on fertility before and after IVF in women who conceived after age 40. *Human Reproduction* 28(2): 350-356.
- Mac Dougall K., Beyene Y. and Nachtigall R.D. 2012b. 'Inconvenient biology:' advantages and disadvantages of first-time parenting after age 40 using in vitro fertilization. *Human Reproduction* 27(4): 1058-1065.
- Malizia B.A., Hacker M.R. and Penzias A.S. 2009. Cumulative live-birth rates after in vitro fertilization. *New England Journal of Medicine* 360(3): 236-243.
- Martin J.A., Hamilton B.E., Ventura S.J., Menacker F., Park M.M. 2002. Births: Final data for 2000. *National Vital Statistics Reports*; Vol. 50, No. 5. Hyattsville, Maryland: National Center for Health Statistics.
- McLanahan S. S. 2004. Diverging destinies: How children are faring under the second demographic transition. *Demography* 41(4): 607-627.
- Menken J. 1985. Age and fertility. How late can you wait? *Demography* 22 (4): 469-483.
- Miller A. R. 2011. The effects of motherhood timing on career path. *Journal of Population Economics* 24(3): 1071-1100.
- Mills M., Rindfuss R.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.
- Mosher W.D., Jones J. and Abma J.C. 2012. Intended and Unintended Births in the United States: 1982–2010. *National Health Statistics Reports* 55, July 2012.
- Moss P. 2015. International Review of Leave Policies and Research 2015. Available at: [http://www.leavenetwork.org/lp\\_and\\_r\\_reports/](http://www.leavenetwork.org/lp_and_r_reports/)
- Mulder C.H. 2006. Home-ownership and family formation. *Journal of Housing and the Built Environment* 21(3): 281-298.
- Mulder C.H. and Billari F.C. 2010. Homeownership regimes and low fertility. *Housing Studies* 25(4): 527-541.
- Musick K. and Micheltore K. 2015. Change in the stability of marital and cohabiting unions following the birth of a child. *Demography* 52(5): 1463-1485.
- Myrskylä M. and Margolis R. 2014. Happiness: Before and after the kids. *Demography* 51(5): 1843-1866.
- Ng E.H.Y. and Ho P.C., 2007. Ageing and ART: a waste of time and money? *Best Practice & Research Clinical Obstetrics & Gynaecology*, 21(1): 5-20.
- Ní Bhrolcháin M. and Beaujouan É. 2012. Fertility postponement is largely due to rising educational enrolment. *Population Studies* 66(3): 311-327.
- Nybo Andersen A.M., Wohlfahrt J., Christens P., Olsen J. and Melbye M. 2000. Maternal age and fetal loss: population based register linkage study. *BMJ* 320(7251): 1708-1712.
- Nyboe Andersen A., Gianaroli L., Felberbaum R., de Mouzon J., and Nygren K.G. 2006. Assisted reproductive technology in Europe, 2002. Results generated from European registers by ESHRE. *Human Reproduction* 21(7): 1680-97.
- Paulson R.J., Boostanfar R., Saadat P., Mor E., Tourgeman D.E., Slater C.C., Francis M.M. and Jain J.K. 2002. Pregnancy in the sixth decade of life. Obstetric outcomes in women of advanced reproductive age. *JAMA* 288(18): 2320-2323.

- Pinborg A. 2005. IVF/ICSI twin pregnancies: risks and prevention. *Human Reproduction Update* 11: 575–593.
- Pison G., Monden C. and Smits J. 2015. Twinning Rates in Developed Countries: Trends and Explanations. *Population and Development Review* 41(4): 629–649.
- Rendall M., Aracil E., Bagavos C., Couet C., DeRose A., DiGiulio P., Lappegård T., Robert-Bobée I., Rønsen M., Smallwood S. and Verropoulou G. 2010. Increasingly heterogeneous ages at first birth by education in southern European and Anglo-American family-policy regimes: a seven-country comparison by birth cohort. *Population Studies* 64(3): 209–227.
- Rindfuss R. R., Morgan S.P. and Offut K. 1996. Education and the changing age pattern of American fertility. *Demography* 33 (3): 277–290.
- Rosero-Bixby L., Castro-Martín, T. and Martín-García T. 2009. Is Latin America starting to retreat from early and universal childbearing? *Demographic Research*, 20(9): 169–194.
- Royal College of Obstetricians and Gynaecologists. 2009. RCOG statement on later maternal age. <http://www.rcog.org.uk/what-we-do/campaigning-and-opinions/statement/rcog-statement-latermaternal-age>
- Salihu H.M., Shumpert M.N., Slay M., Kirby R.S. and Alexander G.R. 2003. Childbearing beyond maternal age 50 and fetal outcomes in the United States. *Obstetrics and Gynecology* 102(5): 1006–1014.
- Schieve L.A., Tatham L., Peterson H.B., Toner J. and Jeng G. 2003. Spontaneous abortion among pregnancies conceived using assisted reproductive technology in the United States. *Obstetrics & Gynecology* 101(5, Part 1): 959–967.
- Schmidt L., Sobotka T., Bentzen J.G. and Nyboe Andersen A. 2012. Demographic and medical consequences of the postponement of parenthood. *Human Reproduction Update* 18 (1): 29–43.
- Selvaratnam T. 2014. *The Big Lie: Motherhood, Feminism, and the Reality of the Biological Clock*. Amherst, New York: Prometheus Books.
- Shaw R.L. and Giles D.C. 2009. Motherhood on ice? A media framing analysis of older mothers in the UK news. *Psychology and Health* 24(2): 221–236.
- Sheps MC. 1965. An analysis of reproductive patterns in an American isolate. *Population Studies* 19 (1):65–80.
- Snijders R.J.M., Noble P., Sebire N., Souka A. and Nicolaides K.H. 1998. UK multicentre project on assessment of risk of trisomy 21 by maternal age and fetal nuchal-translucency thickness at 10–14 weeks of gestation. *The Lancet* 352(9125): 343–346.
- Sobotka T. 2004. Postponement of childbearing and low fertility in Europe. PhD Thesis, University of Groningen. Amsterdam: Dutch University Press.
- Sobotka T. 2017a. Post-transitional fertility: the role of childbearing postponement in fuelling the shift to low and unstable fertility levels. Forthcoming, *Journal of Biosocial Science*.
- Sobotka T. 2017b. Childlessness in Europe: Reconstructing long-term trends among women born in 1900–1972. Chapter 9 in M. Kreyenfeld and D. Konietzka (eds.): *Childlessness in Europe. Contexts, Causes, and Consequences*. Springer.
- Stoop D., Cobo A. and Silber S. 2014. Fertility preservation for age-related fertility decline. *The Lancet*, 384(9950): 1311–1319.

- Sullivan E., Wang Y., Chapman M. and Chambers G. 2008. Success rates and cost of a live birth following fresh assisted reproduction treatment in women aged 45 years and older, Australia 2002–2004. *Human Reproduction*, 23(7): 1639-1643.
- Szewczuk E. 2012. Age-related infertility: a tale of two technologies. *Sociology of Health & Illness*, 34(3): 429-443.
- Taniguchi H. 1999. The timing of childbearing and women's wages. *Journal of Marriage and the Family* 61(6): 1008-1019.
- 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.
- Tough S, Benzies K, Fraser-Lee N and Newburn-Cook C. 2007. Factors influencing childbearing decisions and knowledge of perinatal risks among Canadian men and women. *Maternal and Child Health Journal* 11(2): 189-198.
- Twenge J. How Long Can You Wait to Have a Baby? *The Atlantic* July/August 2013 Issue. <http://www.theatlantic.com/magazine/archive/2013/07/how-long-can-you-wait-to-have-a-baby/309374/>
- Umstad M.P., Hale L., Wang Y.A. and Sullivan E.A. 2013. Multiple deliveries: The reduced impact of in vitro fertilisation in Australia. *Australian and New Zealand Journal of Obstetrics and Gynaecology*, 53(2): 158-164.
- United Nations. 2013. World Fertility Report 2013: Fertility at the Extremes. New York: United Nations, Department of Economic and Social Affairs, Population Division.
- van de Kaa D. J. 2011. On the societal impact of modern contraception. In G. Beets, J. Schippers, E. te Velde (eds.): *The Future of Motherhood in Western Societies*. Springer Netherlands: 49-60.
- VID. 2016. European Demographic Data Sheet 2016. Vienna Institute of Demography and IIASA / Wittgenstein Centre for Demography and Global Human Capital. Available at [www.populationeurope.org](http://www.populationeurope.org).
- Voigt M., Briesse V., Carstensen M., Wolterdorf F., Hallier E. and Straube S. 2010. Age-specific preterm birth rates after exclusion of risk factors—an analysis of the German Perinatal Survey. *Zeitschrift für Geburtshilfe und Neonatologie* 214(4): 161-166.
- Wikipedia. 2016. Pregnancy over age 50. Accessed 10 October 2016 at [https://en.wikipedia.org/wiki/Pregnancy\\_over\\_age\\_50](https://en.wikipedia.org/wiki/Pregnancy_over_age_50)
- Wyndham N., Figueira P.G.M. and Patrizio P. 2012. A persistent misperception: assisted reproductive technology can reverse the “aged biological clock”. *Fertility and sterility*, 97(5): 1044-47.
- Yoo S.H. and Sobotka T. 2016. The role of tempo effect in the ultra-low fertility in South Korea. Paper presented at the 2016 Annual Meeting of the Population Association of America, Washington, D.C., 1 April 2016.

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