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Research Article

Delayed first births and completed fertility across the 1940–1969 birth cohorts

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Abstract

BACKGROUND
The rise in the age at first birth has been universal in low-fertility countries in the last decades. Mothers who have their first child later tend to have fewer children, and in the absence of fertility catch-up at older ages, delayed fertility contributes to cohort fertility decline.

OBJECTIVE
We aim to study how changes in completed cohort fertility (quantum) relate to delayed age at first birth (tempo) across birth cohorts.

METHODS
We use birth histories collected in surveys or censuses in ten high-income countries. We rely on a decomposition analysis that quantifies how much the changes in age at first birth, mothers' completed fertility conditional on age at first birth, and childlessness contribute to the total change in cohort fertility over the 1940–1969 birth cohorts.

RESULTS
In many countries and cohorts, the fertility intensity of mothers increased more at later ages than at earlier ages, reflecting the catching up of those who had delayed childbearing. However, in most countries studied, the increased fertility intensity of mothers at older ages was not sufficient to offset the depressing effect of delayed first births on cohort fertility rates.

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CONCLUSIONS
Increased childlessness and delayed childbearing are important components of the fertility decline. The chances of a full fertility recovery in the future are minimal, given the inertia of mothers' completed fertility conditional on age at first birth across successive birth cohorts.

CONTRIBUTION
This paper adapts a method of decomposition of completed cohort fertility that specifically includes the timing of first birth. Such an approach enhances the understanding of changes in cohort fertility across countries during periods of fertility delay.

1. Introduction

Mean age at first birth started increasing in the 1970s in Western European countries and the 1990s in Eastern European countries. This rise has been notoriously named "fertility postponement," suggesting that the same persons who were not having children at young ages would have them at a later life stage ("fertility recuperation") (Frejka and Calot 2001; Frejka and Sardon 2006; Sobotka et al. 2011). However, amid profound societal and economic transformations, fertility at higher ages remained low in many European countries, and completed fertility continued to drop across birth cohorts (Beaujouan and Toulemon 2021; Sobotka et al. 2011; Zeman et al. 2018).

In the context of delayed childbearing, the connection between age at first birth and the number of children becomes central to understanding fertility levels. Studying the first delaying cohorts born between the late 1940s and the late 1950s, Kohler et al. noted that "late starters in childbearing tend to have lower fertility than early starters" (Kohler, Billari, and Ortega 2002: 647). Such decline in mothers' completed fertility conditional on age, if persisting across the birth cohorts that delayed fertility, constitutes a major mechanism of the decrease in completed cohort fertility observed in most countries. In parallel, childlessness rates were increasing in many countries, pulling completed cohort fertility levels down (Sobotka 2017a).

Despite the massive change in birth timing occurring in the 1940–1969 birth cohorts, detailed cross-country exploration of fertility along the 'age at first birth' dimension is lacking. Mean age at first birth increased at different rates across countries, and the extent of the drop in early fertility and its increase at later ages varied widely (Beaujouan and Toulemon 2021; Burkimsher 2017; Lesthaeghe 2016; Nathan and Pardo 2019; Sobotka et al. 2011). Also, the strength of the association between age at first birth and mothers' fertility intensity seems to vary across countries (Kohler, Billari, and Ortega 2002), but the detail of the phenomenon has been observed only in specific countries or regions so far because of the lack of comparative data (Andersson et al. 2009; Berrington, Stone, and Beaujouan 2015; Castro 2014; Hellstrand et al. 2021; Kocourková and Šťastná 2021). Finally, the share of childless women increased to diverse degrees (Sobotka 2017a). Such strong variations across countries emphasise the need to look for commonalities and differences in their paths to later and often lower fertility.

In this paper, we use decomposition analysis to quantify how much the changes in age at first birth, completed fertility of mothers conditional on age at first birth, and childlessness contributed to the observed changes in the completed cohort fertility of low-fertility countries between the 1940–1949 and 1960–1969 birth cohorts. We refine the results by also showing how much the decrease in the share of women who started to have children before age 25 (age limit empirically defined thereafter) and the change in their family size contributed to the decline in completed cohort fertility between these two birth cohorts, and how much changes from age 25 were fuelling – or not – fertility recuperation among the late starters. We use data from surveys and censuses in ten countries covering six geographical regions with different institutional settings: Austria and Switzerland (German-speaking countries); Great Britain, France, and the Netherlands (Western Europe); Italy (Southern Europe); Norway and Sweden (Northern Europe); Poland (Central and Eastern Europe); and the United States.

As a supplement to this paper, we provide an excel file with aggregate data and detailed calculations of the main indicators for all analysed countries, including the variables published in Tables 1–3 and Figures 3–5.

2. Background

The transition to later fertility and its link with fertility levels has been addressed in a period as well as in a cohort perspective (Bongaarts and Feeney 1998; Frejka and Sardon 2006; Sobotka 2004, 2017b). Studying birth timing from a period perspective has several shortcomings, particularly the inseparableness of tempo and quantum effects – for instance, whether a person is ‘just postponing’ or will remain childless (Schoen 2004). A cohort approach is therefore favoured in theory. In practice, however, it takes many years before the effects of a change in the timing of first births on cohort fertility levels can be observed. Nevertheless, cross-country cohort comparisons are available, and Frejka and Calot (2001) have produced a well-known visualisation showing that in most countries, from one cohort to the next, cumulated cohort fertility first declines sharply at the earliest ages (generally before ages 25 to 30) and then recovers to varying degrees. This approach has also been used to estimate the extent of fertility recovery at older ages across countries and to help construct scenarios for cohort fertility projections (Sobotka et al. 2011). We also adopt a cohort approach for our study because we are particularly interested in how the delay in first births at younger ages is related to fertility levels at older ages and, ultimately, to fertility quantum.

Because Frejka and Calot's (2001) cohort approach is cumulative, it does not provide information on the contribution of changes in first-birth schedules and childlessness to the variation in cohort completed fertility. Mainly, completed cohort fertility depends on whether women ever start having children and on how many children those who start will have conditional on the age at first birth. Kohler, Billari, and Ortega (2002) notice that delayed fertility often corresponds to a lower number of births because of the interaction between the timing of first birth and the quantum of fertility. Further studies show that, indeed, a mother's completed fertility decreases with age at first birth, but that in some countries the strength of the association has waned in the last delaying birth cohorts (Andersson et al. 2009; Berrington, Stone, and Beaujouan 2015; Castro 2014; Kocourková and Šťastná 2021). All these studies confirm the centrality of age-specific behaviour for fertility levels in times of delayed fertility. Now that several cohorts that have experienced an increase in age at first birth are fully observed, we try to improve our understanding of the large cohort fertility changes of recent decades by using a decomposition that better integrates the childlessness and timing dimensions.

Results from existing studies suggest that country context matters for fertility recovery at later ages. In the countries where fertility recuperation has taken place, we may observe an increase in mothers' completed fertility at later ages relative to the previous birth cohorts. This pattern has been observed in Norway and Sweden and to some extent in Denmark (1940s–1950s birth cohorts), the United States, and all Western European countries together (Andersson et al. 2009; Castro 2014; Morgan and Rindfuss 1999), but not in Great Britain (Berrington, Stone, and Beaujouan 2015). This was not observed either in the first delaying cohorts in France and Czechia but seemed to appear in France in the post-transition cohorts (Kocourková and Šťastná 2021). The association between age at first birth and completed fertility rates in Spain and Italy also suggests that few women born in the 1950s to mid-1960s were recovering births at advanced reproductive ages in this context of economic hardship (Kohler, Billari, and Ortega 2002). By studying a range of countries in low-fertility contexts and across birth cohorts covering 30 years of fertility postponement, we hope to refine the results reported so far.

In the next subsections, we give a more detailed description of the components of completed fertility and the mechanisms that link them. What follows is a summary of the variety of contexts in the countries and birth cohorts under study.

2.1 Components of completed cohort fertility

2.1.1 Completed cohort fertility and age at first birth

The increase in cohort mean age at (first) birth and the decline in completed cohort fertility rates between the 1940 and 1970 birth cohorts varied across countries (Frejka and Sardon 2006; Myrskylä, Goldstein, and Cheng 2013; Zeman et al. 2018). In the countries under study, mean ages at birth (Figure 1) and mean ages at first birth (Figure 2) increased by at least two years everywhere except in Poland, starting with the 1945 birth cohort approximately, with an earlier onset in the United States. Birth schedules remain early in most Eastern European countries, although they are starting to shift to later ages, while Southern European countries have the latest fertility profiles (Beaujouan 2020; Burkimsher 2017).

Trends in cohort fertility levels are very country specific (Figure 1). Completed cohort fertility underwent a continuous decrease in the Netherlands, Italy, Great Britain[4], and Austria, and a substantial decrease followed by an increase from the 1950s birth cohorts in the United States. In France, Switzerland, and Sweden, the decline was tempered by a phase of stagnation among women born in the 1950s. Cohort fertility rates were almost constant in Norway, while in Poland, the rapid decline began only among women born after 1960.

It is noticeable that, across birth cohorts, increases in the average age at first birth did not always correspond to decreases in completed fertility. The selected countries allow to cover contrasted variations in mean age at first birth and fertility levels: The two extremes are Poland, where mean age at first birth was almost stable but completed fertility declined in the 1950–1969 birth cohorts, and Norway, where completed fertility was stable despite rising ages at first birth (Figures 1 and 2).

Though these trends are informative, they are not sufficient to understand the underlying mechanisms of possible fertility postponement and recuperation. Notably, the mean age at first birth does not let us differentiate between a decline in fertility rates at early ages and an increase at late ages. For instance, depending on the country, the increase in period mean age at first birth was tied to a collapse in first-birth rates before age 25, a simple shift in the fertility schedule, or a mixture of both (Nathan and Pardo 2019). We overcome this critical issue in the decomposition by using the distribution of mothers by age at first birth rather than the average age at first birth. Further, Frejka and Sardon (2006) show that in many countries, in the pre-postponement birth cohorts, the mode in age-specific first-birth rates was before age 25, while it shifted to after age 25

[4] We use data for England and Wales in the descriptive and background section (Figure 1), while the analysis of mothers' completed fertility conditional on age at first birth (Figures 2 and 3) are based on data for Great Britain (which includes England, Wales, and Scotland but excludes Northern Ireland).

during postponement. The mean age at first birth was also lower than age 25 in the 1980s, becoming higher later on (Nathan and Pardo 2019), and we show in Section 5 that the mode of the age distribution of first births shifted from before to after age 25 across the 1950–1969 birth cohorts. This suggests that age 25 is a key age in the shift to later fertility. Therefore, we further separate the effects of changes in fertility timing on completed cohort fertility between women who had their first child before the age of 25 and those who had it at the age of 25 or older. This provides elements for disentangling the opposite contributions to change in completed cohort fertility of the decline in early fertility due to delayed fertility and of the possible recovery of fertility at later ages.

2.1.2 Mothers' completed fertility conditional on age at first birth

All the studies we have cited so far show that the number of children of mothers decreases with age at first birth (e.g., Kohler, Billari, and Ortega 2002). Although women who have a first child later have a second child faster (Tomkinson 2019), biological constraints and normative limits can shorten their time to have children. Indeed, at later ages, lessened perceived expectations or even disapproval among peers to proceed to a further child, as well as a lack of physical energy to carry and care for another child while older, can lead to keeping the family small (Wagner, Huinink, and Liefbroer 2019). Selection effects can also be at play: Women in the median range of age at first birth generally behave with a median behaviour, but those who start earlier or later than the rest of their birth cohort can be at odds with that behaviour (Tomkinson 2019). Hence, in the pre-postponement cohorts, women who started having children in their 30s possibly had fewer children because they were specific. As the fertility delay unfolds and many more women have their children in their thirties, selection effects may fade, and fertility intensity becomes more similar across age groups. On the other hand, smaller family preferences may have emerged among people who did not have their children at an early age, whether they always wished for smaller families or whether this desire was stimulated by a less family-oriented individual situation at all stages of their life course. This could lead to the persistence or reinforcement of an age-related decrease in the birth intensity of mothers in recent birth cohorts and also explain a lower overall completed fertility.

In the context of delayed fertility, the way in which mothers' completed fertility, conditional on age at first birth, changes from one birth cohort to the next may be the key to the severity of the decline in completed cohort fertility. Here are two illustrative cases. If women who delay childbearing in the recent cohorts would maintain the family size they would have had if they had started childbearing at a younger age in the earlier cohorts, fertility intensity would increase at older ages, allowing for 'full recuperation'. In the opposite case, delaying women in recent birth cohorts could adopt the behaviour of women who started childbearing late in earlier cohorts, so completed cohort fertility would fall sharply because the increase in the age at first birth would not be compensated by higher fertility among mothers who start childbearing at a later age. Many intermediate scenarios are possible, where fertility intensity also varies at young ages, or where women experience intermediate levels of catching-up. The contributions to change calculated in the decomposition allow us to simplify and summarise this diversity.

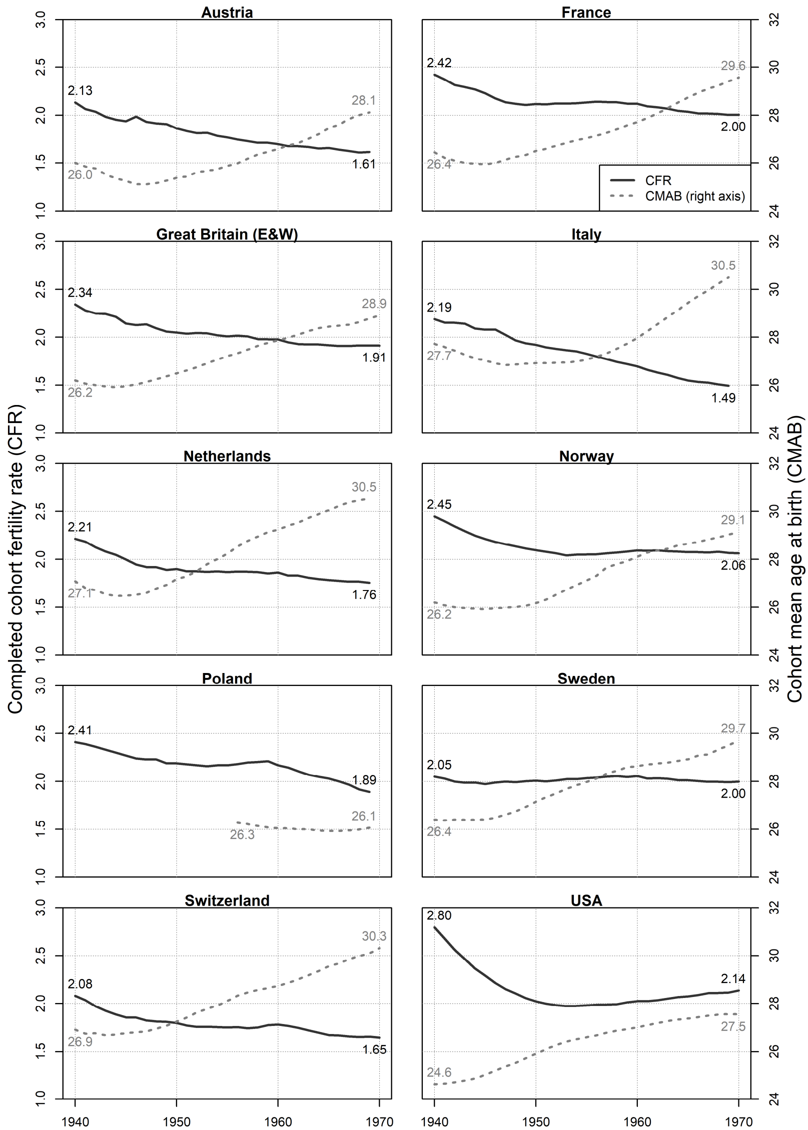
2.1.3 Childlessness

Childlessness is a key component of the completed fertility rate of a birth cohort and is probably also partly endogenous to postponement (Fiori, Rinesi, and Graham 2017). The rise in childlessness is commonly attributed to changes in family norms, motivations to have children, and structural and economic constraints. Generally, the highest levels of childlessness are found in Southern Europe and the German-speaking countries, while levels have remained very low in Central and Eastern Europe for a long time (Frejka 2008; Sobotka 2017a) (see also Figure 2).

The mechanisms by which women become childless are particularly relevant here as they can, but need not, be related to delayed fertility. Indeed, in addition to women who never wanted a child (voluntarily childless) and those who tried but could not have a child (biologically childless), many women find themselves in an intermediate situation that can be described as ‘childless by circumstance’.[5] They can be seen as never having had the opportunity to have the children they (more or less strongly) wanted, becoming “perpetual postponers” (Berrington 2004; Tanturri and Mencarini 2008). Childlessness then becomes an element of the fertility delay itself and is more present where the delay is greater. Although at the individual level wanting a child at an older age is associated with a lower probability of having a child (Beaujouan et al. 2019; Brzozowska and Beaujouan 2021), a positive association between age at first birth and childlessness is not confirmed by an aggregate cross-country comparison, except in Spain and Italy, where the average age at first birth is exceptionally high (Beaujouan and Toulemon 2021). At the aggregate level, childlessness remains only weakly related to the average age at first birth, suggesting that, so far, the country context and its childbearing culture, rather than biological childlessness, are still largely responsible for cross-country differences in childlessness.

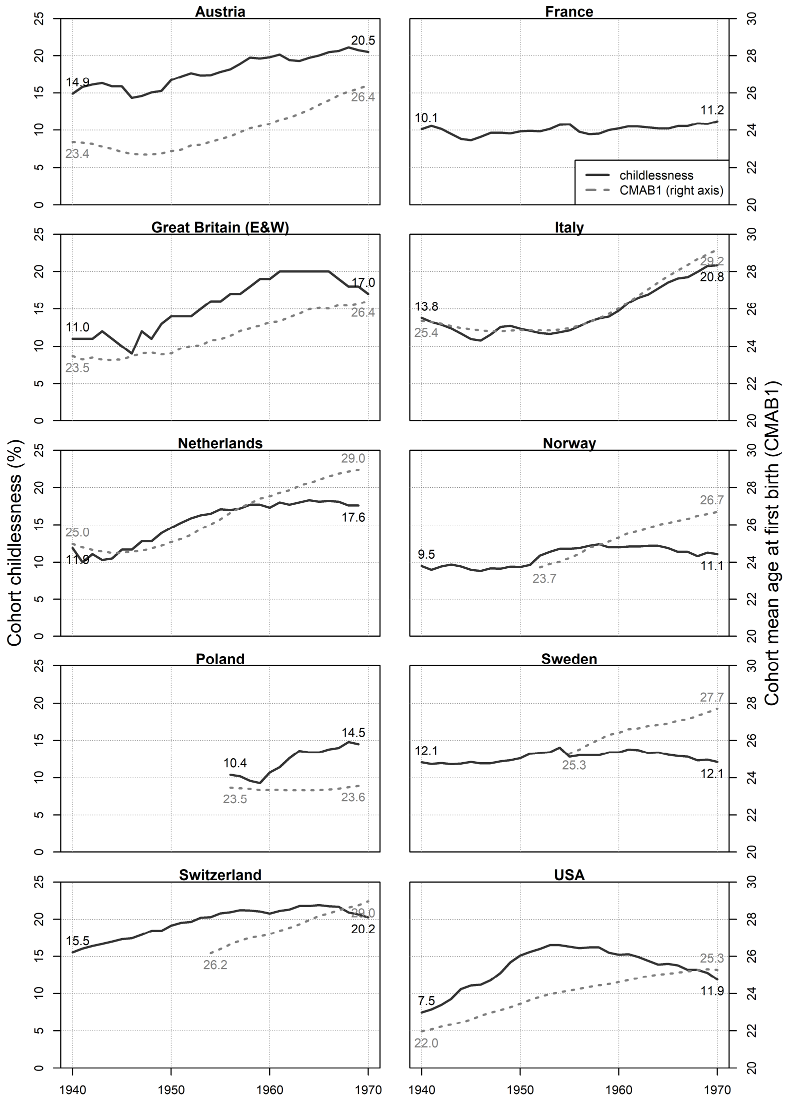
[5] The term was suggested by Brian Buh, who we thank.

Figure 1: Completed cohort fertility rate (CFR) and cohort mean age at birth (CMAB), in ten countries, cohorts 1940–1970



Sources: Human Fertility Database (2022); for Poland (1940–1955) and Norway (1940–1951): Council of Europe (2006).

Figure 2: Cohort childlessness and cohort mean age at first birth (CMAB1) in ten countries, cohorts 1940–1970



Sources: Human Fertility Database (2022); for Austria, Switzerland (CMAB1), and Italy: Human Fertility Collection (2022); for England and Wales: ONS (2018); for France: Toulemon et al. (2008). Childlessness data for Norway (1940–1951), Sweden (1940–1954), and Switzerland (1940–1970): Sobotka (2017a).

2.2 Country contexts in these birth cohorts

The extent of fertility decline at earlier ages and the capacity to recover births at older ages may be related to the economic and institutional settings of countries. The period of 1960 to 2000 (which corresponds to the years when birth cohorts 1940–1969 were aged 20 and over) was foremost a period of economic growth across Europe and the United States, with a marked slowdown in the early 1980s due to the oil crisis (Feenstra, Inklaar, and Timmer 2015; Real GDP Per Capita Penn World Tables 2021). Some countries were more affected than others; for instance, Italy has endured continuous economic stagnation since 2000. In Poland, like in most of Central Eastern Europe, strong economic growth was initiated only in the 1990s.

Unfortunately, the period also staged a remarkable rise in unemployment and social and economic inequalities. Countries where unemployment and female working conditions were worse were also those where fertility became lower (Adserà 2004). State interventions enabling more stable employment and a more adapted labour market for women, as frequently seen in Northern Europe, France, or Belgium, were beneficial to fertility. In contrast, fertility was particularly low where institutions were not facilitating female employment (Southern Europe) and work–family reconciliation (German-speaking countries) (Adserà 2004; Luci-Greulich and Thévenon 2013).

Finally, gender equality in households has increased over this period and appears to play a role in facilitating parenthood (Frejka, Goldscheider, and Lappegård 2018). Notably, Matysiak and Węziak-Białowolska (2016) show that the conditions for work and family reconciliation are best in the Nordic countries, while France, the Netherlands, and the United Kingdom are at intermediate levels (among our selected countries), and the German-speaking as well as Southern and Eastern European countries in the lowest range. This index significantly correlated with total fertility rates in 2008.

Fertility levels appear linked to these economic and cultural aspects, and we will discuss our results in light of these country specificities.

2.3 Research questions

To summarise, the detailed research questions of this paper are as follows:

1. How does the relationship between mothers' completed fertility and age at first birth vary across the studied countries and birth cohorts?

2a. To what extent are the changes in completed cohort fertility between the 1940–1949 and 1960–1969 birth cohorts explained by changes in its three components:

childlessness, age at first birth (composition effect), and mothers' completed fertility conditional on age at first birth (rate effect)?

2b. How do composition and rate effects before age 25 and at age 25 and over contribute to changes in completed cohort fertility?

3. Data

The study is based on survey and census data for the cohorts born from 1940 to 1969 (Table 1). For most of these surveys, the quality of the childbearing history data had been assessed in previous studies to which we refer below. We checked our estimates against external estimates provided by the Human Fertility Database, Human Fertility Collection[6], Council of Europe (2006), and national statistical offices. The comparison is shown in Appendix Figures A1–A3, which compare survey estimates for 10-year cohorts with averages of external estimates over the same cohort groups.

In Austria, we used the 2012 and 2016 micro-censuses. We merged samples of continuing large national surveys for Switzerland (Tillmann et al. 2016) and the United States (Monte and Ellis 2014; US Census Bureau 2021). This was also the procedure for Great Britain, but we used directly the estimates published in Berrington, Stone, and Beaujouan (2015). In France, we used the large 2011 Family Survey (Brée et al. 2016), and in Italy, the 2009 Famiglia e Soggetti Sociali Survey (Winkler-Dworak et al. 2021). For Norway, Sweden, and Poland, we used data from the Generations and Gender Programme (GGP) (Vergauwen et al. 2015; Winkler-Dworak et al. 2021). See Gauthier et al. (2018) or visit the GGP website (https://www.ggp-i.org/) for methodological details. For the Netherlands, the 2013 Onderzoek Gezinsvorming is also part of the GGP, and fertility histories are of good quality (Vergauwen et al. 2015).

Completed cohort fertility and mean age at first birth from the surveys and official data matched very well in most countries and cohort groups. The less satisfactory match was on the share of childless women in Austria and Switzerland. This issue is discussed in detail by Kreyenfeld et al. (2012), who argue that the Austrian Microcensus specifically suffers from "family bias" of overstated fertility level and understated childlessness, as the respondents with young children are easier to reach by interviewers. On the contrary, the results of the Swiss Household Panel show an underestimation of the level of fertility and an overestimation of childlessness, which are also discussed by

[6] The Human Fertility Collection (HFC) does not feature cohort indicators. However, we use the period age-specific fertility rates (ASFR) provided in HFC to calculate ourselves the cohort indicators that are not available in the Human Fertility Database (HFD). This concerns Austria, Switzerland, and Italy, for which there are no, or only short, data series of cohort indicators by birth order in HFD. We transform the period ASFR from HFC into cohort ASFR and calculate summary indicators of cohort childlessness and cohort mean age at first birth.

Kreyenfeld et al. (2012). The differences span 0.1 to 0.15 children per woman regarding completed fertility and 3% to 5% as regards childlessness. We decided to keep these surveys as the discrepancy is not large enough to question their representativeness, but we will interpret the results with caution, particularly for Switzerland. In the United States we identified a mismatch regarding the mean age of first birth, especially for cohorts born 1960–1969. The extent of the difference (by 1.6 years) and the discontinuity with cohort 1950–1959 indicate a problem with survey coverage, for which we could not identify the reason.

When selecting countries, we wanted to cover all regions which recently experienced an increase in mean age at first birth. Nonetheless, pragmatic reasons regarding data availability limited our selection. The postponement and recuperation of cohort fertility occurred mainly in three broad regions: Europe, North America, and East Asia. From these regions, we cover especially Europe, which we further split into Western Europe (the Netherlands, Great Britain, France), Northern Europe (Norway, Sweden), Southern Europe (Italy), German-speaking countries (Austria, Switzerland), and Central Eastern Europe (Poland). Outside Europe, we cover the United States. No other datasets were available to us. Notably, we do not cover East Asia, and also coverage of Central Eastern Europe and Southern Europe is limited to just one country each.

The decision to include Poland among the studied countries – despite the small increase in its mean age at first birth – is twofold. First, we add this country as a representative of the Central Eastern European region, where cohort fertility has decreased significantly to sub-replacement levels in most countries (Zeman et al. 2018). Second, in all countries of the region, fertility postponement is underway, and this is true also for Poland (Tymicki, Zeman, and Holzer-Żelażewska 2018) – the mean age at first birth by age 40 increased from 23.5 years in cohort 1969 to 25.9 in cohort 1979 (HFD 2022). Thus, the study of Poland is still bringing information on the change in fertility quantum in this early postponement transition context.

Table 1: Survey and micro-census data used in the analysis

COUNTRY	CODE	SURVEY	WAVES	N cohorts 1940–1969
Austria	AUT	Microcensus	2012+2016	9,684
France	FRA	French Family Survey	2011	112,931
Great Britain	GBR	CPC General Household Survey and UK Household Longitudinal Study	1979–2009	44,351
Italy	ITA	Famiglia e Soggetti Sociali	2009	8,988
Netherlands	NLD	Onderzoek Gezinsvorming	2013	2,865
Norway	NOR	Generations and Gender Programme (GGS) Wave 1	2007	3,996
Poland	POL	GGS Wave 1	2010	6,291
Sweden	SWE	GGS Wave 1	2012	2,553
Switzerland	CHE	Swiss Household Panel	2013–2019	1,376
United States	USA	Current Population Survey	1990–2018	42,052

4. Methods

Our decomposition analysis explains changes in completed cohort fertility rates (CFR) using three detailed indicators calculated for each birth cohort group (1940–1949 and 1960–1969): the distribution of mothers by age at first birth, mothers' completed fertility conditional on the age at first birth, and the share of childless women.

The decomposition method applied in this study can be found in Berrington, Stone, and Beaujouan (2015), who adapt the original method proposed by Kitagawa (1955) to analyse fertility change by education in Great Britain. Following this approach, we first consider the contribution of changes in childlessness and the cohort fertility rate of mothers (CFM) to differences in CFR between the cohorts 1940–1949 and 1960–1969:

$$CFR^{1960-69} - CFR^{1940-49} = \left[\frac{pm^{1940-49} + pm^{1960-69}}{2}\right] \times \left[CFM^{1960-69} - CFM^{1940-49}\right] + \left[\frac{CFM^{1940-49} + CFM^{1960-69}}{2}\right] \times \left[pm^{1960-69} - pm^{1940-49}\right],$$

where pm is the proportion of mothers in each cohort.[7]

While the second component of the equation reflects the contribution of childlessness to the absolute difference in completed cohort fertility (childlessness effect), the contribution of the first component (changes in the cohort fertility rate of mothers) is further decomposed by applying a similar procedure:

$$CFM^{1960-69} - CFM^{1940-49} = \sum_{x=15}^{40}\left[\left[\frac{M_x^{1940-49} + M_x^{1960-69}}{2}\right] \times \left[CFM_x^{1960-69} - CFM_x^{1940-49}\right]\right] + \sum_{x=15}^{40}\left[\left[\frac{CFM_x^{1940-49} + CFM_x^{1960-69}}{2}\right] \times \left[M_x^{1960-69} - M_x^{1940-49}\right]\right],$$

where M_x^c is the share of mothers with first birth at age x, and CFM_x^c is the completed fertility of mothers conditional on age at first birth x, for any given cohort c.

The first component of the latter equation expresses the contribution of changes in fertility intensity after the first birth (rate effect). In contrast, the second component reflects the contribution of changes in the distribution of mothers by age at first birth (composition effect). The relative weight of these two components is then used to separate the total contribution of changes in CFM into rate and composition effects.

[7] Therefore, for any cohort (c), $pm^c = 1 - childlessness^c$.

As we aim at quantifying to what extent a catch-up behaviour can mitigate the fertility loss due to postponement, we further decompose the impact of changes in M_x^c and CFM_x^c into components before and after age 25 (see Chevan and Sutherland 2009; Thomson, Winkler-Dworak, and Beaujouan 2019, for an extension of this approach). We introduced the reasons for this age choice in Section 2. Building on the previous formula, we examine the specific effects of changes in M_x and CFM_x by establishing a threshold between younger and older ages at first birth:

$$\begin{aligned} CFM^{1960-69} - CFM^{1940-49} \\ = \Bigg[& \left[\frac{M_{<25}^{1940-49} + M_{<25}^{1960-69}}{2}\right] \times [CFM_{<25}^{1960-69} - CFM_{<25}^{1940-49}] \\ & + \left[\frac{M_{25+}^{1940-49} + M_{25+}^{1960-69}}{2}\right] \times [CFM_{25+}^{1960-69} - CFM_{25+}^{1940-49}] \Bigg] \\ + \Bigg[& \left[\frac{CFM_{<25}^{1940-49} + CFM_{<25}^{1960-69}}{2}\right] \times [M_{<25}^{1960-69} - M_{<25}^{1940-49}] \\ & + \left[\frac{CFM_{25+}^{1940-49} + CFM_{25+}^{1960-69}}{2}\right] \times [M_{25+}^{1960-69} - M_{25+}^{1940-49}] \Bigg] \end{aligned}$$

The next section first analyses the three components of cohort fertility change separately, followed by the decomposition analysis.

5. Results

5.1 The three components of completed cohort fertility

As shown in Figure 3, mothers' completed fertility decreases with age at first birth. The slope and levels of completed fertility of mothers conditional on age at first birth (age profiles) appear very similar for countries that are otherwise very different. For instance, in the United States, France, Great Britain, and Poland, mothers' completed cohort fertility is large in the age group 15 to 19, with around 3 children for those having a first child but only around 1.5 children[8] for those having their first child at age 35 to 39. In another group of countries composed of Sweden, Norway, the Netherlands, Austria, Italy, and Switzerland, families started at age 15 to 19 are already relatively small (2.5 or fewer children), but the decrease in cohort fertility is less marked, resulting in a more concave

[8] Mothers' completed fertility gets closer to its minimum (by definition, 1 child per mother) as age increases.

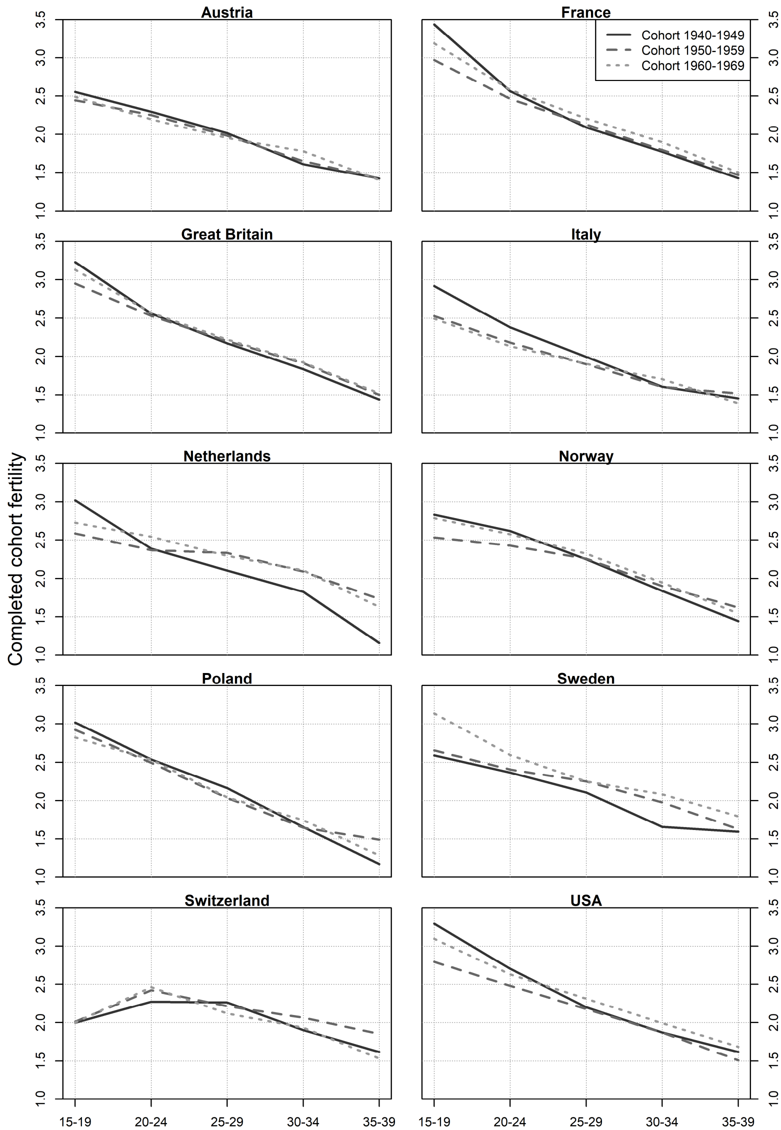
age profile. The number of children at age 35 to 39 is rarely above 1.7 children per mother.

Between the 1940–1949 and 1960–1969 birth cohorts, in most countries, there was a decline or stagnation in completed fertility of mothers who had their first child before age 25, and an increase in completed fertility of those who had their first child from that age (Figure 4). The decrease at young ages was often small, but it dropped considerably in Italy and to a lesser extent in France and the Netherlands. Only Sweden saw an increase instead of a decrease. Although the increase at older ages may appear small (often around 0.1 to 0.2 children), it can affect a substantial share of women who will have more children at that age than in the previous cohorts and may be sufficient to compensate for delayed childbearing. This will depend on the prevalence of fertility delay in the country.

Figure 4 helps us to visualise the shift in age at first birth across generations by showing the distribution of mothers by age at first birth. It shows clear evidence of delayed fertility between the 1940–1949 and 1960–1969 birth cohorts, especially in Western and Northern Europe, where the maximum shifted from the 20–24 age group to the 25–29 group (except in Austria). On the contrary, the shape changed very little in Poland, with most mothers strongly concentrated in the 20–24 age group. In the United States, many first births were delayed, but in the 1960–1969 birth cohort the mode was still the 20–24 age group. Notably, the share of women having their first child at age 30–34 doubled in many countries and even tripled in some (Netherlands, Switzerland, United States). The proportion of women having children between the ages of 20 and 24 has fallen the most. Table 2 summarises the total increase in mean age at first birth between the 1940–1949 and 1960–1969 birth cohorts (last set of columns) – in most countries it was around 2 years, with some extremes, such as almost 4 years in the United States and the Netherlands and 0.8 years in Poland.

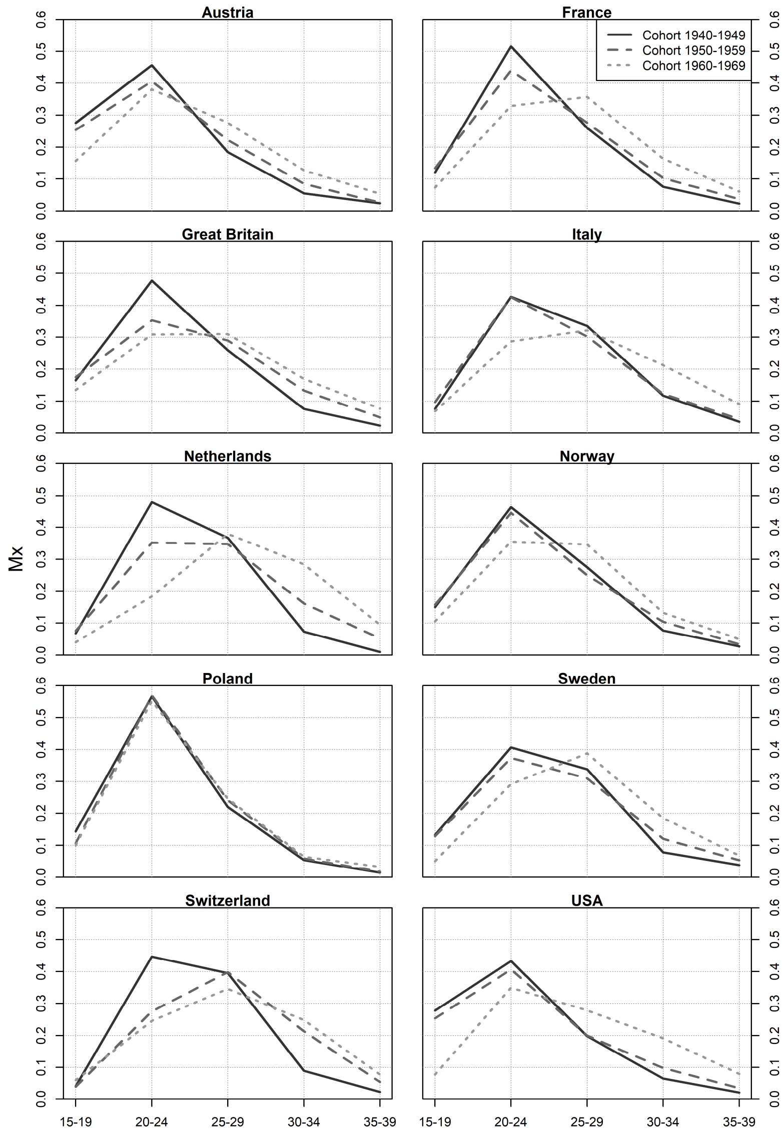
Finally, childlessness is an essential component of fertility levels. Table 2 shows that the share of childless women between the two cohort groups increased by more than three percentage points in all countries except Poland, Norway, and Sweden. Significant increases of more than five percentage points were recorded in the Netherlands and Switzerland. As the level of childlessness in some surveys was consistently above or below the figures from vital statistics sources, we do not comment here on the absolute figures but on the trend, which was mostly consistent.

Figure 3: Completed cohort fertility of mothers by age at first birth (CFMx), cohorts born in 1940–1969 (10-year groups)



Sources: Own computations based on data sources listed in Table 1.

Figure 4: Share of mothers by age at first birth (Mx), cohorts born in 1940–1969 (10-year groups)



Sources: Own computations based on data sources listed in Table 1.

Table 2: Completed cohort fertility rate (CFR), share of childless women (CHL), and mean age at first birth (CMAB1) in analysed countries for the 1940s and 1960s cohorts, and the change between these cohorts

COUNTRY	CFR 1940s	CFR 1960s	diff.	CHL 1940s	CHL 1960s	diff.	CMAB1 1940s	CMAB1 1960s	diff.
Austria	1.96	1.74	–0.22	13%	16%	+3%	22.6	24.8	+2.2
France	2.17	1.98	–0.20	11%	14%	+2%	23.9	26.3	+2.4
Great Britain	2.23	2.00	–0.24	10%	15%	+5%	23.6	25.7	+2.1
Italy	1.91	1.62	–0.30	12%	15%	+4%	25.2	27.1	+2.0
Netherlands	2.01	1.81	–0.20	12%	19%	+7%	24.4	28.3	+3.9
Norway	2.16	2.09	–0.07	12%	11%	0%	23.9	25.5	+1.6
Poland	2.19	2.11	–0.08	11%	10%	–1%	23.2	24.0	+0.8
Sweden	2.04	2.10	+0.07	8%	9%	+1%	24.5	26.9	+2.4
Switzerland	1.79	1.55	–0.23	20%	26%	+6%	25.1	27.7	+2.7
United States	2.34	1.96	–0.38	13%	17%	+4%	22.7	26.6	+3.9

Sources: Own computations based on data sources listed in Table 1.

5.2 Decomposition

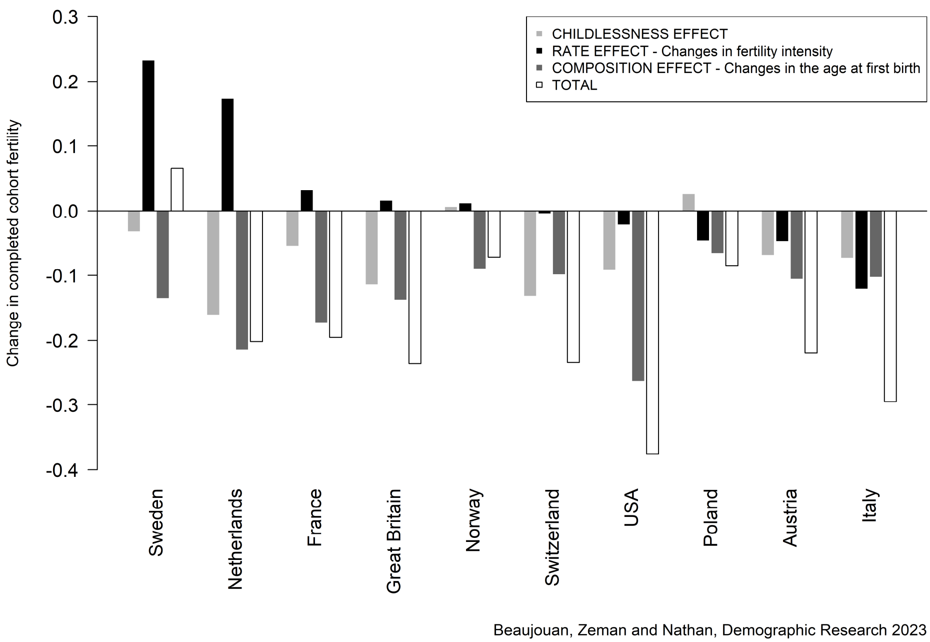
The decomposition quantifies the contribution of the three components described above to the change in completed cohort fertility between 1940–1949 and 1960–1969. First, we highlight the effect of childlessness (change in the share of childless women), rate (reflecting the increase or decrease in the family size of mothers conditional on the age at first birth), and composition (effect of the shift in the age structure of first-time mothers) (Figure 5 and Table 3).

Completed fertility was affected by the increase in childlessness observed in all countries except Poland and Norway. Childlessness contributed to a drop in CFR by –0.05 to –0.11 children in several countries (Austria, Great Britain, France, Italy, United States); the most significant decreases were –0.16 children in the Netherlands and –0.13 children in Switzerland. The smallest reduction was seen in Sweden (–0.03), while in Norway and Poland, fewer childless people brought a minor increase in CFR of +0.01 and +0.03 children, respectively.

The composition effect due to the changes in the relative distribution of the age at first birth between 1940–1949 and 1960–1969 was even stronger than the childlessness effect in all countries except Switzerland: Because mothers' completed fertility declines steeply with age at first birth, an older age schedule at entry into motherhood meant a decrease in CFR of –0.14 children on average (close to values observed in France, Great Britain, and Sweden). The drop was exceptionally strong in the United States (–0.26 children) and the Netherlands (–0.21), but more limited in Poland (–0.07), as well as Italy, Norway, Switzerland, and Austria (around –0.10).

On the other side, the rate effect, which can, in theory, compensate for the composition effect, was generally weak. It was positive in five countries, especially Sweden (+0.23) and the Netherlands (+0.17). It was weaker in France, Great Britain, and Norway (+0.01 to +0.03). In Switzerland, there was zero rate effect, and in the rest of the countries the rate effect was even negative because the drop in mothers' family size at younger ages was contributing more to the (negative) change in completed cohort fertility than the increase at older ages, especially in Italy (–0.12).

Figure 5: Main results of the decomposition of the CFR for women born 1960–1969 versus 1940–1949



Sources: Own computations based on data sources listed in Table 1.
Note: Countries are sorted by rate effects.

To quantify the contribution of a potential catch-up effect, we further decomposed rate and composition effects by splitting cases into two groups of age at first birth: one before and one from the age of 25. In all countries, the importance of fertility at the age of 25 and over for completed cohort fertility increased massively as women delayed having children: The composition effect was always positive and often very large (above 0.30 children); rate effects were positive except in Italy, Poland, and Switzerland (Table 3, columns 3 and 6). A small positive composition effect was even observed in Poland, where the mean age at first birth had changed only slightly. Nevertheless, given the tendency to have fewer children when starting to have them later, the increase in fertility from age 25 due to the compositional age change was weaker than the decrease before that age (columns 6 and 5), and the overall composition effect was negative in all countries.

Table 3: Results of decomposition of the CFR for women born 1960–1969 versus 1940–1949, by group of age at first birth

COUNTRY	Childlessness effect	Rate effect			Composition effect			Total
		Changes in fertility intensity			Changes in the age at first birth			
		Age<25	Age25+	All age	Age<25	Age25+	All age	
Austria	–0.07	–0.05	+0.00	–0.05	–0.40	+0.30	–0.11	–0.22
France	–0.05	–0.01	+0.05	+0.03	–0.56	+0.38	–0.17	–0.20
Great Britain	–0.11	–0.01	+0.03	+0.02	–0.45	+0.32	–0.14	–0.24
Italy	–0.07	–0.10	–0.02	–0.12	–0.30	+0.19	–0.10	–0.30
Netherlands	–0.16	+0.03	+0.14	+0.17	–0.77	+0.56	–0.21	–0.20
Norway	+0.01	–0.02	+0.03	+0.01	–0.36	+0.27	–0.09	–0.07
Poland	+0.03	–0.03	–0.02	–0.05	–0.16	+0.10	–0.07	–0.08
Sweden	–0.03	+0.12	+0.11	+0.23	–0.47	+0.34	–0.14	+0.07
Switzerland	–0.13	+0.06	–0.06	–0.00	–0.37	+0.27	–0.10	–0.23
United States	–0.09	–0.05	+0.03	–0.02	–0.73	+0.47	–0.26	–0.38
column	*(1)*	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*

Sources: Own computations based on data sources listed in Table 1.
Notes: Childlessness effect captures the effect of changes in childlessness, Rate effect captures the effect of changes in fertility intensity after the first birth (fertility limitation or recuperation), and Composition effect captures the effect of changes in the age at first birth (fertility postponement). Total is the difference between CFR for women born in the 1960s and the 1940s. The sum of the columns Age<25 and Age25+ can differ from the total column due to rounded values.

In addition, the increase in mothers' completed fertility from age 25 (rate effect) was too small to compensate for the decrease in fertility due to delayed first births (total composition effect) (comparison of columns 3 and 7). There was still a relatively large contribution of later rates to total completed cohort fertility in Sweden and the Netherlands (+0.11 and +0.14 children per woman, respectively), where rates also rose below age 25 at first birth (column 2). At the other extreme, in Italy, Poland, and Switzerland, the rate effect at the age of 25 and over was negative as at most of these ages mothers' completed fertility had decreased rather than increased (column 3). In the remaining countries, the rate effect was minimal (up to +0.05). Yet, in many countries the rate effect at the age of 25 and over at first birth was about 0.05 larger than the rate effect before that age (column 3 minus column 2 in Table 3), showing that the countries recovered some childbearing through a relative increase in rates between earlier and later ages. The exceptions were the Netherlands, where recuperation was stronger, and Switzerland, Austria, and France, where it was weaker.

6. Conclusions

This study allows us to refine previous research on the importance of the delay in childbearing for fertility levels. Most importantly, none of the countries experienced a rise large enough in mothers' family size conditional on age at first birth over age 25 to compensate for the compositional change of more women having their first child later in life. Only when the rate effect was also positive at younger ages did an increase in cohort completed fertility become visible. Delayed first births thus appear as a driver of fertility decline among recent cohorts because of the persistent negative association between the timing and quantum of cohort fertility. Given the fairly static profiles of mothers' completed fertility conditional on age at first birth, there is also little chance of full fertility recuperation in the near future. In view of the continuing increase in the age at first birth in recent cohorts, we can therefore expect a further decline in cohort fertility levels in many countries. These findings should also be considered when analysing regions at an early stage of the postponement transition (e.g., Latin America): The increasing proportion of women delaying their first birth may be an important element in the path towards low-fertility regimes.

In most countries, the change in mothers' family size conditional on age at first birth was greater above age 25 than below, reflecting fertility recuperation. The difference in the rate effect on completed fertility before and after age 25 was fairly consistent across countries (column 3 minus column 2 in Table 3), although the increase was substantial in the Netherlands while absent in Poland, Sweden, and Switzerland. This consistency suggests that the contribution of catching-up behaviour to fertility levels was quite similar across countries at an equivalent stage of postponement, despite the diversity of their economic and cultural settings. Further research into the factors that may enable or limit fertility catch-up at later ages will provide a better understanding of these mechanisms.

Our study covered only a limited set of countries, where childbearing histories were available in surveys large enough to construct the indicators under consideration. In a few countries, notably Switzerland, the Netherlands, and Sweden, the sample size was rather limited, which may contribute to less stable estimates across birth cohorts. It would have been particularly important to include more Eastern European countries as Poland was the only country in this region and displayed little pattern of postponement and recuperation in the birth cohorts studied. At that pre-postponement stage in Poland, the rates contributed to the decline in completed fertility before as well as after the age of 25. Future research could also be improved by extending our study to include data from countries with very low-fertility rates, such as those in East Asia, and developing regions, such as Latin America.

The incomplete fertility recuperation of the younger cohorts also has implications for period fertility. The total fertility rate (TFR), a widely used measure to monitor fertility levels worldwide, captures changes in the level and the age schedule of fertility rates. In a scenario in which fertility postponement is followed by full recuperation, the TFR is depressed and later boosted due to changes in the timing of childbearing while completed cohort fertility remains unchanged. However, our results suggest that fertility postponement inevitably has a depressing effect on fertility quantum as successive birth cohorts start childbearing at ages when fertility intensity tends to be lower, generally limiting TFR recovery.

One may wonder whether catching up at later ages might become more systematic as countries reach more advanced stages of the postponement transition. This could happen, for instance, if the cohorts that initiated the new behaviour were more limited by norms in their fertility at later ages than those that will follow. We cannot test this hypothesis now because the changes are still unfolding, and it will be a few years before data are available for more recent cohorts in which recuperation and later fertility have become common. Detailed monitoring of within-country changes across cohorts will be necessary to study the adaptation to a later fertility regime and a potential larger rise in family size at later ages after such adaptation has taken place.

Our study did not account for socioeconomic and educational heterogeneity in reproductive behaviour. This is particularly important at a time when low-educated women are showing fertility behaviour that contrasts with the rest of the population: earlier first births, more childlessness, and larger families (Andersson et al. 2022; Brzozowska, Beaujouan, and Zeman 2022; Jalovaara et al. 2019; Rendall et al. 2010). Women with low levels of education tend to have children at the earliest age and women with high levels of education at the latest. It is therefore difficult to predict how the completed family size of mothers, conditional on age at first birth, would change if low-educated women, who have many more children than high-educated women, started having children later. Although low-educated women are much less numerous than in the past and do not differ to the same extent in all countries, exploring heterogeneity would enrich the understanding of the aggregate relationship between the timing and quantum of childbearing (Berrington, Stone, and Beaujouan 2015).

Increasing childlessness with successive cohorts also contributed to decreasing cohort fertility rates. Given that childlessness is sometimes involuntary and has been linked to “perpetual postponement” (Berrington 2004), we can assume that at least part of the rise in childlessness can be attributed to fertility postponement. It is interesting to note that where the composition effect was the largest, such as in the Netherlands and the United States, the contribution of childlessness to the decline in completed fertility was also among the largest. Great Britain and Switzerland, where the rise in childlessness was also substantial but the compositional effect was in the middle range, are countries known for having large shares of voluntarily childless women (Beaujouan and Berghammer 2019; Fiori, Rinesi, and Graham 2017). The share of childlessness induced by fertility postponement is, however, difficult to measure, and in this research we could quantify only the overall contribution of childlessness to the decline in completed fertility.

By making age at first birth a central element of our decomposition analysis, we give it a large role in the decline in completed fertility observed since the 1940s birth cohorts. However, the drop in fertility rates at earlier ages, as comprehensively described by Burkimsher (2017), was not necessarily a postponement of childbearing but could as well have been the onset of lower completed fertility for these cohorts. Therefore, although the decomposition is mathematically accurate, it is not correct to assume causality in the relationship between age at first birth and completed cohort fertility as it may have been the desire for fewer children (i.e., expected lower completed fertility) that was driving fertility variation across ages rather than the reverse. Exploring these issues would require more advanced modelling of the relationship between age, fertility intentions, fertility levels by age, and childlessness (Ciganda and Todd 2021).

Confronting the change in fertility intentions at older reproductive ages with the level of fertility recuperation could improve our understanding of the nature of the unrecovered births. In the most recent birth cohorts observed in Austria and Great Britain, the gap between family size intentions around age 35 and cohort completed fertility has widened rapidly (Beaujouan and Sobotka 2022). Thus, many people appear to have postponed their desire to have children to later ages, but increasingly, they are not having the children they intended. Our finding that mothers’ completed fertility did not increase much at older ages therefore suggests that at least some of them gave up their desire to have more children. Others may have changed their wishes or never had a strong idea about family size. Further research on fertility intentions and fertility over the life course, especially at older reproductive ages, may improve our understanding of the changing age profile of family size.

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References

Adserà, A. (2004). Changing fertility rates in developed countries. The impact of labor market institutions. *Journal of Population Economics* 17(1): 17–43. doi:10.1007/s00148-003-0166-x.

Andersson, G., Rønsen, M., Knudsen, L.B., Lappegård, T., Neyer, G., Skrede, K., Teschner, K., and Vikat, A. (2009). Cohort fertility patterns in the Nordic countries. *Demographic Research* 20(14): 313–352. doi:10.4054/DemRes.2009.20.14.

Andersson, L., Jalovaara, M., Uggla, C., and Saarela, J. (2022). Less is more? Repartnering and completed cohort fertility in Finland. *Demography* 59(6): 2321–2339. doi:10.1215/00703370-10351787.

Beaujouan, É. (2020). Latest-late fertility? Decline and resurgence of late parenthood across the low-fertility countries. *Population and Development Review* 46(2): 219–247. doi:10.1111/padr.12334.

Beaujouan, É. and Berghammer, C. (2019). The gap between lifetime fertility intentions and completed fertility in Europe and the United States: A cohort approach. *Population Research and Policy Review* 38(4): 507–535. doi:10.1007/s11113-019-09516-3.

Beaujouan, É., Reimondos, A., Gray, E., Evans, A., and Sobotka, T. (2019). Declining realisation of reproductive intentions with age. *Human Reproduction* 34(10): 1906–1914. doi:10.1093/humrep/dez150.

Beaujouan, É. and Sobotka, T. (2022). Is 40 the new 30? Increasing reproductive intentions and fertility rates beyond age 40. In: Nikolaou, D. and Seifer, D. (eds.). *Optimizing the management of fertility in women over 40*. Cambridge: Cambridge University Press: 3–18. doi:10.1017/9781009025270.002.

Beaujouan, É. and Toulemon, L. (2021). European countries with delayed childbearing are not those with lower fertility. *Genus* 77(2). doi:10.1186/s41118-020-00108-0.

Berrington, A. (2004). Perpetual postponers? Women's, men's and couple's fertility intentions and subsequent fertility behaviour. *Population Trends* 117: 9–19.

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(26): 733–764. doi:10.4054/DemRes.2015.33.26.

Bongaarts, J. and Feeney, G. (1998). On the quantum and tempo of fertility. *Population and Development Review* 24(2): 271. doi:10.2307/2807974.

Brée, S., Eggerickx, T., Sanderson, J.-P., and Costa, R. (2016). Comparison of retrospective fertility data from censuses in Belgium and family surveys in France. *Population (English Edition)* 71(1): 83–115.

Brzozowska, Z. and Beaujouan, É. (2021). Assessing short-term fertility intentions and their realisation using the Generations and Gender Survey: Pitfalls and challenges. *European Journal of Population* 37: 405–416. doi:10.1007/s10680-020-09573-x.

Brzozowska, Z., Beaujouan, É., and Zeman, K. (2022). Is two still best? Change in parity-specific fertility across education in low-fertility countries. *Population Research and Policy Review* 41: 2085–2114. doi:10.1007/s11113-022-09716-4.

Burkimsher, M. (2017). Evolution of the shape of the fertility curve: Why might some countries develop a bimodal curve? *Demographic Research* 37(1): 295–324. doi:10.4054/DemRes.2017.37.11.

Castro, R. (2014). Late-entry-into-motherhood women are responsible for fertility recuperation. *Journal of Biosocial Science* 47: 275–279. doi:10.1017/S0021932014000121.

Chevan, A. and Sutherland, M. (2009). Revisiting das Gupta: Refinement and extension of standardization and decomposition. *Demography* 46(3): 429–449. doi:10.1353/dem.0.0060.

Ciganda, D. and Todd, N. (2021). Demographic models of the reproductive process: Past, interlude, and future. *Population Studies* 76(3): 495–513. doi:10.1080/00324728.2021.1959943.

Council of Europe (2006). *Recent demographic developments in Europe 2005*. Strasbourg: Council of Europe Publishing.

Feenstra, B.R.C., Inklaar, R., and Timmer, M.P. (2015). The next generation of the Penn World Table. *American Economic Review* 105(10): 3150–3182. doi:10.1257/aer.20130954.

Fiori, F., Rinesi, F., and Graham, E. (2017). Choosing to remain childless? A comparative study of fertility intentions among women and men in Italy and Britain. *European Journal of Population* 33: 319–350. doi:10.1007/s10680-016-9404-2.

Frejka, T. (2008). Parity distribution and completed family size in Europe: Incipient decline of the two-child family model? *Demographic Research (Special Collection 7)* 19(4): 47–72. doi:10.4054/DemRes.2008.19.4.

Frejka, T. and Calot, G. (2001). Cohort reproductive patterns in low-fertility countries. *Population and Development Review* 27(1): 103–132. doi:10.1111/j.1728-4457.2001.00103.x.

Frejka, T., Goldscheider, F., and Lappegård, T. (2018). The two-part gender revolution, women's second shift and changing cohort fertility. *Comparative Population Studies* 43: 99–130. doi:10.12765/CPoS-2018-09.

Frejka, T. and Sardon, J.-P. (2006). First birth trends in developed countries: Persistent parenthood postponement. *Demographic Research* 15(6): 147–180. doi:10.4054/DemRes.2006.15.6.

Gauthier, A., Cabaço, S., and Emery, T. (2018). Generations and Gender Survey study profile. *Longitudinal and Life Course Studies* 9(4): 456–465. doi:10.14301/llcs.v9i4.500.

Hellstrand, J., Nisén, J., Miranda, V., Fallesen, P., Dommermuth, L., and Myrskylä, M. (2021). Not Just Later, but Fewer: Novel Trends in Cohort Fertility in the Nordic Countries. *Demography* 58(4): 1373–1399. doi:10.1215/00703370-9373618.

Human Fertility Collection (2022). Max Planck Institute for Demographic Research (Germany) and Vienna Institute of Demography (Austria) [electronic resource]. www.fertilitydata.org.

Human Fertility Database (2022). Max Planck Institute for Demographic Research (Germany) and Vienna Institute of Demography (Austria) [electronic resource]. https://www.humanfertility.org.

Jalovaara, M., Neyer, G., Andersson, G., Dahlberg, J., Dommermuth, L., Fallesen, P., and Lappegård, T. (2019). Education, gender, and cohort fertility in the Nordic Countries. *European Journal of Population* 35: 563–586. doi:10.1007/s10680-018-9492-2.

Kitagawa, E.M. (1955). Components of a difference between two rates. *Journal of the American Statistical Association* 50(272): 1168–1194. doi:10.1080/01621459.1955.10501299.

Kocourková, J. and Šťastná, A. (2021). The realization of fertility intentions in the context of childbearing postponement: Comparison of transitional and post-transitional populations. *Journal of Biosocial Science* 53(1): 82–97. doi:10.1017/S002193202000005X.

Kohler, H.-P., Billari, F.C., and Ortega, J.A. (2002). The emergence of lowest-low fertility in Europe during the 1990s. *Population and Development Review* 28(4): 641–680. doi:10.1111/j.1728-4457.2002.00641.x.

Kreyenfeld, M., Zeman, K., Burkimsher, M., and Jaschinski, I. (2012). Fertility data for German-speaking Countries: What is the potential? Where are the pitfalls? *Comparative Population Studies* 36(2–3): 349–380. doi:10.12765/CPoS-2011-06.

Lesthaeghe, R.J. (2016). Following the evolution of fertility in second demographic transition settings: The life-cycle sensitive approach. In: De Grande, H. and Vandenheede, H. (eds.). *Back to the roots of demography*. Gavere: ZenonPlus: 105–114.

Luci-Greulich, A. and Thévenon, O. (2013). The impact of family policies on fertility trends in developed countries. *European Journal of Population / Revue européenne de Démographie* 29(4): 387–416. doi:10.1007/s10680-013-9295-4.

Matysiak, A. and Węziak-Białowolska, D. (2016). Country-specific conditions for work and family reconciliation: An attempt at quantification. *European Journal of Population* 32(4): 475–510. doi:10.1007/s10680-015-9366-9.

Monte, L.M. and Ellis, R.R. (2014). Fertility of women in the United States: 2012. (Current Population Reports P20–575) Washington, DC: US Census Bureau:

Morgan, S.P. and Rindfuss, R.R. (1999). Reexamining the link of early childbearing to marriage and to subsequent fertility. *Demography* 36(1): 59–75. doi:10.2307/2648134.

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

Nathan, M. and Pardo, I. (2019). Fertility postponement and regional patterns of dispersion in age at first birth: Descriptive findings and interpretations. *Comparative Population Studies* 44: 37–60. doi:10.12765/CPoS-2019-07.

ONS (2018). Childbearing for women born in different years, England and Wales: 2017. London: Office for National Statistics. https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/conceptionandfertilityrates/bulletins/childbearingforwomenbornindifferentyearsenglandandwales/2017.

Real GDP Per Capita Penn World Tables (2021). PWT v9.1 [electronic resource]. www.ggdc.net/pwt.

Rendall, M.S., Aracil, E., Bagavos, C., Couet, C., De Rose, A., Di Giulio, 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. doi:10.1080/00324728.2010.512392.

Schoen, R. (2004). Timing effects and the interpretation of period fertility. *Demography* 41(4): 801–819. doi:10.1353/dem.2004.0036.

Sobotka, T. (2004). Is lowest-low fertility in Europe explained by the postponement of childbearing? *Population and Development Review* 30(2): 195–220. doi:10.1111/j.1728-4457.2004.010_1.x.

Sobotka, T. (2017a). Childlessness in Europe: Reconstructing long-term trends among women born in 1900–1972. In: Kreyenfeld, M. and Konietzka, D. (eds.). *Childlessness in Europe: Contexts, causes, and consequences*. Cham: Springer: 17–53. doi:10.1007/978-3-319-44667-7_2.

Sobotka, T. (2017b). Post-transitional fertility: The role of childbearing postponement in fuelling the shift to low and unstable fertility levels. *Journal of Biosocial Science* 49(S1): S20–S45. doi:10.1017/S0021932017000323.

Sobotka, T., Zeman, K., Lesthaeghe, R.J., Frejka, T., and Neels, K. (2011). Postponement and recuperation in cohort fertility: Austria, Germany and Switzerland in a European context. *Comparative Population Studies* 36(2–3): 417–452. doi:10.12765/CPoS-2011-10.

Tanturri, M.L. and Mencarini, L. (2008). Childless or childfree? Paths to voluntary childlessness in Italy. *Population and Development Review* 34(1): 51–77. doi:10.1111/j.1728-4457.2008.00205.x.

Thomson, E., Winkler-Dworak, M., and Beaujouan, É. (2019). Contribution of the rise in cohabiting parenthood to family instability: Cohort change in Italy, Great Britain, and Scandinavia. *Demography* 56(6): 2063–2082. doi:10.1007/s13524-019-00823-0.

Tillmann, R., Voorpostel, M., Antal, E., Kuhn, U., Lebert, F., Ryser, V.A., Lipps, O., and Wernli, B. (2016). The Swiss household panel study: Observing social change since 1999. *Longitudinal and Life Course Studies* 7(1): 64–78. doi:10.14301/llcs.v7i1.360.

Tomkinson, J. (2019). Age at first birth and subsequent fertility: The case of adolescent mothers in France and England and Wales. *Demographic Research* 40(27): 761–798. doi:10.4054/DemRes.2019.40.27.

Toulemon, L., Pailhé, A., and Rossier, C. (2008). France: High and stable fertility. *Demographic Research (Special Collection 7)* 19(16): 503–556. doi:10.4054/DemRes.2008.19.16.

Tymicki, K., Zeman, K., and Holzer-Żelażewska, D. (2018). Cohort fertility of Polish women, 1945–2015: The context of postponement and recuperation. *Studia Demograficzne* 2(174): 5–23. doi:10.33119/SD.2018.2.1.

US Census Bureau (2021). Current Population Survey [electronic resource]. https://www.census.gov/programs-surveys/cps.html.

Vergauwen, J., Wood, J., De Watcher, D., and Neels, K. (2015). Quality of demographic data in GGS Wave 1. *Demographic Research* 32(24): 723–774. doi:10.4054/DemRes.2015.32.24.

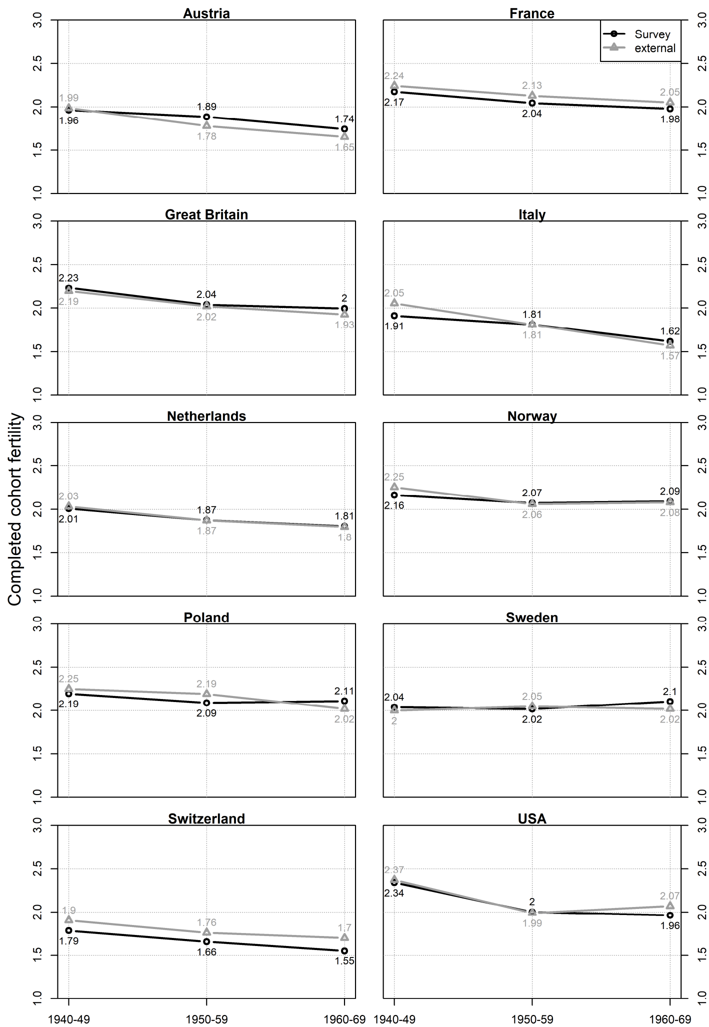
Wagner, M., Huinink, J., and Liefbroer, A.C. (2019). Running out of time? Understanding the consequences of the biological clock for the dynamics of fertility intentions and union formation. *Demographic Research* 40(1): 1–26. doi:10.4054/DemRes.2019.40.1.

Winkler-Dworak, M., Beaujouan, É., Di Giulio, P., and Spielauer, M. (2021). Simulating family life courses: An application for Italy, Great Britain, Norway, and Sweden. *Demographic Research* 44(1): 1–48. doi:10.4054/DemRes.2021.44.1.

Zeman, K., Beaujouan, É., Brzozowska, Z., and Sobotka, T. (2018). Cohort fertility decline in low fertility countries: Decomposition using parity progression ratios. *Demographic Research* 38(25): 651–690. doi:10.4054/DemRes.2018.38.25.

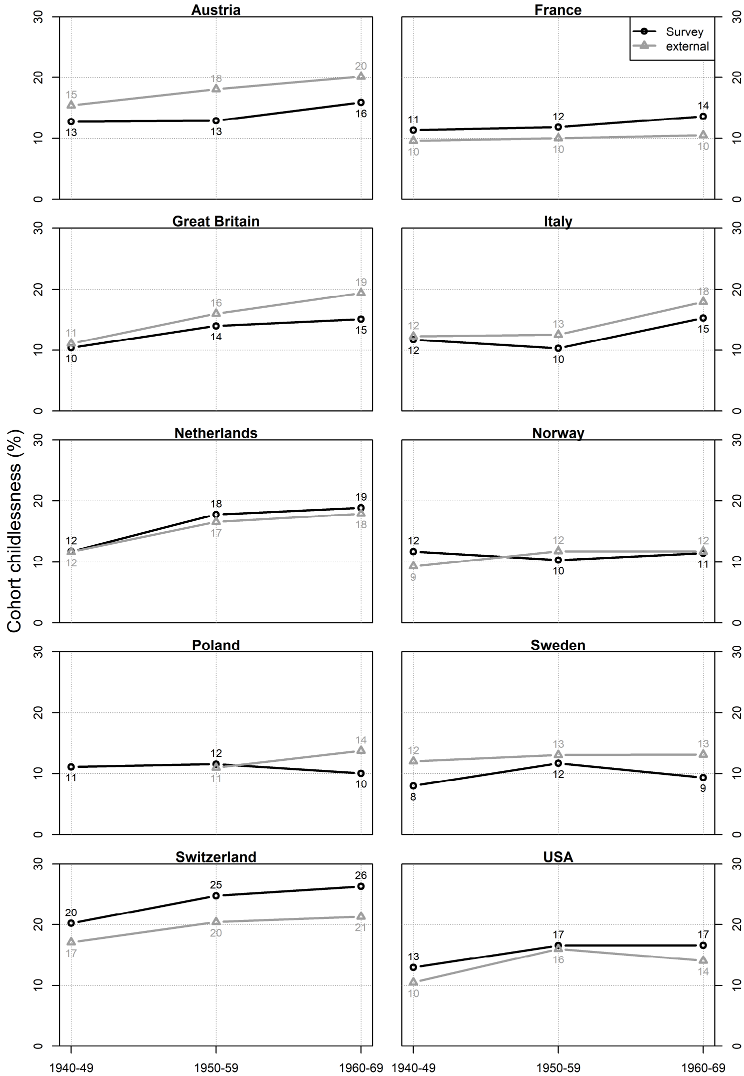
Appendix

Figure A-1: Completed cohort fertility for women born 1940–1969 (10-year groups)



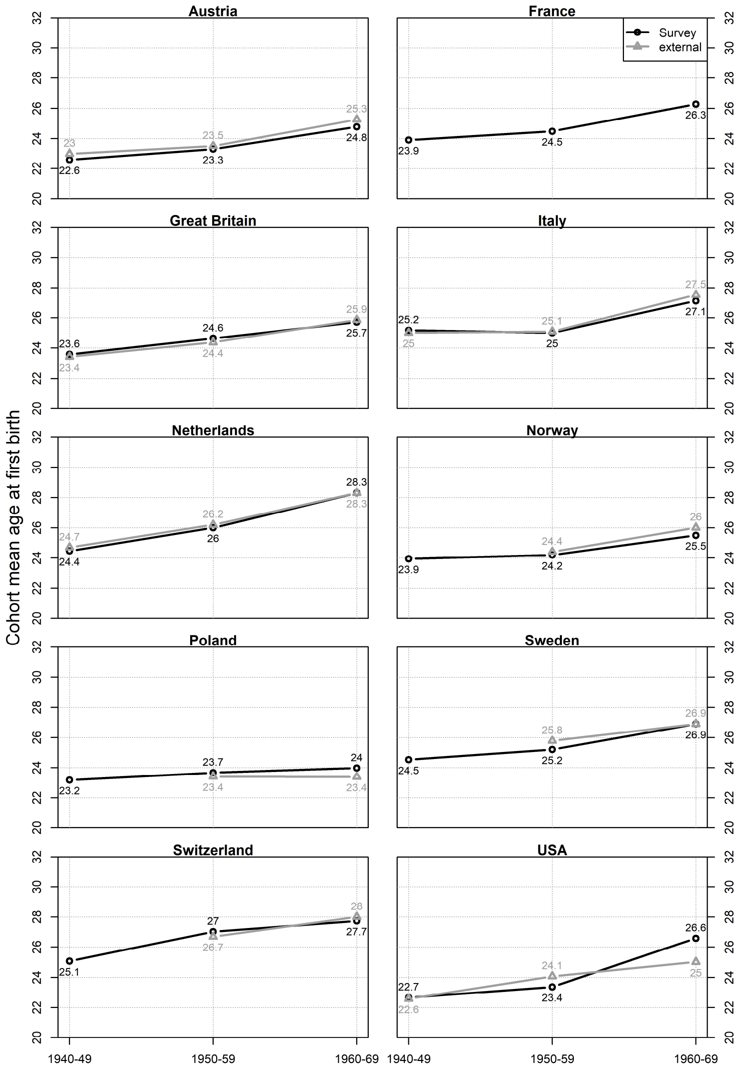
Sources. Surveys: Own computations based on data sources listed in Table1. External: Human Fertility Database (2022); for Poland (1940–1955) and Norway (1940–1951): Council of Europe (2006). External data indicators for 10-year cohorts are calculated as average of yearly indicators.

Figure A-2: Share of childless women, cohorts born 1940–1969 (10-year groups)



Sources: Surveys: Own computations based on data sources listed in Table1. External: Human Fertility Database (2022); for Austria and Italy: Human Fertility Collection (2022); for England and Wales: ONS (2018); for France: Toulemon et al. (2008); for Norway (1940–1951), Sweden (1940–1954), and Switzerland: Sobotka (2017a). External data indicators for 10-year cohorts are calculated as average of yearly indicators.

Figure A-3: Cohort mean age at first birth, cohorts born 1940–1969 (10-year groups)



Sources: Surveys: Own computations based on data sources listed in Table1. External: Human Fertility Database (2022); for Austria, Switzerland, and Italy: Human Fertility Collection (2022); for England and Wales: ONS (2018). External data indicators for 10-year cohorts are calculated as average of yearly indicators.