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Max Planck Institute for Demographic Research

Konrad-Zuse-Strasse 1 ▪ D-18057 Rostock ▪ Germany ▪ Tel +49 (0) 3 81 20 81 - 0 ▪ Fax +49 (0) 3 81 20 81 - 202 ▪ www.demogr.mpg.de

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All-time low period fertility in Finland: drivers, tempo effects, and cohort implications

Julia Hellstrand I julia.hellstrand@helsinki.fi
Jessica Nisén
Mikko Myrskylä

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Julia Hellstrand (1,2), Jessica Nisén (1,2), Mikko Myrskylä (1,2,3)

1. Department of Social Research, University of Helsinki
2. Max Planck Institute for Demographic Research
3. London School of Economics and Political Science

Abstract

In several European countries previously characterized by relatively high and stable cohort fertility, and particularly in the Nordic countries, period total fertility rates (TFR) have declined since 2010. The largest of these declines has been observed in Finland, where the TFR reached an all-time low of 1.49 in 2017. We analyze the decrease in the TFR in Finland since 2010, and assess the consequences of this trend for the completed fertility of women currently of childbearing age using complementary approaches that build on existing parametric and novel nonparametric methods. Decomposition of the fertility decline shows that this trend has been close to universal, with all age groups and parities contributing, but with first-order births and ages 25-29 making the largest contributions. At older ages, we document an important qualitative shift in fertility dynamics: for the first time since the early 1970s, women aged 30+ are experiencing a sustained fertility decline. All of our forecasting methods suggest that cohort fertility is likely to decline from the 1.85-1.95 level that was reached by the 1940-1970 cohorts, to a level of 1.75 or below among women born in the mid-1980s. The tempo-adjusted TFR also suggests that quantum change is driving the decline. These findings are evidence of a strong quantum effect, and are particularly striking because they call into question whether Finland will continue to be part of the Nordic fertility regime, which has been characterized by high and stable fertility.

Keywords: period TFR, cohort fertility, forecasting, Finland, Nordic fertility regime

Corresponding author: Julia Hellstrand, Julia.hellstrand@helsinki.fi

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Introduction

In recent decades, family demographic research has often shown that Finland and the other Nordic countries have relatively high and stable cohort fertility (Andersson et al. 2009; Jalovaara et al. 2018). This trend has been partly attributed to the institutional and socio-cultural settings of these countries, which strongly promote gender equality in the labor market and in the family (Ellingsæter and Leira 2006; Rønsen and Skrede 2010). As the Nordic countries have similar policies aimed at promoting work-family reconciliation among dual-earner couples, scholars have argued that these policies contribute to a common Nordic fertility regime with very similar period and cohort fertility patterns (Andersson 2004; Neyer et al. 2006; Andersson et al. 2009). These patterns include fertility postponement, and, unlike in other countries, strong recuperation of births at older ages. Thus, in these countries, cohort fertility has remained stable at around two children per woman, while female labor market participation has remained high.

There is, however, evidence that the total fertility rate (TFR) has been decreasing across the Nordic countries (Finland, Norway, Iceland, Denmark, and Sweden) since 2010 (Comolli et al. 2018). The average TFR across the Nordic countries decreased from 1.97 to 1.74 in just five years, from 2010 to 2015; and the decrease has been strongest in Finland, where the TFR declined from 1.87 in 2010 to an all-time low of 1.49 in 2017 (Official Statistics of Finland (OSF) 2018). Moreover, preliminary data from Statistics Finland indicate that the TFR in Finland has fallen even further, to 1.40 in 2018 (Official Statistics of Finland (OSF) 2019) – well below the 2016 EU average of 1.60, and far below the current Nordic country average (OECD 2019). Indeed, this TFR is close to the all-time lowest TFR recorded in the Nordic countries, of 1.38 in Denmark in 1983 (Andersson 2004). During this era, fertility regimes were shifting rapidly, and all Nordic countries had comparatively low period TFRs, as higher-order births decreased and fertility shifted to older ages. It is unlikely that these factors can explain decreasing fertility levels today, because most variation in fertility in Europe is currently driven by parities below three (Frejka 2008; Zeman et al. 2018). However, the demographic determinants driving these contemporary fertility declines are unknown, as no existing studies have detailed the components of the TFR decline.

Like other period-based measures, the TFR estimates childbearing intensity during one calendar year, and is therefore not necessarily indicative of the number of children any real female cohort eventually will have. Instead, the TFR estimates what the average total number of children born to each woman would be for a fictive group of women if they experienced the age-specific fertility rates obtained for one calendar year over their entire reproductive lives. The TFR is vulnerable to tempo distortions, and may be depressed if women are delaying childbearing in a given period

(Bongaarts and Feeney 1998). Thus, a decrease in the TFR can be driven by either delayed childbearing or less childbearing. A cohort perspective on fertility is, by contrast, free from this tempo distortion, and a decrease in the completed cohort fertility rate purely reflects less childbearing. The recent decrease in period fertility in Finland raises the question of to what extent this decrease will be reflected in the quantum of fertility of Finnish female cohorts currently of childbearing age. While the most recent cohort fertility forecast for Finland did not indicate that the country's fertility quantum is decreasing (Myrskylä, Goldstein, and Cheng 2013; Schmertmann et al. 2014), the rapid decline in period fertility in recent years suggests that it is. Updated forecasts are therefore required.

The aim of this study is to investigate the recent rapid decline in the TFR in Finland, and its potential effects on cohort fertility. Our main research questions are as follows: (1) Which age groups and parities have contributed to the period fertility decline in 2010-2017? (2) What would the TFR in this period have been in the absence of fertility postponement? (3) Are women born after the early 1970s likely to have fewer children than earlier cohorts; and, if so, how many fewer? Answering these questions is important because a substantial decrease in cohort fertility in Finland could call into question whether there is a common (high) fertility regime in the Nordic countries – or, at least, whether Finland belongs to this regime. Furthermore, as Finland continues to be ranked among the countries with high levels of gender equality (World Bank 2012), decreasing cohort fertility would challenge the idea that high gender equality levels are associated with fertility increases or relatively high fertility (Myrskylä, Billari, and Kohler 2011; Myrskylä, Goldstein, and Cheng 2012). To address questions (1) and (2), we use standard demographic decompositions and tempo adjustments. To address question (3), we employ existing parametric and model-based approaches to estimate the CFRs, and a novel nonparametric approach to assess possible recuperation paths for cohorts who have postponed childbearing.

Gender equality and fertility in Nordic countries

The long-term fertility decline that characterizes the demographic transition has typically been negatively associated with socioeconomic development; i.e., as societies reach more advanced levels of development, their fertility rates tend to decrease (Lee 2003; Bryant 2007). However, among the most developed societies, the relationship between fertility and socioeconomic development may weaken, or even turn positive (Myrskylä, Kohler, and Billari 2009; Fox, Klüsener, and Myrskylä 2018), due to fertility increases at advanced ages and improvements in gender equity (Myrskylä, Goldstein, and Cheng 2012). While it appears that increased gender equity has contributed to the trend toward fertility declining to around the replacement level; it also appears that at later phases of the demographic transition, improvements in gender equity can prevent fertility from falling to very low levels (McDonald 2000, 2013). It has thus been argued that at later stages of the transition, gender equity in family-oriented institutions needs to catch up with gender equity in individual-oriented institutions, like the educational system and the labor market. Consistency in the level of equity in family- and individual-oriented institutions reduces the work-family conflicts experienced by women, and therefore promotes relatively high fertility levels.

Anderson and Kohler (2015) extended the demographic transition model by arguing that there is a "gender equity catch-up" phase, building on the findings of McDonald (2000, 2013). When traditional norms that reinforce male breadwinner and female homemaker roles prevail in families while female labor force participation is increasing, women are likely to experience work-family conflicts, and fertility rates are likely to fall. In turn, when families embrace gender equity, women's work-family conflicts are expected to decrease, and fertility rates are expected to recover. Anderson and Kohler (2015) have divided countries into first- and second-wave developers based on the timing of their socioeconomic development, and have noted that levels of gender equity tend to be higher among the countries that developed earlier. Goldscheider, Bernhardt, and Lappegård (2015) have observed that the gender revolution occurred in two stages: women's entry into the labor force, followed by men's increasing involvement in the family. They argue that the second stage is currently emerging at varying speeds across countries, and predict that as men's involvement in the family increases, fertility will recover. Esping-Andersen and Billari (2015) have asserted that the evolution of a gender-egalitarian equilibrium is unstoppable, and that once gender egalitarianism achieves normative dominance, a return to higher fertility will occur.

In line with these predictions, family policy instruments that provide institutional support to ease women's work-family conflicts have been shown to have a positive impact on fertility at the macro level (Luci-Greulich and Thevenon 2013). Nordic countries have been leading internationally in implementing policies aimed at supporting working parents with young children (Thevenon 2011). While analyses on female and male labor force participation and domestic work have suggested that the gender revolution did not increase cohort fertility by the end of the 20th century, it is clear that cohort fertility has decreased the least among the countries with the highest gender equity levels, and has declined the most in the countries where working women continue to face a "second shift" (Frejka, Goldscheider, and Lappegård 2018). The Nordic countries appear to represent a particularly favorable setting for reducing work-family conflicts, as they have a track record of sustaining relatively high fertility despite having high female labor market participation rates (Frejka and Calot 2001; Andersson et al. 2009). As these countries are considered forerunners in gender equality (Esping-Andersen 2009; Goldscheider, Bernhardt, and Lappegård 2014), and in family demographic patterns (Kulu, Vikat, and Andersson 2007), they are of considerable interest in family and fertility research.

Analyses for the Nordic countries provide partial support for the existence of a positive relationship between gender equality and fertility, including at the individual level. Studies have shown that the equal division of housework between spouses encourages childbearing in Norway (Dommermuth, Hohmann-Marriott, and Lappegård 2015), and that larger contributions to childcare by fathers increase second birth risks in Denmark (Brodmann, Esping-Andersen, and Güell 2007). Fathers' uptake of parental leave has been found to be positively associated with continued childbearing in Sweden and Norway (Oláh 2003; Duvander and Andersson 2006; Duvander, Lappegård, and Andersson 2010). Research for Finland indicated that when fathers contribute more to childcare, even if not more to other types of housework, the likelihood of a second birth increases; and that birth rates are generally lower when women spend more hours on domestic work (Miettinen, Lainiala, and Rotkirch 2015). There is also evidence that a strong attachment to the labor market among women is associated with higher first birth rates, and, to some extent, with second birth rates, in Finland (Vikat 2004; Jalovaara and Miettinen 2013) and in the other Nordic countries (e.g., Kravdal 1994; Andersson 2000; Kreyenfeld and Andersson 2014). These findings could indicate that levels of work-family conflict in these countries are low. However, in times of economic uncertainty, anticipated difficulties in finding work after childbirth could strengthen this relationship, while also leading to fertility postponement, or even to fertility decline (Matysiak and Vignoli 2008).

Although the Nordic countries are seen as having high levels of gender equity, women in these countries continue to perform more unpaid work than men, including more childcare and other housework (Hook 2006; Prince Cooke and Baxter 2010). A recent study found, somewhat surprisingly, that in the Nordic countries in particular, mothers are more likely than women in childless couples to carry a double burden of performing a larger share of unpaid work than their male partner, despite performing an equal share of paid work (DeRose et al. 2019). Moreover, the relationship between gender equality and fertility in the Nordic countries is far from straightforward, as the availability of long parental leaves may help to preserve gender inequality by discouraging mothers' employment (Rønsen and Sundström 2002). Rates of continued childbearing have been shown to be relatively high among mothers who make extensive use of long family leaves (Duvander, Lappegård, and Andersson 2010; Erlandsson 2017). Similarly, public policies promoting gender equality may benefit different groups of women unequally: while differences in cohort fertility by women's level of education have converged (Jalovaara et al. 2018), differences in fertility by women's field of education remain (Hoem, Neyer, and Andersson 2006; Rønsen and Skrede 2010). Finland is currently an exception, as highly educated Finnish women continue to have slightly fewer children than their less educated counterparts (Nisén 2016; Jalovaara et al. 2018). Moreover, the level of gender equality in a society may not affect the fertility of those who do not find a partner. Fertility in Finland is characterized by very high levels of ultimate childlessness on the one hand (currently at 20 percent), and relatively high rates of continued childbearing among mothers on the other (Sobotka 2017; Jalovaara et al. 2018).

Fertility trends in Finland in the context of fertility trends across high-income countries

To situate fertility trends in Finland within broader developments in fertility, we describe period and cohort fertility trends across high-income countries. This comparison helps to illustrate the similarities and differences between fertility trends in Finland and in other countries, and demonstrates how understanding the current fertility decline in Finland can contribute to our understanding of fertility developments more broadly.

Based on selected countries from the Human Fertility Database, Figure 1 displays the developments in period fertility since 1960, and Figure 2 presents the developments in cohort fertility for women born in 1940-1970.[1] Among the first-wave developers – a group that includes the Nordic, the English-speaking, and the continental European countries – the steep fall in period fertility to below-replacement levels occurred in 1960-1970, when female labor force participation was increasing (Brewster and Rindfuss 2000). The period fertility decline among the second-wave developers – a group that includes Eastern and Southern European countries and East Asia – occurred later. In Eastern Europe, period fertility remained above replacement level until the post-communist crisis of the 1990s, when it fell to very low levels; and then recovered somewhat (Sobotka 2011). In the last few decades, the second-wave developers have reported lowest-low fertility, with TFRs below 1.3 (Kohler, Billari, and Ortega 2002; Goldstein, Sobotka, and Jasilioniene 2009); while the period fertility of the first-wave developers has remained fairly stable, or has slightly recovered (Anderson and Kohler 2015).

As Figure 1 shows, the highest TFRs in recent decades have been observed in the first-wave developers, such as the Nordic countries, the US, Northern Ireland, and France. Over the last three decades, Iceland, Sweden, and the US have had above-replacement level fertility in some years. At

[1] The HFD computes the TFR and the CFR as a sum of age-specific fertility rates across all ages from ≤12 to 55+ from a certain calendar year and from a certain cohort, respectively. For the most recent cohorts, the rates are considered completed at ages close to 50.

the other extreme, East Germany had an exceptionally low TFR of 0.78 in 1994, and Taiwan had a TFR of below one in 2010. However, the two distinct fertility regimes, with the first-wave developers characterized by relatively high and the second-wave developers by relatively lower rates (Rindfuss, Choe, and Brauner-Otto 2016), have in most recent years started to converge. Many countries with relatively high fertility reached a peak in their TFR around 2010 and have subsequently experienced declines of varying speed, while the TFRs in low fertility countries, and in particular in Eastern Europe, are substantially recovering. Even amid these trends, Finland's rapid fertility decline stands out, as its current all-time low rate of 1.49 is lower than the rates of many second-wave developers. Norway and Iceland also reported an all-time low fertility rate in 2017, of 1.62 and 1.71, respectively. The decline in fertility has been somewhat slower in Sweden, and in Denmark the TFR recovered slightly after 2014.

Fluctuations in period fertility do not necessarily affect cohort completed fertility, since period-based measures like the TFR are sensitive to shifts in the timing of childbirth (Bongaarts and Feeney 1998), and period rates tend to underestimate the completed fertility level when births are being postponed (Myrskylä, Goldstein, and Cheng 2013). Looking at developments in cohort fertility provides an overview of the fertility quantum trends without the distorting impact of changes in timing. The rapid decrease in the TFR observed in many countries starting in the 1960s reflects a quantum effect since the completed fertility for women who then were in their prime childbearing age, namely women born in the 1940s, has decreased as well. The delayed decline in period fertility in Eastern Europe is reflected in the decline in cohort fertility for women born in the 1960s. In turn, Sweden's "rollercoaster" fertility around the year 1990 (Hoem and Hoem 1996) is an example of a tempo effect, as the corresponding cohort fertility remained stable.

The dominant trend in cohort fertility over the 1940-1970 birth cohorts has been declining (Figure 2), and the decline has been faster among the second-wave than the first-wave developers (Frejka, Goldscheider, and Lappegård 2018). The second-wave developer countries of Japan, Spain, and Italy are so far the only countries that have experienced completed fertility below 1.5. The level of 1.75 can be viewed as a threshold between low and "very low" cohort fertility (Zeman et al. 2018) and rates below 1.75 are also observed in some Continental and Eastern European countries. As Myrskylä, Goldstein, and Cheng (2013) have pointed out, the long-term consequences on population decline and population aging differ widely depending on whether a country's fertility rate is 1.75 or 1.50. Except for the US, where cohort fertility has been increasing and is currently above replacement level, the Nordic countries are the only countries where cohort fertility has remained close to the replacement level over the last 30 years. This pattern has been noted as a feature of the Nordic fertility regime (Andersson et al. 2009), with Norway currently having the highest and Finland currently having the lowest cohort fertility among the Nordic countries (Jalovaara et al. 2018). Iceland is an outlier, as its cohort fertility has been considerably higher than that of the rest of the Nordic countries, and has decreased from above 2.7 to below 2.3 during the last decades. In Finland, cohort fertility has declined slightly among the most recent cohorts: among women born in the 1960s, fertility fell from nearly two to 1.9.

[Figure 1 about here]

[Figure 2 about here]

Data and methods

Data

In our study, we use aggregated data from the Human Fertility Database (HFD). The HFD is a source of high-quality fertility data, and is based on a collaboration between the Max Planck Institute for Demographic Research and the Vienna Institute of Demography. For the analysis of period fertility, we use data containing both unconditional and conditional fertility rates by calendar year, age, and birth order starting from the year 1960. The conditional fertility rates control for age and parity (e.g., second births are related to women of parity one only), whereas the unconditional fertility rates only control for age. For cohort fertility estimation, we use period fertility rates by calendar year, age reached during the year, and birth cohort for all countries with data available in the HFD database starting from the 1900 birth cohort. The published time-series of HFD rates from Finland at the time of writing (February 14, 2019) ends in 2015, but we were kindly provided with preliminary data for the years 2016-2017 (personal communication).[2]

Methods

Our analyses are based on several different methods that examine the decreasing period fertility in Finland independently of each other, and from different angles. First, time trends in fertility rates are described by five-year age groups, and the drop in period fertility between 2010 and 2017 is decomposed into additive age and parity contributions. We decompose the differences in the TFR computed from conditional age- and parity-specific fertility rates ($TFRp$) using the stepwise replacement method (Andreev, Shkolnikov, and Begun 2002; Andreev and Shkolnikov 2012). In

[2] The as yet unpublished HFD updates on births for the most recent years do not distinguish between mothers born in Finland and mothers born abroad. The period fertility tables also do not make this distinction. Moreover, the cohort data are based on statistical models, and do not necessarily correspond exactly with the fertility behavior of real cohorts. (Jasilioniene et al. 2015)

addition to adjusting for population age structure, the $TFRp$ adjusts for differences in the parity composition of the female population. Therefore, the $TFRp$ may differ slightly from the conventional TFR.

Second, we use tempo-adjusted TFR (Bongaarts and Feeney 1998) to analyze the impact of changes in the timing of childbearing on the recent fertility decline. A decrease in the observed TFR can be attributed to increasing tempo effects if there is no decrease in the tempo-adjusted TFR, while quantum changes can be held responsible if the observed and the tempo-adjusted TFR show similar decreases. Since the last year's observation is lost in the Bongaarts-Feeney adjustment, we calculate a crude estimate following Goldstein, Sobotka, and Jasilioniene (2009) to replace the lost observation (Appendix 1).

Third, cohort fertility is forecasted using three different methods: the simple freeze rate method, the five-year extrapolation method (Myrskylä, Goldstein, and Cheng 2013), and a Bayesian method (Schmertmann et al. 2014). By forecasting cohort fertility, we aim to address the question of whether cohorts currently of childbearing age will ultimately have fewer children than earlier cohorts; and, if so, how many fewer. The tempo adjustments decompose changes in period fertility into tempo and quantum components, whereas the forecasting methods estimate cohort fertility, and may detect pure fertility quantum changes. The freeze rate method freezes the latest observed age-specific fertility rates into the future. The five-year extrapolation method estimates the trend over the past five years, extrapolates the trend five years into the future, and then freezes the rates (Myrskylä, Goldstein, and Cheng 2013). The Bayesian forecasting method (Schmertmann et al. 2014) produces a probabilistic forecast by combining prior demographic information about plausible age patterns and time trends in fertility, and extrapolating into the future fertility rates over both time and age (Appendix 2). Recent evaluations of the forecasting performance of a large number of cohort forecasting methods have suggested that the five-year extrapolation method (Myrskylä, Goldstein, and Cheng 2013) and the Bayesian forecasting method (Schmertmann et al. 2014) are among the most accurate cohort fertility completion methods (Bohk-Ewald, Li, and Myrskylä 2018).

Fourth, we use a novel nonparametric forecasting approach to assess – without making modeling assumptions – whether recorded fertility history includes recuperation paths that would prevent Finnish cohort fertility from declining strongly. This approach is based on the work of Keyfitz (1985, 1989), Denton, Feaver, and Spencer (2005), and (Dudel 2015), but is modified to fit our purpose of estimating possible fertility recuperation paths for older cohorts, and their consequences for completed fertility. With HFD data, we use this approach to calculate for a cohort with observed age-specific fertility rates up to age x the universe of fertility changes for ages above x that have been observed in the past, and add these changes to the most recent year's fertility rates.

As an example, consider the cohort born in 1980 whose fertility rates are observed up to age 37 in 2017. The rate at age 38 is observed in 2018, and the final rate at age 44 is observed in 2024. To complete the fertility schedule of this cohort, we calculate from the year 2017 the change one year ahead, the change two years ahead, and so on; up to the change seven years ahead. We then sum up these changes to form a possible recuperation path for this cohort. To derive a universe of possible recuperation paths for each cohort born between 1975 and 1987, we used all HFD data after year 1975. This resulted in a total of 910 possible fertility recuperation schedules for the cohort born in 1987, and up to 1,342 possible schedules for the cohort born in 1975. For each cohort, we resampled from the universe of fertility recuperation schedules with replacement (10,000 samples) to derive nonparametrically a probabilistic distribution of the potential future fertility trajectories. We also completed the same procedure but restricted the possible recuperation schedules to those observed in the Nordic countries, because the Nordic patterns may better reflect the realm of recuperation possibilities for Finland.

Results

Age-specific fertility developments in 1960-2017

Figure 3 shows the development in period fertility rates by five-year age groups in Finland in 1960-2017. Since the 1970s, the timing of childbirth has been shifting to older ages. Since the rapid period fertility decline in the 1960s that affected almost every age group, fertility rates at ages below 25 have continued to decrease, while fertility rates at ages 30+ have been increasing. The fertility rate among 25-29-year-olds peaked in the early 1990s, at a rate of nearly 140 live births per 1,000 women; while the corresponding rate for 30-34-year-olds was around 100. In the past, 20-24-year-old women had children with a higher intensity than 35-39-year-old women. But since 2010, this pattern has reversed, and fertility has become more concentrated at older ages. Notably, since 2010, there have been declines in fertility in nearly all age groups: women below age 30 have been reducing their childbearing intensity even more rapidly than in the past, while the fertility rates of women aged 30+ have been decreasing for the first time since the early 1970s. The downward trend among women over age 30 is suggestive of a quantum effect, since women who postpone childbearing to late reproductive ages are at higher risk of experiencing infertility.

[Figure 3 about here]

Contributions of age and parity to the decrease in period fertility in 2010-2017

Figure 4 shows the decomposition of the decrease in the $TFRp$ between 2010 and 2017 by age and parity. The $TFRp$ (TFR adjusted for both the age and the parity female distribution) fell from 1.86 in 2010 to 1.48 in 2017.[3] The greatest contributions to this steep decline came from the decreasing childbearing intensity of women in their late twenties, although women at nearly every age contributed to this trend. Women close to the end of their reproductive years were the only ones who, albeit very modestly, contributed positively to fertility change. Birth order decomposition shows that the contributions produced by the decreasing intensity of first births account for more than 75 percent of the fall in period fertility. This decrease is not only pronounced among the youngest women but also among women in their early 30s. Second and third births account for 21 percent of the total decline in fertility while higher-order births play a negligible role in explaining the fertility decline. The changes in first birth intensity imply that the share of young childless women has increased: of the women in the 25-29 age group, 64 percent were childless in 2010 (Official Statistics of Finland (OSF) 2010) and 69 percent were childless in 2017. Similarly, the childless share rose from 37 percent in 2010 to 41 percent in 2017 in the 30-34 age group.

Further results indicate that the decrease in first-order childbearing has been particularly pronounced among highly educated women, and that the decrease in third- and higher-order childbearing has been stronger in rural than in urban areas (Appendix 3). The decrease in period fertility has not, however, been strongly concentrated in any of these population sub-groups, and can therefore be viewed as a widespread phenomenon within Finland.

[Figure 4 about here]

Tempo-adjusted TFR in 1990-2017

The tempo-adjusted TFR for Finland was calculated for the 1990-2017 period. Figure 5 shows the observed and tempo-adjusted TFR and the mean age at childbearing in this period by birth order and by all birth orders combined. The mean age of total childbearing was 30.9 years in 2017, which represents an increase of two years since 1990. The tempo-adjusted TFR was higher than the observed TFR in every year since 1990, which means that in the absence of fertility postponement, the TFR would have been higher. If the mean age of childbearing had not increased, the TFR would

[3] These differ from the TFR only marginally: the TFR for 2010 was 1.87 and the TFR for 2017 was 1.49.

have been higher than two in 1994, 1995, and 2010; and would have been no lower than 1.75 in any year in the 1990-2016 period. If the development in the mean age of childbearing observed in 2017 followed a similar pattern in 2018, the estimated tempo-adjusted TFR for 2017 would be 1.65. Since the tempo-adjusted TFR has been higher than the observed TFR in each year since 1990, the tempo effect during this whole time period is clear. However, the tempo-adjusted fertility rate has been decreasing in tandem with the observed TFR in 2010-2017, which indicates that the decrease in the TFR in Finland since 2010 is not mainly attributable to changes in the timing of childbearing.

The mean age at first birth was 29.1 in 2017, which represents a total increase of 2.6 years since 1990. The mean ages at second and third birth increased less, from 29.2 in 1990 to 31.1 in 2017 for the second birth, and from 31.8 in 1990 to 32.9 in 2017 for the third birth. Since 2010, the TFR has decreased from 0.78 to 0.61 for first-order births, from 0.60 to 0.50 for second-order births and from 0.30 to 0.22 for third-order births. The tempo adjustments show the largest tempo effect for first-order births.

[Figure 5 about here]

Cohort fertility of women born since 1974

Figure 6 shows the observed and forecasted completed cohort fertility rate (CFR) for the 1940-1987 birth cohorts in Finland. The latest CFR is observed for women born in 1973, since they reached age 44 in 2017, and thus have (almost) completed their fertility schedule. These women had an average of 1.89 children, which is approximately the level that has been consistently observed over the last 30 years. However, all three forecasting methods suggest that there will be a substantial decrease in the completed cohort fertility rates of women who are currently in their childbearing years. According to all three methods, the average number of children born to each woman is likely to be lower than 1.75 for women in their early thirties (1985 birth cohort) and lower than 1.7 for women currently aged 30 (1987 birth cohort). For women in their late thirties (1980 birth cohort), cohort fertility is expected to reach 1.82, which is an all-time low in Finland based on the current available HFD data since the 1924 birth cohort, given that the lowest value previously observed was 1.85 for the 1950 birth cohort. Even if the fertility rates remained stable and did not decrease further at any age, the CFR would approach 1.65 for the cohorts born in the late 1980s. This is, however, the most optimistic scenario, since both the five-year extrapolation method and the Bayesian method suggest that fertility declines will be larger. Both the five-year extrapolation and the Bayesian method forecast completed fertility of 1.6 for the cohort born in 1987, for whom fertility has been observed up to age 30. The forecast uncertainty is, however, greater for cohorts with many as yet unobserved age-specific fertility rates. Taken together, the cohort fertility forecast indicates that unless age-specific rates recover very rapidly, the cohort fertility rate in Finland will decrease dramatically in the near future.

[Figure 6 about here]

Potential for recuperation of cohort fertility

How unlikely is it that fertility rates will recover fast enough to prevent a strong decrease in cohort fertility? While the probabilistic Bayesian forecast answers this question, the answer is ultimately based on a model, and it is unclear whether the model assumptions hold in the current context. To complement the model-based results, we used an approach that does not impose any restrictions on the smoothness or the shape of the fertility schedules. We calculated the changes in age-specific fertility rates from all HFD countries since 1975, and illustrate their consequences for cohort fertility in Finland in Table 1. To keep their CFR at 1.75, and using freeze rates as the baseline, a recuperation of 0.02 would be needed for the 1985 cohort. In other words, the remaining fertility rates needed to make the CFR complete would have to increase by a total of 0.02 from the most recent observed age-specific fertility rates at ages 33-44. As this level of recuperation has occurred in more than half of the trajectories in the HFD countries, it is not unlikely. The level of recuperation needed to keep the CFR at 1.75 increases for the younger cohorts. For the 1987 cohort, an increase of 0.10 is required, which has been observed in only 16 percent of the trajectories in the HFD countries.

Since strong recuperation at older ages has been a particular feature of the Nordic countries (Andersson et al. 2009), we additionally calculated the corresponding chances of keeping the CFR at 1.75, but based on the patterns observed in the Nordic countries only. The likelihood of keeping the CFR at 1.75 would then be higher; at 75, 62, and 32 percent, respectively, for the 1985, 1986, and 1987 cohorts. However, the likelihood that the CFR will remain at the latest observed level of 1.89 is extremely low, even given the recuperation patterns typical of the Nordic countries. Recuperations with strength levels in the 90th percentile would result in a CFR of around 1.80, but projections based on the most typical recuperation patterns would result in a CFR below 1.75 for the youngest cohorts. Keeping the CFR at the level that has been observed in recent decades in Finland would therefore require a recuperation that is stronger than any that has previously occurred. Thus, while this non-parametric analysis shows that it is still possible for the CFR to remain above 1.75 for women born in the late 1980s, it is not what the current trend in Finland is indicating.

[Table 1 about here]

Discussion

Using aggregated data from the Human Fertility Database, we described the rapid decline in period fertility in recent years in Finland, and estimated the ultimate cohort fertility for women currently of childbearing age. Our focus was on Finland because the period fertility decline that started in 2010 in many relatively high-fertility countries was particularly pronounced there. During the 2010-2017 period, the long-term decrease in fertility rates among women below age 30 accelerated, while the long-term increase among women at older ages stagnated or even turned negative – as was the case among 30-39-year-olds. The greatest contributions to the decrease were produced by decreasing first-order births, and particularly at ages 25-29. However, the fertility decline is a widespread phenomenon in Finland. The period rates are depressed because the age at entering motherhood has increased, and would have been higher in the absence of fertility postponement. The tempo-adjusted TFR did not, however, show increasing tempo effects, which implies that the decrease in total fertility is not explained by the accelerating postponement of childbearing. By updating the existing Finnish cohort fertility forecast (Myrskylä, Goldstein, and Cheng 2013; Schmertmann et al. 2014) with the most recent data, our results suggest that among women born since the mid-1980s, completed fertility will fall sharply to levels below 1.75 unless fertility rates recover very rapidly. A turnaround in fertility at older ages would help to counterbalance decreases at younger ages, but a catch-up process that keeps cohort fertility stable is highly unlikely to occur. This finding points to an important shift in fertility patterns in Finland, as the country's cohort fertility declined only slightly among women born in the 1960s, and has generally been stable at around 1.90 over the last 30 years.

The multiple forecasting approaches used in this study produced consistent forecasts for women in their later childbearing years; e.g., of close to 1.80 for the 1980 cohort. These forecasts are also consistent in terms of the direction of fertility development. However, the magnitude of the expected cohort fertility decline varies to some extent across the methods, as the central estimate for the late 1980s cohorts is around 1.6 for the extrapolation-based methods; 1.65 for the freeze rate method; and 1.7 for the non-parametric approach. These differences in forecasted fertility are partially attributable to the inherent increase in uncertainty when forecasting with a longer time horizon, but they also reflect systematic differences in the modeling assumptions, and the implications of these assumptions. For example, the recent change in the trend in fertility rates among women aged 30+ from positive to negative suggests that different assumptions about future fertility developments are needed, since it is impossible to know whether this new trend will continue, plateau, or reverse; or when a deviation from this trend might occur. A key strength of our analysis is that the forecasting methods used in this study are based on different assumptions, and allow for each of these fertility developments to occur.

The five-year extrapolation method (Myrskylä, Goldstein, and Cheng 2013) and the Bayesian method (Schmertmann et al. 2014) extrapolate past trends into the future. As recent trends are negative among all age groups except women aged 40+, these methods produce the lowest CFRs, and perform well when a continuous trend is uninterrupted during a period of time. If the trend plateaued, as the freeze rate method assumes, the forecasted CFRs would be slightly higher. These three methods still consistently produce forecasted CFRs substantially below 1.75 for women born in the late 1980s. However, the nonparametric approach suggests that there is a 1/6 to a 1/3 chance of the CFR staying at 1.75 or higher for the late 1980s cohorts. This approach does not make assumptions about future trends, and instead shows the most likely recuperation paths based on recorded fertility histories in high-income countries over the past 40 years. As the main feature of the fertility histories has been an ongoing increase in fertility at higher ages, this nonparametric method samples possible recuperation histories from a dataset dominated by patterns in which the old-age fertility rate increases. Consequently, this method produces the highest forecasted CFR of 1.70 for the 1987 birth cohort observed up to age 30. Importantly, however, the lack of assumptions regarding trends or age schedules in this non-parametric approach implies that some of the forecasted recuperation trajectories may be implausible in terms of the age-shape or time trend. Moreover, while our forecasts use data up to 2017, preliminary data indicate that fertility has continued to decline since 2017 (Official Statistics of Finland (OSF) 2019). This suggests that our estimate that the likelihood of the CFR remaining at 1.75 or above is 1/6-1/3 is likely to be an upper bound of the true likelihood of such a fertility recuperation occurring.

The current findings challenge the view of Finland as part of the common Nordic fertility regime. A cohort fertility decline in Finland would be an interesting development more generally, given the widespread assumption that the Nordic countries have maintained close to replacement-level fertility through generous social policies promoting work-family reconciliation. A common feature of childbearing behavior in these countries has been a strong recuperation of postponed births at older ages, which has caused cohort fertility to remain stable even as the age at entry into motherhood has increased (Andersson et al. 2009). This new trend of stagnating or decreasing childbearing intensity among Finnish women in their thirties implies that this pattern may be changing in Finland. The evidence suggests that women currently of higher childbearing ages are not catching up on births to the same extent as previous generations. Based on several cohort forecast approaches applied in this study, a catch-up that would keep cohort fertility stable is highly unlikely to occur. However, given the recent history of recuperation paths observed in the Nordic countries, there was, as of 2017, still a reasonable possibility that completed fertility would not fall below 1.75 if fertility was substantially recovered at older ages. The crucial question is whether a strong recuperation typical of those in the Nordic countries can still be expected in Finland.

Compared to other Nordic countries and other countries in general, Finland has high levels of ultimate childlessness (Neyer et al. 2006; Kreyenfeld and Konietzka 2017). For instance, the percentage of women born around 1970 who were still childless at age 40 was 20 percent in Finland versus 12 percent in Norway (Jalovaara et al. 2018). As we found in this study, the decline in period fertility is mainly attributable to decreasing first birth rates, although rates of higher-order births, and particularly of second-order births, have decreased as well. This means that in Finland, larger shares of young women are currently childless than was the case only a few years ago: less than half of all Finnish women currently aged 30 have entered motherhood. Without an exceptionally strong recuperation of first births at older ages, ultimate childlessness will further increase in Finland. Indeed, childlessness may become a strong driver of cohort fertility decline, given the trend toward increasing childlessness observed in many countries among women born in the 1940s or later (Sobotka 2017; Zeman et al. 2018). In the Nordic context, however, Finland might become even more of an outlier, since in Denmark, Norway, and Sweden increases in ultimate childlessness have plateaued among the most recent cohorts (Sobotka 2017; Jalovaara et al. 2018).

Given that Finland is considered an advanced country in terms of gender equality, the current findings do not necessarily support the assumption that there is a positive association between fertility and gender equality. Recent theories suggest that fertility levels will increase if the “second shift” experienced by working women is alleviated by men becoming more involved in the family and stronger institutional support (Esping-Andersen and Billari 2015; Goldscheider, Bernhardt, and Lappegård 2015; Anderson and Kohler 2015). In a recent study on changes in fertility rates within countries over time, Kolk (2019) found no evidence that fertility increases in societies with the most advanced levels of gender equality. Frejka, Goldscheider, and Lappegård (2018) showed, however, that although the gender revolution has not yet resulted in increased cohort fertility, it has prevented it from decreasing further. Previous individual-level studies have noted that the macro pattern of comparatively high levels of gender equality and fertility in the Nordic countries may obscure subgroup heterogeneity, such as high fertility being concentrated among women who stay home to care for their children for long spells, or who work in more family-friendly jobs in the public sector (Rønsen and Sundström 2002; Duvander, Lappegård, and Andersson 2010; Miettinen, Gietel-Basten, and Rotkirch 2011). If cohort fertility in Finland, as the conventional forecasts predict, falls below 1.75, it would reach levels that are currently observed among the "late developers;" i.e., countries like those in Southern and Eastern Europe, where the fertility transition occurred later and gender equality is less advanced (Anderson and Kohler 2015).

Despite the common view of the Nordic countries as gender equal, Finland can be considered less gender equal in some respects than the other Nordic countries (Andersson et al. 2006; Grönlund, Halldén, and Magnusson 2017). For example, care for very young children is more home-based in Finland than it is in the other Nordic countries: less than half of all children aged 1-2 were enrolled in day-care institutions or publicly financed day-care in Finland in 2016, while this share varied between 70 and 90 percent in the other Nordic countries (Nordic Social Statistical Committee (NOSOSOCO) 2017). This practice is not gender-neutral, because home-based child care is mainly provided by mothers: in 2016, the share of paid leave taken by fathers was around 11 percent in Finland and Denmark, compared to 28 percent in Sweden. Accordingly, the employment rate of mothers (employed and not absent on leave) with at least one child aged 0-2 in 2012 was 38 percent in Finland, slightly below the OECD average of 42 percent; but was as high as 68 percent in Denmark (OECD 2019). Furthermore, in a recent study, Hudde (2018) suggested that Finland is an outlier among the Nordic countries in terms of gender attitudes, as Finns' views regarding the ideal division of breadwinner and caregiver tasks among parents are more similar to those in Germany than to those in Denmark, Norway, or Sweden. Thus, despite the relatively high overall level of gender equality, it is plausible that some less gender-equal aspects of Finnish society have paved the way for the recent fertility decline, and may weaken prospects for a strong recuperation of cohort fertility.

To understand the current childbearing trends in Finland, it is also necessary to consider the relevance of factors other than the gender equality level and women's work-family reconciliation options. There is evidence from the Nordic countries that fertility rates are positively related to economic cycles (Andersson 2000; Kravdal 2002). In Finland, the recession in the early 1990s did not show such a pro-cyclical pattern, but the recent Great Recession did (Hiilamo 2017). There is also individual-level evidence of a positive relationship between female attachment to the labor market and first and second birth risks in Finland (Vikat 2004; Jalovaara and Miettinen 2013). More generally, Matysiak, Sobotka, and Vignoli (2018) showed that fertility rates in Europe were negatively affected by the Great Recession in 2008-2014, and argued that not only the timing but the quantum of fertility may have been affected. Particularly in the Nordic countries, the ongoing decline in period fertility is puzzling because the economic recession ended years ago. Comolli et al. (2018) found almost homogeneous developments in childbearing risks after the recent recession even though the severity of the crisis varied significantly between countries. This finding suggests that the recession may have led to similar perceptions of uncertainty across countries. Earlier research has, however, argued that periods of economic uncertainty mainly lead to delayed childbearing, rather than to less childbearing (Sobotka, Skirbekk, and Philipov 2011).

Furthermore, Van Bavel (2012) argued that the new gender imbalance in education, with women currently being more educated than men in most European countries, will negatively affect opportunities to find a partner of the opposite sex and hence have implications for fertility. In Finland, a high regional male-female ratio has been shown to increase fertility among younger women (Lainiala and Miettinen 2014) and not having a partner is cited among the most important subjective reasons for postponing or abandoning childbearing (Miettinen 2015). Additionally, lifestyle reasons may be influencing fertility developments in Finland. Recent Finnish surveys have shown that younger women nowadays cite the desire to pursue interesting life goals other than parenting as the most important reason why they are postponing childbearing (Miettinen 2015). Furthermore, whereas the share of Europeans who view childlessness as an ideal has historically been relatively low, varying between one and six percent in most countries (Miettinen and Szalma 2014), childlessness seems to be gaining ground as a preferred family form in Finland. The annual Family Barometer survey for Finland found that in both 2015 and 2018, over 20 percent of childless Finns in their twenties said they regard zero children as their ideal number of children, whereas a decade ago, this share was below six percent (Berg 2018). Additionally, a decrease in the mean personal ideal number of children was recently documented among those who said they want to become parents. Consequently, the recent strong period fertility decline may reflect changes in family values in Finland[4]. This assumption would not be at odds with our finding of a sharp decrease in first births among women aged 25-29. Moreover, it would make the recuperation of fertility at older ages even more unlikely in the years to come.

The Nordic countries, which are often characterized as forerunners in gender equality, have had relatively high and stable cohort fertility in recent decades, despite the ongoing process of fertility

[4] Of course, changes in lifestyle preferences may also be influenced by changes in the circumstances for childbearing (Schoen et al. 1999; Letherby 2002).

postponement. Using a variety of analytical tools, including several cohort fertility forecasts, this study has shown that the all-time low period fertility currently observed in Finland is not a consequence of accelerating fertility postponement, but is most likely a reflection of decreasing fertility quantum. Finnish women who were born in the mid-1980s, and are thus currently of higher childbearing ages, are likely to end up having considerably fewer children than previous generations of women. Our results therefore suggest that Finland may be deviating from the typical Nordic model of fertility. Recent fertility declines in other Nordic countries tentatively point to developments similar to those in Finland, albeit at fertility levels that are still higher than those in Finland. If, however, the other Nordic countries follow Finland, the concept of the Nordic model for fertility may require updating. Indeed, research is needed to determine whether the recent period fertility decline in other relatively gender-equal countries, such as the Nordic countries, reflects a quantum effect as well. If this turns out to be the case, more nuanced studies on the relationship between gender equality and fertility may be needed. This study casts doubt on the assumption that Finland will continue to be seen as a Nordic country characterized by relatively high and stable fertility, and thus suggests that even having comparatively strong institutional support for gender equality may not hinder declines in fertility.

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TABLES AND FIGURES

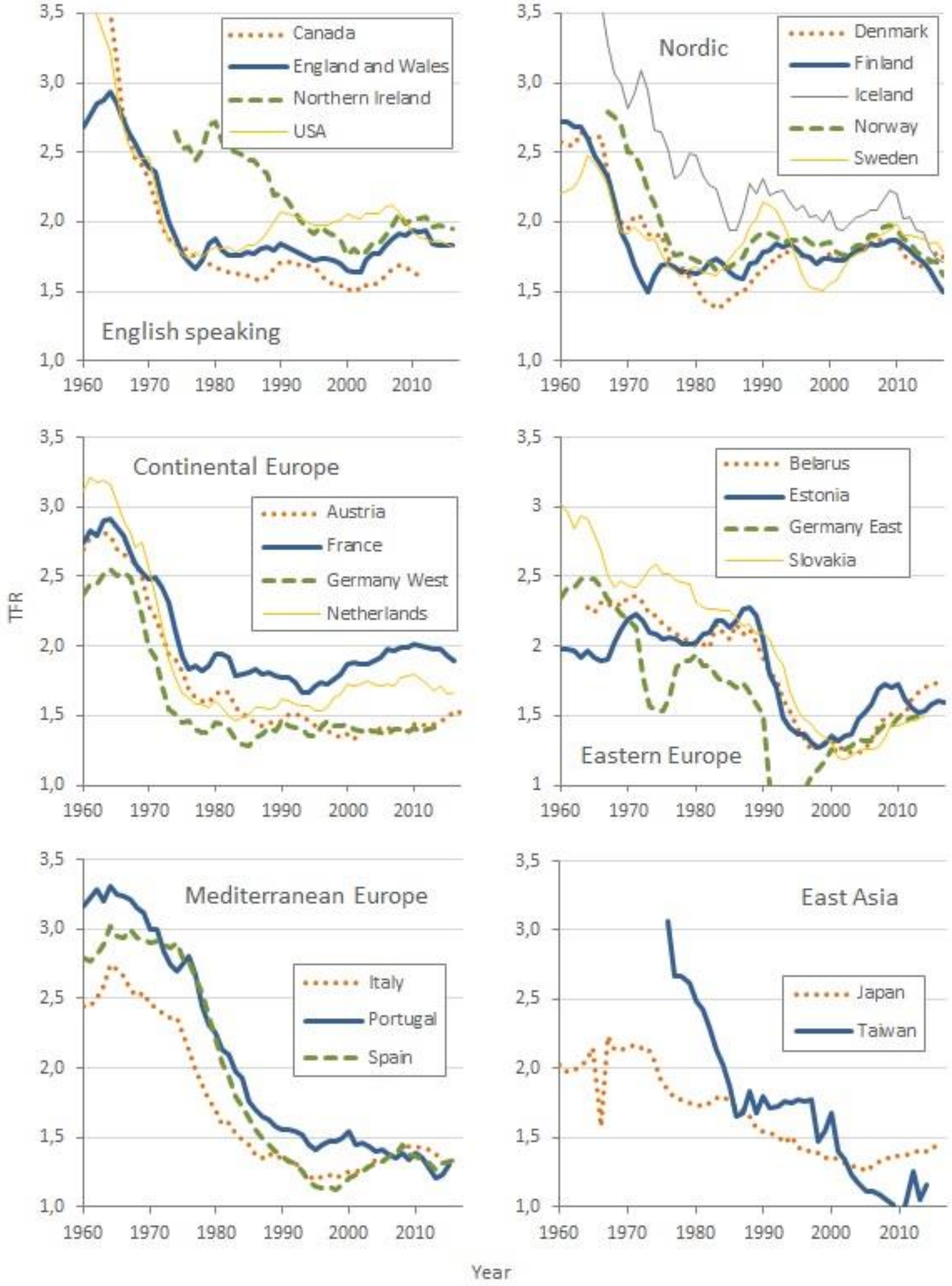

Fig. 1
Total fertility rate (TFR) in 1960-2017 by country group.
Source: Human Fertility Database. Max Planck Institute for Demographic Research (Germany) and Vienna Institute of Demography (Austria). Available at www.humanfertility.org (accessed 4.3.2019); Eurostat 2019 (TFR in 2017 in Denmark and Sweden, in 2016-2017 in Finland and Iceland, and in 2015-2017 in Norway).

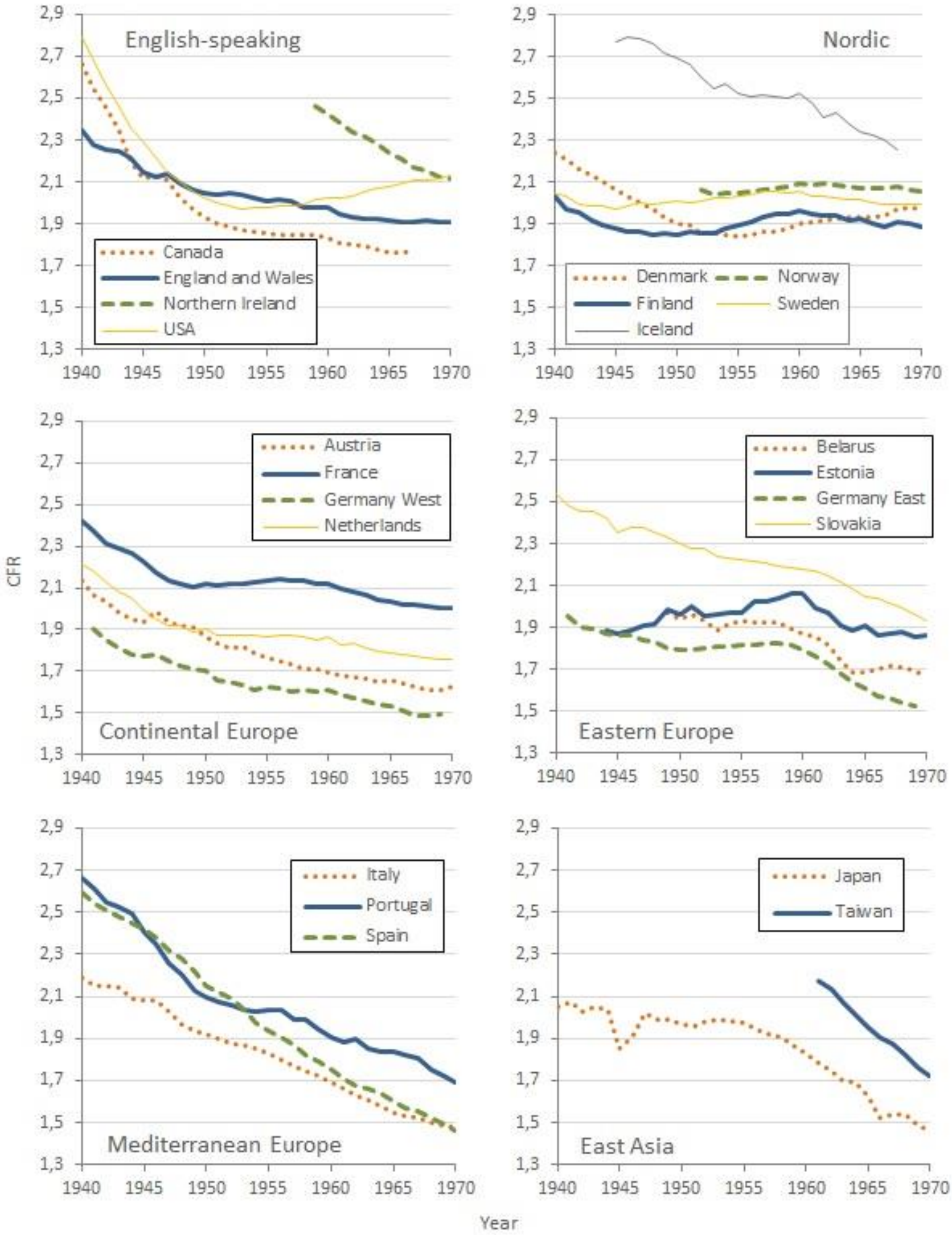

Fig. 2
Cohort fertility rate (CFR) of women born in 1940-1970 by country group.
Source: Human Fertility Database. Max Planck Institute for Demographic Research (Germany) and Vienna Institute of Demography (Austria). Available at www.humanfertility.org (accessed 26.10.2018).

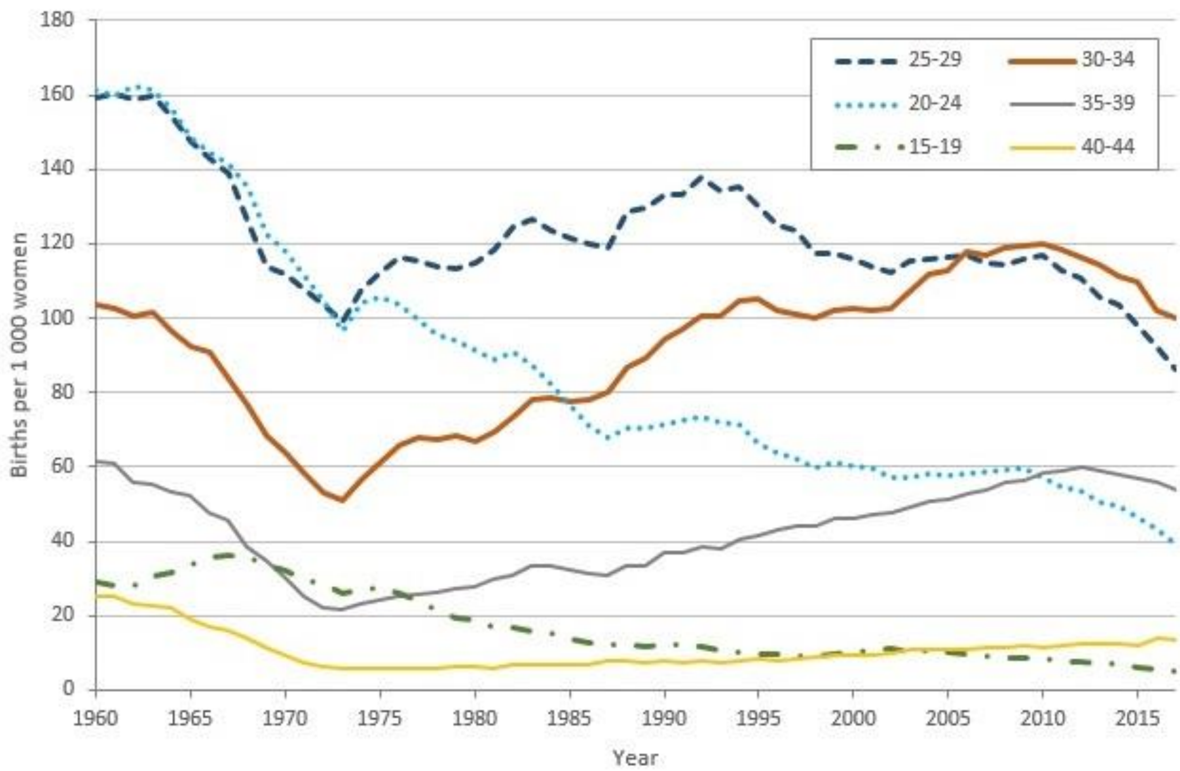

Fig. 3
Age-specific fertility rates in Finland in 1960-2017.

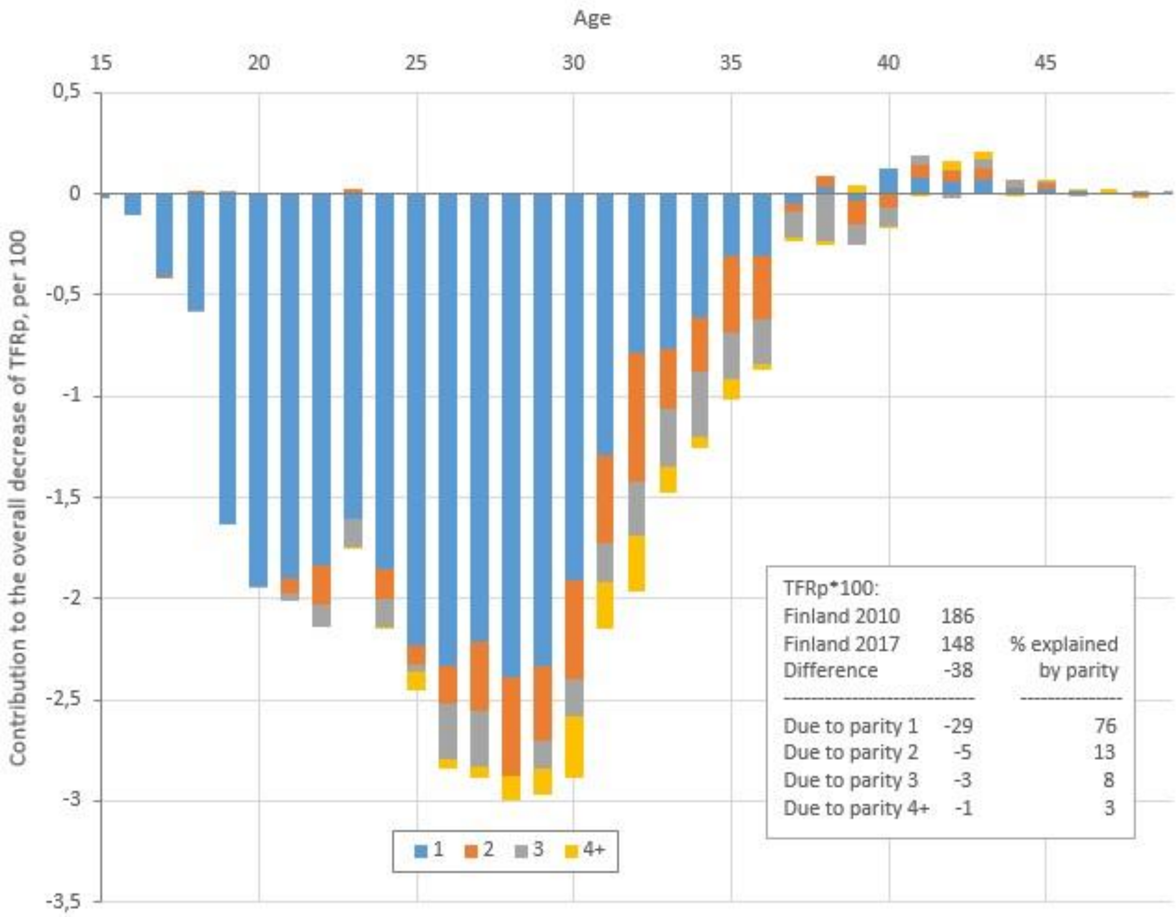

Fig. 4
Decomposition of the decrease in the age- and parity-adjusted TFR in Finland in 2010-2017 by age and parity.

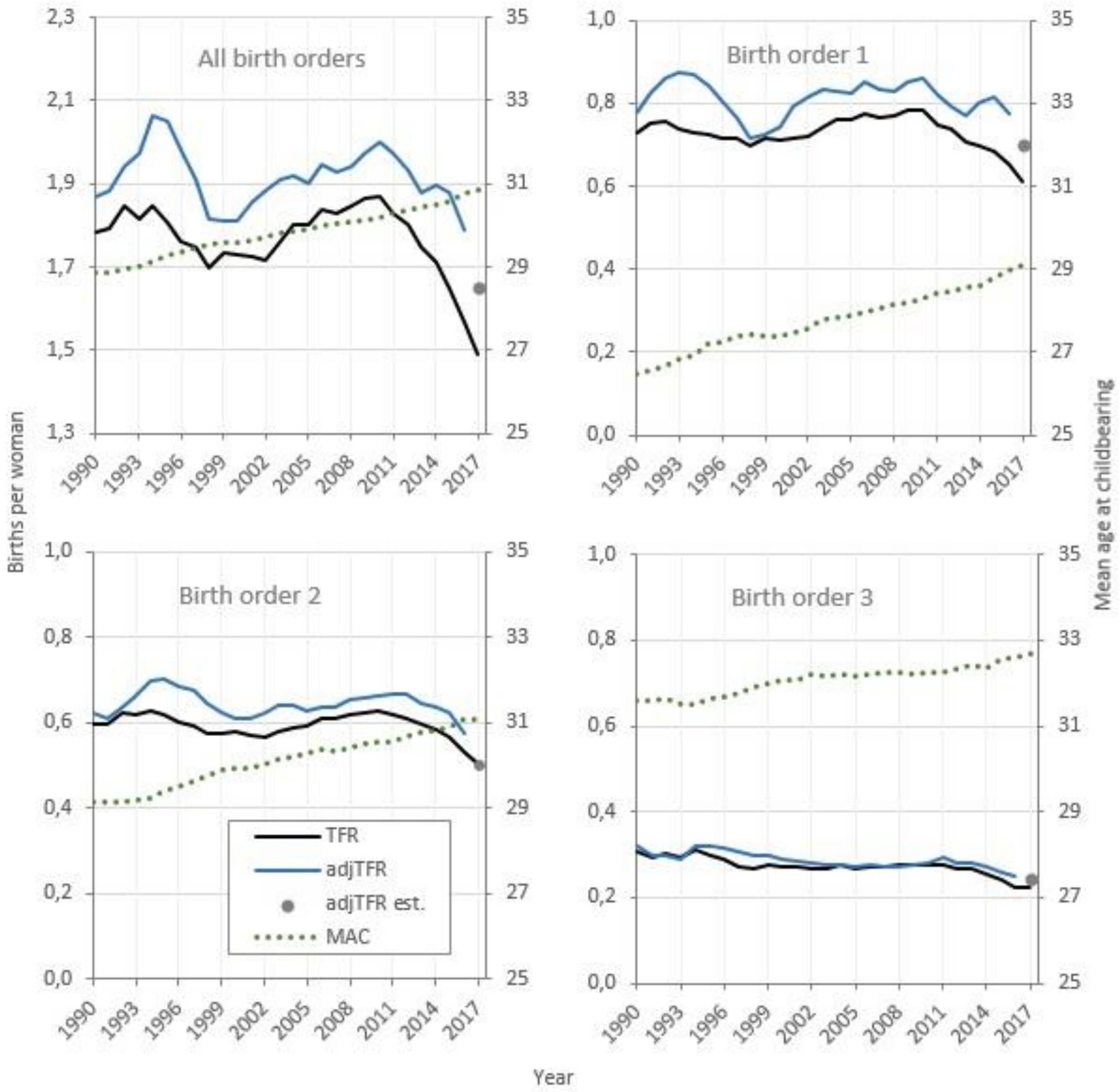

Fig. 5
Observed and tempo-adjusted TFR and mean age at childbearing by birth order, calculated by unconditional fertility rates, in 1990-2017 in Finland.

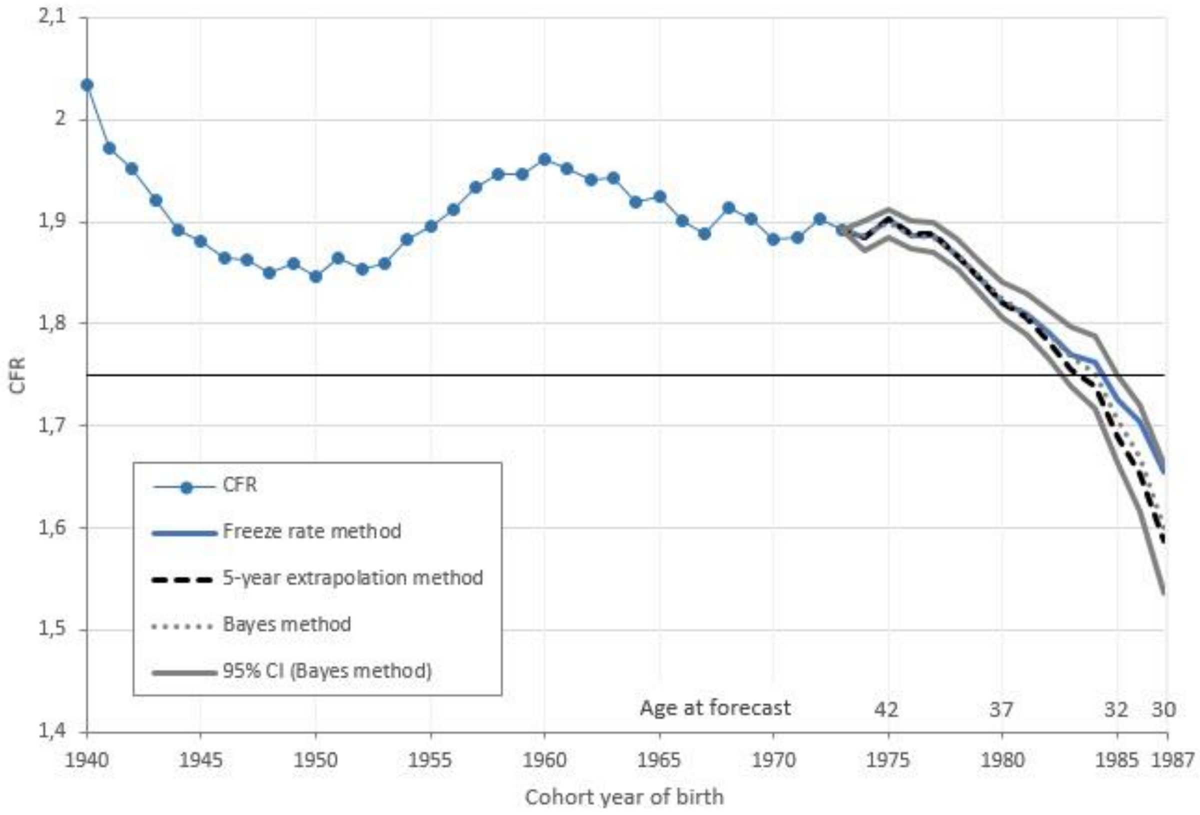

Fig. 6
The observed CFR for cohorts born in 1940-1973 and the forecasted CFR for cohorts born in 1974-1987 in Finland.

Table 1
Forecasted CFR for cohorts born in 1975, 1980, and 1985-1987; the distribution of CFRs based on fertility changes observed in HFD countries since 1975; and the likelihood of staying at 1.75 or higher based on past observed changes.

	Cohorts				
Year of birth	1975	1980	1985	1986	1987
Age at forecast	42	37	32	31	30
Forecasted CFR					
Freeze rate	1.90	1.82	1.73	1.70	1.65
5-year extrapolation	1.90	1.82	1.70	1.65	1.59
Bayesian model	1.90	1.82	1.71	1.67	1.60
Forecasted CFR based on empirical distribution of fertility changes					
99.5th percentile (99% CI)	1.91	1.85	1.85	1.86	1.85
97.5th percentile (95% CI)	1.90	1.84	1.83	1.84	1.81
90th percentile (80% CI)	1.90	1.84	1.80	1.80	1.78
Median	1.90	1.83	1.75	1.74	1.70
10th percentile (80% CI)	1.90	1.81	1.69	1.66	1.60
2.5th percentile (95% CI)	1.90	1.80	1.64	1.60	1.53
0.5th percentile (99% CI)	1.90	1.78	1.56	1.50	1.41
Likelihood of staying at 1.75 (%)					
Based on all HFD countries	-	-	53	43	16
Based on the Nordic countries	-	-	75	62	32

Note: The estimates in the last row of the table are based exclusively on the Nordic countries (Denmark, Finland, Iceland, Norway, and Sweden).

Online Appendices (Electronic Supplementary Material)

Appendix 1: Tempo-adjusted TFR

The tempo-adjusted total fertility rate ($adjTFR$) by Bongaarts and Feeney (1998) is the sum of order-specific adjusted fertility rates

$$adjTFR_i(t) = \frac{TFR_i(t)}{1 - r_i(\mathrm{t})}$$

which adjust for the order-specific changes in the mean age of childbearing. The adjustment factor $r_i(t)$ is estimated by

$$r_i(t) = \frac{MAC_i(t+1) - MAC_i(t-1)}{2}$$

where $MAC_i(t)$ is the mean age of childbearing by birth order i at year t. We consider the birth orders 1,2,3,4, and 5+. Due to the large annual fluctuations in the adjusted rates, a smoothed version of the $adjTFR$ is calculated using a three-year moving average of the adjustment factors by each birth order to increase stability in the time-series.

Since the last year's observation is lost in the Bongaarts-Feeney adjustment, a crude estimate is calculated to replace the lost value. We use the adjustment factor

$$r_i(t)' = MAC_i(t) - MAC_i(t-1)$$

for the last year's observation, following Goldstein, Sobotka, and Jasilioniene (2009); but emphasize that the crude estimate should be read with caution. The crude estimate assumes that the development in the mean age of childbearing will follow roughly the same trend this year as the trend that was observed in the previous year – which is, however, not necessarily true.

Appendix 2: Bayesian forecasting of cohort fertility

The Bayesian forecasting method (Schmertmann et al. 2014) automatically includes uncertainty estimates, and no explicit choice between the freeze rate approach and the time trend extrapolating approach needs to be made in the Bayesian framework. It also uses two separate nonoverlapping subsets formed from the HFD: contemporary data and historical data. The contemporary data consist of 10 complete cohort schedules for Finnish cohorts born in 1964-1973 and 30 incomplete schedules for Finnish cohorts born in 1974-2003, and its surface is to be forecasted. Historical data (Table 2) consist of S = 648 complete cohort schedules for cohorts born in high-income countries between 1900 and 1960, and is used as a priori information about typical shapes of the cohort fertility schedules and time-series trends in fertility rates across countries.

The prior distribution for typical fertility rates is constructed based on three basic categories of a prior information: cohort schedule shapes, time-series freeze rates, and time-series freeze slopes. The cohort category of prior information tells us what typical shapes of cohort schedules are and the time-series categories of prior information tell how smooth a time-series is likely to be at a given age based on historical data. These categories of a prior information are then combined to determine likely or unlikely fertility surfaces. The general features of past rate surfaces are assumed to persist into the future. Historically unlikely fertility surfaces that have age patterns in cohort fertility schedules that differ from patterns in historical data, and that have patterns in time-series of age-specific rates that differ from the corresponding series in historical data, have high penalties, and are thus assigned lower prior probabilities.

The Bayesian model could be applied using either the prior shape and the time-series, or the prior time-series only. If the cohort fertility schedule of interest is not well represented in the historical data, a model with prior time-series only may be preferable. Our results are based on the prior shape and the time-series, but a prior distribution with time-series only penalties did not substantially change the results.

Table 2 (Appendix)
The historical dataset used to build the prior information in the Bayesian forecasting model.

Country	*n*	Birth cohorts
Austria	25	1936-1960
Bulgaria	29	1932-1960
Canada	55	1906-1960
Czechia	26	1935-1960
Estonia	17	1944-1960
Finland	37	1924-1960
France	30	1931-1960
Germany	20	1941-1960
Western Germany	20	1941-1960
Eastern Germany	20	1941-1960
Hungary	26	1935-1960
Lithuania	17	1944-1960
Netherlands	26	1935-1960
Portugal	36	1925-1960
Russia	17	1944-1960
Slovakia	26	1935-1960
Sweden	61	1900-1960
Switzerland	44	1917-1960
Great Britain	2	1959-1960
England & Wales	38	1923-1960
Scotland	31	1930-1960
Northern Ireland	2	1959-1960
USA	43	1918-1960

Appendix 3: Age-specific fertility developments by birth order, statistical grouping of municipalities and level of education

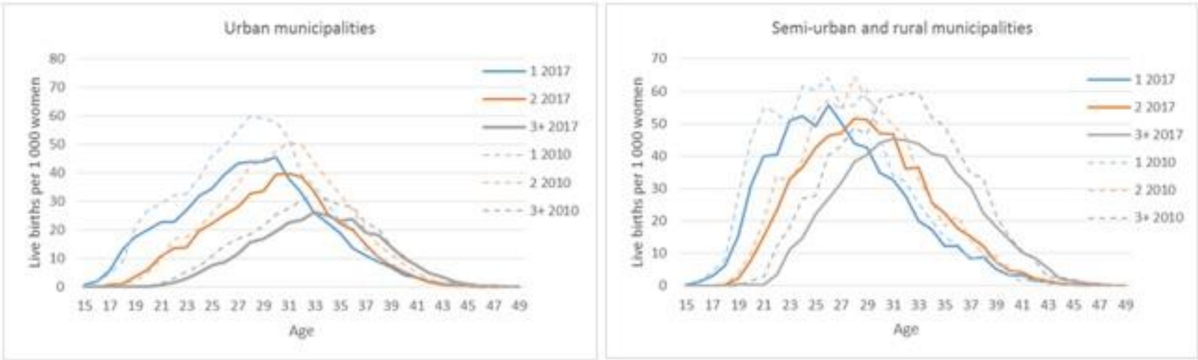

Fig. 7 (Appendix)
Age-specific fertility rates by birth order and statistical grouping of municipalities in 2010 and 2017 in Finland. *Source:* Statistics Finland 2018. Note: The statistical grouping of municipalities is based on a municipality's degree of urbanization and divides the municipalities by the proportion of the population living in urban settlements, and by the population of the largest urban settlement. Urban municipalities include municipalities with at least 90 percent of the population living in urban settlements, or municipalities where the population of the largest urban settlement is at least 15,000. An urban settlement is a cluster of dwellings with at least 200 inhabitants.

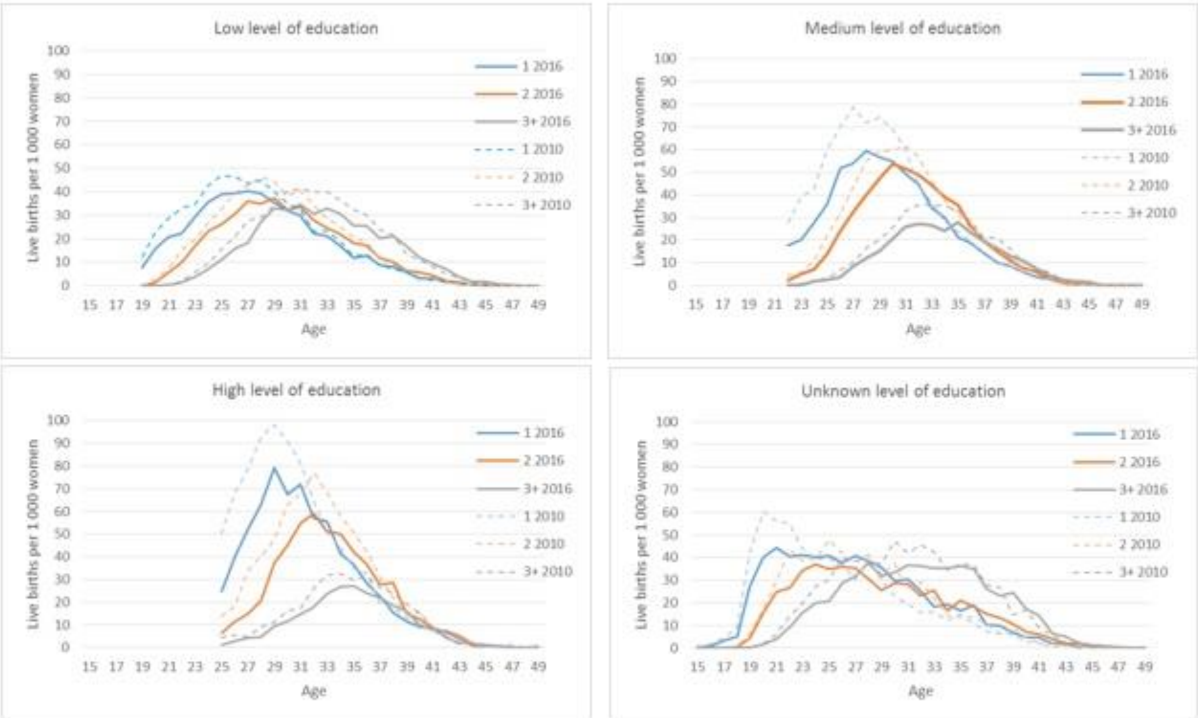

Fig. 8 (Appendix)
Age-specific fertility rates by birth order and level of education in 2010 and in 2016 in Finland.
Source: Statistics Finland 2018. Note: Low level includes upper secondary and post-secondary non-tertiary education (ISCED 3-4). Medium level includes short-cycle tertiary education and bachelor's or an equivalent level (ISCED 5-6). High level includes master's or doctoral or an equivalent level (ISCED 7-8). Unknown level includes levels lower than upper secondary education or an educational level not classified elsewhere (ISCED 0-2 or 9).