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Not Just Later, but Fewer: Novel Trends in Cohort Fertility in the Nordic Countries

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ABSTRACT With historically similar patterns of high and stable cohort fertility and high levels of gender equality, the Nordic countries of Sweden, Finland, Norway, Denmark, and Iceland are seen as forerunners in demographic behavior. Furthermore, Nordic fertility trends have strongly influenced fertility theories. However, the period fertility decline that started around 2010 in many countries with relatively high fertility is particularly pronounced in the Nordic countries, raising the question of whether Nordic cohort fertility will also decline and deviate from its historically stable pattern. Using harmonized data across the Nordic countries, we comprehensively describe this period decline and analyze the extent to which it is attributable to tempo or quantum effects. Two key results stand out. First, the decline is mostly attributable to first births but can be observed across all ages from 15 to the mid-30s. This is a reversal from the previous trend in which fertility rates in the early 30s increased relatively steadily in those countries in the period 1980–2010. Second, tempo explains only part of the decline. Forecasts indicate that the average Nordic cohort fertility will decline from 2 children for the 1970 cohort to around 1.8 children for the late 1980s cohorts. Finland diverges from the other countries in terms of its lower expected cohort fertility (below 1.6), and Denmark and Sweden diverge from Finland, Iceland, and Norway in terms of their slower cohort fertility decline. These findings suggest that the conceptualization of the Nordic model of high and stable fertility may need to be revised.

KEYWORDS Nordic fertility regime • Period fertility • Cohort fertility • Fertility timing • Forecasting

Introduction

Compared with other high-income countries, the Nordic countries of Iceland, Norway, Sweden, Denmark, and Finland combine relatively high fertility levels with high female labor market participation rates. The Nordic countries' relatively high fertility regime is often attributed to public policies that lower the opportunity costs of family formation and promote work-family reconciliation and gender equality (Andersson 2004; Andersson et al. 2009; Neyer et al. 2006). The Nordic countries are often seen

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as forerunners in fertility behavior. Several recent fertility theories are based on the empirical associations between gender equality and fertility observed in Nordic countries (Duvander et al. 2019). For example, at later phases in the demographic transition, improvements in gender equality may prevent fertility from falling to very low levels (Esping-Andersen 2009; McDonald 2000, 2013). Furthermore, some theories have postulated specifically that increases in fertility are conditional on men becoming more involved in family life to ease the double burden of balancing work and family that women tend to carry (Anderson and Kohler 2015; Esping-Andersen and Billari 2015; Goldscheider et al. 2015). Thus, understanding fertility in the Nordic countries can contribute to an understanding of fertility trends in countries beyond the region.

However, the Nordic countries have experienced a sustained decline in their period fertility rates since 2010 (Comolli et al. 2020; Hellstrand et al. 2020). Although the decrease in period fertility was also observed in other countries tending to have relatively high fertility (e.g., France, Ireland, the United Kingdom, and the United States), trends in Nordic countries stand out (Human Fertility Database 2019). In 2018, the total fertility rate (TFR) reached 1.41 in Finland and 1.56 in Norway: these are the lowest levels across the Nordic countries and are lower than the 2017 European average TFR of 1.58 (Figure 1). The economic crisis of 2008 has been considered a potential candidate for the recent fertility decline, but evidence suggests that fertility levels have not been declining coherently with the severity or duration of the economic crisis (Comolli et al. 2020), which makes the Nordic fertility decline especially puzzling. The declines in period fertility suggest that the common high Nordic fertility regime may be changing. More broadly, these trends challenge the idea that high gender equality hinders fertility declines.

Whether the strong decline in period fertility in the Nordic countries will affect the total number of children that women currently of childbearing age will ultimately have is not yet known. Period-based measures are sensitive to the timing of childbearing (Bongaarts and Feeney 1998) and tend to underestimate the completed fertility of cohorts when women postpone childbearing (Myrskylä et al. 2013). Most of the previously observed variation in period fertility in the Nordic countries has been attributed to tempo effects, given that the completed cohort fertility level has been nearly constant and close to replacement level for cohorts born since the 1940s (Andersson et al. 2009; Jalovaara et al. 2019). A key example of a tempo effect is the so-called roller-coaster fertility that Sweden experienced in the 1990s (Hoem 2005), when the TFR fell from its peak level of 2.14 in 1990 to an all-time low of 1.51 in 1999. This short-term trend had no implications for cohort fertility.

Further, existing cohort fertility forecasts for the Nordic and other high-income countries are becoming outdated; they do not cover the last decade (Myrskylä et al. 2013; Schmertmann et al. 2014). These forecasts were produced in a period when age 30+ fertility was increasing and younger age fertility was stable or decreasing only slightly, which produced stable or even increasing cohort fertility up to the late 1970s cohort. For Finland, the findings of Hellstrand et al. (2020) suggest that the decline in period fertility will be reflected in cohort fertility: the completed fertility of women born in the late 1980s could fall below 1.7. A comparable analysis—or an analysis that attempts to distinguish the tempo from the quantum contributions to the recent decline in fertility—has not yet been conducted for the other Nordic countries. Therefore, it remains unknown whether the recent decline in period fertility across

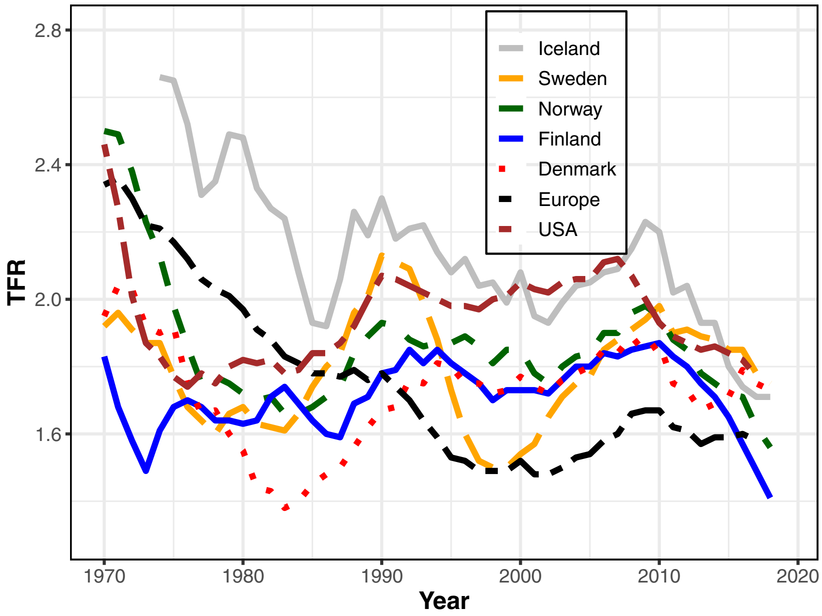

Fig. 1 Total fertility rate (TFR) in the Nordic countries and average TFR among European countries in 1970–2018. European countries include Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, and the United Kingdom. Sources: Eurostat (2019), Nordic Statistical Bureaus (2020), and the Human Fertility Database (2020).

the Nordic countries merely reflects fertility postponement, or whether the cohort fertility levels in these countries are undergoing long-term changes.

A cohort fertility decline in the Nordic countries would indicate that the concept of a common Nordic regime characterized by high and stable cohort fertility, which is based on current fertility levels, may need to be revisited. Furthermore, although Nordic countries are often considered prime examples of countries with macro-level associations between high gender equality levels and fertility increases (Myrskylä et al. 2011; Myrskylä et al. 2012), the finding that cohort fertility is decreasing in these countries would contest this assumption. Micro-level findings for the Nordic countries have already pointed out that the relationship between gender equality and fertility is ambiguous. The availability of long parental leave schemes may hinder developments in gender equality by discouraging mothers' employment (Rønsen and Sundström 2002): higher fertility is concentrated among mothers who make extensive use of long family leaves (Duvander et al. 2010; Erlandsson 2017).

In this study, we analyze recent fertility trends in the five Nordic countries using the latest available data. Using demographic decompositions, tempo adjustments, and innovative cohort forecasting methods, we document the contributions of age and parity to the decline in TFR in 2010–2018, estimate the magnitude of the decrease in period fertility without tempo distortions, and forecast completed fertility for women aged 30 and older. Our main objective is to investigate whether the period fertility decline that started in 2010 in the Nordic countries reflects a decline in fertility quantum and, if so, how the magnitude of this decline differs across these countries. The key strengths of our study are the comparison of five countries simultaneously undergoing a fertility transition; the use of harmonized, high-quality, up-to-date data for each country; and the application of several methods that independently examine the recent period fertility decline from different angles and under different assumptions.

The Common Nordic Fertility Regime

The Nordic countries' childbearing trends and family policies share many characteristics and have historically conformed to the established idea of a common Nordic fertility regime (Andersson et al. 2009)—that is, relatively high and stable cohort fertility underpinned by high levels of support for working mothers. Finland can be seen as a slight outlier, where ultimate childlessness has historically been considerably more common than in the other Nordic countries (Hellstrand et al. 2020; Kreyenfeld and Konietzka 2017). Iceland has also historically displayed a distinct pattern, with higher fertility. However, it is generally agreed that Nordic countries provide a favorable setting for combining work and family life, which has resulted in high labor force participation rates for women and high rates of enrollment in childcare. Thus, these countries are often considered vanguards of family demographic developments in the Western world.

Although most high-income countries have experienced a decline in cohort fertility starting with the 1940s birth cohorts, cohort fertility stabilized in the Nordic countries at around replacement level among the cohorts born in the 1940s or later (Frejka 2017; Zeman et al. 2018). Consequently, the long-term implications of very low fertility that many European countries have been facing (Morgan 2003) have not previously been pressing policy concerns in the Nordic region. A weak downward trend started with the 1960s cohorts because of decreasing progression to third and higher-order births rather than increasing childlessness (Zeman et al. 2018). Cohort fertility for women born in the early 1970s is 1.9 in Finland, 2.0 in Denmark and Sweden, 2.1 in Norway, and 2.3 in Iceland (Human Fertility Database 2019). Few high-income countries, including the United States and Northern Ireland, also have cohort fertility above replacement level. In contrast, cohort fertility has dropped below the 1.5 level in some Southern European and East Asian countries for the cohorts born in the 1970s (Frejka 2017).

Regarding parity distributions in the Nordic countries, a strong uniformity is characteristic of the first and second births, whereas differences in childlessness and third and fourth births indicate some cross-country diversity also in the Nordic model. Childlessness levels are generally around the European average (Sobotka 2017a), and the two-child norm is strong in these countries (Duvander et al. 2019; Frejka 2008). In all Nordic countries, ultimate childlessness rose slightly starting with the 1950s cohorts but plateaued for the 1960s–1970s cohorts at a level ranging from 12% in Norway to 15% in Sweden (Andersson et al. 2009; Jalovaara et al. 2019). In Finland, ultimate childlessness is above 20% for the cohorts born in the early 1970s, which is among the highest shares globally (Kreyenfeld and Konietzka 2017). However, Finland makes up for its high proportion childless through the large proportion of its population with multiple children. For example, about 10% of all recent births in Finland were of fourth or higher birth order, which is the highest share across all EU member states and twice as high as the share in other Nordic countries (Eurostat 2019a). Consequently, the share of women with two children is lower in Finland (about 36% in the mid-1970s cohort) than in the other Nordic countries (around 42% to 45% in Denmark, Norway, and Sweden) (Human Fertility Database 2019). Iceland also stands out with a high proportion of third births: the share of recent births of third birth order is close to 20%, compared with around 15% in other Nordic countries (Eurostat 2019a). Compared with other high-income countries, the Nordic region ranks highest in the progression from first to second births; in third and higher birth progression, Nordic countries place only slightly below the top-ranking levels observed in the United States, New Zealand, and Australia (Zeman et al. 2018).

In high-income countries, fertility postponement has been one of the main demographic trends in recent decades (Mills et al. 2011; Nathan and Pardo 2019; Sobotka 2017b). One of the most striking demographic developments in the Nordic countries has been the strong fertility recuperation at older ages, which has counterbalanced postponement (Andersson et al. 2009; Lesthaeghe 2010). Whereas the widespread postponement of fertility observed in most high-income countries has been linked to rising educational enrollment and career building (Ní Bhrolcháin and Beaujouan 2012), fertility recuperation has been characterized as a consequence of welfare provisions that support dual-earner families with young children (Kravdal and Rindfuss 2008; Lesthaeghe 2010). Indeed, the Nordic countries are known to have the highest levels of gender equality in the world and to promote work-family reconciliation among couples by offering some of the world's most progressive family policies (Neyer et al. 2006; Rindfuss et al. 2016). Building on the ideas of McDonald (2000, 2013), recent theories predict a return to higher fertility after gender equality in the family catches up with gender equality in other spheres of society, such as in the educational system and the labor market (Anderson and Kohler 2015; Esping-Andersen and Billari 2015; Goldscheider et al. 2015). Macro-level findings imply that gender revolution in terms of men becoming more involved in family life has hindered strong declines in cohort fertility but has not increased it (Frejka et al. 2018).

Policy Goals and Fertility in Nordic Countries

Given the general assumption that the Nordic countries' family policies have helped to create a favorable setting for relatively high fertility (Adserà 2004; Brewster and Rindfuss 2000), we provide a brief overview of the Nordic policy goals and their implementation. Social and gender equality is an explicit policy goal of the social democratic Nordic welfare states (Esping-Andersen 1990), with high labor market participation for both men and women as an underlying precondition for maintaining the Nordic model. These countries promote a dual earner–dual caregiver model in which men and women are expected to participate equally in both paid work and childrearing (Ellingsæter and Leira 2006; Gornick and Meyers 2009). However, although Nordic countries are the most gender-equal countries globally (World Bank 2012), their policy goals of obtaining gender equality are not fully achieved in practice. High overall Nordic female employment rates are accompanied by high rates of part-time work among women and occupational segregation: women are more likely than men to work in the public sector but are less likely to hold high positions (Mandel and Semyonov 2006). The share of women's total employment that is part-time work is close to or slightly above the 2018 EU average of 31% in Norway, Denmark, Iceland, and Sweden, but it is much lower in Finland (at 19%) (Eurostat 2019b). Additionally, Nordic men perform less unpaid work than their female counterparts, even though they share domestic responsibilities more equally than men in most other countries (Hook 2006; Prince Cooke and Baxter 2010).

The Nordic family policies are in line with general policy goals designed to promote gender equality rather than to promote childbearing per se (Rønsen 2004). For instance, a nontransferable earmarked part of paid parental leave that compensates for income loss after childbirth is reserved for each parent, and access to affordable daycare for young children is guaranteed, regardless of the parents' labor market status. As an alternative to daycare, parents in Norway and Finland can choose the option to care for children at home after the paid leave ends and receive a cash-for-care compensation until the child turns age 2 in Norway and home care allowance until the child turns age 3 in Finland. The actual uptake of paid leave by fathers tends to be higher when a larger part of this leave is earmarked for the father. The only exception to this pattern is Finland, where fathers' uptake of parental leave is as low as it is in Denmark (11% in 2016), even though Denmark has not had any quota reserved for fathers since the short quota in 1997–2002 (Grødem 2014; Nordic Social Statistical Committee 2017). In Norway, Sweden, and Iceland, the uptake of parental leave by fathers varies between 20% and 30%.

Although all Nordic countries support the dual earner–dual caregiver model, some variation exists. Sweden, Iceland, and Denmark are grouped in the *one-year leave, gender equality–oriented model*, with a well-paid parental leave for most of the first year following childbirth that can be shared among parents. Norway and Finland have a *parental choice–oriented model* with very long leave periods due to the additional availability of the low-paid home care arrangements (Wall and Escobedo 2013). Further, Denmark differs from Sweden and Iceland in its lower support for caring fathers (no father's quota), and Finland stands out with relatively low childcare enrollment and uptake of parental leave by fathers (Grødem 2014). Daycare coverage for 1- to 2-year-olds has during the last decades been steadily increasing to levels currently at 70% to 90% in other Nordic countries; in Finland, the increase has been slow, and the level remains below 50% (Nordic Social Statistical Committee 2017).

The last decade has seen no major shifts or cutbacks in family policies; rather, the policy environment has been relatively stable, with generally minor and gradual adjustments, mainly concerning changes in the father's quota. In Finland, the father's quota was first introduced in 2013, one to two decades later than the other Nordic countries, and an attempt to lengthen this nine-week quota was abolished in 2018 (Eerola et al. 2019; Rostgaard 2014). In Sweden, the father's quota was increased from 8 to 12 weeks in 2016 (Duvander et al. 2019). The length of the father's quota has been expanded and reduced several times in Norway: from 10 to 12 weeks in 2011, from 12 to 14 weeks in 2013, from 14 to 10 weeks in 2014, and from 10 to 15 weeks in 2018. The aim of the reduction in 2014 was to ensure families' flexibility and freedom of choice, but it also resulted in a decreased uptake of leave by fathers (Ruud 2015). In Iceland, the income compensation for parental leave was reduced in the aftermath of the economic recession in 2009, resulting in a lower leave uptake by fathers (Duvander et al. 2019; Sigurdardottir and Garðarsdóttir 2018).

The home care allowance scheme is important in Finland (Erlandsson 2017), and most mothers make some use of this payment (Haataja and Juutilainen 2014). Several attempts to shorten the payment in Finland have been unsuccessful (Heinonen and Saarikallio-Torp 2018; Salmi and Lammi-Taskula 2013). In Norway, the length of the cash-for-care payment was reduced by one year in 2012 and now covers only children younger than 2 years (Grødem 2014). The uptake of cash-for-care payment has been steadily declining in Norway, although it increased slightly due to the significant increase in the amount of payment for 1-year-olds in 2014 (Duvander and Ellingsæter 2016). In Sweden, municipalities could previously choose to pay a childcare contribution for 1- to 3-year-olds, but in 2016, this voluntary municipal scheme was removed (Nordic Social Statistical Committee 2017).

To sum up, Nordic countries have been leading internationally in implementing policies that aim to support work-family balance among parents (Thévenon 2011). Furthermore, studies have consistently highlighted the positive impact of policies supporting work-family reconciliation and fathers' participation in domestic work on fertility in high-income countries (Luci-Greulich and Thévenon 2013; Thévenon and Gauthier 2011). However, the substantial decline in period fertility that has recently occurred in the Nordic countries despite their exemplary family and social policies calls into question whether these countries can still be seen as illustrative examples of the association between gender equality and fertility. Thus, more insight into fertility decline and its underlying reasons is needed.

Data and Methods

Data

We base our analyses on a combination of aggregated data obtained directly from national statistical agencies as well as data from the Human Fertility Database (HFD), a source of high-quality fertility data based on a collaboration between the Max Planck Institute for Demographic Research and the Vienna Institute of Demography (Human Fertility Database 2019). From the HFD, we use several types of age- and birth order–specific fertility rates. First, we use incidence rates that relate births of women in a certain age group/cohort to all women in that age group/cohort, regardless of parity. Second, we use two types of conditional rates: births of (1) order i related to women of parity $i-1$, and (2) order i related to all women who have not yet reached parity i. The age of the mother was recorded as the age at (1) the time of birth for the period-based rates and (2) the end of the year for the cohort-based rates. Data for all Nordic countries for the most recent years[1] are not yet available in the HFD, but the respective national statistical agencies supplied them to us. We used these data

[1] As of August 19, 2020, all types of fertility rates (as described earlier) in 2017–2018 for Denmark and conditional rates and the female parity distribution in 2016–2018 for Norway and 2009–2018 for Iceland were missing from the HFD.

to calculate fertility rates to match the format in the HFD.[2] Thus, we have complete time series of rates from 1970 to 2018 for all countries. For Iceland, we have rates that relate births of order *i* to women of parity $i-1$ since 2009.

Methods

We describe trends in fertility rates by five-year age groups using incidence rates. We use the stepwise replacement method (Andreev and Shkolnikov 2012; Andreev et al. 2002) and conditional fertility rates (births of order *i* related to women of parity $i-1$) to decompose the difference in the TFR computed from conditional age- and parity-specific fertility rates ($TFRp$) in 2010 and 2018. Because the $TFRp$ adjusts for both the age and the parity composition of the female population, it might differ slightly from the conventional TFR. However, the $TFRp$ allows us to decompose the recent period fertility development into additive age and parity contributions.

Changes in the timing of childbearing are known to impact TFR. We apply the tempo- and parity-adjusted TFR (Bongaarts and Sobotka 2012), denoted as TFR(BS), to measure the distorting impact of changes in fertility timing on the TFR. The TFR(BS) is an improvement over the simple tempo-adjusted TFR (Bongaarts and Feeney 1998), denoted as TFR(BF), because it controls for the female parity distribution and removes the additional distorting parity composition effect that influences the conventional TFR (Bongaarts and Sobotka 2012). The TFR(BS) exhibits smaller year-to-year fluctuations and is a closer approximation of completed cohort fertility (Bongaarts and Sobotka 2012). However, whereas the TFR(BF) can be calculated using incidence rates only, the TFR(BS) requires information on the female population by parity and is calculated using conditional rates on births of order *i* related to all women who have not yet reached parity *i*. We therefore apply the TFR(BF) when we lack data on the female parity distribution, as we do for Iceland before 2009.

In addition, we apply existing parametric and model-based approaches (Myrskylä et al. 2013; Schmertmann et al. 2014) and a new nonparametric approach (Hellstrand et al. 2020) to estimate the cohort fertility rates (CFRs) for women currently aged 30 and older. For cohort fertility estimation, we use the age-specific incidence rates that relate births to women in a certain cohort to all women in that cohort. The forecasts estimate the ultimate total number of children for women still of reproductive age. Using the simple freeze rate method, which freezes the latest observed age-specific fertility rates into the future, we estimate what the cohort fertility would be if the age-specific rates do not change over the coming years. The five-year extrapolation method (Myrskylä et al. 2013) extrapolates the trend from the past five years into the future and then freezes the rates. The extrapolation of trends performs well when older age fertility develops continuously, without interruption, over a period of time. If the trends change, the freeze rate method may be preferable. Using age-specific fer-

[2] Because of rules about identifiable data for Denmark and Norway, cells with less than three observations were set to 0, and cells with three to four observations were set to 5 in the tables that were used to calculate the fertility rates. Only live births to individuals registered as living in Denmark when giving birth were included. Parities include previous out-of-country births for both expatriates and migrants, provided that these children were residing in Denmark on December 31 of any year from 1985 onward.

tility rates from the HFD countries before 1960 as prior data, the Bayesian forecasting method (Schmertmann et al. 2014) produces a probabilistic forecast that includes estimates of uncertainty and extrapolates trends in fertility rates over both time and age. The freeze rate method, the five-year extrapolation method, and the Bayesian method are among the best-performing cohort fertility forecasting methods (Bohk-Ewald et al. 2018), and all are applied in this study.

The Bayesian forecasting method has strong model-based assumptions regarding trends and age schedules. Thus, developments in age-specific fertility rates that would lead to cohort schedules with shapes not seen in historical data are considered unlikely and rated as having low probability. A nonparametric method that lacks such conservative assumptions was developed to address this problem (Hellstrand et al. 2020). This approach overcomes the drawbacks of strict modeling assumptions and the subsequent narrow confidence intervals in existing parametric methods. The nonparametric method estimates how cohort fertility will develop if the past recuperation paths observed in fertility histories are applied to women with incomplete age schedules. For a cohort with observed age-specific fertility rates up to age x, we calculate the universe of fertility changes for ages above x that have been observed in the past and then add these changes to the most recent year's fertility rates. For the fertility histories, we use data from all HFD countries since 1975. During this period, the general pattern was characterized by decreases in younger age fertility and increases in older age fertility. Consequently, the median forecast of the nonparametric approach estimates the completed cohort fertility if older age fertility starts to increase in accord with the main pattern in historical data.

However, the forecasted cohort fertility for cohorts at the higher childbearing ages of 35 and older depends very little on the choice of forecasting method. First, fertility rates at ages 35 and older contribute little to the overall cohort fertility. Second, these rates usually do not change substantially over a short period. For cohorts aged 30–35, the forecasted cohort fertility can vary greatly depending on the method used; thus, the uncertainty about the forecasted cohort fertility is larger. Fertility rates at ages 30–35 contribute strongly to completed fertility and may change substantially over short periods. By using a variety of different methods, we estimate a range of forecasts and do not rely on the assumptions of any single method. For more details of the methods, see section 1 of the online appendix.

Results

Developments in Age-Specific Fertility in 1990–2018

Over the past three decades, the trends in age-specific fertility rates have been similar across the Nordic countries. These trends are illustrated by five-year age groups shown in Figure 2. Fertility postponement is reflected in the negative trend up to age 30 and in the overall positive trend at older ages up to the year 2010. Teen births are becoming rare, but births to mothers over age 40 are increasing, although these rates are still much lower than those for women in other age groups. Most importantly, since 2010, when the period fertility decline started, all Nordic countries—albeit Denmark to a lesser extent—have seen a considerable decrease in fertility rates at

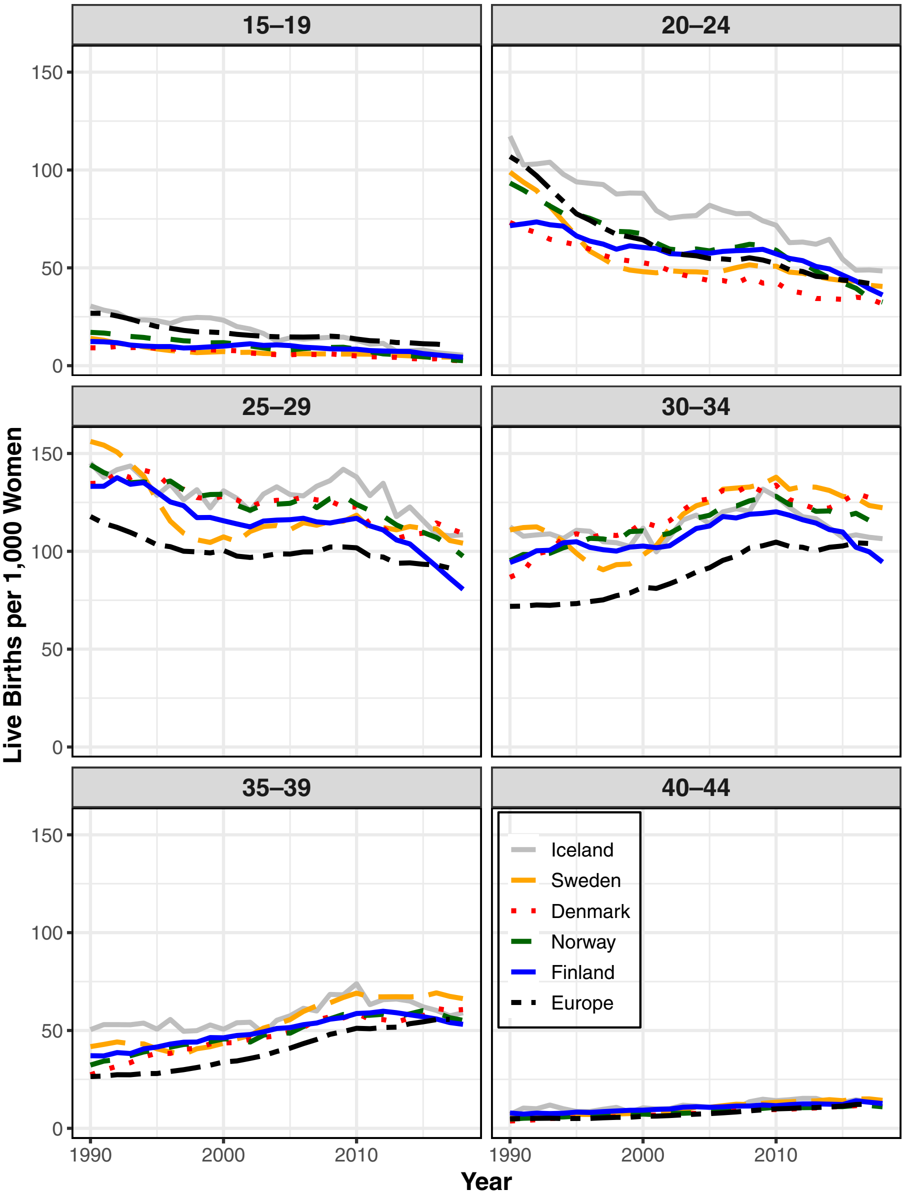

Fig. 2 Age-specific fertility rates in the Nordic countries in 1990–2018. European countries include Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, and the United Kingdom.

ages 20–39. We observe convergence in fertility rates for the age group 20–24 across the countries due to rapidly decreasing rates for this group in Finland, Iceland, and Norway. For the age group 25–29, we observe the strongest decrease in fertility rate in Finland, which stands out for having low fertility rates in the peak childbearing years of 25–34. For the age group 30–34, we observe considerable variation in the current fertility rate among countries. Overall, these findings imply that the fertility recuperation pattern typical of the Nordic countries is weakening and that the prospects for stable cohort fertility in the near future are diminishing.

Age and Parity Contributions to the Decrease in Period Fertility in 2010–2018

To analyze the changes in age-specific fertility by parity progression, we decompose the recent period fertility decline into additive age and parity contributions. The decomposition of the decrease in $TFRp$ between 2010 and 2018 by age and parity is shown in Figure 3. The decline that is being decomposed differs between the countries: from 0.42–0.47 in Finland and Iceland to 0.15–0.19 in Sweden and Denmark. The dominant pattern in all countries is the decreasing first-birth intensity, with the strongest decreases found in Finland and Norway. The contribution of declining first births to the change in $TFRp$ is largest at ages below 30. However, first-birth intensities have also decreased at ages above 30 in all Nordic countries but Iceland. Thus, we notice a new trend toward family formation postponement among Nordic women in their early 30s. Decreasing first-birth intensities explain most of the total decrease in period fertility since 2010—that is, between 57% in Iceland and 91% in Denmark.

Higher-order parities have contributed only slightly to the total fertility decline. Across all countries, the contribution of second births to the total fertility decline is less than 13%. Moreover, the contributions of parity 3 and parities 4 and higher are small in all countries except Iceland, where one-quarter of the decline is attributable to third births and an additional 10% to fourth or higher-order births. Notably, Iceland has a higher starting level for third-order births than the rest of the Nordic countries. However, decreases in higher-order births at older ages play an important role in some of the countries: at ages 30+, second and higher-order births explain nearly all the decline in Iceland and about 50% of the decline in Finland and Norway. When all parities are considered, we see small increases in older age fertility in Denmark and Iceland (at ages close to 40, second-birth intensities have increased somewhat in Denmark, and first- and second-birth intensities have increased in Iceland) but almost no increases in older age fertility in the rest of the Nordic countries. The rapid decline in fecundity after age 35 and the new trend toward postponement among women in their early 30s weakens the prospects for fertility recuperation in the coming years in the Nordic countries. For a comparison of long-term trends and current levels in age- and parity-specific trends among the countries, see Figure A1 in the online appendix.

Fertility Timing and Tempo Adjustments

Our main focus is determining whether the large changes in fertility since 2010 can be explained by timing or tempo effects. To analyze the impact of changes in fertility timing on period fertility, we use the tempo- and parity-adjustment method TFR(BS)[3]

[3] For Iceland, we use TFR(BF) until 2008.

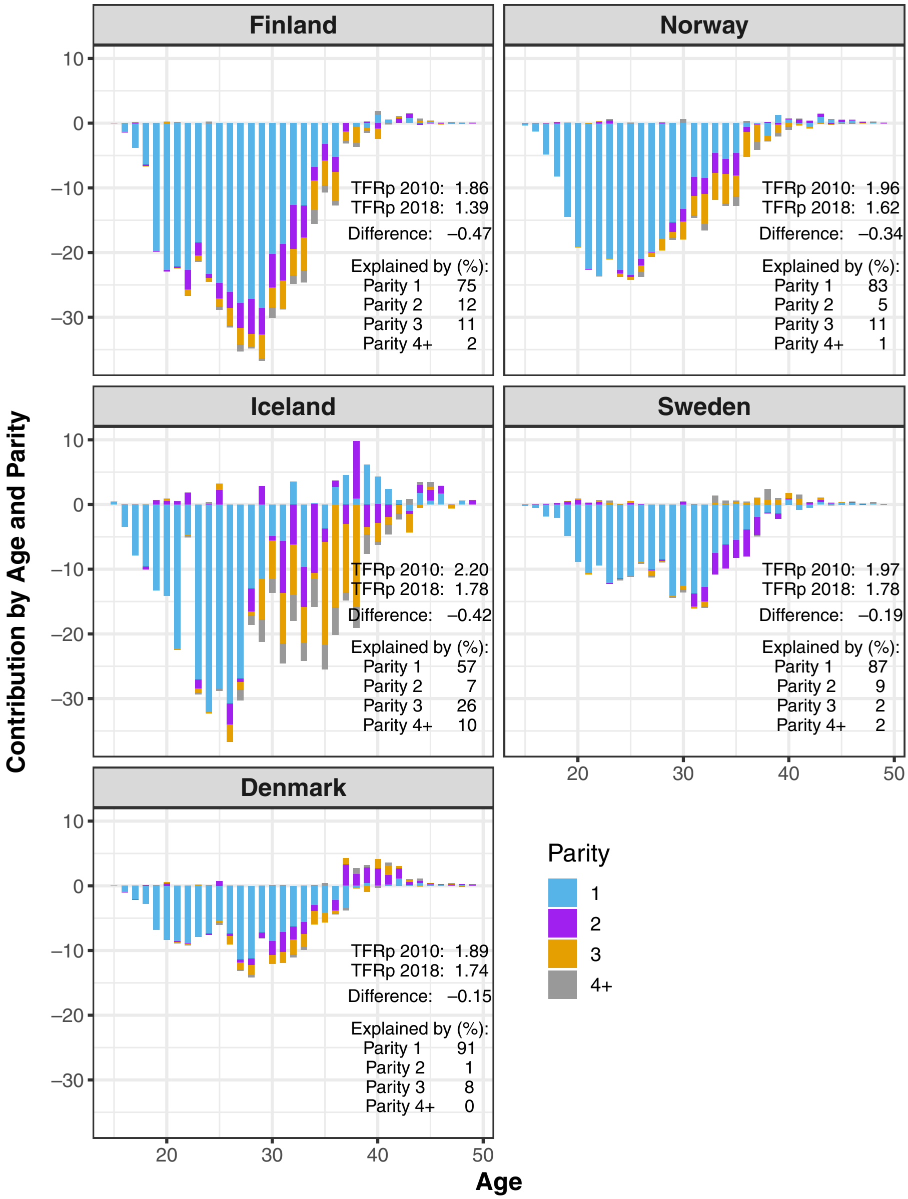

Fig. 3 Decomposition of the decrease in the age- and parity-adjusted TFR in the Nordic countries in 2010–2018 by age and parity. Sources: Authors' calculations based on Nordic Statistical Bureaus (2020) and the Human Fertility Database (2020).

(Bongaarts and Sobotka 2012). Figures 4 and 5 show the development in fertility timing, period TFR, and TFR(BS) in the Nordic countries in 1990–2018. In 2018, the mean age at first birth was around 29.5 in Denmark, Finland, Norway, and Sweden, which was slightly above the 2017 European average of 28.9; Iceland had a mean age at first birth of only 28.3. All Nordic countries experienced an increase in the mean age at first birth in recent decades, but the speed of the increase varied between countries

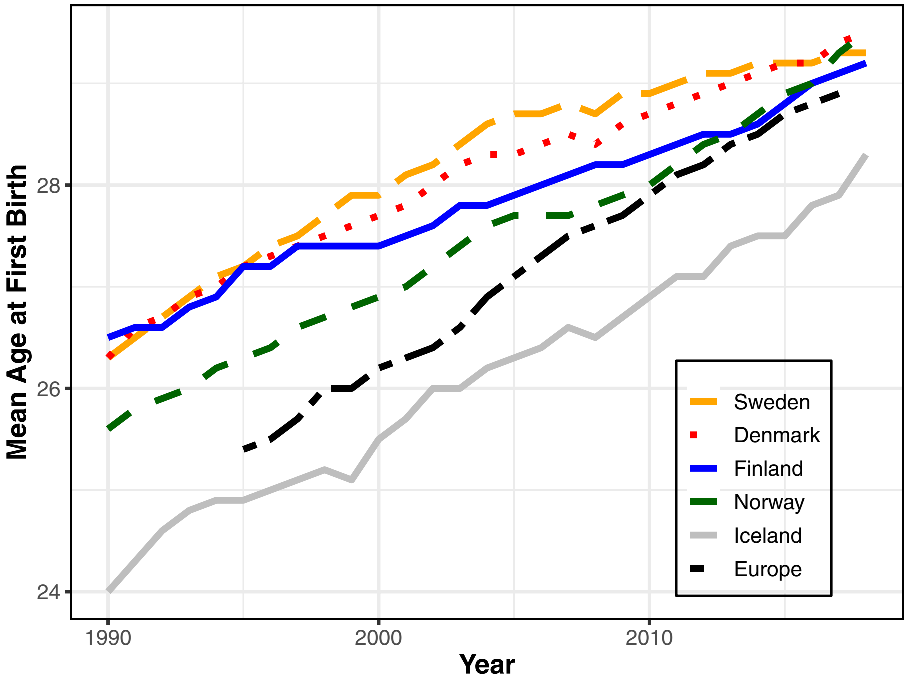

Fig. 4 Mean age at first birth in 1990–2018 in the Nordic countries and in Europe. European countries include Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Lithuania, Luxembourg, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, and the United Kingdom. Sources: Authors' calculations based on Eurostat (2019), Nordic Statistical Bureaus (2020), and the Human Fertility Database (2020).

and periods. Since 1990, Finland has experienced the slowest total increase in the age at first birth (2.8 years), and Iceland has experienced the fastest increase (4.4 years). For the period after 2010, we observe signs of accelerated fertility postponement mainly in Norway and Finland. Since 2010, the mean age at first birth has risen by 1.5 years in Norway but by less than 0.5 years in Sweden. Although the development in fertility timing in Finland and Norway has been lagging behind that in Sweden and Denmark, the country differences in the age at first birth have recently decreased substantially.

In the Nordic countries, the TFR(BS) has been consistently more stable and at higher levels than the conventional TFR; the TFR(BS) has been at around 2 in all countries, except Iceland, where it has been even higher. The TFR(BS) has, however, decreased since 2010, particularly in Finland, Iceland, and Norway. These findings suggest that the quantum of fertility is decreasing as well and that the accelerated fertility postponement alone cannot explain the period decline. TFR and tempo- and parity-adjusted rates by birth order are shown in Figure A2 in the online appendix.

Cohort Fertility

To highlight the patterns in both timing and quantum among women still of child-bearing age in the Nordic countries, we show the observed cohort age-specific fer-

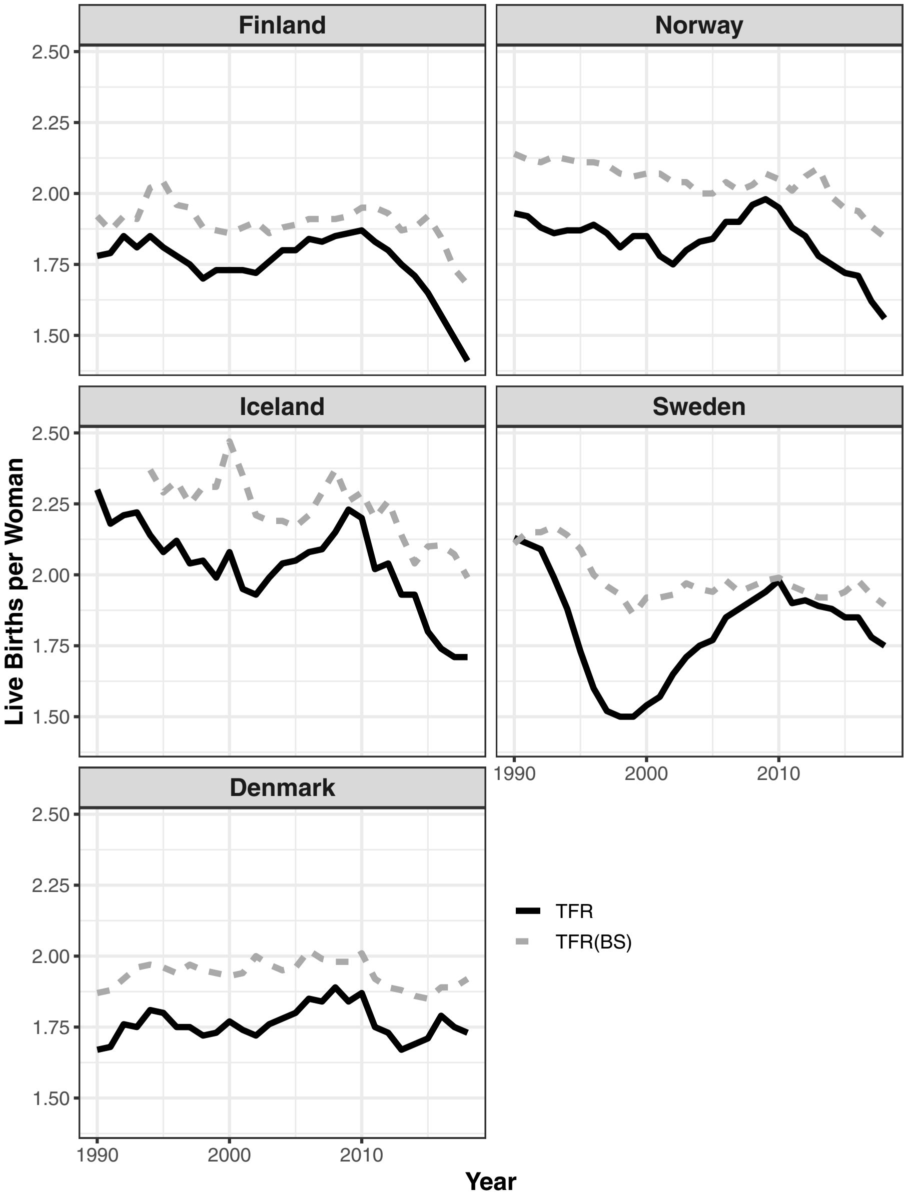

Fig. 5 Observed TFR and tempo- and parity-adjusted TFR, TFR(BS), in 1990–2018 in the Nordic countries. For Iceland, we use the tempo-adjusted TFR, TFR(BF), for the years up to 2008. Sources: Authors' calculations based on Nordic Statistical Bureaus (2020) and the Human Fertility Database (2020).

tility rates in Figure 6 and the cumulated cohort fertility rates and the proportion of women childless for selected cohorts in Table 1. The tendency of the age schedules to shift to the right along the *x*-axis—which is observed in all countries but less so in Sweden—reflects the general pattern of fertility postponement. The reduced peak in the fertility schedules in nearly all countries reflects the decrease in fertility at around

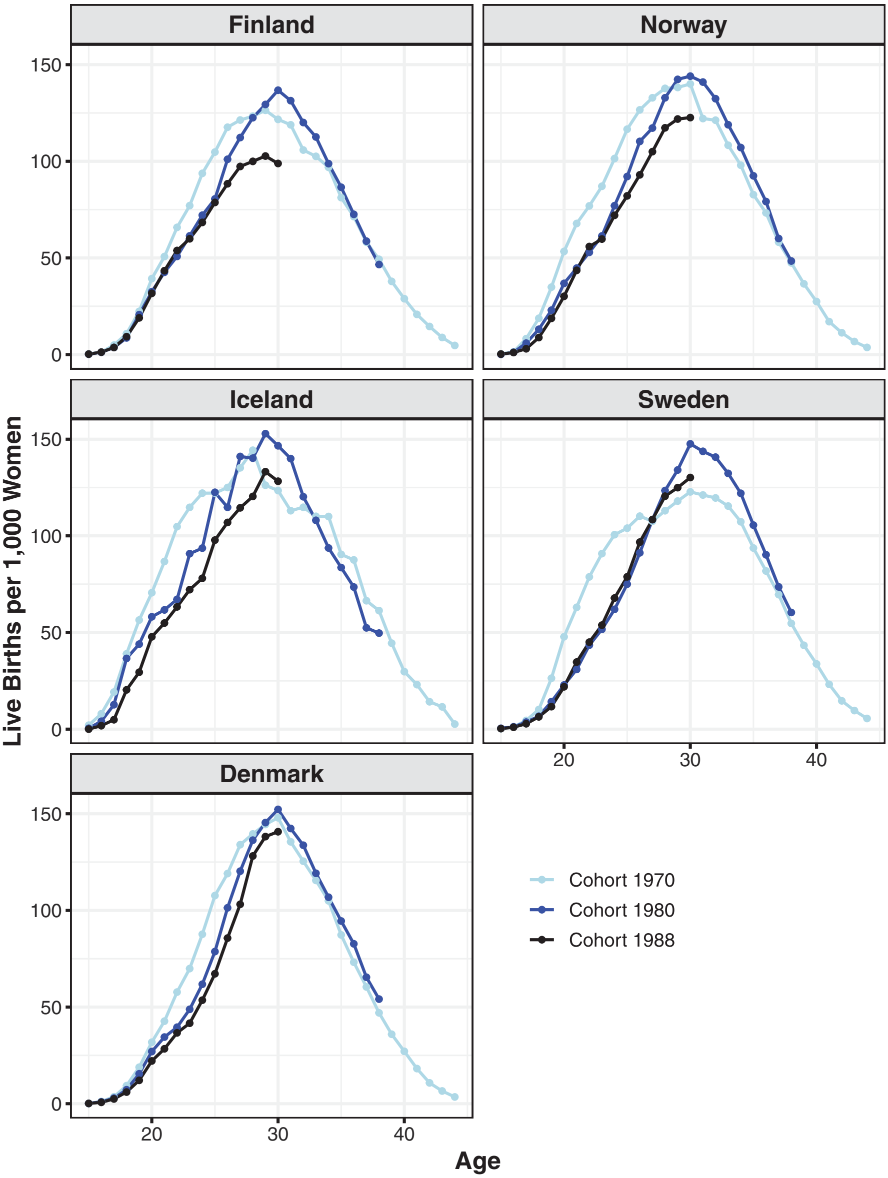

Fig. 6 Age-specific fertility rates by cohort and country. Sources: Authors' calculations based on Nordic Statistical Bureaus (2020) and the Human Fertility Database (2020).

age 30 in recent years. In line with the pronounced decreases documented earlier for Finland, the peak in fertility rates for the 1988 cohort at 100 live births per 1,000 women is much lower in Finland than it is in the other Nordic countries, where the peak level is between 120 and 140 live births per 1,000 women. These results suggest that catching up on all postponed births at older ages would lead to very odd shapes in completed age schedules for the youngest Finnish cohorts. Although deviations

Table 1 Cumulated fertility rates and the proportion childless by cohort (age reached in 2018) and country

Cohort (age in 2018)	Finland	Iceland	Norway	Sweden	Denmark
A. Cumulated Cohort Fertility Rate					
1970 (48)	1.88	2.28	2.06	1.99	1.97
1975 (43)	1.90	2.20	2.01	1.94	1.95
1980 (38)	1.70	2.01	1.83	1.79	1.77
1985 (33)	1.25	1.51	1.37	1.31	1.27
1986 (32)	1.13	1.35	1.24	1.19	1.15
1987 (31)	0.98	1.18	1.08	1.04	1.02
1988 (30)	0.86	1.07	0.94	0.90	0.87
B. Proportion Childless (%)					
1970 (48)	19.9	12.5	13.4	14.0	16.9
1975 (43)	19.6	13.9	14.1	14.2	17.1
1980 (38)	23.5	16.3	17.7	18.0	20.8
1985 (33)	36.8	27.4	29.9	31.5	33.2
1986 (32)	41.3	34.1	34.1	35.9	37.0
1987 (31)	46.5	38.1	40.1	41.4	41.6
1988 (30)	52.2	41.9	46.5	47.6	48.2

from the bell-shaped curve exist (e.g., the bimodal fertility schedule in the United States), such exceptions are often attributed to two populations mixing rather than to a population-level pattern of strong postponement and recuperation (Sullivan 2005).

The country patterns of the cumulated cohort fertility rates and the childlessness levels for the cohorts still of childbearing age are the same as those observed for cohorts who have completed childbearing (Table 1). Finland has the lowest cumulated fertility and the highest level of childlessness, and Iceland has the highest cumulated fertility and the lowest level of childlessness at all ages above 30. The 1988 cohort who reached age 30 in 2018 has had, on average, 0.86 children in Finland and 1.07 children in Iceland. Of this cohort, more than 52% were still childless at age 30 in Finland, compared with just 42% in Iceland.

What the Future Holds: A Forecast of Cohort Fertility

Figure 7 displays the cohort fertility forecasts for Nordic women born in 1975–1988.[4] All forecasting methods produce consistent results in terms of the direction of the forecast, although the point estimates and the width of the confidence intervals vary to some extent. Our interpretation of the results does not put special emphasis on any single method, instead summarizing what the results generated by these methods jointly suggest about the future of cohort fertility.

Regardless of which method is applied, the findings indicate that cohort fertility will slowly decrease or stabilize in Denmark and Sweden but will decline sharply in Finland, Iceland, and Norway. Finland is expected to continue to have the lowest cohort fertility among the Nordic countries, reaching levels substantially below

[4] Exact values are available in Table A1 in the online appendix.

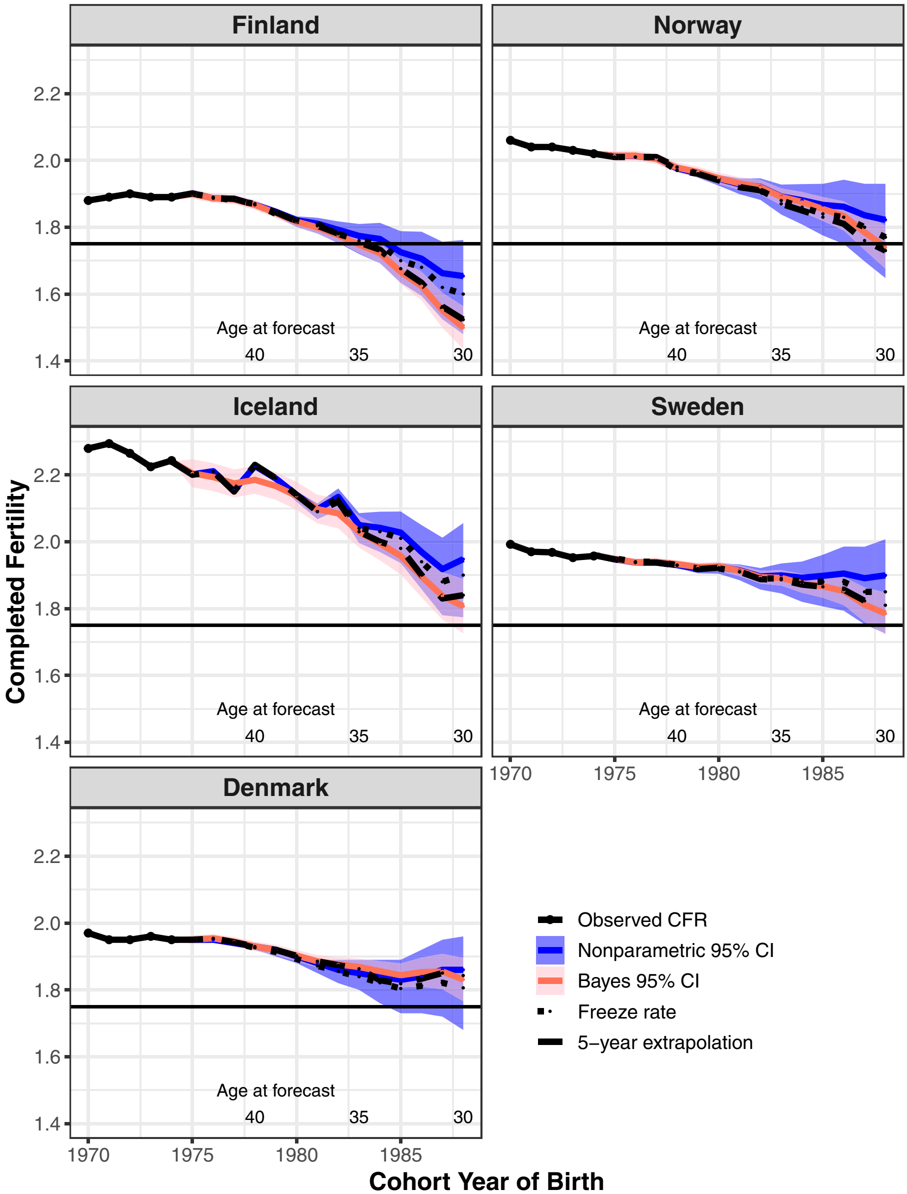

Fig. 7 Observed completed cohort fertility rate (CFR) for the 1970–1974 cohorts and forecasted CFR for the 1975–1988 cohorts in the Nordic countries. The unbroken black line indicates the threshold for very low fertility, at 1.75. CI=confidence interval. Sources: Authors' calculations based on Nordic Statistical Bureaus (2020) and the Human Fertility Database (2020).

1.75, which marks the threshold between low and very low cohort fertility (Zeman et al. 2018). We observe the weakest declines in cohort fertility when applying the nonparametric approach, which does not assume any stability or continuity in trends but allows for the possibility that sharp recoveries could occur. However, even with this method, we observe declines in cohort fertility for three of the five countries, and the 95% confidence interval for the youngest cohort includes completed fertility at levels of 1.48–1.76 in Finland, 1.65–1.93 in Norway, 1.77–2.06 in Iceland, 1.73-2.01 in Sweden, and 1.68–1.96 in Denmark.

At the other end of the methods spectrum are the five-year extrapolation and Bayesian approaches that rely on extrapolation of trends. These methods produce lower estimates of cohort fertility than the nonparametric approach because recent trends have been negative. The Bayesian approach, which is accompanied by prediction intervals, also produces narrower intervals than the nonparametric approach because of its added assumptions regarding smoothness. However, the overall qualitative conclusions regarding the trends, when derived using extrapolation approaches rather than the nonparametric approach, are very similar: overall cohort fertility will decline, although not necessarily in Denmark and Sweden.

The freeze rate approach assumes that the current period fertility will persist. This method produces forecasts that lie between those generated by the nonparametric approach and the extrapolation methods. For the youngest cohort, the freeze rate method yields completed fertility estimates of 1.60 in Finland, 1.77 in Norway, 1.81 in Denmark, 1.85 in Sweden, and 1.90 in Iceland. Although the freeze rate method has been criticized for underestimating completed fertility when fertility is postponed, the estimates it produces may be more reasonable in the current circumstances, in which the long-term increasing trend in older age fertility appears to be changing, and we do not yet know whether this trend change in fertility at older ages is temporary. According to the freeze rate method, the Nordic average completed fertility will decrease from 2.0 to an all-time low of 1.8.

When we compare the projected completed fertility trends (using the freeze rate approach) with the decline in TFR in 2010–2018 for the cohorts who were aged 30 in 2010–2018—namely, women born in 1980–1988—we see that the magnitude of the cohort fertility decline is about one-half as strong as the observed TFR decline. The magnitude of the TFR(BS) decline in 2010–2018 is similar to that of projected completed fertility trends, although the TFR(BS) level is generally higher.

Discussion

This study analyzed recent fertility dynamics in the Nordic countries. Our study was the first to analyze the most recent trends by age and parity and to forecast cohort fertility for the Nordic countries using up-to-date data from the Human Fertility Database and Nordic statistical agencies. Using a variety of methods and approaches, we found strong indications that the recent decline in period fertility in the Nordic countries is not fully attributable to timing effects—that is, to the postponement of births. The forecasts show that the period decline is likely to translate into a decline in cohort fertility and that cohort fertility is likely to fall to an all-time low: from an average of 2 children for the 1970s cohorts to an average of around 1.8 children for the late 1980s cohorts. Two trends appear to be occurring in the Nordic countries: (1) fertility is declining strongly in Iceland, Norway, and Finland; and (2) fertility is decreasing less sharply or is even stabilizing in Denmark and Sweden. In terms of cohort fertility levels, Finland diverges from the rest of the Nordic countries, with levels expected to fall well below the very low fertility threshold. Tempo adjustments to period fertility measures generally produced results consistent with the forecast estimates.

Despite the long-term trend of fertility postponement, cohort fertility in the Nordic countries previously remained stable because of strong fertility recuperation at older ages (Andersson et al. 2009; Lesthaeghe 2010). Welfare provisions and organizational features that support dual-earner families with young children have been considered to promote such a recuperation pattern (Kravdal and Rindfuss 2008; Lesthaeghe 2010). However, in addition to observing a long-term negative trend in fertility rates at ages below 30, we documented that older-age fertility has been declining since 2010 in all Nordic countries. We found signs of accelerated fertility postponement, particularly in Iceland, Norway, and Finland. Nonetheless, changes in fertility timing failed to fully explain the recent period fertility decline. Given that fertility at around age 30 is declining for the cohorts born in the 1980s and older-age fertility is increasing only slightly, it appears that fertility recuperation is weakening in the Nordic countries, despite progressive support for families with children.

Parity-specific analyses showed that declining first-birth intensities explain most of the recent period fertility decline in all Nordic countries. First-birth intensities declined the most in Finland but decreased substantially in Norway and Iceland as well. Although the declines in first-birth intensities were concentrated at ages below 30, there were also notable declines at higher ages. These findings indicate that the decline in fertility at ages 30 and older reflects a new postponement trend in family formation. Furthermore, we observed almost no signs of fertility recuperation for any parity in any of the studied countries. In contrast to previous findings showing that decreasing progression to third and higher-order births has been driving the weak downward trend in cohort fertility that started with the 1960 cohort (Zeman et al. 2018), the current forecasted cohort fertility decline seems to be driven also by increasing childlessness. Consequently, the plateau in the level of childlessness in Denmark, Norway, and Sweden (Jalovaara et al. 2019) may be temporary. Declines in subsequent childbearing were observed particularly in Iceland, where declining third-birth intensities explain one-quarter of the period fertility decline. Less extreme declines in subsequent childbearing were also found in Finland and Norway.

The magnitude of the expected cohort fertility decline varies between countries. Denmark and Sweden are on a trajectory of relatively weak declines in cohort fertility. For these two countries, there is still a reasonable possibility that the weak declines will be counterbalanced by increases in older-age fertility. Cohort fertility decline will accelerate if the current trend in older age fertility continues, but the decline could level off for the late 1980s cohorts if Swedish women currently in their early 30s catch up on postponed births following the recuperation patterns of earlier cohorts. However, in Finland, Iceland, and Norway, large declines in cohort fertility will be difficult to avoid even if women currently of childbearing age in these countries begin to catch up on postponed births with a higher intensity than typically observed in earlier cohorts. Although the trajectories of the sharp decline in cohort fertility in these three countries differ from the cohort fertility trends in Denmark and Sweden, some differences exist in the cohort fertility trend between these three countries. For the cohort born in 1970, the cohort fertility rate is 2.3 in Iceland, 2.1 in Norway, and 1.9 in Finland. These differences have been attributed to the large proportion of women with three children in Iceland and the large proportion of childless women in Finland. Iceland is exceptional in that the main driver of its cohort fertility decline seems to be decreasing family size and, to a lesser extent, decreasing progression to first birth.

Previous forecasts of cohort fertility have suggested that cohort fertility will remain stable or even increase in the Nordic countries (Myrskylä et al. 2013; Schmertmann et al. 2014). However, these forecasts did not use data after 2010, and their forecasts covered women born in 1966–1979 with forecast uncertainty growing for the youngest women. Because our forecasts use more recent data and cover women born in 1975–1988, there is an overlap in the forecasts only for women born in 1975–1979. For most countries and cohorts, our point estimates for cohort fertility for these women are below the lower bound of the prediction intervals of the previous forecasts. This difference reflects the fact that the methods of Myrskylä et al. (2013) and Schmertmann et al. (2014) extrapolated an increasing trend in older age fertility after 2010, when these trends actually began to reverse. Notably, the late 1970s cohort was in their early 30s when the previous forecasts were produced; in our study, they were already around 40 and had completed a much larger share of their childbearing, thus making the uncertainty in our forecasts small. The difference between our results and previous forecasts is particularly interesting in light of the recent evaluation of Bohk-Ewald et al. (2018), who analyzed the forecasting performance of a large number of cohort fertility–forecasting methods. The approaches developed by Myrskylä et al. (2013) and Schmertmann et al. (2014) were among the top performers. Reuse of these methods now with data up to 2018 suggests that the trends in cohort fertility are much less positive than previously thought, highlighting the challenges of forecasting.

The Nordic countries are frequently cited in demographic theories positing that the increasing participation of men in family life and stronger institutional support are critical components in efforts to prevent fertility from falling to very low levels in rich countries (Anderson and Kohler 2015; Esping-Andersen and Billari 2015; Goldscheider et al. 2015). There are no signs that gender equality is declining or that family policies are weakening in the Nordic countries (Rostgaard 2014; World Bank 2012), which could, according to these theories, cause fertility to decline. During the recent decade, both Norway and Sweden have lengthened the father's quota and either shortened or abolished the cash-for-care payments (Duvander et al. 2019), although Norway experienced a temporary setback in 2014 (Ruud 2015). In fact, these countries are witnessing a general decline in fertility despite their favorable characteristics. It could be argued that Finland differs from the rest of the Nordic countries because it does less than the other countries to promote work-family reconciliation. For example, in Finland, the preference for home care allowance is strong; the father's quota was introduced comparatively late, and fathers' uptake of parental leave is low; the rate of part-time employment is low; and no attempts to lengthen the father's quota or to shorten the home care allowance period in recent years have been successful. However, the declines observed in the other Nordic countries require alternative explanations. Among these countries, Sweden has the longest and most flexible parental leave scheme, Iceland has the most gender-equal parental leave scheme, and Norway has the longest paid parental leave earmarked for the father. In most Nordic countries, fathers tend to take full advantage of parental leave, and most children are enrolled in daycare from an early age (Duvander et al. 2019). Beyond the potential case of Finland, the differences in family policies or in gender-equality measures across the Nordic countries are not related to the strength of the recent fertility decline.

The mechanisms that underlie the Nordic fertility decline remain unclear, but existing evidence points in directions beyond the influence of family policies or gender equality developments. First, as noted earlier, the Nordic family policies have not changed greatly in the last decade. Second, the decline is driven mainly by decreased progression to first birth. However, in general, in high-income countries, regional variation in progression to first birth is smaller than variation in the progression to higher-order births, and fertility differences between countries are largely driven by variation in the probability of second and third births (Frejka 2008; Zeman et al. 2018). This suggests that variation in family policies might have a greater impact on higher birth intensities than on first births. Third, cohort ultimate childlessness has increased most among lower-educated women (Jalovaara et al. 2021), who might profit less from policies that help to reconcile work and family life. The reduction of opportunity costs of childbearing through the Nordic family policies may be more important for higher-educated women and couples than for those who are less-educated because the former attach more importance to the dual-earner model. The mechanisms behind the Nordic fertility decline appear to be different than those identified in other European countries because, for instance, very low fertility in Eastern European countries coexists with high overall progression to first parity (Zeman et al. 2018). Different population subgroups in the Nordic countries have experienced rather similar period fertility trends: fertility rates have decreased for both native and nonnative women (Lundkvist 2020; Official Statistics of Finland [OSF] 2017; Statistics Denmark 2020; Tønnessen 2020) and across educational groups (Comolli et al. 2020), yet first-birth rates have decreased faster among lower-educated women since 2014. Despite subnational regional differences in the levels of fertility in Nordic countries (Campisi et al. 2020), fertility has decreased in both urban and rural areas (Hellstrand et al. 2019).

It is unclear how the Nordic fertility decline is related to other potential explanations, such as changes in economic uncertainty, cultural factors, or union formation. Labor market status has become a central determinant of childbirth in many modern societies (Matysiak and Vignoli 2008), and fertility trends tend to correlate with economic cycles (Andersson 2000; Schneider 2015; Sobotka et al. 2011). Although recent comparisons of Nordic countries have shown that fertility levels during and after the recent recession in 2008–2014 did not correlate with the severity or duration of the economic crisis—Iceland was hit the hardest by the recession, followed by Finland, Denmark, Sweden, and Norway—Comolli et al. (2020) suggested that the recent decline in period fertility could be attributed to the broader experience of increasing labor market insecurity. A detailed analysis from Norway highlighted not only the importance of women's own labor market situation for their fertility but also the economic circumstances around them, with local unemployment rates contributing to a decline in first births (Dommermuth and Lappegård 2017). Finland may also be in a special position regarding economic circumstances: the cohorts currently of childbearing age survived the particularly severe recession of the early 1990s, and Finland currently stands out with a high share of 15- to 29-year-olds not in employment, education, or training (OECD 2020). Fixed-term employment is much more common in Finland and Sweden than in Denmark or Norway, especially among younger people (Rasmussen et al. 2019), and fixed-term employment has been shown to delay parenthood (Sutela 2012). In future studies, more emphasis should be put on the global financial crisis and its effect on youth unemployment and subjective experience of economic security. Recently, scholars have advanced the narrative framework to assess the role of individual future prospects of uncertainty on fertility decisions (Vignoli et al. 2020).

Cultural factors are also likely to explain variation in fertility (Inglehart 1990; Surkyn and Lesthaeghe 2004), but their role in the current fertility changes still remains ambiguous. There are some indications that preferences regarding family life in Finland have only recently been changing: during the last decade, the desired number of children people express to have has decreased, and in particular, the share who express 0 as their ideal number of children has increased (Berg 2018; Rotkirch 2020). Qualitative research from Finland emphasized that economic and social uncertainty and lifestyle factors seem to shape young adult plans to have children more strongly than before (Miettinen 2015; Rotkirch et al. 2017). Comparable research on such preferences is missing for the other Nordic countries, although Dommermuth and Lappegård (2017) speculated that the general trend in declining third births in Norway may indicate that women increasingly prefer fewer children. It is plausible that childlessness and having fewer children are becoming increasingly accepted in the Nordic countries. Further, changes in partnering may explain part of the decline. For instance, in Finland, the majority of the ultimate childless men and women have never lived in long-term coresidential unions (Jalovaara and Fasang 2017), and the proportion living alone has recently increased, especially among men (OSF 2018).

The period fertility decline that started in 2010 in the Nordic countries has also been observed in other countries with relatively high fertility, such as France, Ireland, the United Kingdom, and the United States (Human Fertility Database 2019). If the cohort fertility decline estimated for the 1970s and 1980s cohorts in the Nordic countries turns out to be part of a global trend, the Nordic countries (although probably not Finland) may remain at the top of the fertility league in Europe, albeit at lower levels than before. Thus, it could be argued that cohort fertility would be even lower in the Nordic countries in the absence of regional policies that support work-family reconciliation. Up-to-date forecasts for other high-income countries would put the Nordic countries in perspective. Regarding the positive association between gender equality and fertility, many of the arguments rest on observed and expected trends in period fertility, which are unstable and affected by changes in fertility timing. Refocusing on cohort fertility questions the plausibility of a U-shaped fertility trend over time.

Our findings indicate that the common Nordic fertility regime characterized by relatively high fertility is reshaping, with cohort fertility decreasing because of a lack of fertility recuperation at older ages. More broadly, our results call into question our understanding of the patterning of fertility across high-income countries and illustrate that fertility declines can occur even in contexts favoring work-family reconciliation and high levels of gender equality. Consequently, more nuanced studies on the relationship between gender equality and fertility are required. Future comparative research that explores the links between economic uncertainty, the value placed on family, and fertility rates could shed light on the causes of the recent fertility decline in the Nordic countries and beyond. Future studies should pay attention to the transition to parenthood and ultimate childlessness, given that decreasing first births are the main driver of the recent decline in period fertility. ■

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