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Abstract

Recent period trends in the Nordic countries show rapid declines in first births, particularly among lower-educated men and women. This study translates these period changes into cohort patterns and analyzes observed and forecasted ultimate childlessness by education for men and women born 1970–1987/88 in Denmark, Finland, Iceland, Norway, and Sweden using register-based data. We apply three forecasting methods: freeze rates, five-year extrapolation, and a nonparametric approach based on historical first-birth probabilities. Results reveal the steepest increases in ultimate childlessness among the lowest educated, approaching as high as 40% among low-educated women and 50% among low-educated men in some of the countries. Among the higher tertiary educated, childlessness is overall lower and remains relatively stable. By contrast, men with lower tertiary education show notable increases in childlessness, in some cases reaching levels similar to or higher than those of upper-secondary-educated men. While overall childlessness in Denmark remains stable, it exhibits the fastest widening educational gap. These findings underscore a growing educational polarization in the transition to parenthood across the Nordic societies, with women's childlessness patterns increasingly resembling those of men—a marked shift in the region's fertility landscape.

Keywords: Ultimate childlessness, educational gradients, Nordic countries, forecasting, gender convergence

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Introduction

The Nordic countries have long been recognized for relatively high fertility rates supported by generous family policies. However, recent sharp declines in first births—especially among the least educated (Comolli et al. 2020)—suggest a potential shift in the Nordic fertility model. Globally, childlessness tends to increase with higher female educational attainment (e.g., Wood et al. 2014). However, recent evidence from the Nordic region points to a reversed pattern: individuals with lower education levels, both women and men, now show the highest proportions of childlessness (Jalovaara et al. 2019). This shift is particularly striking given the Nordic commitment to social equality and the historical role of family policies supporting broad access to parenthood.

In Finland, childlessness at age 35 years has increased over the past decade for both men and women across all educational levels (Jalovaara and Miettinen 2024). However, these age-specific patterns must be interpreted in light of persistent educational differences in the timing of first births: lower-educated individuals tend to enter parenthood earlier, while those with higher education often postpone childbearing into their 30s or later (Andersson et al. 2009). As a result, rising childlessness at age 35 may reflect a mix of delayed fertility among the highly educated and more permanent childlessness among lower-educated individuals. This underscores the need to move from age-specific snapshots and forecast ultimate childlessness to better understand whether recent first-birth declines signal postponement or long-term shifts in Nordic fertility.

Forecasts of completed cohort fertility indicate that recent period fertility declines since 2010 reflect not just delayed births but also a lasting quantum decline—marking the first predicted drop in completed fertility in decades (Hellstrand et al. 2021). Yet, to date, few studies have forecasted ultimate childlessness in the context of this recent decline, and none have done so comprehensively by examining educational attainment (but see Beck et al. 2024 for Norway). This gap is critical, as the recent decline in fertility stems largely from reductions in first births, fueling growing public concern regarding ultimate childlessness.

In this research note, we forecast ultimate childlessness (measured at age 44) in men and women by education (measured at age 35) in Finland, Sweden, Norway, Denmark, and Iceland. Using register-based cohort data and three forecasting methods—freeze rates, five-year extrapolation, and nonparametric—we translate recent period trends into cohort patterns. In doing so, we highlight both persistent and newly emerging educational inequalities in family formation across the Nordic region. Given the Nordic countries' leadership in family demographic trends and pioneering in gender equality, insights into their evolving fertility patterns hold wide relevance, potentially signaling future trends for other societies advancing gender equality and related family support measures.

Background

The Nordic fertility regime has traditionally combined relatively high fertility with high female employment, supported by generous family policies—such as paid parental leave and subsidized childcare—and a strong commitment to gender equality. However, the sharp declines in period fertility since 2010 (Hellstrand et al. 2021) have raised questions of whether this regime is fracturing and whether it continues to enable childbearing across the socioeconomic spectrum.

In most Nordic countries, ultimate childlessness now exceeds 20% among the lowest-educated women, rising from around 10% for cohorts born in the early 1940s, while remaining below 15%—and even slightly declining—among the highly educated in most countries, particularly for cohorts born in the early 1970s (Jalovaara et al. 2019). The gap for men is wider: for example, among cohorts born in the late 1960s in Finland and Denmark, childlessness was around 20% for tertiary-educated men and 35% for the lowest-educated men. Microeconomic theories suggest that higher socioeconomic resources generally increase couples' likelihoods of having children, with men's resources having a particularly consistent effect (Becker 1993). The increasing similarity in educational childlessness patterns among women indicates that these economic factors are now relevant for both genders. The traditional opportunity costs of childbearing for highly educated women (Oppenheimer 1994) appear to have been largely mitigated by comprehensive work–family reconciliation policies. However, it is poorly understood why fertility, particularly among the low educated, is declining so rapidly.

Changes in educational gradients should be interpreted alongside shifts in the educational distribution across cohorts. Among older cohorts, changes in childbearing patterns occurred in the context of rapid educational expansion. This context is crucial when interpreting past gradients in childlessness among native born by education, as the group with only basic-level education was steadily shrinking and becoming increasingly selective. However, this expansion has largely stalled for native-born cohorts born in the 1970s and later in the Nordic countries (Figure 1).

In Sweden, for example, the share of native-born men with only basic-level education at age 35 fell to 9% for the 1975–1976 cohorts but rose again to around 20% among those born in the 1980s. Similar, though less pronounced, reversals are observed in Norway and Denmark, affecting both men and women. The attainment of higher tertiary education among both genders has stagnated in Finland and Sweden, while continuing to grow in Denmark, Norway, and Iceland. Finland has the lowest share of individuals with only basic education, but the highest and rising shares of upper-secondary educated: 54% of men and 41% of women born in 1987.

As the size of the low-educated group among native borns has stabilized, growing marginalization within this category is likely less influential in recent patterns of ultimate childlessness. Consequently, future increases in childlessness among younger cohorts may more accurately reflect broader social and behavioral shifts rather than changes in group composition.

[FIGURE 1 ABOUT HERE]

Data and Methods

We use individual-level register-based data from Denmark, Finland, Iceland, Norway, and Sweden, covering cohorts born in 1970–1987, and up to 1988 for Denmark. The data include information on birth histories and highest completed education. The analytic sample consists of individuals born in the respective country (native born) and present in the population at age 35, when most have completed their education. Measuring education at this age balances minimizing misclassification with the goal of including as young cohorts as possible, since fertility patterns by education vary depending on when education is measured (Andersson et al. 2009). For instance, individuals classified as low educated at age 30 who have children often continue their studies and attain higher degrees later, while those without children by 30 generally do not. Educational attainment is categorized according to ISCED 2011 as basic (levels 0–2), upper secondary (3–4), lower tertiary (5–6), and higher tertiary (7–8).

We compute age-specific first-birth probabilities, denoted $p_x^{(1)}$, as the probability of a first birth at age x among those who are childless at that given age, for ages 15–44. Ultimate childlessness is estimated as the product of the complements of these probabilities:

$$Ultimate\ childlessness = \prod_{x=15}^{44}(1 - p_x^{(1)}).$$

Childlessness is considered complete at age 44, as first births beyond this age are very rare. For cohorts with incomplete fertility schedules (born 1979–1987/88), we implement three forecasting methods. First, the freeze rate approach assumes constant rates beyond observed rates. Second, the five-year extrapolation method projects the recent five-year trend forward five years into the future and holds it constant thereafter. Third, we apply a nonparametric method based on empirical year-on-year changes in age-specific first-birth probabilities. Unlike the first two approaches — which assume stability or a continued (mostly negative) trend and do not allow for fertility recuperation — this method incorporates the possibility of fertility recovery based on historical patterns.

The nonparametric method is based on (Hellstrand et al. 2020) but modified to fit the purpose for ultimate childlessness. Consider, for example, a cohort currently aged 35 for whom we have observed first-birth probabilities up to age 35 but need to predict rates for ages 36 to 44. The rate at age 36 will be observed next year, age 37 in two years, and so on — up to age 44, nine years ahead. To calculate corresponding changes from the past, we use historical age-specific first-birth probabilities from the Human Fertility Database, supplemented with additional data obtained through personal communication with Tomas Sobotka. These data, which form the basis of our calculations, cover countries in Europe, North America, and East Asia, with the earliest data point from 1950, though most span from 1980 to 2020 (Appendix Figure 1). For a given jump-off year in the past, we compute the one-year-ahead change at age 36, the two-year-ahead change at age 37, and so on through age 44. These are structured as joint nine-element change vectors, capturing the age-specific dependencies in fertility behavior.

We sample from these historical vectors and apply them to the most recently observed rates for the given cohort, generating simulated fertility schedules up to age 44. Each simulation yields a value for ultimate childlessness, and the resulting quantile distribution forms a prediction interval. These intervals reflect the variability that would occur if first-birth trajectories resemble patterns observed in the past — that is, if age-specific changes are drawn for the same empirical distribution as historical data. In this sense, they capture empirical uncertainty based on historical variability, rather than probabilistic uncertainty. We apply the same approach to all cohorts with incomplete fertility schedules aged 36 to 43, adjusting the number of remaining years accordingly.

Results

Figure 2 presents observed (cohorts 1970–1978) and predicted (cohorts 1979–1987/88) ultimate childlessness by gender and country. The predicted rise in childlessness is generally stronger among men than women. In Sweden, ultimate childlessness is projected to increase from 13% to approximately 17% (95% CI: 15.2–18.1) among women and from 22% to 27% (95% CI: 24.9–29.5) among men. Norway exhibits a comparable upward trend, starting off slightly below that of Sweden. In Denmark, levels of childlessness remain relatively stable, at just above 15% for women (95% CI: 15.3–18.3) and around 25% for men (95% CI: 23.9–28.3). Finland starts at higher levels, with predicted increases from 20% to 25% (95% CI: 23.2–27.4) among women and from 27% to 36% (95% CI: 33.3–39.3) among men. Iceland, initially characterized by the lowest level of childlessness (7% for women and 12% for men), experiences a marked rise particularly among men, reaching 22–26% in the 1987 cohort, close to the level in Denmark.

The lower bounds of the prediction intervals reflect scenarios in which fertility recuperation after age 35 follows strong patterns, as observed in historical data. Notably, even under these optimistic assumptions, ultimate childlessness is projected to rise.

[FIGURE 2 ABOUT HERE]

The predicted levels of ultimate childlessness by education are shown in Figure 3. Childlessness is expected to rise across educational groups, but the magnitude of this increase varies by education level, gender, and country. The strongest increases are observed among lower-educated men and women. For example, in Finland, ultimate childlessness is projected to rise from 20% to 36% (95% CI: 33.4–37.6) for women with basic education, and from 34% to 46% (95% CI: 42.6–49.4) for similarly educated men. Comparable increases are seen in Denmark. By contrast, predicted childlessness remains relatively stable among higher tertiary-educated men and women across all countries. However, men with lower tertiary education stand out—especially in Sweden and

Norway—with projected increases that bring their levels close to or even higher than those of upper-secondary-educated men.

While Finland and Sweden display clear educational gradients beyond just the basic level—with childlessness gradually decreasing with higher education—Norway and Denmark primarily show a divide between the basic educated and all other groups. Denmark, in particular, shows one of the steepest increases in educational inequality in childlessness across the Nordic region, despite a relatively stable overall level of childlessness.

[FIGURE 3 ABOUT HERE]

Complementary predictions using the freeze rate and five-year extrapolation methods are shown separately in Figure 4 to avoid cluttering the main plots. These are presented as differences between the point estimates of each method and the non-parametric median forecast for the youngest cohort (born 1987/88). These alternative estimates align closely with the median forecast, especially for women, for whom the deviations are at most around one percentage point. The median forecast captures a recuperation pattern that is slightly positive, hence providing forecasts of ultimate childlessness slightly below the freeze rate estimates. For men, recent trends in first-birth probabilities at older ages have been more pronouncedly negative, resulting in childlessness estimates up to two percentage points higher (or more) than the median forecast. Hence, if the declining trend in older age first-birth probabilities continues, ultimate childlessness among men likely falls closer to the upper bound of the prediction intervals.

[FIGURE 4 ABOUT HERE]

Discussion and Conclusion

In this research note, we have examined the evolving educational gradients in ultimate childlessness among Nordic men and women born between 1970 and 1987/88, combining observed data and forecasts. Our results confirm evidence of a reversed pattern among women in the Nordic countries, where the lowest educated—both women and men—now show the highest and rising levels of ultimate childlessness.

Our findings show that the educational gradients in ultimate childlessness are steepening, with women's patterns increasingly resembling those of men. For example, in Denmark—the most extreme case—ultimate childlessness among women with only basic-level education is predicted to rise from around 20% (early 1970s cohort) to approximately 35% (late 1980s cohort), resulting in a 20-percentage-point gap compared with women with higher tertiary education, whose levels remain relatively stable around 15%. Among men, childlessness for the youngest cohorts exceeds 40% among the lowest educated and remains below 20% for the highest educated. Similar trends, but with slightly higher levels, are observed in Finland. Childlessness among women with no education beyond the basic level is predicted to remain below 30% in Norway and Sweden and around 20% in Iceland.

This shift indicates changes in the long-standing Nordic fertility model, which has traditionally featured relatively high fertility among high-income countries and strong family policies supporting gender equality and work–family reconciliation. While earlier cohorts experienced a shrinking and increasingly marginalized basic-educated group with rising childlessness, this pattern is less clear for recent cohorts, partly due to stalled educational expansion and even increases in the low-educated population. In Norway, for instance, this stagnation in educational expansion may partly be explained by the 1994 comprehensive upper secondary school reform, which significantly reduced program options and has been linked to increased dropout rates, particularly among vocational students (Lindbekk 2015). The size of the basic-educated group is not negligible—for men, it ranges from 10% in Finland to 18–26% in the other Nordic countries among the youngest cohorts; for women, it is approximately 6% in Finland and between 11 to 14% elsewhere.

The educational gradients manifest not only between the lowest and highest education groups but also between low and middle, and middle and higher education levels, particularly in Finland and Sweden. In Finland, the positive educational gradient among women disappeared by the early 1970s cohort, with childlessness hovering around 20% across all groups. Since then, the gradient has reversed, with childlessness predicted to increase to just above 20% for tertiary-educated women, around 27% for those with upper secondary education, and exceeding 35% for the basic-educated. This pattern suggests that childbearing behavior and its determinants are increasingly differentiated across the entire educational spectrum, rather than driven solely by divergence at the bottom.

Furthermore, men with lower tertiary education show somewhat unexpected patterns. In Sweden and Norway, projected increases in ultimate childlessness bring their levels close to—or even exceeding—those of men with only upper secondary education. Sensitivity analyses for Sweden indicate that this higher childlessness is primarily driven by individuals who attended short-term tertiary programs but did not complete a degree (results not shown).

Our forecasting approach applies multiple methods based on differing assumptions regarding age-specific first-birth probabilities beyond age 35—ranging from constant rates to continued trends, to possible recuperation—and suggests that the declining first-births rate is unlikely to be solely due to delayed childbearing. As the cohorts studied are largely past typical ages of first parenthood (at least 35 years), these projections are considered robust. Importantly, all methods point to the same conclusion: a lasting increase in ultimate childlessness, particularly among the less educated. While the Human Fertility Database lack historical birth data fully disaggregated by education or for men in general to be used in the nonparametric approach, the data cover complete populations across many countries, with some series extending back to the 1950s. This allows us to capture long-term trends that likely reflect group-specific recuperation patterns that are stronger among higher-educated individuals and more limited among the lower educated. Even if we focused only on nearly fully observed cohorts (e.g., up to age 38), the qualitative conclusions—rising childlessness and widening educational gaps—would remain the same.

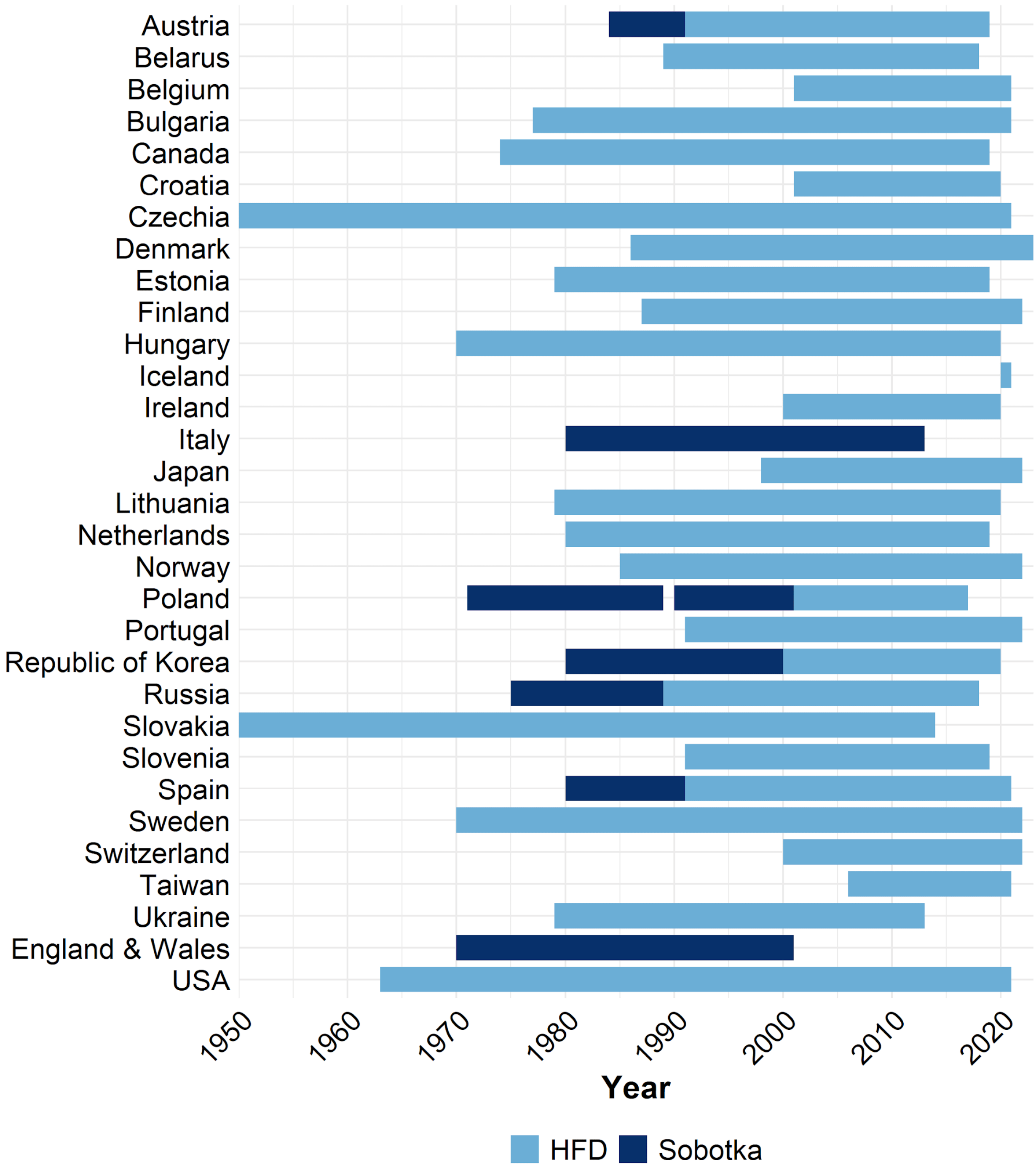
Turning to potential drivers, the widening educational divergence in childlessness likely reflects broader structural and policy dynamics. Lower-educated individuals face greater economic insecurity stemming from segmented labor markets and rising living costs, which constrain their opportunities to form and maintain stable partnerships. Indeed, previous studies have documented a decline in partnership formation and increasing rates of partnership dissolution especially among the lower educated, further complicating family formation (Hellstrand et al. 2022). While work–family reconciliation policies remain robust overall, they tend to favor higher-educated dual-earner households and inadequately address the needs of the most vulnerable. In Denmark, the financial crisis mostly hit those with only basic education, causing lasting effects, while people with secondary education or higher faced few long-term impacts (Christensen et al. 2024).

These widening disparities are likely to have important long-term consequences. Lower-educated individuals already face elevated risks for poor health, economic insecurity, and limited social capital—and rising childlessness compounds these disadvantages (Read et al. 2016). As more people reach old age without close family to rely on, this may deepen existing vulnerabilities and contribute to growing inequality in later life. In this sense, diverging childlessness patterns are not only a demographic trend but also a growing concern for social policy.

Our analysis is restricted to men and women born in each respective study country, as administrative registers may not capture the complete fertility histories and educational attainment prior to immigration. Consequently, the results do not reflect the total resident population. The proportion of the individuals aged 35–44 born outside their country of residence is substantial, with 2023 estimates of 17% in Finland, 25% in Denmark, and approximately 33% in Norway, Sweden, and Iceland (Eurostat 2025). Fertility patterns and educational gradients among immigrants may differ from those observed in native-born residents, highlighting the need for further research to assess whether the patters identified here extend to migrant populations and, by extension, to the total population.

Future research should focus on identifying and understanding potential barriers to fertility faced by lower-educated groups. This knowledge is crucial for informing policies that more effectively support family formation and promote equitable opportunities for parenthood across all educational levels, aligning with the overall policy goals of the Nordic countries. Previous studies have also shown that lower-educated women who do become mothers face a higher risk of multipartnered fertility—a pattern likewise observed among men in Norway—highlighting the complex family formation challenges faced by this group (Lappegård and Rønsen 2012; Jalovaara et al. 2022). Given these complexities, ongoing monitoring of fertility trends—including parity-specific patterns and educational disparities—is essential amid rapidly evolving reproductive behaviors.

Appendix



Appendix Figure 1: Age-specific first-birth probabilities used as historical data in the non-parametric approach, obtained from the Human Fertility Database (HFD) and through personal communication with Tomas Sobotka.

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Figures

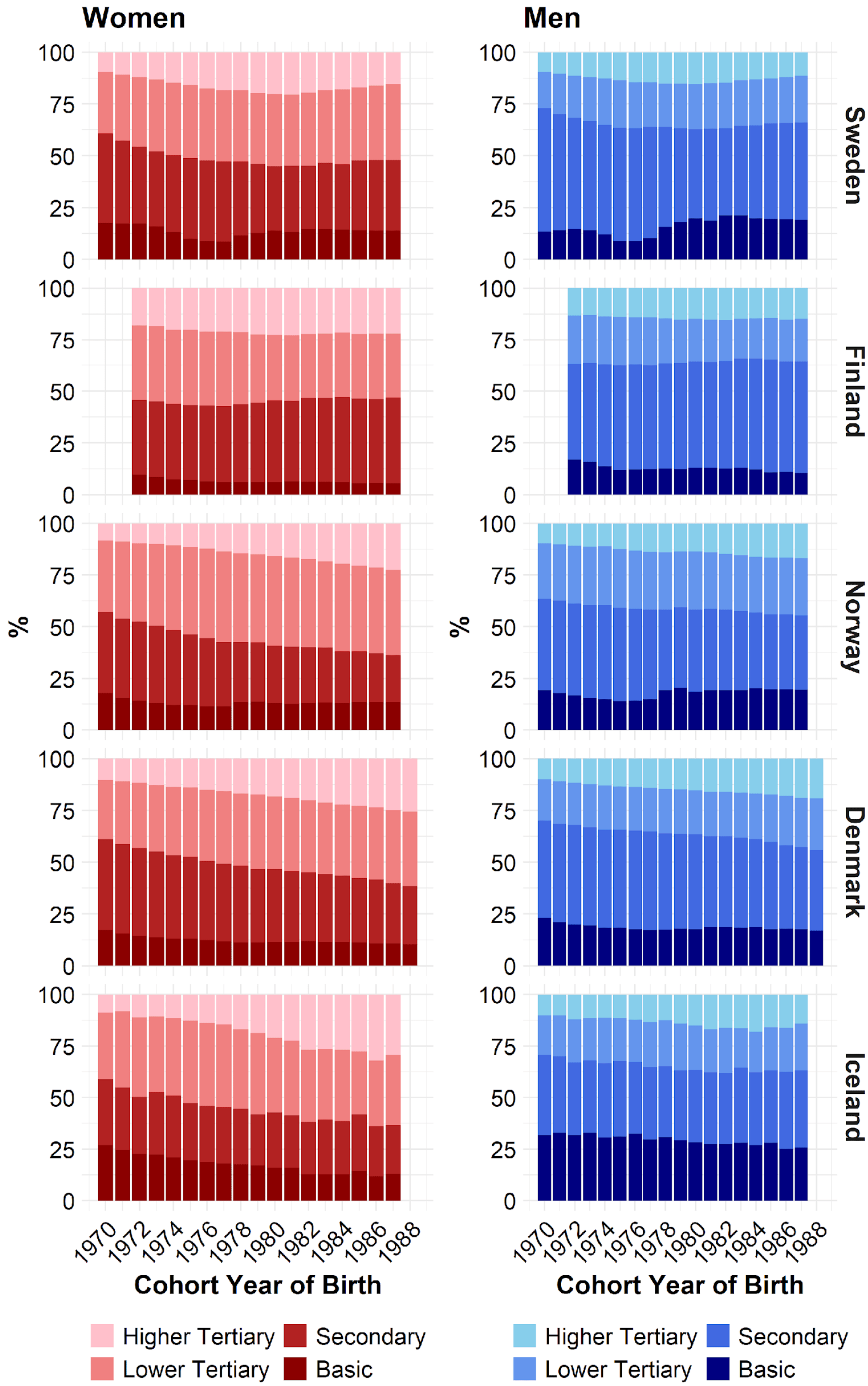

Figure 1: Education distribution for the native born at age 35 by sex, country, and birth cohort (1970–1987/88).

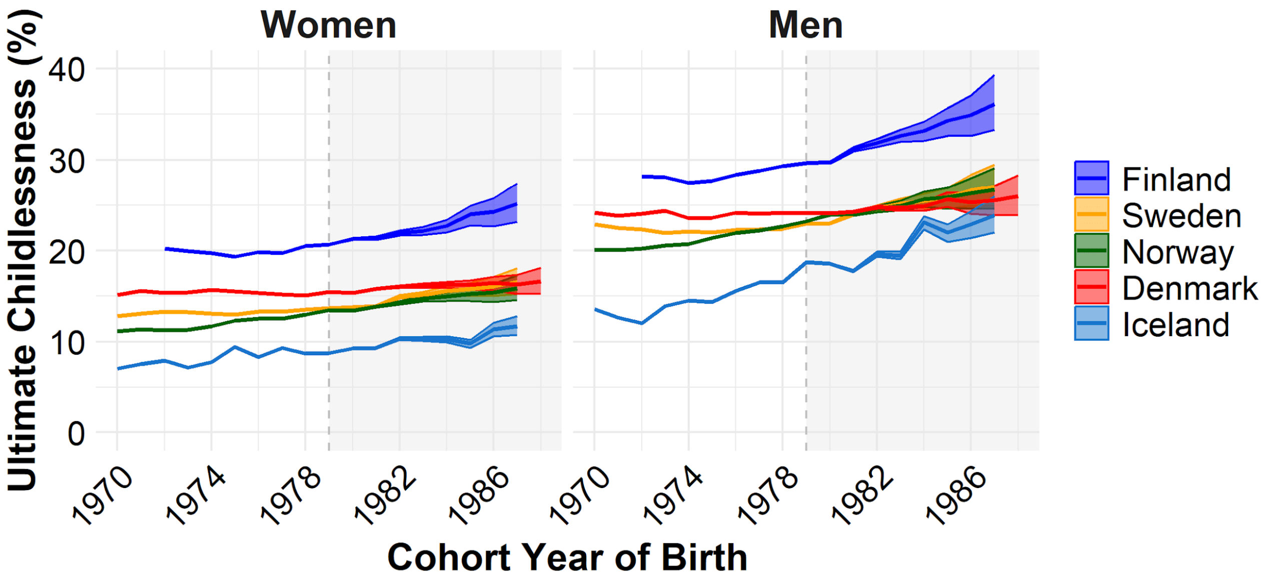

Figure 2: Ultimate childlessness by gender and country. Observed childlessness covers cohorts 1970–1978 (1970–1979 for Denmark) and predicted childlessness covers cohorts 1979–1987 (1980–1988 for Denmark).

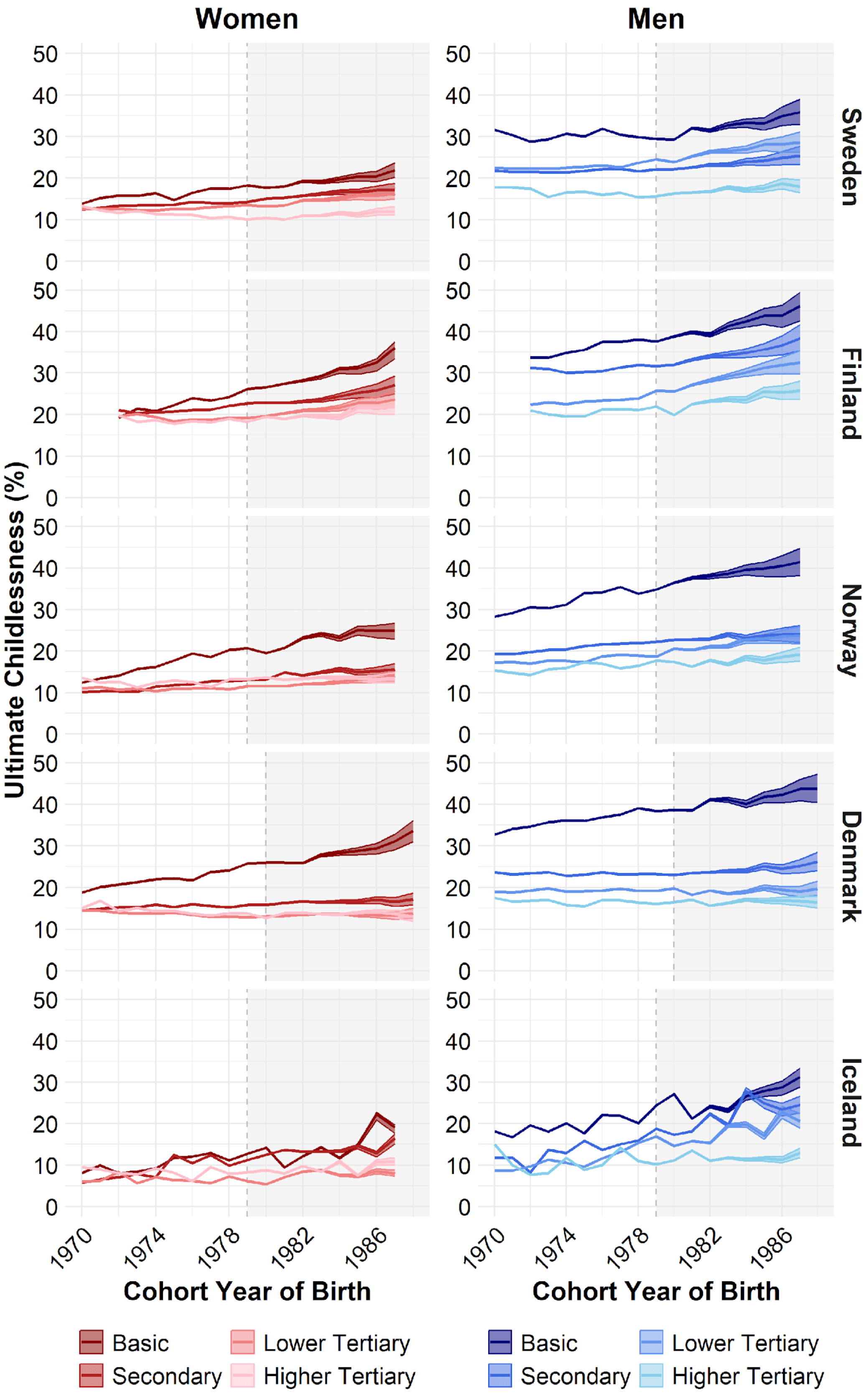

Figure 3 Observed (cohorts 1970–1978) and predicted (cohorts 1979–1987; 1980–1988 for Denmark) ultimate childlessness by country, gender, and education.

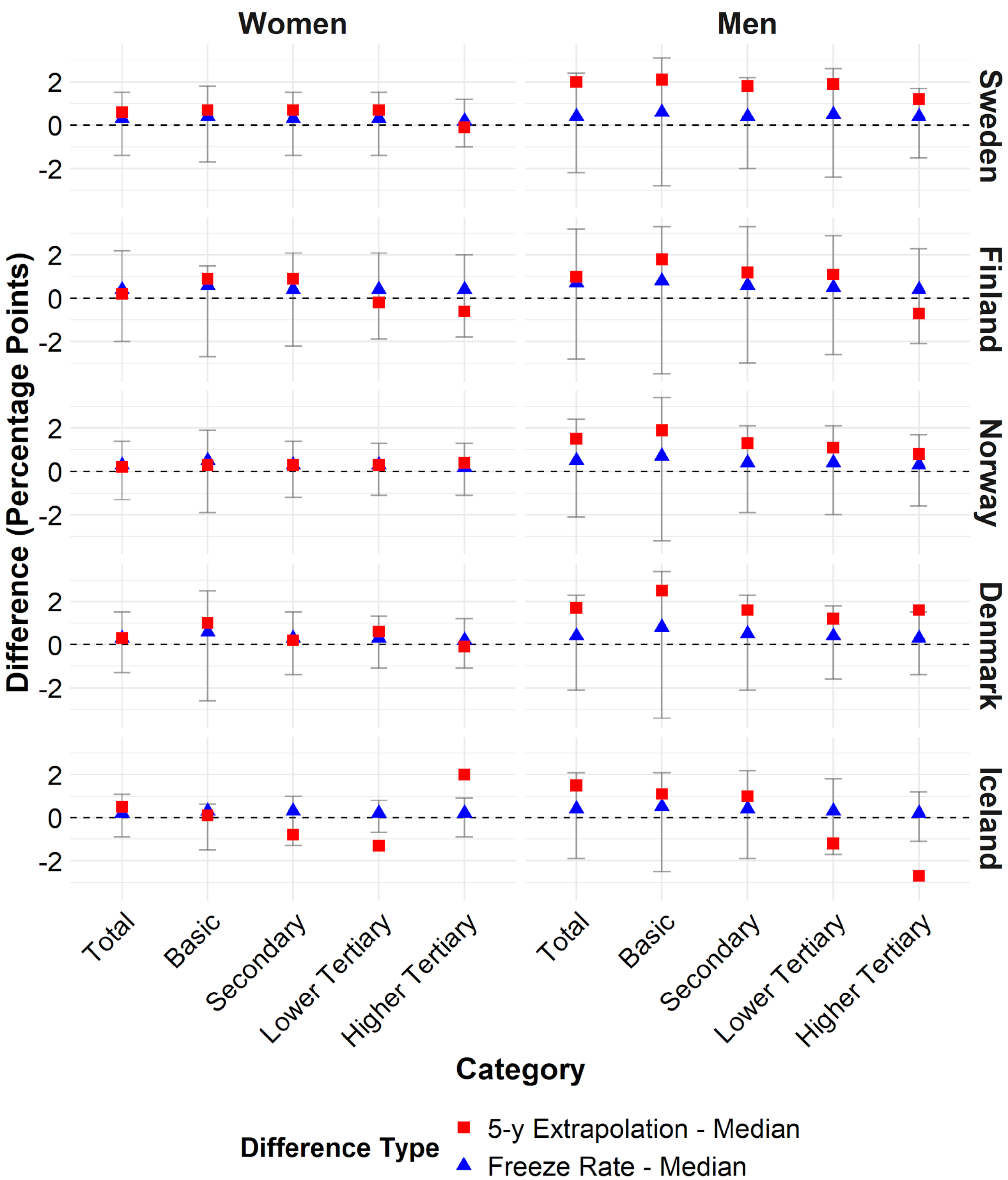

Figure 4: Differences between the point estimates from the freeze rate approach and the five-year extrapolation method and the median forecast from the non-parametric approach, by country, gender, and educational group, for the 1987/88 cohort.