Cohort Fertility Measures Derived from WPP 2024: Global, Regional and Country Analysis

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Introduction

A large body of research and knowledge has been accumulated concerning fertility trends and levels, and their causes globally. Most of the comparative studies and global datasets are based on cross-sectional data and period fertility measures. The existing literature on cohort fertility is limited to countries in Europe, Northern America or Eastern Asia, based on the analysis of available single age fertility data, either for individual countries or regional comparative studies. In contrast, the present state of knowledge on cohort fertility levels and trends is rudimentary in other parts of the world.

Cohort fertility, which measures the average number of children women have over their lifetime, offers a more robust representation of fertility trends, providing valuable insights into long-term fertility patterns (Frejka and Calot, 2001; Frejka 2016) and a more accurate indication of the eventual accumulation of births in the population. It focuses on the quantum of fertility, the actual number of children born, and is unaffected by changes in the tempo of fertility, the timing of births in the lives of women. In contrast, period total fertility trends are susceptible to fluctuations in the timing of births and can be severely distorted in times when childbearing is shifted towards earlier or later ages, or there are major changes in the spacing of births (Bongaarts and Feeny, 1998; Bongaarts and Sobotka, 2012). As cohort fertility is based on the complete reproductive history of women born in the same calendar year, full information is not available for women who are currently of childbearing age. This makes cohort fertility measures more difficult to obtain, and when they become available, they are regarded as outdated by policymakers.

Demographers have tried to overcome this issue by developing various methods to forecast cohort fertility rates for those cohorts still of reproductive age based on projections of age-specific fertility rates. The simplest example is the “freeze-rate” method. This technique assumes that the most recently observed age-specific fertility rates will remain constant in the near future to estimate that the total number of children women in a specific cohort are expected to have over their lifetimes. The main limitation of this approach is that it fails to account for the dynamic nature of timing of births, ignoring potential future changes in age-specific fertility rates. In contexts where childbearing is postponed to older ages, it tends to underestimate completed fertility, as seen in many European and North American countries. In 2013, Myrskylä et al. used a five-year extrapolation method, which extrapolated the trend in age-specific fertility rates from the past five years into the future, and then froze the rates. This method was simple to implement, and the short timeframe reduced the risks of incorporating long-term fluctuations or unpredictable shifts in fertility patterns and allowed for the compilation of confidence intervals. A Bayesian approach, proposed by Schmertmann et al. in 2014, involved the use of priors that incorporated historical patterns of fertility, as well as recent trends in fertility rates. This approach provided a quantifiable evaluation of uncertainty and allowed the use of all available data, avoiding strong *a priori* assumptions.

Concurrent to these developments, revisions of the United Nations' *World Population Prospects* (WPP; United Nations, 2024a) have, since the 2015 revision, used an approach to the projection of period fertility for all countries, including age-specific measures, based on probabilistic models grounded in the concept of the demographic transition fitted to available empirical observations and, for low fertility countries, the observations on the impact of postponement of childbearing on overall fertility rates (United Nations, 2015; Ševčíková et al., 2016; United Nations, 2024b). Subsequently, this method was incorporated into the probabilistic population projection framework and used in all the recent revisions. Projections are provided for all years up to 2100.

The accuracy of short-term fertility projections was assessed by Bohk-Ewald et al. (2018), who catalogued and compared 20 different methods for forecasting completed cohort fertility over short time periods. They assessed each method using input datasets taken from the *Human Fertility Database* and UN WPP data compilation. They compared empirical observations of completed cohort fertility by age 40 years with model predictions generated from input datasets truncated at a selection of ages below 40 years. They found that only four methods produced predictions that outperformed simple "freeze-rate" extrapolations. These included the methods of Schmertmann et al. (2014) and Ševčíková et al. (2016), the latter of which formed the basis of fertility projections for the revisions of the WPP since the 2015 revision, as described above (United Nations, 2024b).

The primary objective of this study is to present a more comprehensive picture of the levels and trends of fertility globally by adding the perspective of cohort fertility measures. We use estimates and projections of single age-specific period fertility rates from the 2024 revision of the WPP (WPP2024; United Nations, 2024a) to derive the fertility profiles and measures for the cohorts born between 1935 and 2055, offering a unique opportunity to understand what happened in those cohorts that have already aged out of the reproductive period and what will likely occur to those who are still in the reproductive age or will enter the reproductive age in the future.

In over half of all countries and areas (55 per cent), with more than two-thirds of the global population, the fertility level is below 2.1 births per woman in 2024, including countries that have had low fertility for decades and other countries that joined this group only recently (United Nations, 2025). In the last two decades, a number of studies described how cohort fertility forecasts for countries with long histories of low fertility in Europe and Northern America did not indicate that cohort fertility was decreasing substantially (Myrskylä et al. 2013; Schmertmann et al. 2014). However, a more recent study by Hellstrand et al (2021), showed that Nordic countries, while also experiencing a postponement of childbearing, are indeed having fewer children overall, resulting in decreasing cohort fertility trends. This study offers updated estimates and projections of cohort fertility in low-fertility countries.

The remainder of this study is structured as follows. The first section contains a detailed description of the data and methods employed in the World Population Prospects to estimate and project period total fertility rates and age-specific fertility rates, as well as the procedures used to transform these period measures into cohort fertility indicators. Following the methodological section, the paper presents the analytical results of the global and regional trends in cohort fertility, along with some country examples that illustrate various fertility patterns and the differences when looking at period and cohort measures, including for countries affected by crises and conflicts, and new insights into future cohort fertility for low-fertility countries. Finally, the paper concludes with a discussion of the key findings, the assessment of data and methods limitations and potential avenues for future research.

Data and methods

The estimates presented in this paper are based on the single-year age-specific fertility rates published in the WPP 2024 (United Nations, 2024a). Since the 2022 revision, this global population dataset has provided a complete set of demographic indicators at the single age/single year resolution from 1950 to 2100 for all countries and areas of the world. Additionally, the age range for fertility rates now covers ages between 10 and 54 years (inclusive). These newly available single age/single-year fertility rates allow for the calculation of cohort fertility for all countries, areas, regions, and globally. The cohort measures, namely single age and five-year age groups and total fertility rates, were calculated using the methodology from the Human Fertility Database (Jasilioniene et al., 2015).

In what follows, we provide additional details on the methodology used to produce estimates and projections of period fertility measures in the WPP and then describe how these were transformed into measures of cohort fertility.

Estimates and projections of fertility in WPP 2024

The 2024 revision of the WPP employed a Bayesian approach to produce both estimates (1950-2023), and projections (2024-2100), of period fertility (United Nations, 2024b). Total fertility rates (TFRs) for each country were estimated using a Bayesian hierarchical model, accounting for the uncertainty of the underlying empirical data (Liu and Raftery, 2020). Age-specific fertility rates (ASFRs) were estimated by 5-year age groups for women aged from 10 to 54 years with a Bayesian hierarchical model fitted to empirical fertility rates from various sources (Chao et al., 2023). The empirical data used for the model implementation came from vital registration (43.3%, including also Sample Registration System for India and Bangladesh), household-based demographic surveys (29.5%), estimates (24.6%) and censuses (2.5%). Empirical data were available for 236 countries and territories and counted for a total of 143,208 data points. The estimated 5-year fertility rates were then graduated into single-age rates using empirical distributions for country-years with high quality vital registration data (e.g., countries and periods with single-age fertility estimates included in the Human Fertility Database), or using the calibrated spline method (Schmertmann, 2014) otherwise. The graduated series were finally adjusted to be consistent with the estimated TFRs from the first step.

Total fertility rates were projected using probabilistic models fitted to the estimated historical series for the period 1950-2023 and accounting for the uncertainty in recent estimates (Alkema et al., 2011; Raftery et al., 2014; Liu & Raftery, 2020). The models are grounded in the concept of the demographic transition. Projections during periods when fertility continued to decline were generated using a Bayesian hierarchical model that included a parametric double logistic decline curve. Projections during the low-fertility, post-transition phase were generated using a time-series model that assumed fertility would fluctuate around a long-run, country-specific level. This level, along with other model parameters, was estimated within a Bayesian framework informed by empirical evidence from low-fertility countries that have experienced the postponement of childbearing and related increase in period fertility rates (United Nations 2024b).

Once the projections of total fertility were finalized, the ASFRs were derived from the projected proportionate age-specific fertility rates (PASFRs) for women aged 10-54 years. The PASFRs were assumed to transition from the observed national trend to a global model age pattern, with the speed of this transition dependent on the estimated time at which fertility stops declining (Ševčíková et al., 2016).

The methods are implemented in the bayesTFR library for the R statistical software package (Ševčíková, Alkema, and Raftery 2011; Liu, Ševčíková, and Raftery 2023). All estimates and projections of ASFRs and TFRs are publicly available online as downloadable files (https://population.un.org/wpp/) or via an interactive data portal (https://population.un.org/dataportal/). The full dataset of age-specific period fertility estimates and projections is publicly available from the UN Population Division Data Portal (https://population.un.org/dataportal/).

Calculating cohort fertility measures

Following the method used in the Human Fertility Database (Jasilioniene et al., 2015), cohort measures were calculated by splitting the single age-specific period fertility estimates and projections into Lexis triangles, using a cumulative fertility indicator. Specifically, in each year, the period single age-specific fertility rates were summarized into cumulative fertility rates, then transformed to the logit scale, and finally transformed into Lexis triangles using a piecewise cubic Hermite interpolating polynomial. Cohort single age fertility rates were computed from the resulting triangles. These were also aggregated into five-year age groups for comparison purposes.

Given that the WPP data cover the period 1950-2100, fertility measures are calculated for cohorts between 1935 (women aged 15 years in 1950) and 2055 (women aged 45 years in 2100) to ensure that the obtained cohort measures include at least women aged 15-45. The prediction intervals of projected period total fertility are incorporated in both cohort and period measures, since the calculations are based on 2,000 410,trajectories of projected total fertility rates from WPP2024. The 2.5th and 97.5th percentiles of prediction intervals are displayed in the figures.

Global, regional, and country-level estimates of cohort fertility

The cohort fertility measures derived through the methods described above are analyzed in the following section, presenting global and regional trends in cohort fertility and comparing them with corresponding period measures, followed by the examination of selected countries illustrating different fertility dynamics. The annex figures present the results for 201 countries or areas with a population above 90,000 inhabitants in 2024.

Results

Global and regional trends in cohort fertility measures

The results at the global level show that the fertility decline occurring in the second half of the twentieth century is more gradual when observed from the cohort measures than from the period measures. Figure 1 illustrates the global period and cohort total fertility rates, where the reference year for each cohort is the year in which the cohort would be 30 years of age (the cohort's birth year is shown in brackets). The sharp decline observed after 1990 and the drop in the past decade at the period level correspond to rather smooth declines at the cohort level. The cohort of 1935 is estimated to have 4.7 live births per woman, while at the period level, global total fertility reached that level in 1971, when the 1935 cohort was aged 36 years. The first global cohort of women projected to go below replacement level (2.1 live births per woman) is projected to be the one born in 2029. Figure 2 shows the age-specific fertility rates by cohort and period. This illustrates the decline in the overall number of births women have, on average, and the shift in the timing of childbearing at the global level from both the period and cohort perspectives.

Figure 3 shows fertility by cohort and period in SDG regions. Some regions present time trends by cohort that are in line with the trends by period shifted by 30 years (sub-Saharan Africa, Oceania excluding Australia and New Zealand), while others display notable differences between cohort and period trends. These differences are primarily driven by changes in the age patterns of fertility, including the postponement of childbearing and reductions in fertility at young ages, as well as the impact of conflicts and crises. The first region where cohort fertility reached the replacement level was Europe and Northern America, where women born in 1946 already had fewer than 2.1 live births on average. In Australia and New Zealand, the first cohort to reach the replacement level was born in 1966, whereas it was born in 1972 in Eastern and South-eastern Asia. For Latin America and the Caribbean, cohort fertility is projected to fall below the replacement level for those born in 1989, in Central and Southern Asia for the 2015 cohort, in Northern Africa and Western Asia for the 2036 cohort, and in Oceania (excluding Australia and New Zealand) for the 2046 cohort. In sub-Saharan Africa, the cohort of women born in 2055 is projected to still have more than replacement-level fertility, with 2.3 live births per woman.

Cohort and period fertility measures: country examples

Figures 4 and 5 provide more detailed evidence at the country level. In Argentina and Uruguay, the recent rapid decline in period fertility appears to be primarily driven by reductions in early childbearing and the projected subsequent postponement of fertility to later ages. A comparison of cohort and period trends shows the effects of changes in the age pattern of fertility. In Argentina, fertility among girls aged 15-19 declined by more than 60% in the last 10 years (falling from 66.6 live births per 1,000 girls in 2014 to 26.4 in 2023), while in Uruguay, the decline was around 53% (from 58.2 to 27.4). The projections in WPP 2024 assume a partial recovery of births in older ages among women in these cohorts. At the cohort level, the overall fertility decline is less sharp, with cohort fertility expected to stabilize around 1.6 in Argentina, and 1.5 in Uruguay, starting from the cohorts born after 2000.

Between 2005 and 2015, Egypt and Algeria saw an increase in period fertility in the wake of the Arab Spring. The combination of increased government subsidies aimed at improving living standards and the temporary disruption of family planning activities led to an increase in period fertility (Winckler, 2023). However, this temporary increase is not reflected at the cohort level, where fertility declines temporarily slowed down and resulted in a stagnation of overall fertility for the cohorts born between 1978 and 1994 in Algeria and between 1976 and 1990 in Egypt, before resuming.

In Central Asia, countries such as Kazakhstan and Uzbekistan experienced an increase in period fertility in the early 21st century. These recent changes in fertility were largely driven by increases in higher birth orders, particularly concentrated among specific ethnic groups, changes in population composition through selective emigration (Spoorenberg, 2015). Cohort trends show a similar trajectory, although the decline and subsequent increase are less pronounced compared to the period trends. The temporary increase in completed cohort fertility is unique compared to the historical trends observed for cohort fertility in other countries and is likely related to the changing ethnic composition of the subsequent cohorts, impacted by large emigration flows of ethnic Russian and German population in the 1990s in response to economic and social developments in the 1990s (Becker et al, 2005). Similar cohort fertility increases, though of smaller magnitudes, are expected also for Armenia, Azerbaijan and Georgia (see annex figures).

The impact of conflicts in Iraq and Cambodia had significant effects on period fertility rates. During the Khmer Rouge regime (Heuveline, 2007), period fertility in Cambodia fell to 2.72 children per woman in 1977, compared to 6.0 live births in 1971, before rebounding to 6.4 in 1984. However, at the cohort level, trends show a relatively smooth decline for the cohorts of women in their reproductive years during this period. In Iraq, during the 2003-2011 war, period fertility stopped declining and even rose, but at the cohort level fertility continued to decline. The rise in adolescent birth rates (from 64.4 live births per 1,000 girls aged 15-19 in 2003 to 89.6 in 2011) as well as in fertility among women aged 20-24 years contributed to this trend. The post-2003 abrupt shift in the timing of fertility toward younger ages was the result of an increased prevalence of early marriage among women with little education, most likely as a response to the dire security situation and rising conservatism throughout the country (Cetorelli, 2014).

In China, the effects of the Great Leap Forward and the One-Child Policy were markedly pronounced at the period level, influencing the period fertility measures at the global level. Examining cohort fertility trends reveals that fertility steadily declined between the 1935 and 1955 cohorts, before the rate of decline slowed for younger cohorts. Recent rapid declines in period fertility rates in China are projected to appear more gradual when viewed in terms of cohort fertility rates, as projected by the WPP2024. In India, recent reductions in adolescent fertility (steep decline in births per 1,000 girls aged 15-19 declined from 138.2 in 1990 to 14.1 in 2023), together with a concurrent reduction in childbearing among women in their 20s, have resulted in a rapid decline in period fertility. However, according to WPP2024 projections, fertility rates in older age groups are expected to decline slowly, or even slightly increase, leading to more gradual fertility declines from the cohort perspective.

New insights into future cohort fertility in low fertility countries

The rapid declines in period fertility in low-fertility countries in recent years have resulted in cohort fertility declining further to levels not previously observed. For example, the cohorts of women born in 1983 (those aged 40 years in 2023, the last year of the estimation in the WPP2024) are expected to have less than 1.5 births per woman by the age of 50 years in Italy, Japan, the Republic of Korea, Poland, Singapore, and Spain, with the lowest value expected for Singapore at 1.1 births per woman. Therefore, sustained levels of low fertility for a long period of time will unavoidably lead to lower levels of completed cohort fertility. When compared to the 1973 cohorts (those aged 50 years in 2023), most countries will see a decline in the average number of births per woman (Figure 5), although a small increase is expected in a small number of countries, including Belarus, Georgia, Lithuania and the Russian Federation with increases of more than 0.1.

Projections provide an indication of the eventual completed cohort fertility of women presently in their reproductive years. When comparing the projected completed cohort fertility for the cohorts born in 1983 and 1993 (women aged 40 and 30 years in 2023, the last year of estimation in the WPP 2024), completed cohort fertility is projected to stabilize, although at low levels of around 1.4, in Italy, Japan, and Spain. In most countries, further declines are expected, with completed cohort fertility in 26 countries or areas reaching levels below 1.5 births per woman from the 1993 cohort (as compared to 9 countries in the 1983 cohort), including countries and areas outside of Europe and Eastern Asia. In China, while the cohorts of women born in 1973 and 1983 have similar level of cohort fertility at 1.85 births per woman, the cohort 1993 is expected to have much lower cohort fertility at 1.44 births per woman (with 95th percent prediction interval between 1.33 and 1.56). However, fertility projections are subject to substantial uncertainty, and the cohort fertility of women presently in their reproductive years will depend on the extent of fertility recuperation above the age of 30 years in these countries.

The increases in cohort fertility in low-fertility countries are rarely observed. Germany (increase from 1.50 in 1968 cohort to 1.62 in 1981 cohort), Luxembourg (increase from 1.68 in 1957 cohort to 1.91 in 1970 cohort), Latvia (increase from 1.62 in 1975 cohort to 1.76 in 1982 cohort), Lithuania (increase form 1.69 in 1973 cohort to 1.82 in 1983 cohort), Russian Federation (increase from 1.6 in 1972 cohort to 1.76 in 1983 cohort), Belarus, Denmark, Belgium are the only increases of more than 0.1 birth observed in the cohorts that already reached nearly the end of reproductive age (aged 40 and above in 2023), while Japan had an increase of almost 0.1 (see annex figures). This is in stark contrast to common upswings and fluctuations of period fertility rates in low-fertility countries. Some increases in cohort fertility are projected for the future, though with increasing levels of uncertainty; for example, in Bulgaria, Hungary, Portugal and Slovakia this might be related to the undergoing shifts in the timing of childbearing that were not fully reflected in the projections of period fertility measures in WPP2024.

Validation of results

To ascertain how well the cohort measures derived from fertility estimates from the World Population Prospects match the observed cohort fertility, we compared our results with the completed cohort fertility data available in the HFD database. As illustrated in Figure 8, the differences are generally small, with the majority being close to 0% or not exceeding +/-1%. Most countries have almost identical cohort fertility data in the WPP and HFD (Figure 6 shows an example of France and Poland). In Germany (Figure 7), completed cohort fertility data were also available from the Federal Statistical Office. When comparing the WPP and HFD data with the official NSO figures, the time trends are very close to each other. For some countries, however, the differences are higher than +/-2.5% in some periods (Japan, Belarus, Russian Federation, and USA). Further investigation is required to understand the causes of such discrepancies, one of the reasons being the use of different empirical data for the estimates of age-specific fertility rates.

Conclusions

This study presents the first global dataset of cohort fertility measures, including with prediction intervals. While cohort fertility measures and their comparison with period measures have been extensively studied in some countries, especially those included in the Human Fertility Database (Human Fertility Database, 2024), we have extended the analysis to all countries and areas of the world. In addition, we have provided estimates for the 1935 cohort and projections up to the 2055 cohort, using the full range of age-specific fertility rates as estimated (1950-2023) and projected (2024-2100) in the WPP 2024. Our main contribution is to document cohort fertility trends in the global context without being restricted to a specific period, region, or fertility level. Improved description and analysis may also prove useful in refining theoretical underpinnings of fertility trends, particularly in the context of low fertility. The cohort fertility estimates based on updated projections that use the most recent data are crucial for understanding how low the overall fertility can fall.

The cohort fertility dataset, based on the WPP 2024 data, offers a unique opportunity to assess and compare fertility trends across countries and regions from a new perspective. There is wide agreement across diverse populations and different periods that cohort fertility measures, compared to period measures, are more stable as they are less influenced by abrupt changes in specific years due to events and conditions that might affect fertility rates in the given period. Moreover, period fertility may be distorted by shifts in the timing of childbearing to older or younger ages, which may not necessarily result in changes to completed cohort fertility (Bongaarts and Sobotka 2012). The results presented in this paper confirm that fluctuations, drops, or increases in the period fertility caused by conflicts, pandemics, natural disasters, economic cycles and crises, or the implementation of fertility-related policies often had little (and never a sudden) impact on completed cohort fertility. Furthermore, the cohort fertility measures provide additional checks regarding the performance of age-specific fertility projections used in the WPP (Ševčíková et al., 2016), especially for the completion of fertility in the cohorts undergoing important shifts in the timing of childbearing when the projection starts.

The availability of good quality data for fertility estimates on the entire period from 1950 to 2023 is an issue for many countries without complete vital registration systems, leading to higher uncertainty in fertility estimates and projections and the inability of data to capture potential period variations. In these countries, the empirical data used as inputs in the estimation model for the age-specific fertility rates were derived from sample surveys (with larger sampling errors) or were missing altogether. On the contrary, for countries that have age-specific fertility data from complete vital registration or a sequence of surveys, the impacts of major events or crises, social and economic transformations and fertility-related policies influencing reproductive behaviours are well-represented in period measures and the cohort measures show smooth trends with high accuracy.

It is also important to note that, for women who are currently of reproductive age or will enter their reproductive years in the future, cohort fertility measures are based partially or entirely on projected fertility rates from the WPP2024, which are inherently subject to uncertainty that is reflected in the predictions intervals from BHM projections. This uncertainty is also reflected in the cohort fertility estimates from year 2024 onwards, slowly widening prediction intervals as a larger number of reproductive years is covered by projections. The prediction intervals should be considered when interpreting the results.

As noted by Van Raalte et al. (2023), there are inherent limitations in deriving cohort measures from period data, because of the temporal and cohort-size bias generated when transitioning from Lexis squares to Lexis parallelograms. The present study, however, follows the same approach used in the HFD, which is the data source used by Van Raalte as the “true” value when comparing cohort estimates derived from period measures (Schmertmann, 2024). The analysis depicted in the validation of results section also shows how close our estimates are to the HFD data, providing additional evidence of the quality of the data presented.

However, despite these methodological challenges, cohort fertility measures grounded in robust fertility estimates and projections from WPP 2024 provide additional perspectives for analyzing and understanding global fertility trends and comparisons across countries and over time. In future research, cohort fertility data can be used as an alternative approach to projections of fertility using cohort fertility instead of period fertility rates as inputs.

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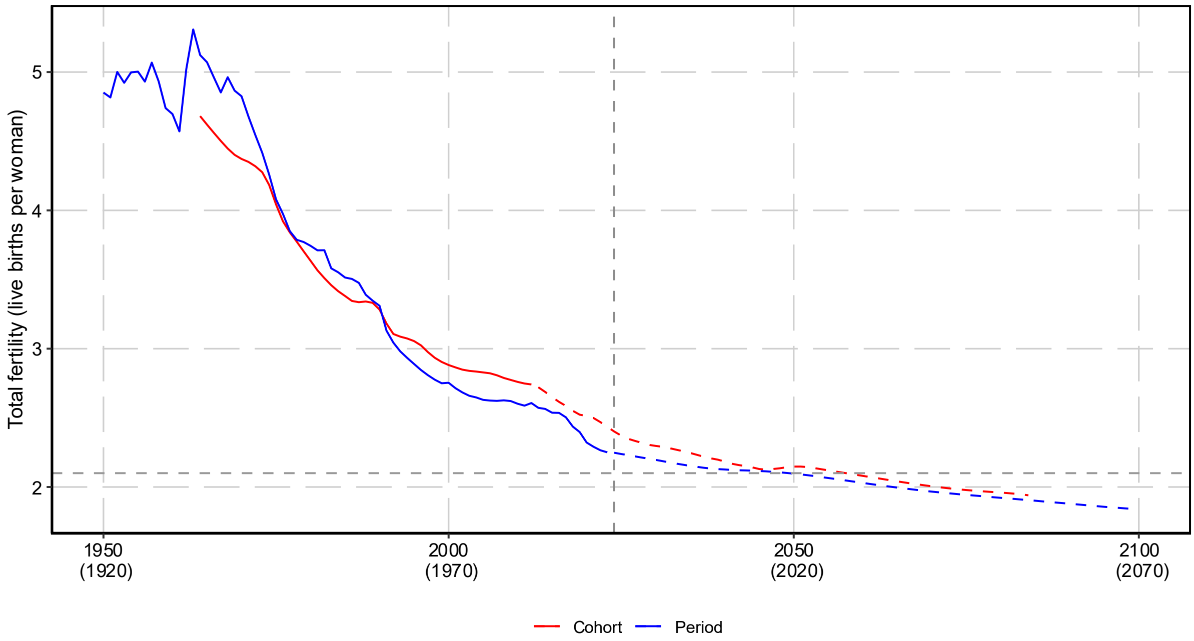
Figure 1. Total fertility rate by period and cohort approach, by year of reference, global level. For cohort rates, the year of reference represents the year in which the women in the specific cohort reached 30 years of age



Source: The period fertility rates are from World Population Prospects 2024 and cohort fertility rates were calculated by the authors.

Note: For cohort rates, the year of reference represents the year in which the women in the specific cohort reached 30 years of age. The cohort's birth year is presented in brackets. Uncertainty ranges represent 2.5th and 97.5th percentiles.

Figure 2. Age-specific fertility rates by cohort and by period, global level. Yellow line marks the year 2023 (last year of estimates in WPP2024) and the cohort 1983 (that reached age 40 years in 2023).

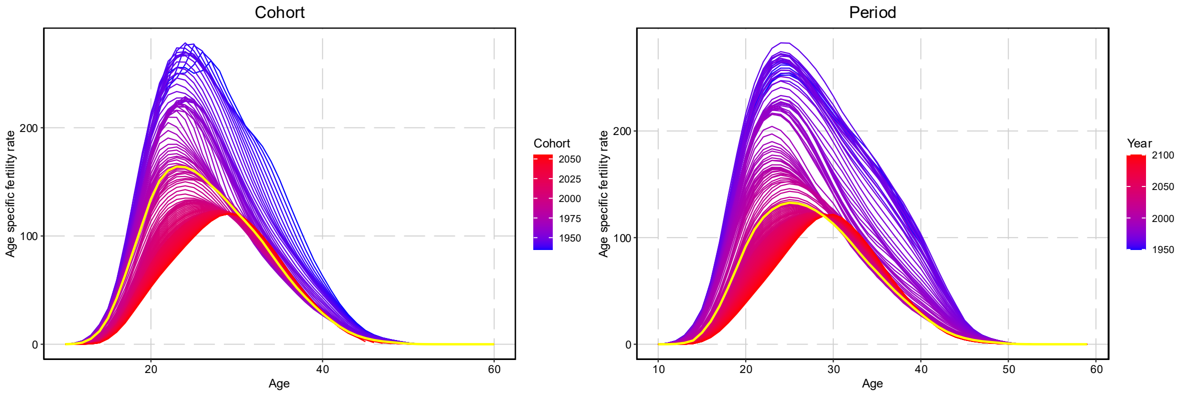
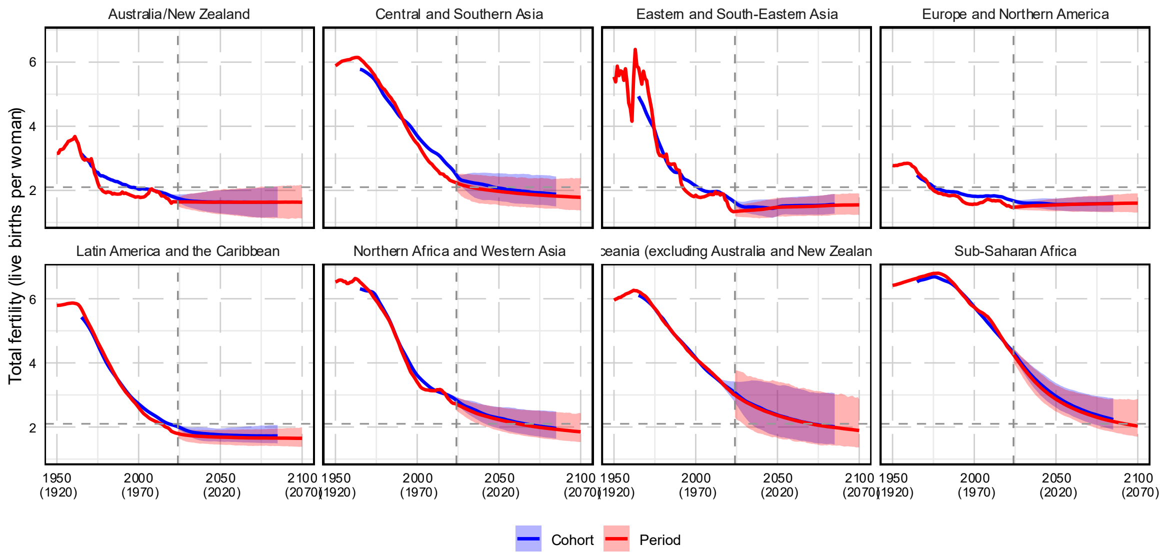


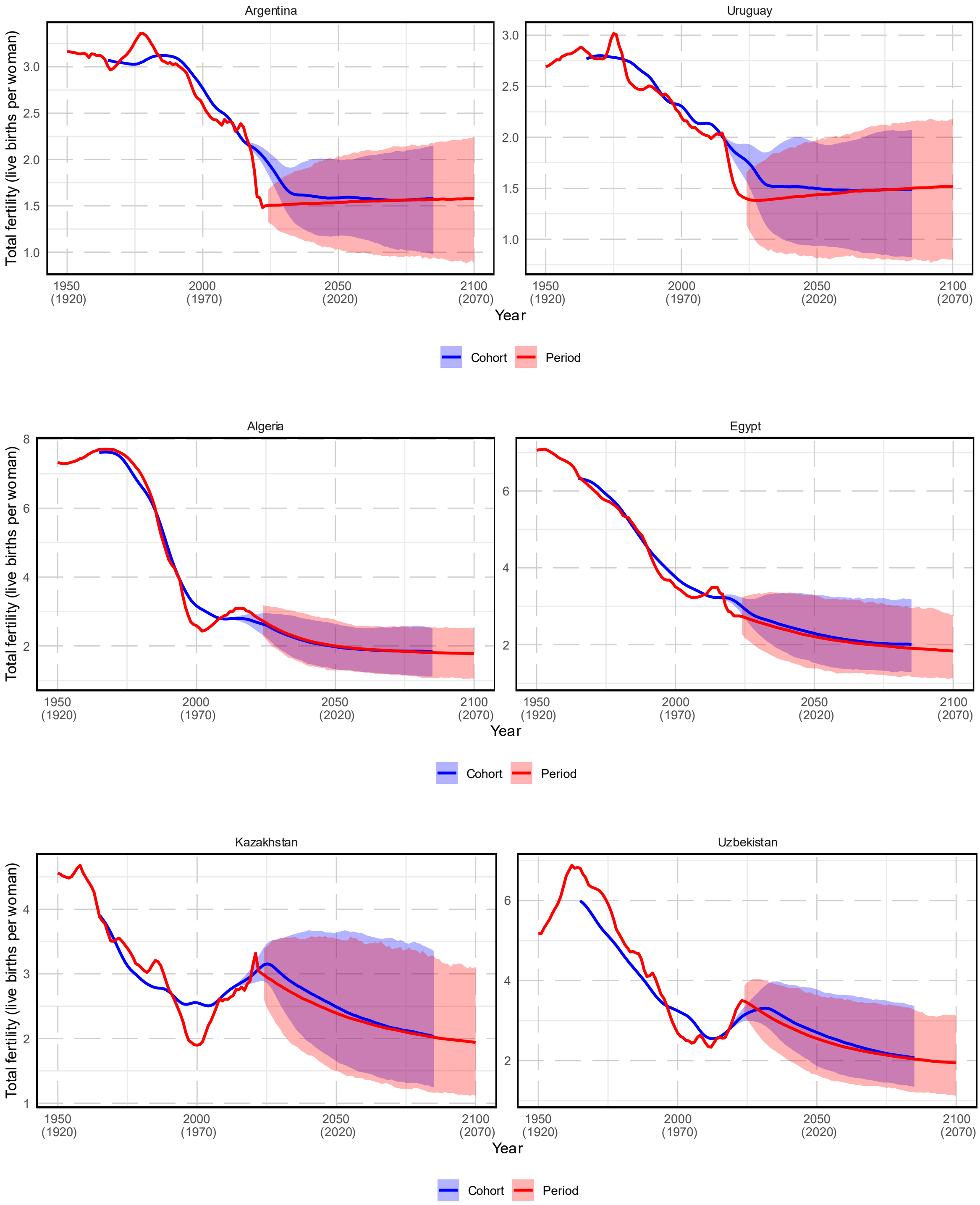
Figure 3. Total fertility rate by period and cohort, by year of reference, SDG regions.

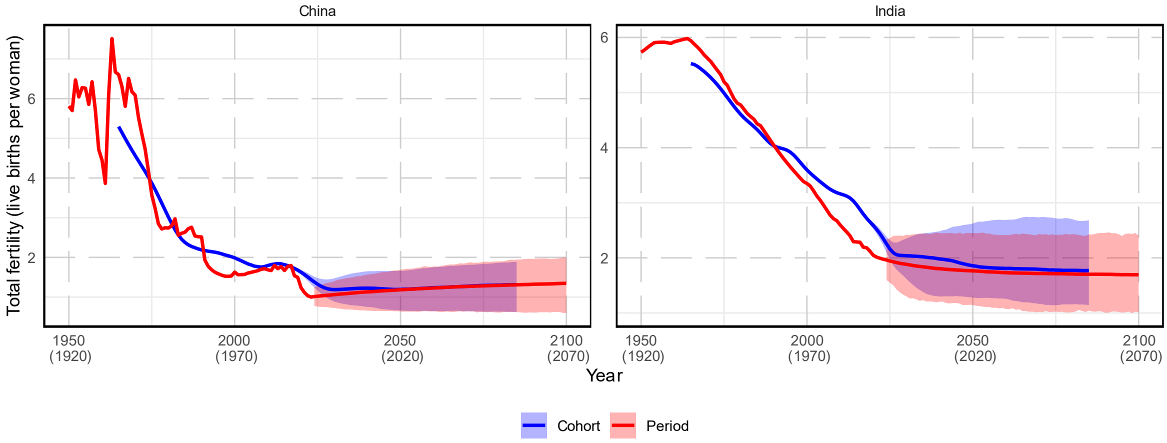


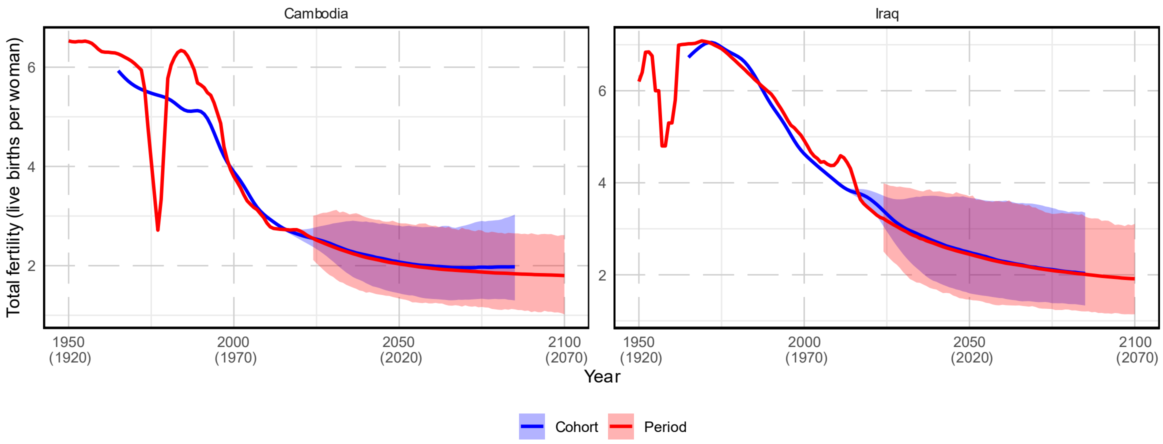
Source: The period fertility rates are from World Population Prospects 2024 and cohort fertility rates were calculated by the authors.

Note: For cohort rates, the year of reference represents the year in which the women in the specific cohort reached 30 years of age. The cohort's birth year is presented in brackets. Uncertainty ranges represent 2.5th and 97.5th percentiles.

Figure 4. Total fertility rate by period and cohort, by year of reference, selected countries.



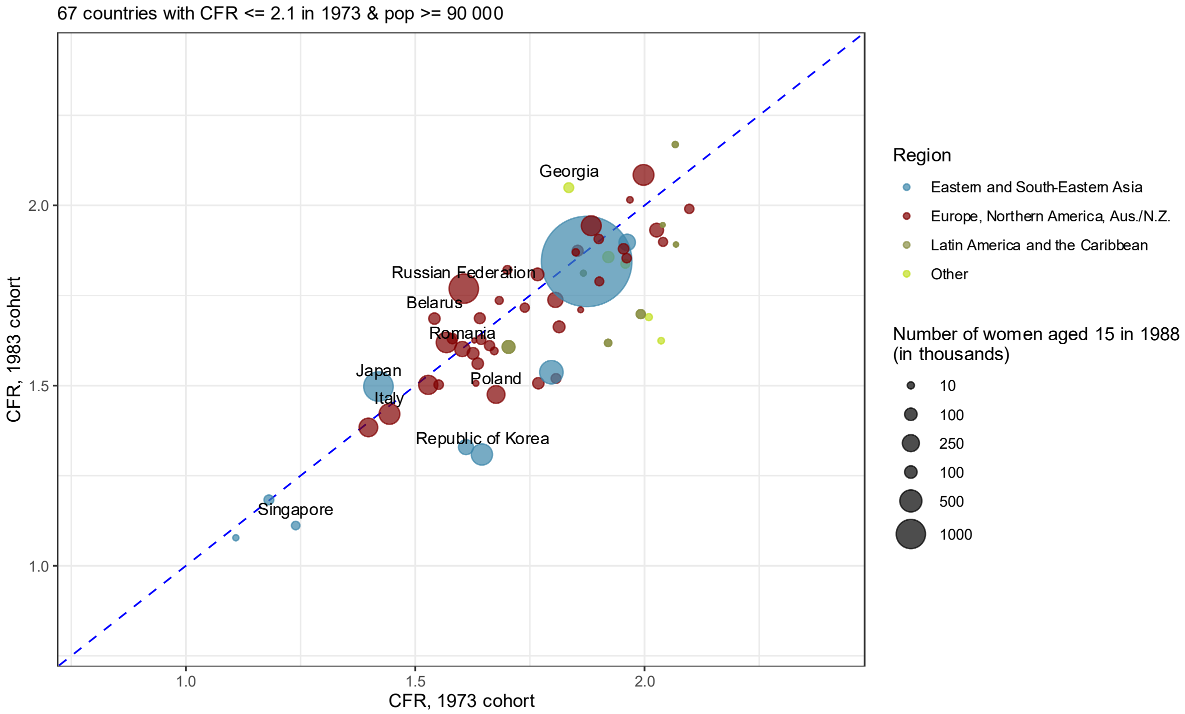




Source: The period fertility rates are from World Population Prospects 2024 and cohort fertility rates were calculated by the authors.

Note: For cohort rates, the year of reference represents the year in which the women in the specific cohort reached 30 years of age. The cohort's birth year is presented in brackets. Uncertainty ranges represent 2.5th and 97.5th percentiles.

Figure 5. Completed cohort fertility comparison for cohorts 1973 and 1983 (top panel) and cohorts 1983 and 1993 (bottom panel)



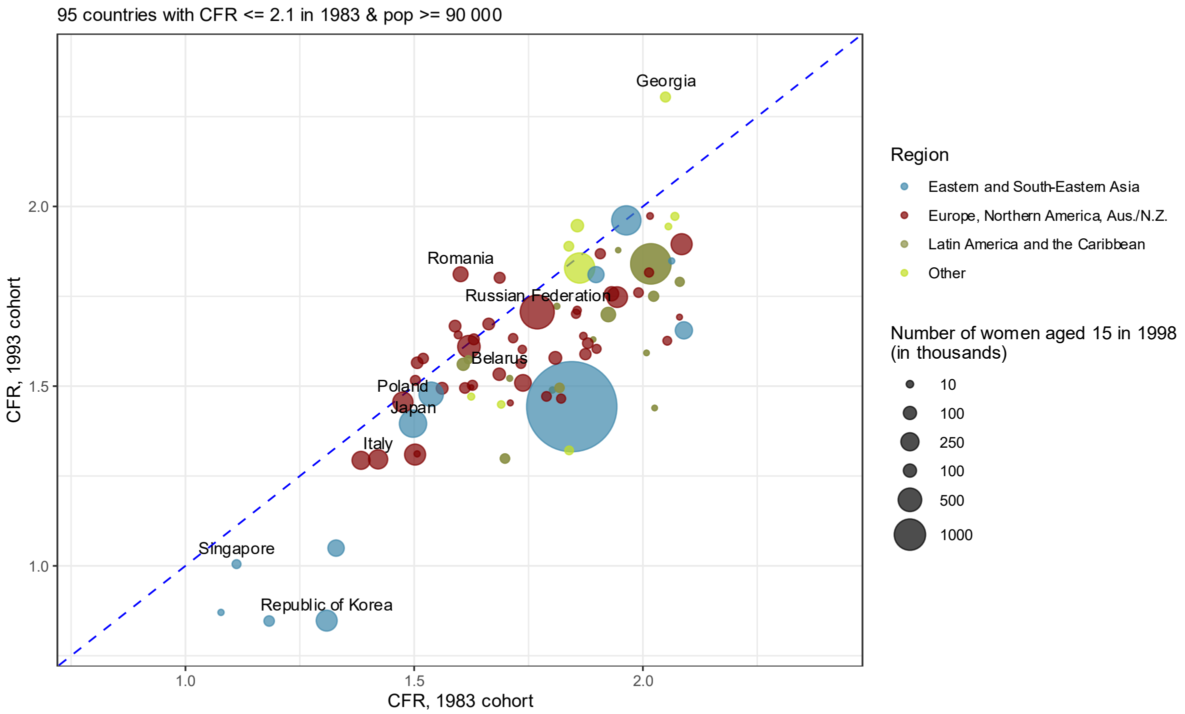


Figure 6. Total fertility rate by cohort, selected countries, selected sources.

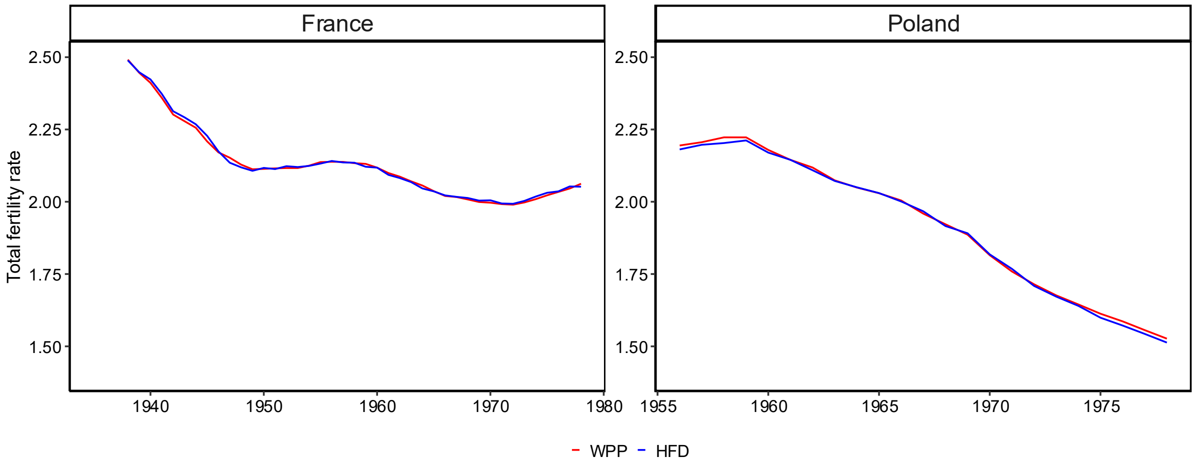


Figure 7. Total fertility rate by cohort, Germany, selected sources.

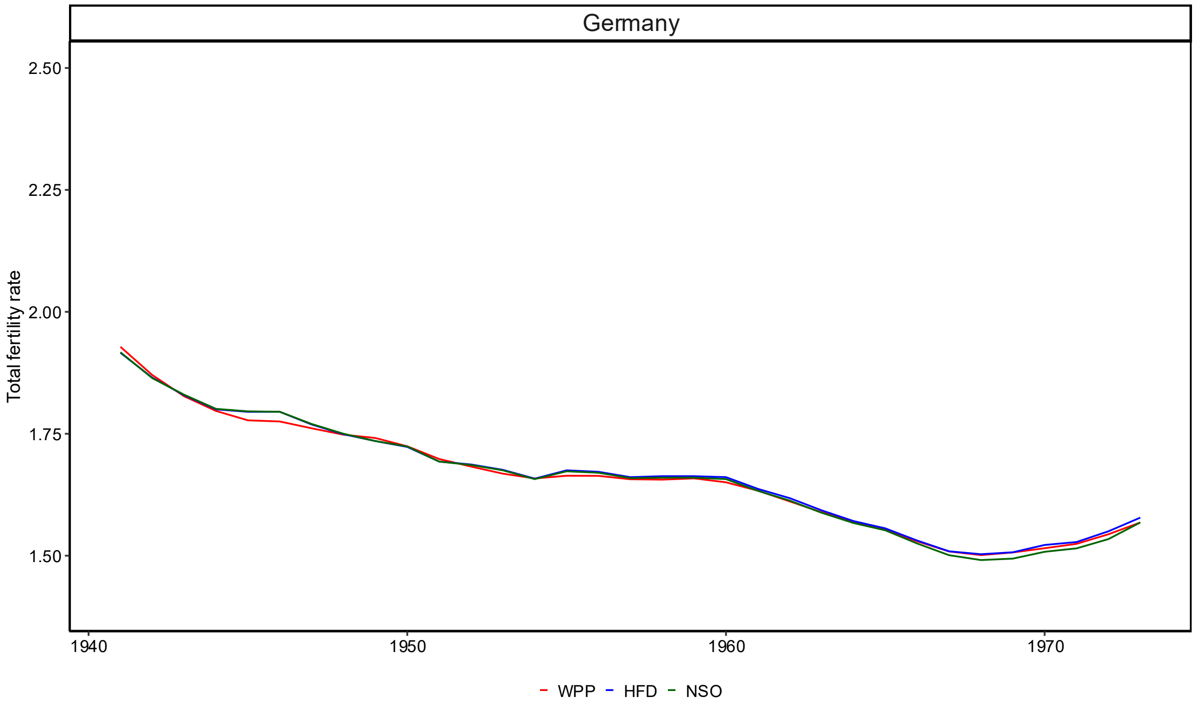


Figure 8. Percentage error between WPP and HFD total fertility rate, selected countries