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Visualising Age-Specific Fertility Patterns in the Former German Democratic Republic (GDR) and in East Germany, 1956-2024

Roland Rau, Heike Trappe

This contribution introduces the new category, "A Picture Is Worth a Thousand Words". It consists of one figure, up to ten references, an abstract of up to 100 words and a main text of approximately 1,000 words. The purpose of this category is to showcase interesting depictions of demographic phenomena. Often, a figure can convey more than can be described in 1,000 words. These data visualisations can be used for various purposes, such as teaching or replication studies. Therefore, the data used must either be included or freely available, and the underlying code must be licensed under an open-source licence.

For more information on the submission guidelines, please visit the CPoS website at: https://www.comparativepopulationstudies.de/index.php/CPoS/about/submissions

Abstract: In this contribution, the authors visualise how fertility dynamics have changed in East Germany over a period of 69 years, covering much of the existence of the German Democratic Republic (GDR), the societal transformation following reunification and the more recent past. The Lexis surface plot provides an intuitive understanding of the underlying developments that have contributed to the change in the age-specific fertility rates (ASFRs). It reveals distinct periods of fertility timing. Two major period effects profoundly reshaped age-specific fertility patterns in East Germany in the second half of the 20th century.

Keywords: Lexis surface plot · Age-specific fertility rates · GDR · East Germany

Lexis surface plots have been used in demography for approximately 40 years (e.g., *Caselli et al.* 1985). They offer two major advantages: First, they allow large amounts of data to be presented in a compact way. Second, when the *x*-axis is used for calendar time (period) and the *y*-axis for age, birth cohorts follow the 45° line when the axes are plotted at a 1:1 aspect ratio. This enables age-, period-, and cohort effects to be visualised without encountering the well-known identification problem. Pure age effects appear as horizontal lines, period effects as vertical lines, and cohort effects induce a pattern on the diagonal (*Rau et al.* 2018).

In this visualisation, we plot age-specific fertility rates (ASFRs) based on over 11 million live births to women aged 15-45 years in the former German Democratic Republic (GDR) and East Germany between 1956 and 2024. Data from 1990 onwards

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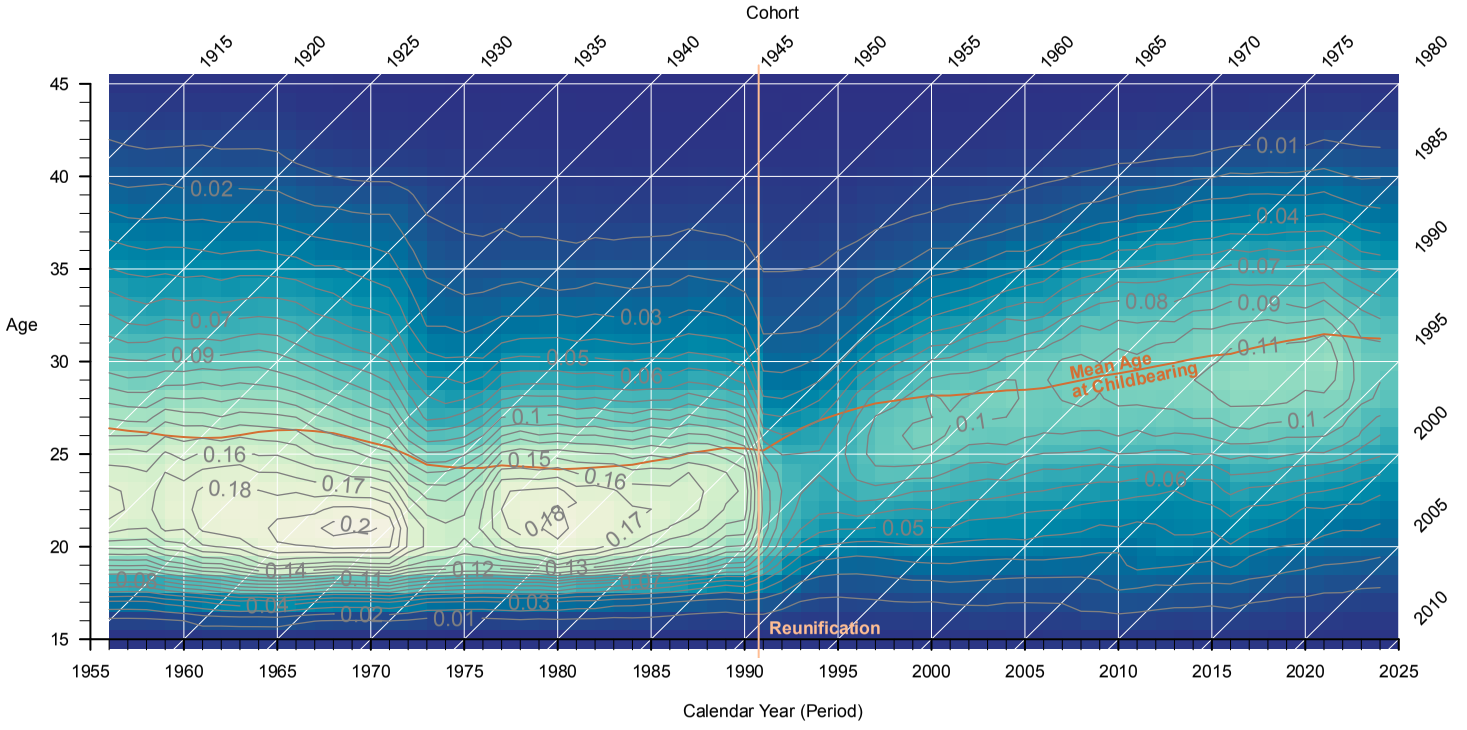

Note: The shades in the graph correspond to the ASFRs. Selected levels of fertility are depicted by contour lines. These highlight areas with equal levels of age-specific fertility. The orange line shows the mean age at childbearing for each year. Vertical, horizontal and diagonal lines have been added to detect potential period, age, or cohort effects, respectively.

Source: Own design based on data from the *HFD* and *Destatis*. For details see *Data and methods* below.

is limited to East Germany, excluding East Berlin. Ideally, the visualisation would be shown by parity, but unfortunately, this data is unavailable for the period 1990-2008.

The Lexis surface plot reveals some interesting features related to the impact of period effects on age-specific fertility in the former GDR and East Germany after reunification. Three periods emerge where fertility patterns were distinctly different: the end of the 1950s to the beginning of the 1970s; the mid-1970s to 1990; and the second half of the 1990s to the present day. During the first period, the majority of births occurred among women up to the age of 25, although births also occurred quite commonly up to the age of 35. This pattern is largely attributable to women in the pre-war and war cohorts who were born in the 1930s and early 1940s with a declining tendency to have children at higher ages. The mean age at childbearing remained above 25 years during this period.

From the late 1960s onwards, and particularly in the early 1970s, birth rates declined across all age groups. This decline was largely due to the fertility behaviour of women born in the second half of the 1940s. A new fertility pattern emerged that was even more age-compressed than in the previous period. From the second half of the 1970s onwards, age-specific fertility rates recovered, contributing to elevated ASFRs for women under 25 years until the end of the 1980s. Although this is not visible in the figure, it is interesting to note that the mean age at first birth for women decreased during the 1970s and increased only slightly between 1985 and 1989 (*HFD* 2025). Unlike in the previous period, fertility at higher ages remained the exception, with births mainly concentrated among women in their twenties. From the early 1970s until 1986, the mean age at childbearing remained below 25.

The decline in fertility in the late 1960s can be linked to the ambivalent situation that emerged for women in particular, as their participation in the labour force was already very high (67 percent in 1965), yet the societal conditions necessary for reconciling family life and employment (e.g. public childcare) were not yet in place. The timing of births was also facilitated by the introduction of oral contraception in 1965 and a liberal abortion law in 1972. Against the backdrop of declining fertility – with the replacement level last reached in 1971 – and concerns about falling female labour force participation, the GDR government introduced social policies to support women in their roles as workers, mothers, and housewives. As a result of the policies and incentives for early childbearing that had been in place since the early 1970s, the ASFRs recovered for most of the 1970s and 1980s. These policies included interest-free marriage loans, preferential housing allocations, and support for mothers still in education (*Trappe* 1996).

Following Germany's reunification in October 1990, a new pattern of age-specific fertility emerged. Between 1991 and 1995, the absolute number of births plummeted, while women's mean age at childbearing increased by almost two years. This was partly due to the fertility behaviour of the "unification cohorts" born in the second half of the 1960s, which resulted in lower levels of completed fertility than those of their predecessors and successors (*Pötzsch* 2013). Cohorts who reached adulthood after reunification began forming families at an increasingly older age than their predecessors, indicating a shift towards a new fertility pattern. This is reflected in the Lexis surface plot by increased ASFRs between the ages of 25 and 35 from 1995

onwards, which are less concentrated around certain ages than before reunification. Instead, births became more widely distributed across women's reproductive ages with an increasing tendency towards childbearing in the thirties. This indicates greater diversity in the timing of female fertility. Since 2000, women's mean age at childbearing has increased further, eventually stagnating above 30 after 2020. However, the recent stagnation masks a slight decrease in women's age at first birth (*Destatis* 2025). In contrast to previous periods, the overall age-specific fertility patterns appear to have remained largely unchanged in the wake of the pandemic.

The reunification of Germany was accompanied by a sudden and unprecedented decline in the Total Fertility Rate (TFR) in East Germany. It fell from 1.5 in 1990 to 1.0 in 1991, reaching a low of 0.8 between 1992 and 1995, before rising again gradually (*HFD* 2025). This decline was partly due to a rapid increase in the age at family formation and family expansion, as well as to a postponement of childbearing. It has been attributed to a variety of factors, ranging from new opportunities to uncertainties in all areas of life (e.g., *Kreyenfeld* 2000, 2003).

Taken together, the transition from a highly age-compressed fertility pattern in the late 1970s and 1980s to a much more age-diverse pattern signals a fundamental change in the timing of family formation and expansion over the female life course. Unlike most Western and state socialist societies, East Germany is exceptional in that it experienced two period effects over the second half of the 20th century that altered age-specific fertility patterns profoundly (*Pattaro et al*. 2020: 696).

Data and methods

The plot contains two different data sets: 1) age-specific fertility rates and 2) the mean age at childbearing. Both data sets were compiled from the same two data sources: The Human Fertility Database (*HFD*, www.humanfertility.org) and Germany's Federal Statistical Office (*Destatis*, www.destatis.de). Both sources provide the data free of charge. The HFD requires a registration first, whereas Destatis does not.

1) ASFR: Age-specific fertility rates from the Human Fertility Database

Two data sources were used: The Human Fertility Database was used for age-specific fertility rates for the years 1956–1999 and data from Destatis for the years 2000-2024. Although the original data from both sources include a wider age range, we have restricted our analysis to the range from 15 to 45 since fertility at ages below 15 and above 45 is virtually negligible.

2) Mean age at childbearing

We used data from Destatis for the years 2009-2024 according to the "Altersjahrmethode", i.e. by calendar year and age of the mother at birth of the child. The HFD also provides estimates of the mean age at childbearing. However, there were considerable differences in relation to the Destatis data for the years covered

in both data sets (2009-2017). Therefore, we estimated the mean age at childbearing ourselves using data from the HFD on the number of births by age of the mother *x* for the years 1956-2008, assuming that births occur on average at age *x+0.5*. The differences between the two data sources were then negligible. See the code files for further details.

Replicability

The data required from the HFD are available (after registration) at:

- ASFR:
https://www.humanfertility.org/File/GetDocument/Files/DEUTE/20190507/DEUTEasfrRR.txt

- For the estimation of the mean age at childbearing:
https://www.humanfertility.org/File/GetDocument/Files/DEUTE/20190507/DEUTEbirthsRR.txt

- The data from Destatis have been made available on:
https://gitlab.com/rolandrau/data-visualization-cpos-2026

- All code is written in the R language (R Core Team, 2026), version 4.6.0., and can be accessed at:
https://gitlab.com/rolandrau/data-visualization-cpos-2026

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Prof. Dr. Roland Rau (✉), Prof. Dr. Heike Trappe. University of Rostock. Germany.
E-mail: roland.rau@uni-rostock.de; heike.trappe@uni-rostock.de
URL: https://www.isd.uni-rostock.de/rau/
https://www.isd.uni-rostock.de/en/famdemo/trappe-heike/

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