HUMAN FERTILITY DATABASE DOCUMENTATION: BULGARIA

Authors:

Yordan Kalchev
former Head of Division, Population Statistics,
National Statistical Institute, Sofia, Bulgaria

Nadezhda Karlezhova
Population Statistics,
National Statistical Institute, Sofia, Bulgaria

Kryštof Zeman
Vienna Institute of Demography
E-mail: krystof.zeman@oeaw.ac.at

Dora Kostova
formerly Max Planck Institute for Demographic Research

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WARNINGS:

Due to high out-migration, not captured in the official population statistics, fertility indicators for the period since 2007, when Bulgaria entered the European Union, should be used with caution (for further details, see section 4.4).

Due to lower quality of input data prior to 1960, detailed period indicators and all cohort fertility indicators, especially childlessness, should be used with caution (for further details, see section 5).

1 General information

This report describes statistical data provided by the National Statistical Institute (NSI), Bulgaria, to the Human Fertility Database (HFD). The data include the number of live births by age of the mother, mother's year of birth, and birth order; the number of live births by month; and the female population by age and parity (number of live-born children) from the population censuses 2001 and 2011. Data on birth counts provided for the HFD and described in this report originate from official vital statistics publications or were directly obtained from the NSI.

All the input data used for generating the HFD output data and indicators are specified in Appendix 1.

1.1 Brief history

Bulgaria is located in South-Eastern Europe and occupies the eastern part of the Balkan Peninsula. The borders of the present Republic of Bulgaria have not changed since 1946. Since 1991, Bulgaria has been a republic with a parliamentary form of government. Bulgaria joined the European Union in 2007. Visa-free entry of Bulgarian nationals to the EU had been granted already in 2001.

As a result of socio-economic and political changes, as well as deteriorating living conditions after 1990, there have been significant shifts in the demographic behaviour of the population, resulting in a natural population decline, very low fertility, and widespread emigration. Emigration peaked already at the turn of the 1980s and beginning of the 1990s, with a negative net migration estimated at over 470 thousand in the period 1989–1993 (Council of Europe 2006). The population of Bulgaria has declined rapidly over the last two and a half decades. The 1985 population census registered 8,949,649 inhabitants permanently residing in Bulgaria. Twenty-five years later, according to data from the 2011 census, this figure dropped to 7,364,570. Census 2021 then report further decline, to 6,520,314.

1.2 Data collection

The Bulgarian National Statistical Institute is a governmental agency responsible for collection, processing and dissemination of population data. It was established in 1880-1881 (together with the Bulgarian Statistical Organization).

An official document – *certificate of birth* – is issued for each birth. The document includes information about the newborn child, about the mother, and about the father (if he is known), irrespective of their marital status.

All vital events in Bulgaria are registered by the *Unified System for Civil Registration and Administrative Services of Population* (thereafter referred to as the "civil registration system"). The administrative records are sent to the NSI on a monthly basis. Data are further processed, and detailed vital statistics and basic demographic indicators are published annually by the Population Division at the NSI.

Seventeen population censuses took place in Bulgaria since the establishment of the Bulgarian Statistical Organization in 1880. The first nine censuses were conducted between 1880 and 1934. After the WWII, population census was conducted every ten years in 1946, 1956, 1965, 1975, and 1985. This regularity was interrupted with the 1992 census, which was carried out earlier because of the urgency to produce reliable population counts after the huge out-migration in 1989–1990. The 2001 population census was the first census that was conducted following the Eurostat recommendations in order to assure data comparability with other European countries. Population data from the most recent 2011 population census are available at https://www.nsi.bg/census2011/indexen.php

1.3 Territorial coverage

There were no territorial changes in Bulgaria during the period covered by the data provided for the Human Fertility Database (since 1947).

'Resident population', one of the crucial concepts used in the vital statistics and population censuses, includes all people who reside permanently in the country and have not left it officially as of December 31 of the respective year (or at the census date) for a period of more than one year. Foreign citizens who have stayed in Bulgaria for less than a year are not included in the resident population.

The aggregate number of live births includes live-born children with Bulgarian citizenship (including those with dual citizenship[1]) irrespective of their place of birth, as well as those with non-Bulgarian citizenship but who were born in Bulgaria and for whom Bulgaria is a primary place of residence. Children with Bulgarian citizenship born abroad may sometimes be subject

[1] The Bulgarian nationality law allows Bulgarian citizens to hold foreign citizenship in addition to their Bulgarian citizenship. A newborn can acquire Bulgarian citizenship by descent if at least one of the parents is a Bulgarian citizen.

to late registration and would appear in the database by the date of registration and not by the date of occurrence of the event. For more details, see section 4.2 further in this document.

2 Birth count data

Birth data included in the Human Fertility Database refer to the period spanning 1947–2021. Data for births in 1947–1985 are taken from the official demographic publications. Starting in 1986, the data were extracted from the *Information System 'Demography'* database (ISD) established at the NSI on the basis of individual birth records. These data are specified by single years of age, birth cohort of the mother, and birth order; birth orders up to 11+ are distinguished.

Data on live births by month cover the years 1900, 1905, 1910, 1920, 1925, 1930 and 1935, and the period 1939–2021.

3 Population count data

3.1 Population count data by age

The annual age structure of women since 1947 is taken from the Human Mortality Database (HMD). The data from the HMD for 1985–2010 differ from official data of the NSI, as they are adjusted for underestimation of migration and mortality in inter-censal periods (see Figures 1 and 2; for details, see the file "About mortality data for Bulgaria", Philipov et al. 2022).

Figure 1: Differences between the previously used estimates ("old") and the current estimates ("new", adjusted with the 2011 census data) of female population exposure in 2009

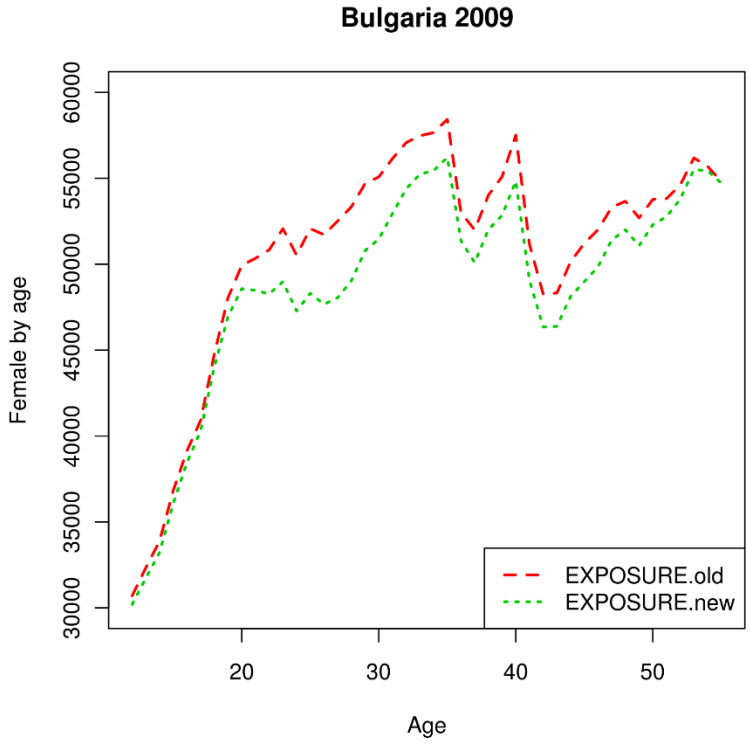
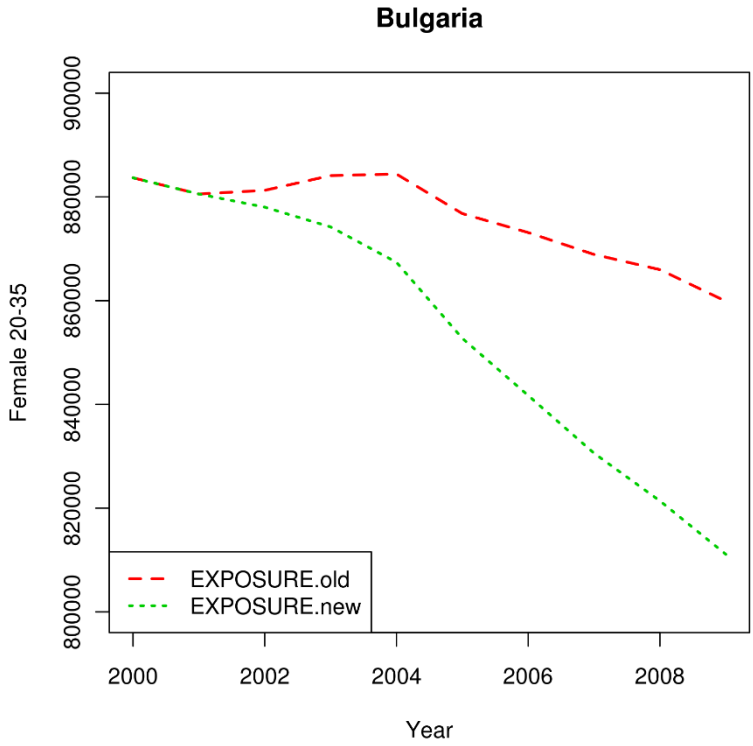
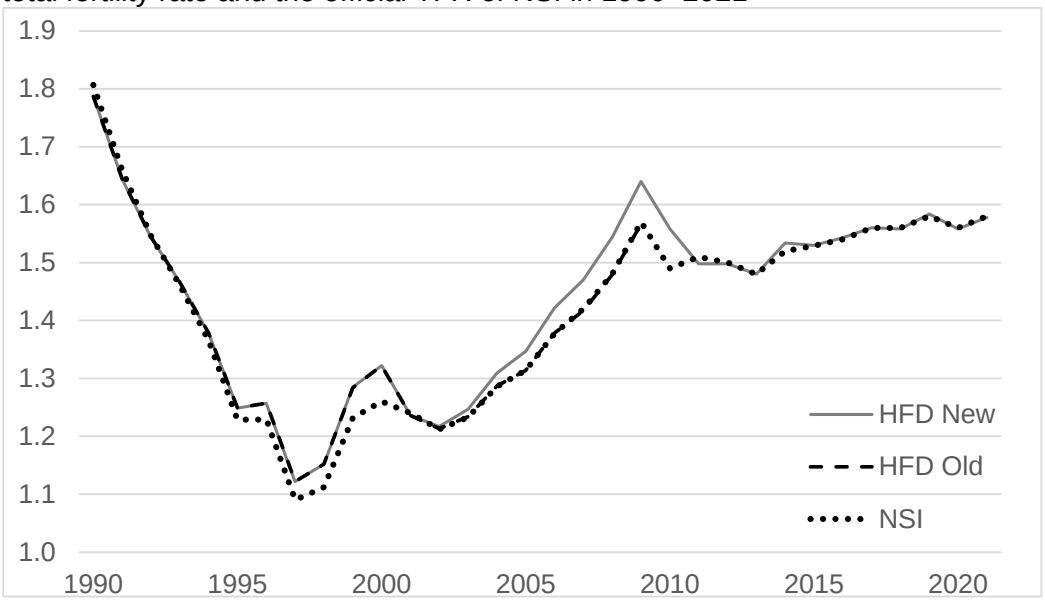


Figure 2: Differences between the previously used estimates ("old") and the current estimates ("new", adjusted with the 2011 census data) of female population at age 20–35 in 2000–2009



Since the current release of the HFD data for Bulgaria employs the HMD population exposures adjusted using the 2011 census data, all the population exposure estimates as well as fertility rates and other indicators for 2002–2009 can differ from the previous HFD data release as of October 2011. The number of women at childbearing ages has decreased by about 5% for the years 2002–2009. Consequently, the age-specific fertility rates and the TFR have increased by up to 5% for this period. The maximum change in the TFR, from 1.567 to 1.640, has been recorded for the year 2009 (see Figure 3). Due to differences in the population exposure estimates, there is a gap between the official TFR and that computed by the HFD in 1990–2010, which goes up to 0.07 (Figure 3).

Figure 3: Comparison of previous HFD estimates ("old") and the current HFD estimates ("new", computed using the population exposures adjusted with the 2011 census data) of the total fertility rate and the official TFR of NSI in 1990–2021



3.2 Population count data by age and parity

The distribution of the female population by age and the number of live-born children is currently available from the censuses 2001 and 2011. These data are tabulated by single years of age and number of live-born children up to parity five and higher. Similar data were also collected in the 1985 census, but the results were not published and thus are not available. The 1992 census did not collect information on the number of live-born children.

4 Specific details

4.1 Definition of live birth

The definition of live birth that was in force in Bulgaria **in 1970–2008** differed from that in the WHO recommendations. Some of the births that would be considered live births or stillbirths in other countries may therefore have been recorded as miscarriages in Bulgaria. For a more extensive discussion of this problem, see Philipov et al. (2022).

> *"In accordance with the methodology valid up to 2008 inclusive, the definitions about the born children's status are the following:*
>
> *A live born child is the one, who weighs 1 000 or more grams and has shown signs of life at the completion of pregnancy no matter its duration. The signs of life are breathing, functioning of the heart, pulsation of the umbilical cord or voluntary movement of the muscles. At the presence of one of these signs it is considered that the child is born alive. If the foetus weighs less than 1 000 grams it is accepted as live born if it has been alive for at least 6 days.*
>
> *A stillborn child is the one who has not shown signs of life and its length is 35 or more centimeters at the completion of pregnancy or the pregnancy has continued at least 28 weeks. The number of stillborn children does not include the abortions, which are premature interruptions of pregnancy in unnatural or natural way.*
>
> *In accordance with the same methodology an abortion is defined as interruption of the pregnancy when the foetus has not shown signs of life and its length is below 35 centimeters or the pregnancy has continued less than 28 weeks. It is accepted that abortions are also the cases when the foetus weighs less than 1 000 grams and has not lived at least 6 days from the birth.*
>
> ***Since 2009** according to Decree No 32 from 30.12.2008 of the Ministry of Health, the following definitions about the born children's status have been applied:*
>
> *A live born child is the one, who has shown signs of life at the completion of pregnancy no matter its duration. A foetus with a weight below 600 grams and/or duration of pregnancy less than 22 weeks is accepted as live born if it has been alive for at least 3 days.*
>
> *A stillborn child is the one who has not shown signs of life and its weight is 600 and more grams at the completion of pregnancy and/or the pregnancy has continued at least 22 weeks.*
>
> *In accordance with the new Decree an abortion is defined as interruption of the pregnancy when the foetus has not shown signs of life and its weight is below 600 grams and/or the pregnancy has continued less than 22 weeks. It is accepted that abortions are also the cases when the foetus has not lived at least 3 days from the birth".* (NSI 2019, p.1–2)

For 1947–1959, the order-specific data comprise of all births, ***including stillbirths***. However, for the periods 1947–1949 and 1953–1959 data on live births by age-group of the mother are available. Total numbers of live births for 1950–1952 were obtained from the distribution of live births by calendar month (see the input file with monthly data: BGRmonthly.txt). Based on these data, estimates of live births for the period 1947–1959 were generated. For the description of the method, see Appendix 2.

4.2 Age

Data on births by age of the mother refer to age in completed years (ACY). Data for 1947–1959 are only by 5-year age groups, including the broad age group ≤19. Since such a broad age group cannot be satisfactorily recalculated into single years of age using the present HFD methodology (see the HFD Methods Protocol), data were first recalculated into narrower age groups 12–14 and 15–19 using the method described in Appendix 3.

Data on live births by single age of the mother for 1960–1977 (with no birth order specification) were provided by the Observatoire Démographique Européen, who obtained them from the Committee for Integrated Social Information System to the Council of Ministers in 1983. These data were combined with official data of births by 5-year age groups and birth order to obtain data by single years of age groups and birth order.

Data on live births by single years of age and birth cohort of the mother for 1978–1985 come from the official demographic publications. Data for 1978–1985 (for all birth orders combined) and for 1986–2021 (both by birth order and for all birth orders combined) originally are classified by age of the mother and mother's birth cohort. In other words, these data were provided for the HFD in the format of Lexis triangles. For some years, however, the schedule of births by Lexis triangles resembles a "zig-zag" pattern (see Figure 4), indicating that some of births might have been allocated into wrong Lexis triangles. Due to these data quality issues, the HFD combines the original data by Lexis triangles into Lexis squares (sorted by age in completed years) and redistributes them into Lexis triangles using own methodology (see the HFD Methods Protocol).

It is most likely that this "zig-zag" pattern to a large extent has to do with late registration births. As mentioned earlier, the data on live births for Bulgaria include live-born children with Bulgarian citizenship irrespective of their place of birth. In order to obtain Bulgarian documents (i.e., birth certificate, passport, etc.), children born abroad must be registered in Bulgaria not later than in 6 months after their birth. In reality, however, children born abroad are often registered with a delay[2]. According to data from the National Statistical Institute (NSI), the number of late registration births increased from about 60 births in 1995 (0.08% of all births) to more than 2,000 births (2.96%) in 2010. These births are added to births that have occurred in the current calendar year (i.e., they appear in the database by date of registration) with reported age of the mother at birth and mother's year of birth calculated by subtracting the mother's age at birth from the current (birth registration) year. In order to smooth data inconsistencies that result from mixing up births recorded by date of occurrence with those recorded by date of registration, starting from 1995 the HFD combines the original data by Lexis triangles into Lexis squares (sorted by age of the mother in completed years). The birth counts by Lexis squares are then split into Lexis triangles using the HFD methodology.

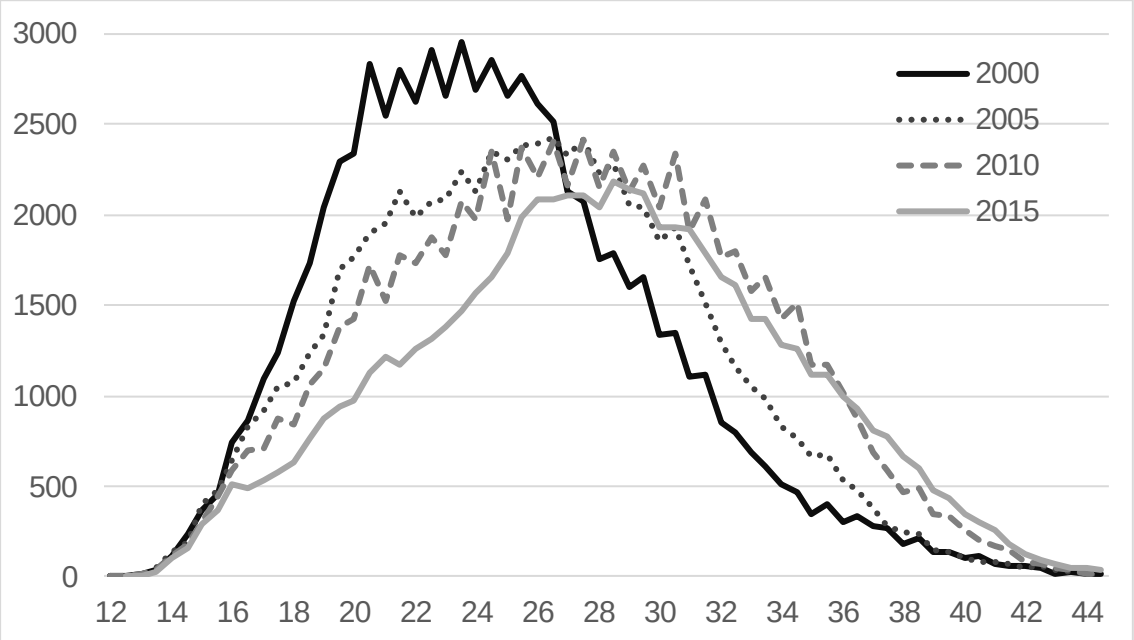
Data users must be aware, however, that the inclusion of late registration births in the data on live births by age of the mother (Lexis squares) for the period 1995–2021 may lead to a slight overestimation of fertility indicators, particularly after the recalculation of population estimates using the 2011 census data. We also have to declare that the true number of children born abroad is not known, as well as it is not known how many of them are included into the Bulgarian vital statistics and how many are not covered. It is unclear if all births born abroad

[2] This is particularly true for children with dual citizenship who do not need Bulgarian documents for traveling.

were assigned unknown birth order (see also section 4.4). It is also unclear whether births to Bulgarian citizens permanently residing abroad are included in the Bulgarian vital statistics for all the period of 1995–2021, and how this number was changing over time. The only information regarding this issue by the NSI is that the data include children with usual residence (current address) in the Republic of Bulgaria irrespective of their place of birth.

We estimate that around 5% of births included in the Bulgarian vital statistics around the year 2010 are births to Bulgarian residents born abroad.

Figure 4: Illustration of the "zig-zag" pattern in numbers of births by Lexis triangles, Bulgaria, 2000–2015



4.3 Birth order

Birth order is defined by the total number of live-born children a woman has previously delivered, without counting stillbirths, and irrespective of her current or previous marital status. In case of multiple deliveries, each child born is assigned a separate birth order.

4.4 Unknown cases

The number of cases with unknown age of the mother and/or unknown birth order of the child varies during the period covered. In 1947–1980, the number of unknown cases was gradually decreasing from about 300 to less than 100 a year. In 1981–1994, only very few cases with unknown age of the mother were recorded, and there were practically no cases with unknown birth order of the child. For foundlings (abandoned children) whose mothers were unknown, the age of the mother was imputed as 17 and the birth order was set to one. No unknown cases were recorded in 1995–1999. Since 2000, births to Bulgarian residents living abroad have been recorded as births of unknown birth order. The number of births with unknown birth order has risen since 2007, when Bulgaria entered the European Union and the number of Bulgarian women living and bearing children abroad increased substantially. While between 2000 and 2006 there were only about 20–50 cases with unknown birth order per year, since 2007 the number is around 700 annually (about 0.8–0.9% of total number of live births).

In 1960–1977, the order-specific data classified by 5-year age groups include a category of unknown age, while the non-order specific data classified by single age groups do not have

such a category because the births with unknown age of the mother have been redistributed across the categories of known age. This leads to a slight disagreement between the number of births in the 5-year age groups and the corresponding sums of births calculated from the single year age groups. However, the differences are very small.

Figure 5: Births of unknown age or birth order, Bulgaria, 1947–2021

5 Quality of the data

The civil registration system introduced in 1973 covers in detail all new-born children in the country, as well as births to Bulgarian residents temporarily living abroad. The data are considered to have a high degree of reliability and completeness. The data go through formal and logical tests, both in the National Civil Registration System and at the National Statistical Institute (Information System 'Demography', ISD). Quality checks are made for each record, and individual registrations of births are compared with the population numbers recorded in the ISD. In cases where the data need to be corrected, information from birth certificates[3] is used for this purpose. However, there are a few issues that need to be discussed in greater detail.

5.1 Cohort childlessness

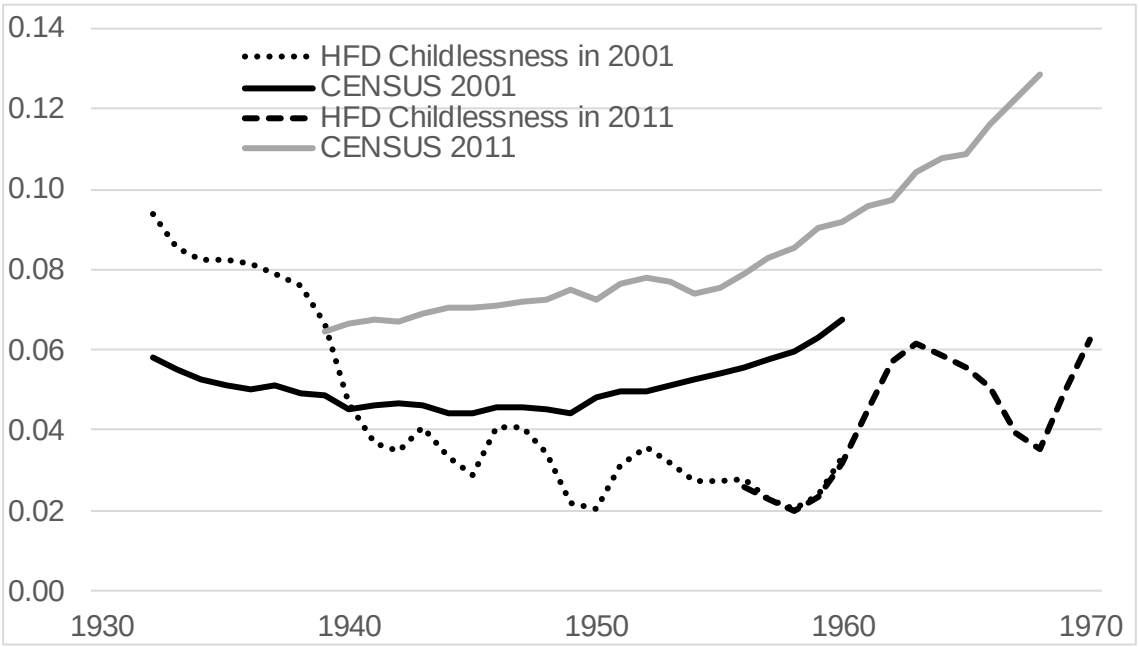
The quality of population data is affected by high and undocumented migration in the period after 1989. According to expert estimates more than 300,000 persons left the country in 1989 and 1990[4] and another 200,000 emigrated during the next 2–3 years. High emigration continued into the 1990s and 2000s. It had a second peak after 2007, when Bulgaria entered the European Union. In the last 25 years (between the censuses of 1985 and 2011) Bulgaria lost more than 1.5 million people (or about 17% of its population) in total due to a negative natural increase and a negative migration balance. Such a high emigration inevitably affected the structure of the population and contributed to increasing mismatch between occurrences (live births) and the exposure (the female population to

[3] The birth certificate is an official document of the civil registration system and has legal value.
[4] Most of the first wave emigrants were ethnic Turks who left Bulgaria for Turkey, mostly involuntary, in the late spring and summer of 1989.

which these births occur). These issues are also discussed in the country documentation for Bulgaria in the Human Mortality Database (Philipov et al. 2022).

As a result of the mismatch between the vital events and the exposed-to-risk population, some fertility indicators may reach implausible values. This problem is particularly evident in the estimates of cohort childlessness in the cohorts of women born in 1940–1958. The proportion of childless women in these cohorts is lower than 5% (with the lowest value of 2.0% in the cohorts 1950 and 1958) and is highly fluctuating between the cohorts. The 2001 census results show a very low level of childlessness of 4–6% for the cohorts 1940–1960 as well (Koytcheva and Philipov 2008). However, the HFD computations display yet lower, and often implausible, values (see Figure 6).

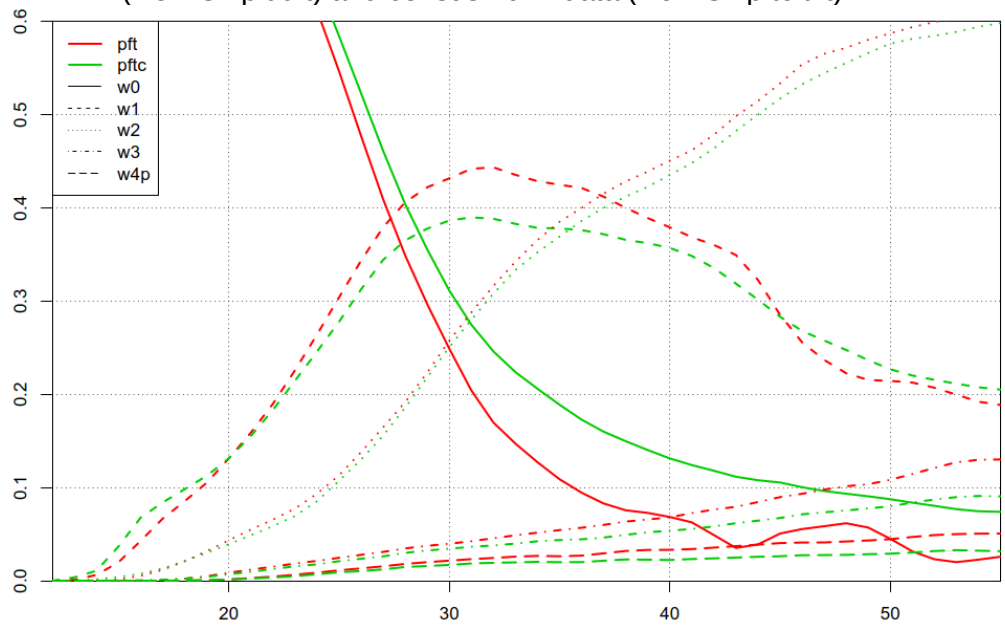
Figure 6: Childlessness of the cohorts 1932–1970 based on data from various sources (see the note)



Note: data come from the censuses 2001 and 2011 and HFD period fertility tables for 2001 and 2011 (see the file BGRpft.txt)

Data for higher parities are even more problematic. As shown in Figure 6, which compares the HFD estimates of childlessness that are based on vital statistics data with the 2011 census results, there are huge differences between the two data sources. While the cumulation of vital statistics data used in the HFD computations underestimates the proportion of women with one and two children, it overestimates the proportion of women with three and more children (Figure 7). This error is particularly evident for older cohorts. We attribute this difference to the low quality of data before 1986 (i.e., affecting the cohorts born before 1971) and also to the high emigration prior to the 2011 census. The HFD cohort fertility indicators for Bulgaria should therefore be used with extreme caution.

Figure 7: Proportion of women with 0, 1, 2, 3 or 4+ children in 2011 according to HFD data (file BGRpft.txt) and census 2011 data (file BGRpftc.txt)



5.2 Monthly births

For 1987, the total number of live births based on age- and birth order-specific data is by 1 case higher than the sum of monthly birth data; for 1990, the total number of live births based on age- and birth order-specific data is by 2 cases higher than the sum of monthly birth data. The reasons for these discrepancies have not been identified.

5.3 Implausible mean ages

There are different subpopulations in Bulgaria with distinct fertility behaviour. Women with three and more children are mainly of Roma ethnicity, who begin their reproduction at a young age. The recent postponement of births is much more prevalent among women of Bulgarian ethnicity than among Turks and Roma (Koytcheva and Philipov 2008). This can explain why the mean age at second childbirth has exceeded that of the third one in 2009. In this year, the peak age for third birth rates was at age 21–23, while the peak in second birth rates was reached at age 30.

6 Revision history

Changes with the March 2023 revision:

The current HFD data release employs new population exposure estimates based on the 2011 census results. Due to this change, fertility rates and other indicators for 2002–2009 considerably differ from the previous data release as of October 2011 (for details, see section 3.1).

Since the original data on births by Lexis triangles, provided by the NSI, show a zig-zag pattern in some of the years in the period 1978–2021, it was decided to switch to using births by Lexis squares in the HFD calculations for Bulgaria (for details, see section 4.2).

New data for 2010–2021 were added.

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APPENDIX 1
INPUT DATA USED FOR HFD CALCULATIONS

BIRTHS

Period	Type of data	Age range	Birth order	RefCode(s)
1947–1959	Annual number of total births by age of mother and birth order (Lexis squares)	-19, 20–24, …, 40–44, 45+, unknown	1, 2,…, 8, 9+, unknown	1
1947–1949, 1953–1959	Annual number of live births by age of mother (Lexis squares)	-19, 20–24, …, 40–44, 45+, unknown	–	1
1960–1985	Annual number of live births by age of mother and birth order (Lexis squares)	-14, 15–19, …, 45–49, 50+, unknown	1, 2,…, 8, 9+, unknown	1
1960–1977	Annual number of live births by age of mother (Lexis squares)	-14, 15, …, 49, 50+	–	4
1978–1985*	Annual number of live births by age of mother (Lexis squares)	12, …, 49, 50+, unknown	–	1
1986–1994*	Annual number of live births by age of mother and birth order (Lexis squares)	10, …, 50, 51+, unknown	1, 2,…, 5, 6+, unknown	2
1995–2021*	Annual number of live births by age of mother and birth order (Lexis squares)	10, …, 50, 51+, unknown	1, 2,…, 10, 11+, unknown	2, 5, 9
1900, 1905, 1910, 1920, 1925, 1930, 1935, 1939–2021	Annual number of live births by month	–	–	1, 2, 6, 10

* Data by Lexis squares for 1978–2021 were obtained from data that originally were classified by Lexis triangles.

FEMALE POPULATION: Distribution by age and parity

Period	Type of data	Age range	Parity	RefCode(s)
01.03.2001	Number of women by age and parity	0, …, 99, 100+	0, 1, 2, 3, 4, 5+	3
01.02.2011	Number of women by age and parity	12, …, 69, 70+	0, 1, 2, 3, 4, 5, 6, 7+	7

FEMALE POPULATION: Exposure by age and year of birth

Female exposure population by calendar year, age and year of birth (Lexis triangles) is estimated using data on population size and deaths from the Human Mortality Database, which is available at http://www.mortality.org or http://www.humanmortality.de.

APPENDIX 2

ADJUSTMENT OF ALL BIRTHS TO LIVE BIRTHS

For the years 1947–1959, birth counts by age of the mother and birth order are available only for all births, including stillbirths. However, for the years 1947–1949 and 1953–1959[5], the total number of live births in each age category is available, and for the years 1950–1952, the total annual number of live births is available.

Since the likelihood of stillbirths may vary with age, for the years where the number of live births by age category is available, an age- and period-specific calculation was performed to estimate the number of live births at each birth order. For the years where only the total number of live births is available, a period-specific calculation was performed. Note that both calculations may result in a non-integer estimate of the number of live births by age.

Age- and period-specific calculation

In order to produce an estimate of the number of live births by age and birth order $B_i^*(x,t)$ for the years for which both live births $B(x,t)$ and total births $B^A(x,t)$ are available by age of the mother, we make a two-step computation. First, we calculate the ratio of live births to total births for a given age and year $r(x,t)$ (formula 1). Then we multiply the counts of total births specific for age and birth order $B_i{}^A(x,t)$ in the given year by this ratio (formula 2).

$$r(x,t) = \frac{B(x,t)}{B^A(x,t)} \tag{1}$$

$$B_i^*(x,t) = r(x,t) \cdot B_i{}^A(x,t) \tag{2}$$

Period-specific calculation

In order to estimate the number of live births by age and birth order $B_i^*(x,t)$ for the years for which only total (in respect to birth order) counts of both live births $B(t)$ and total births $B^A(t)$ are available, we perform a similar procedure. We calculate the ratio of live births to total births for a given year $r(t)$ and then we multiply the counts of total births specific for age and birth order $B_i{}^A(x,t)$ in this year by the estimated ratio (formulae 3 and 4).

$$r(t) = \frac{B(t)}{B^A(t)} \tag{3}$$

$$B_i^*(x,t) = r(t) \cdot B_i{}^A(x,t) \tag{4}$$

[5] In 1954 the recorded number of live births with unknown age of mother (313) is higher than the recorded number of total births (i.e. including stillbirths) with unknown age of mother (280), resulting in *r*(*UNK,1954*)>1. The reason of this discrepancy is unknown. HFD uses the first figure (313).

APPENDIX 3

ADJUSTMENTS OF AGE CATEGORY ≤19

For the years 1947–1959, birth counts by age and birth order are available only for the age category ≤19. Because such a broad age group cannot be satisfactorily recalculated into single age groups using the HFD methodology (see the HFD Methods Protocol), the data are split into two age intervals 12–14 and 15–19 using a simple method described below.

First, the ratio of births in the age interval 12–14 to births in the age interval 12–19 is estimated for each birth order *i* using the known values for the years 1960–1969:

$$r_i(12 \le x \le 14) = \frac{B_i(x \le 14, t = 1960 - 1969)}{B_i(x \le 19, t = 1960 - 1969)}, \text{ for } i = 1, 2 \quad (5)$$

$$r_i(12 \le x \le 14) = 0, \text{ for } i = 3, 4, 5+, \text{UNK} \quad (6)$$

The obtained values used in the further calculations are $r_1(12 \le x \le 14) = 0.76\%$ and $r_2(12 \le x \le 14) = 0.08\%$.

Then the number of live births in the age interval 12–14 for each year of the period 1947–1959 and each birth order is estimated as:

$$B_i(12 \le \mathrm{x} \le 14, t) = r_i(12 \le \mathrm{x} \le 14) \cdot B_i(x \le 19, t) \quad (7)$$

The remaining births from the age interval ≤19 belong to the age interval 15–19.