HUMAN FERTILITY DATABASE DOCUMENTATION: THE CZECH REPUBLIC

Author: Kryštof Zeman
Vienna Institute of Demography, Austrian Academy of Sciences
E-mail: krystof.zeman@oeaw.ac.at

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1 General information

This report documents the data for the Czech Republic collected for the Human Fertility Database (HFD) project, including age and birth order-specific data on births, total births by calendar month, and data on the distribution of women by age/birth cohort and the number of live-born children. The birth count data originate from official vital statistics publications as well as from individual birth record files provided by the Czech Statistical Office. Information on the parity-specific distribution of women is based on official results of population censuses.

Data on births by age of mother and birth order were included in the greatest possible detail. Time series cover years 1925–1937 and 1945+. Monthly data on births are available for 1919–1937 and 1945+. Population data for 1950–2014 have been processed and documented in the Human Mortality Database (HMD, www.mortality.org). Data on female population by parity are available from seven population censuses carried out in the period 1950–2011.

Due to data quality problems described in the following sections of this document, only data since 1950[1] **are used for the calculation of the HFD output.**

Registration of births is considered complete and covers the whole territory of the Czech Republic. Data on births include all births to permanent residents of the Czech Republic, as well as births that were registered abroad (see below).

The area of the Czech Republic covers 78,866 km^2. Since the last major administrative division change in 2000, the territory of the Czech Republic has been divided into eight territorial units (NUTS2), 14 regions (NUTS3), and 77 districts (LAU1). In 2015, the number of municipalities was 6,253.

According to the 2011 census, the population of the Czech Republic was 10,436 thousand, of whom 7.1% were born in different countries, and 4.9% were of foreign citizenship. The three major groups of foreign residents are citizens of Ukraine, Slovakia, and Vietnam.

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

1.1 Territorial coverage

The territory of the Czech Republic (historically also known as the “Czech Lands”), which was part of Czechoslovakia in 1918–1938 and 1945–1992 and has constituted an independent country since 1 January 1993, has had the same borders since 1920. During the period of 1919–1937, Czechoslovakia included, in addition to the territory of the present-day Czech and Slovak Republic, the region of Subcarpathian Rus (Zakarpattia Oblast of Ukraine, also known as Carpathian Ruthenia). Data were collected separately during this period for Bohemia,

[1] With the exception of the series of monthly birth counts that starts in 1919.

Moravia with Silesia, Slovakia and Subcarpathian Rus. The historical regions of Bohemia, Moravia, and Moravian Silesia form the territory of the Czech Republic.

In 1939, the German-controlled "Protectorate of Bohemia and Moravia" emerged after the territory of "Sudetenland," located on the Czech borders with Germany and Austria (with a majority of ethnic German inhabitants) was incorporated directly into Germany in 1938. In 1945, Czechoslovakia was reconstituted within its former borders, with the exception of Subcarpathian Rus, which was incorporated into the Soviet Union, and with some minor changes on the Slovak-Hungarian and Slovak-Soviet border. The area of the Czech Republic was not affected. For the years 1945 and 1946, the officially published statistics on births and population do not include population of German ethnicity.

In 1958, minor territorial changes affected two small settlements across the Czech-Polish border. After the breakdown of Czechoslovakia in 1993, minor territorial changes affected three small settlements over the Czech-Slovak border, with negligible effects on population statistics.

To sum up, there were no territorial changes in the Czech Republic in the period since 1950 that could have a significant effect on population and vital statistics.

The official name of the Czech Republic changed several times over the course of the last century, and the way it is addressed in official publications changed accordingly. All of the following names refer to the same territory: Čechy, Morava a Slezsko (1925–1948), České země (1949–1954 and 1966–1968), České kraje (1955–1965), and, after the federalisation of Czechoslovakia, Česká socialistická republika (1969–1989). Since 1989, the official name has been Česká republika.

1.2 Data collection and availability

The relevant historical starting point of Czech statistical data collection is the formation of Czechoslovakia on October 28, 1918, and, subsequently, the establishment of the State Statistical Office (Státní úřad statistický), which collected data on marriages, divorces, births, deaths, abortions, internal and external migration, and population counts[2] for the whole territory of Czechoslovakia during 1919–1937 and 1947–1992.

A break in the data series on births occurred in 1938–1945 due to World War II. Vital statistics for the whole territory were not published during 1938–1944, and the existing statistics cover only part of the present territory of the Czech Republic, the "Protectorate of Bohemia and Moravia." Data on the territories annexed by Germany have not been reconstructed, and thus the data for the complete territory of the Czech Republic are not available for this period. After the Second World War, the expulsion and exodus of 2.8 million ethnic Germans (Srb 2004) contributed to the significant decrease in the population living in Czech territory from 10.9 million in 1938, to 8.8 million in 1948 (as of 1 January). The number of war-related casualties among the population of the Czech Republic was estimated at 425,000 (Srb 2004).

For the years 1945 and 1946, the officially published statistics on births by structures do not include women with German ethnicity (Srb 2004). Therefore, the sum is 17.9% lower than total number of births in the Czech Lands for 1945, and 5.5% lower for 1946. However, the

[2] Data on marriages, births and deaths for the Czech Lands are available starting in 1785, but only as total numbers or with little detail (e.g., live and still births, non-marital births, deaths until one year of age). Data on divorces are available from 1919 onwards. Data on abortions are available from 1953 (spontaneous abortions and induced abortions for medical reasons) and 1957 (induced abortions for social reasons). Recently, data on abortions have been collected by the Institute of Health Information and Statistics of the Czech Republic. Data on international migration are available for 1922-37 and from 1947 onwards. In the years 2005-2006, the migration data source was the Alien Information System (Alien and Border Police Service). Since 2007, the migration data source has been the Central Population Register Record (Ministry of Interior). (CZSO 2015a)

population count data for 1945 and 1946 do not cover the German population (CZSO 1981). Therefore, the data for 1945–1946 should be used with caution.

The statistical office was renamed repeatedly, especially during the 1960s. In 1960, it was called "Ústřední úřad státní kontroly a statistiky" (Central Office of the State Control and Statistics); in 1961–1963, "Ústřední komise lidové kontroly a statistiky" (Central Commission of the People's Control and Statistics); in 1964–1965, "Státní úřad statistický" (State Statistical Office); and finally, "Federální statistický úřad (Federal Statistical Office) for the period 1966–1992. The Federal Statistical Office was divided into the Czech Statistical Office and the Slovak Statistical Office. The State Statistical Office and, later, the Federal Statistical Office, published vital statistics for the whole of Czechoslovakia, and separately for the Czech and Slovak Republics. In 1974–1985, the Czech Statistical Office published vital statistics publications for the Czech Socialist Republic only. Data on population change have been available in electronic form since 1991. Since 1993, the Czech Statistical Office (CZSO) has been responsible for collecting and processing the vital statistics data in the independent Czech Republic.

The statistical office also prepares and conducts population censuses, and processes and publishes census results. Nine censuses have taken place since 1919 (1921, 1930, 1950, 1961, 1970, 1980, 1991, 2001, and 2011). Census data covered population present at the time of the census during the period 1921–1950, and resident population in 1961–1991 (all inhabitants with a permanent residence permit for the Czech Republic were included). For 2001, the covered population was resident population of the Czech Republic, irrespective of citizenship, as well as foreigners on long-term stay (i.e. the stay based on visa over 90 days, as stipulated) and foreigners with granted asylum status. In the 2011 census, the data refer to all persons whose place of usual residence on Census Day 2011 was in the Czech Republic. A person should have lived in the Czech Republic for at least twelve months or intend to stay for at least twelve months in the Czech Republic to be counted among the country's usual resident population.

Vital statistics data refer to the resident population of the Czech Republic, irrespective of citizenship. Since 2001, the figures have also included (in accordance with the Population and Housing Census 2001) foreigners on long-term stay (i.e. the stay based on visa over 90 days, as stipulated by Act No. 326/1999 Coll.) and foreigners with granted asylum status (in compliance with Act No. 325/1999 Coll.). Since 1 May 2005, in accordance with amendment No. 326/1999 Coll., the figures have included citizens of the European Union on temporary stay in the territory of the Czech Republic, and citizens of other countries on long-term stay. The data also contain information on events (marriages, births, and deaths) of permanent residents of the Czech Republic that took place abroad (CZSO 2015a).

2 Birth count data

2.1 Birth count data by age of mother and birth order

Birth count data included in the Human Fertility Database cover the periods 1925–1937 and 1945+. Data for the periods 1925–1937 and 1945–1990 come from the official publications; for 1991–2007, the figures were tabulated from individual birth records provided by the CZSO. Since 2008, data have been provided on a yearly basis from the Demographic Statistics Unit of the Czech Statistical Office. A detailed list of references and sources is included separately in the reference file. While vital statistics publications containing data on births date back to 1919, births were not specified by birth order until 1925.

The design of the vital statistics publications changed several times over the period 1925–1990, and these changes influenced the level of detail of the available data on births by age in completed years (ACY) of mother and birth order, as shown in Appendix 1. In that period, the birth count statistics were also affected by the changes in the definition of vitality of births. Until

1985, only total births were recorded by age and birth order, but, since 1986, these statistics have been available for live births.

In 1925–1973, data on births by single years of age of mother and birth order were published separately by marital status (births within and outside marriage, both categories recorded by biological birth order). Examples of the original table layouts as published in the official demographic yearbooks are available on request in the special Excel file (both the original Czech version and its English translation are provided). While data for marital births were available for birth orders 1 through 10+, data on births out of wedlock were only available for birth orders 1 through 7+. Therefore, it is possible to obtain order-specific data only up to the 7+ birth order category. Since 1974, data by birth order have been shown irrespective of the marital status of the mother for births up to birth order 10+.

Less detailed data on live births are available for the period before 1986, and will be used for estimating the number of live births by birth order and by single years of age of the mother.[3] Since 1949, age-specific data for live births have been available (not specified by birth order). Vital statistics records since 1959 also included a table on live births by birth order and age of mother in five-year age groups. For 1919–1948, live births are tabulated in no greater detail than five-year age groups, for all birth orders combined.

For the period since 1991, files on individual birth records were used to tabulate live births by Lexis triangles (both age in completed years and birth cohort of mother are distinguished) and birth order. A similar table has been published in the official vital statistics publications since 2004, and is available online at the CZSO website.[4]

2.2 Birth count data by month

Totals of live births by calendar month and year of birth are available for 1919–1937 and 1945+. For 1945 and 1946, the data do not include births to women of German ethnicity.

3 Population count data

3.1 Population count data by age

The annual age structure of women since 1950 is taken from the Human Mortality Database (HMD); for reference, see the document “About mortality data for the Czech Republic” (Rychtaříková, Jasilionis, and Grigoriev 2015) on the HMD website (www.mortality.org).

The population estimates from the HMD differ from the official population estimates of the CZSO, as the former are adjusted for underestimation of migration in inter-censal periods (for reference, see Rychtaříková, Jasilionis, and Grigoriev 2015). Differences in the population exposure cause a gap between the official TFR and that computed by the HFD of about 0.01–0.03.

3.2 Population count data by age/cohort and parity

The distribution of women by the number of live births is available from the census data. Women aged 15 and over are asked to report the number of live births they have ever had, as

[3] See Appendix 2 for details on iterative proportional fitting procedure (IPF).
[4] E.g. for 2014 see CZSO 2015, Table D.06 *Live births: by age and year of birth of mother, sex, legitimacy and birth order* at https://www.czso.cz/csu/czso/demographic-yearbook-of-the-czech-republic-2014

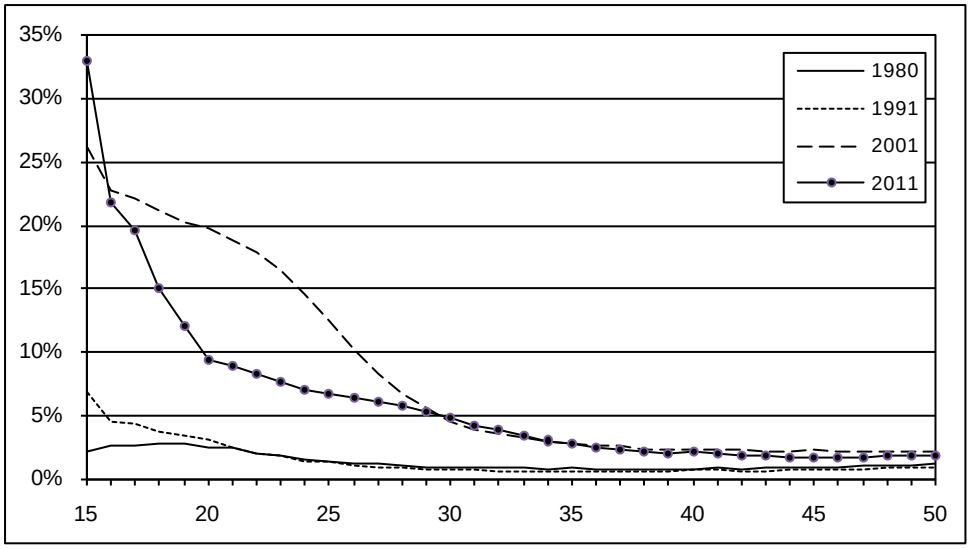
well as the number of children they have born in their current marriage.[5] Data on the number of women by the number of children have been collected since the census of 1930. For the purposes of the HFD, data from censuses 1950, 1961, 1970, 1980, 1991, 2001 and 2011 are used. In the 1930 census, only married, widowed, and divorced women were asked about the number of children they had given birth to during their current (or most recent) marriage.

Data from the earlier censuses show a low proportion of women with an unreported (unknown) number of children when compared to the data from the 2001 and 2011 censuses (see Table 1 and Figure 2). In 2001, the proportion of unknown cases was below 3% at ages above 35, but reached considerably higher values at younger ages, peaking at 26% among women aged 15. It is very likely that a large majority of women who did not report their number of children at the 2001 census were childless. In fact, when women with an unknown number of children in 2001 are added to those who reported being childless, the completed fertility rates and parity distributions are practically identical to the estimates generated using data from the 1991 census and vital statistics data for 1991–2001 (see Figure 3). Since 2001 and 2011 census data have produced downward-biased estimates of childlessness when unknown cases are disregarded, women with an unknown number of children are assumed to be childless in the calculations for the HFD.[6]

Table 1: Percentage of women at age 15–49 with an unknown number of live born children, censuses 1950 to 2011

Census date	Unknown parity (15–49)
1.3.1950	2.8%
1.3.1961	0.7%
1.12.1970	0.6%
1.11.1980	1.3%
3.3.1991	1.5%
1.3.2001	8.6%
26.3.2011	5.7%

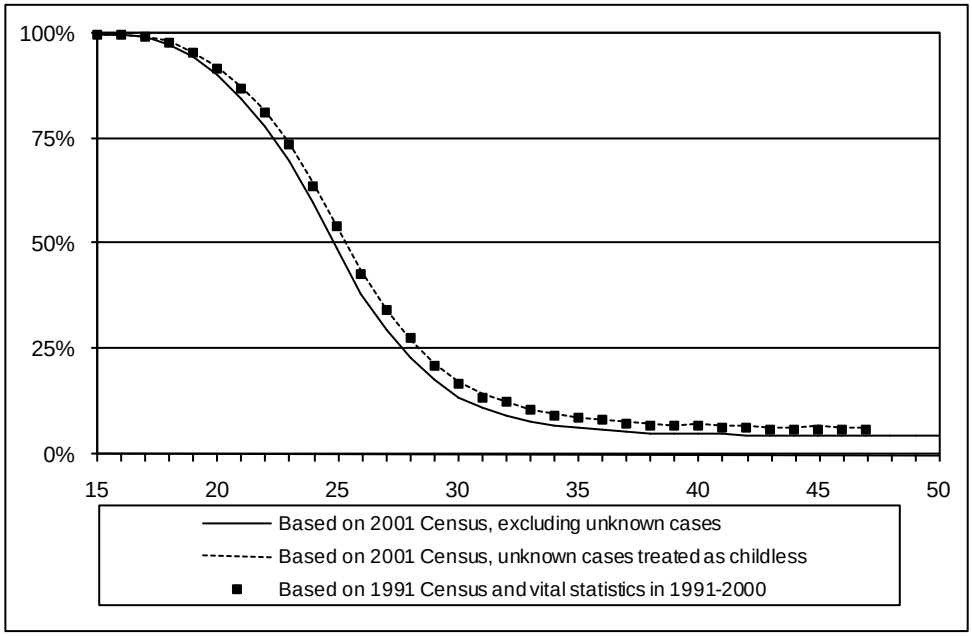
Figure 2: Percentage of women with an unknown number of live born children by age, censuses 1980, 1991, 2001 and 2011



[5] Women were asked to answer a question on the "Total number of children born alive" that they had ever had. The phrasing of the question was the same through period 1950–1991; in 2001, respondents were asked to indicate "the number of all born children"; in 2011 the question was back again on "Total number of children born alive".

[6] Although the problem of missing records on women's parity status is relatively minor in the 1980 and 1991 censuses, we recommend treating women with unknown number of children as childless in these cases as well.

Figure 3: Estimated percentage of childless women by age on January 1, 2001, using different estimates based on the 1991 and 2001 Census and vital statistics data



4 Specific details

4.1 Definitions of live birth and stillbirth[7]

Different definitions of live birth applied in the period since 1925, influencing the number and the proportion of live births in the vital statistics. These definitions are relevant to the data in the HFD, since only the data on total births (not on live births) by birth order and age in completed years of mother age are available until 1985.

Definition of live birth before 1948:
Live birth was defined as any fetus showing signs of life: a heartbeat or breathing. Any fetuses delivered after a gestation period of 28 weeks showing no signs of life were considered stillborn. In this period, the proportion of stillbirths among total births gradually decreased from 2.8% to 1.5%.

Definition of live birth valid 1949 to 1952:
Live birth was defined as any fetus showing signs of life: a heartbeat or breathing. Fetuses showing no signs of life and weighing more than 400 g were registered as stillbirths. Those having a birth weight below 400 g were considered spontaneous abortions. In this period, the proportion of stillbirths among total births was 1.5% to 1.7%.

Definition of live birth valid from 1953 to 1964:
Live birth was defined as a birth of a fetus that showed signs of life (breathing or a heartbeat), born after 28 weeks of gestation, longer than 35 cm and weighing at least 1000 g. All fetuses not meeting the criteria of live birth but surviving at least 24 hours were considered live births. Those surviving less than 24 hours were registered as spontaneous abortions. A fetus of at least 28 weeks' gestation, with a body length of at least 35 cm, a birth weight of at least 1000

[7] This section has been compiled from the following sources: Mészáros and Jasilionis (2007), Rychtaříková, Jasilionis, and Grigoriev (2015), Potančoková (2011), and CZSO (2013, 2015a, 2015b).

grams, but not breathing, was considered a stillbirth. In this period, the proportion of stillbirths among total births gradually decreased from 1.2% to 0.8%.

WHO definition of live birth valid from January 1, 1965 to February 28, 1988:
Live birth refers to the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of the pregnancy, which, after such separation, breathes or shows any other evidence of life—e.g. beating of the heart, pulsation of the umbilical cord or definite movement of voluntary muscles—whether or not the umbilical cord has been cut or the placenta is attached. Each product of such a birth is considered live born. In this period, the proportion of still births among total births gradually decreased from 0.7% to 0.4%.[8]

Definition of live birth valid since January 3, 1988:
Decree No. 11/1988 of the Ministry of Health of the CSR from January 22, 1988 defines a live-born child as a child fully expelled or removed out of the mother's body, who gives a sign of life and whose birth weight is (a) 500 g or more, or (b) lower than 500 g, if it survives 24 hours after delivery. The signs of life include respiration, heartbeat, umbilical pulsation or active movement of muscles, even if umbilical cord is not interrupted or placenta delivered. A stillborn child is a child fully expelled or removed out of the mother's body, not showing any sign of life and whose birth weight is 1000 g or more (CZSO 2007). In this period, the proportion of still births among total births was 0.3% to 0.4%.

Definition of live birth valid since 1 April 2012:
"As at 1st April 2012, a regulation No. 11/1988 Coll. of the Ministry of Health of the CR, which defined a live birth and stillbirth, was cancelled. General definitions of terms live birth and stillbirth are not contained in the currently valid legislation. These definitions along with all cases of abortions are stated only in the guidelines for filling in the "Death certificate (Report on examination of the deceased person)" (in the regulation No. 297/2012 Coll.), namely how to fill out a Death certificate (Report on examination of the deceased person). A stillbirth is also defined in the Commission Regulation (EU) No. 328/2011 implementing Regulation (EC) No. 1338/2008 of the European Parliament and of the Council on Community statistics on public health and health and safety at work, as regards statistics on causes of death, namely for the purposes of the regulation." (CZSO 2013: Methodological notes)

"Live births are defined in the Regulation (EU) No. 1260/2013 on European demographic statistics." (CZSO 2015a: Methodological notes). The article 2(e) of the Regulation says: "'live birth' means the birth of a child who breathes or shows any other evidence of life, such as beating of the heart, pulsation of the umbilical cord or definite movement of voluntary muscles, regardless of gestational age" (EU 2013).

The effect of the legislation change on the number and structure of live births is negligible (CZSO 2015b).

4.2 Age

The age of the mother was recorded in completed years (Lexis squares). Since 1991, the births counts have been available by both mother's age in completed years and birth cohort (Lexis triangles).

[8] The 1965 administrative change in the definition of live birth resulted in an increase of the infant mortality rate in 1965 from 19.1‰ (based on the 1964 definition) to 23.7‰ (based on the 1965 definition). The difference was due to 700 live births in 1965 that would have been considered spontaneous abortions in 1964. (Rychtaříková, Jasilionis, and Grigoriev 2015).

4.3 Birth order

Czechoslovak vital statistics publications distinguished between “birth order” and “birth order within current marriage” as early as 1919–1937. “Birth order” always refers to biological (true) birth order of a child to the mother, and is used in all tables included into HFD.

The methodology of reporting birth order was changed in accordance with the Regulation (EU) No. 1260/2013 on European demographic statistics in 2014. The birth order is newly surveyed only among live births, and counts only previous live births (CZSO 2015a: Methodological notes). The effect on the legislation change on the number and structure of live births is negligible (CZSO 2015b).

4.4 Unknown cases

During 1925–1985, the reported births included unknown cases of age or order. Since 1986, there have officially been no unknown cases, or the unknown cases were allocated into known values according to the intern algorithm of the CZSO.

4.5 Minor inconsistencies in the vital statistics records for 1981

The age- and parity-specific births published in the 1981 Demographic Yearbook (CZSO 1982) do not sum into the published totals. However, the HFD includes data as published. The inconsistencies are negligible, and should not have any significant influence on the level of fertility indicators:

- The sum of 1st order births by age is 61,083, but the printed total is 61,081.
- The sum of 8th order births by age is 106, but the printed total is 107.
- The sum of 9th order births by age is 67, but the printed total is 68.

4.6 Revision history

The current release includes new data for 2012–2014. There are no other changes as compared to the previous release as of 8 February 2013.

Acknowledgements

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APPENDIX 1
DESCRIPTION OF DATA USED FOR THE LEXIS DATABASE[9]

BIRTHS

Period	Type of data	Age range	Birth order	RefCode
1950–1973*	Annual number of live births by age of mother (Lexis squares)	≤14, 15, …,44, 45-49, 50+, unknown	1, 2,…,7+, unknown	3, 12
1974–1985*	Annual number of live births by age of mother (Lexis squares)	≤14, 15, …,44, 45-49, 50+, unknown	1, 2,…,10+, unknown	3, 12
1986–1990	Annual number of live births by age of mother (Lexis squares)	≤14, 15, …,44, 45-49, 50+	1, 2,…,10+	3
1991–2014	Annual number of live births by age of mother, mother's year of birth and birth order (Lexis triangles)	12,…, 61	1, 2,…,10+	2, 1
1919–2014	Annual number of live births by month	—	—	3, 1, 11

* Estimated using iterative proportional fitting procedure – see Appendix 2.

FEMALE POPULATION: Distribution by age and parity

Period	Type of data	Age range	Year of birth, range	Parity	RefCode	Notes
01.03.1950	Number of women by age and parity	15, …, 94, 95+, unknown	—	0, …, 14, 15+ , unknown	4	**'Golden census'** unknown parity to be distributed proportionally
01.03.1961	Number of women by age and parity	15, …, 94, 95+, unknown	—	0, …, 14, 15+ , unknown	5	unknown parity to be distributed proportionally
01.12.1970	Number of women by age and parity	15, …, 94, 95+, unknown	—	0, …, 11, 12+ , unknown	6	unknown parity to be distributed proportionally
01.11.1980	Number of women by year of birth and parity	—	1880, …, 1980 , unknown	0, …, 25, unknown	7	unknown parity to be regarded as parity 0
03.03.1991	Number of women by year of birth and parity	—	1881, …, 1991 , unknown	0, …, 20, unknown	8	unknown parity to be regarded as parity 0
01.03.2001	Number of women by year of birth and parity	—	1894, …, 2001 , unknown	0, …, 15, unknown	9	unknown parity to be regarded as parity 0
26.03.2011	Number of women by year of birth and parity	—	-1906, 1907-11,…,1933-36, 1937,…,1996, unknown	0,…,10+, unknown	10	unknown parity to be regarded as parity 0

[9] The columns "RefCode" in the tables of Appendix 1 present references to data sources. The full list of references is provided in the document CZEref.pdf (see section "Input Data" on the country page).

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

IPF method

The ***iterative proportional fitting procedure*** (IPF, also known as RAS algorithm) is an iterative algorithm for estimating single values of a contingency table such that the marginal totals remain fixed. In Human Fertility Database (HFD) the IPF is used for estimating live births by age of mother and birth order $LB_{i,x}$, when these data are available only for the distribution of total births $TB_{i,x}$ (including stillbirths), whereas numbers of live births are specified by less detailed subtotals—namely live births by age of mother LB_x and live births by birth order LB_i. In the initial stage of HFD, this was the case for the databases of two countries, the Czech Republic 1950-1985 and Slovakia 1950-1985.

The iterative procedure repeats step (k) consisting of two estimations until a certain criterion is reached. The estimations are:

- Estimate by rows: $B_{i,x}^{k'} = B_{i,x}^{k-1} / \sum_i B_{i,x}^{k-1} * LB_x$
- Estimate by columns: $B_{i,x}^{k} = B_{i,x}^{k'} / \sum_x B_{i,x}^{k'} * LB_i$
- in the first step ($k=1$), known values of total births by age of mother and birth order $TB_{i,x}$ are used as $B_{i,x}^{0}$
- The criterion is that for each (i,x): $\left|B_{i,x}^{k} - B_{i,x}^{k-1}\right| \leq 0.01$. After reaching this criterion in step k^{max}, estimated values are used as numbers of live births by age of mother and birth order $LB_{i,x} \cong B_{i,x}^{k\,\max}$