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COHORT AND PERIOD FERTILITY OF POLISH WOMEN, 1945–2008

INTRODUCTION

This article is a follow up to the analysis published by Holzer and Holzer-Żelażewska (1997). The original article focused on changes in the levels of fertility of women who were born in 1930–1979 and who gave birth in the years 1945–1994. The present paper expands the scope of the analysis, for cohorts born in 1946–1990 who gave birth in the years 1961–2008. Moreover, we add a period perspective for the years 1989–2008, in order to fully grasp changes in the reproductive behaviour after 1989, as well as, the recent upward trends in period fertility. The extension of the analysis was possible due to the availability of individual level data from births' registration data, for the years 1985–2008, provided by the Central Statistical Office in Warsaw.

The paper consists of two parts. The first one essentially replicates the analysis published in the paper by Holzer and Holzer-Żelażewska (1997), with an extension offered by the available registration data. This includes age-specific cohort fertility rates (for cohorts born in 1946–1985) as well as the total cohort fertility rates. The second part of the paper adds a period perspective to the fertility changes in Poland. Here we focus on the period total fertility rate, fertility rates by parity, and age-specific fertility rates. Moreover, using the Bongaarts-Feeney adjustment (Bongaarts and Feeney 1998) we try to account for changes in the TFR related to quantum and tempo effects.

DATA AND METHODS

In the analysis of cohort and period fertility we are using two sets of data. First dataset is this same as used by Holzer and Holzer-Żelażewska (1997). The second database has been created with the use of registration data provided by the Central

Statistical Office (CSO). This section describes the main characteristics of the two datasets and the necessary assumptions, which needed to be adopted before proceeding to the main analysis.

The authors of the original 1997 contribution had to make certain assumptions in order to estimate relevant rates, which would be comparable across time. This was due to the fact that for some periods of time, detailed data needed for calculation of age-specific fertility rates was missing or incomplete. The following problems related to the calculation of rates can be mentioned:

- The definition of a live birth changed over the time;
- Data on births for early years did not have the information that is needed to divide births into ’older’ and ‘younger’ according to the Lexis diagram. Therefore, the respective numbers needed to be estimated;
- The number of women by single year age groups had to be estimated for some years to assure comparability with the neighbouring years (this was especially important around the census years).

Below we present definitions, sources of data and the methodology adopted for the estimation of missing data. The obtained rates present changes in cohort fertility, which allow us to describe the trends and any significant departures from regularities. During the 40-year period taken into account in this analysis, three definitions of a ‘live birth’ were used by the CSO to register births:

- Until 1962 a live birth was the complete expulsion or extraction of a newborn from the mother’s body, irrespective of the duration of pregnancy. At the moment of cutting of the umbilical cord, the newborn would have to show any signs of life or not show any signs of life, but would have to be brought back to life.
- In 1963 births with a birth weight higher than 600 and lower than 1001 grams that did not survive the first 24 hours were excluded from the live birth statistics. These births were classified as a separate group called “non-viable births with signs of life”. Births that weighed less than 600 grams were excluded from the births statistics altogether.
- Since 1994 a new modified live birth definition was introduced, which states that a live birth occurs when a foetus, whatever its gestational age, exits the maternal body and subsequently shows any sign of life, such as voluntary movement, heartbeat, or pulsation of the umbilical cord, for however brief a time and regardless of whether the umbilical cord or placenta are intact. However for statistical purposes this definition was slightly modified and a newborn is considered to be a live birth if it weighs at least 501 grams or – if the birth weight is unknown – it has been extracted from the mother’s body after at least 22 weeks of gestation or is at least 25 cm long.

For the purposes of this analysis, we have used the numbers of live births that were reported according to the live birth definition existing at the time. However, we made a rough estimate of the number of live births for the years 1963–1993, by using the 1994 live birth definition. The results for single years of reproductive age of the mother were higher by 0.3–0.7 per cent, from the figures published by the

CSO for the respective years. This implies that the numbers of live births for the years preceding 1994 are slightly underestimated. It was, however, not possible to recalculate the number of live births by single years of mother's age, according to the contemporary live birth definition, since there was no methodological basis for such calculations. Moreover, the error due to the use of the slightly underestimated numbers of births has no significant influence on the analysis of cohort fertility rates.

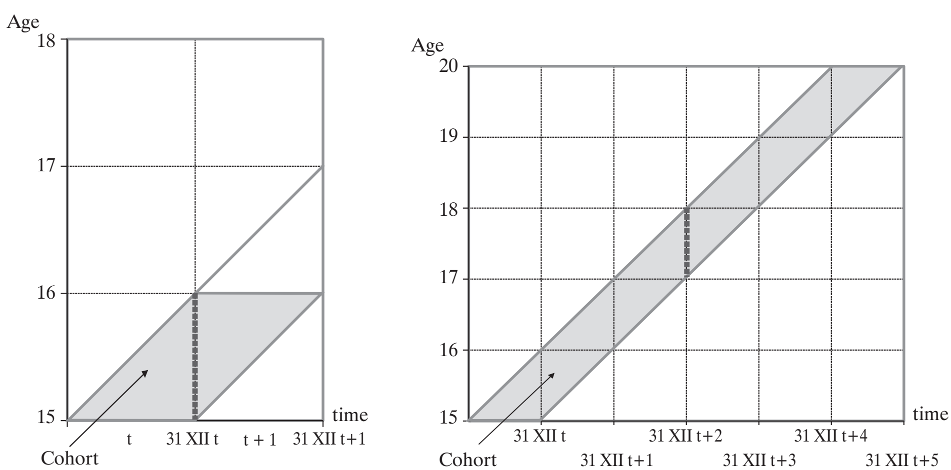
The registration data obtained from the CSO in Warsaw covers the period between 1985 and 2008. Each file contains all the births registered in a calendar year with an exact child's birth date. Additionally, there is information concerning: the mother's birth date, mother's residence (rural, urban), newborn's birth weight, viability of birth, parity, mother's level of education, marital status, date of marriage, and date of previous childbirth.

It has to be noted here, that the registration dataset slightly differs from the number of actual births within a year. This results from the fact that some children born in December are registered in January of the following year. However, this seems to have a minor influence on the calculated rates, since children registered in the year different from the year of birth constitute, on average, no more than 0.2 per cent of the total number of births in a given year (with exception of 1994, when the definition of a live birth changed).

To the extent possible, a unified methodology was used to calculate cohort fertility rates. The number of births was identified according to the Lexis diagram (see Figure 1a) and divided by the number of women as of December 31st of year *t*. In the case of five-year cohort fertility rates, one-fifth of the number of births from five consecutive years was divided by the number of women as of December 31st of year $t + 2$ (see Figure 1b).

Figure 1. Lexis diagram

a) single year cohort fertility rates b) five-year cohort fertility rates



Age-specific fertility rates for cohorts born as early as 1922 were calculated using data on live births for the years 1961–2008. This data, however, covers only 12 cohorts that have completed the childbearing process, i.e. those born in the years 1946–1958. For generations born before 1946, the age-specific fertility rates for younger mothers are missing, and those born after 1957 have not yet completed the childbearing process. The number of women as of December 31st was also used as the denominator to calculate the period fertility measures.

CHANGES IN COHORT FERTILITY

COHORT AGE-SPECIFIC FERTILITY RATES

Table 1 presents age-specific fertility rates for selected cohorts. They show that over the period under consideration, significant changes have occurred in the fertility patterns in Poland. One may observe a distinct decrease of age-specific fertility rates for consecutive cohorts. Furthermore, cohorts born in the mid-1970s are characterised by a visible shift of childbirth from young to older ages. The age group that traditionally used to be characterised by the highest fertility has moved from 20–24 to 25–29 in the more contemporary cohorts (see Figure 2).

The cohort age-specific fertility rates, analyzed over time, show some very distinctive trends. Figure 2 provides an overall picture of the changes in the childbearing patterns. The following figures show in detail that the late 1940s, 1950s and early 1960s birth cohorts followed very similar childbearing patterns, characterised by the highest age-specific cohort fertility rate at age 22–23. Fertility in the prime childbearing ages increased between the 1950 and 1960 cohorts, as illustrated in Figure 2a. Cohorts born in the 1960s and 1970s noted a considerable decline in fertility among women in prime childbearing ages, with a shift of peak fertility rate to age 27–28 for the cohorts from the late 1970s.

Figure 2c demonstrates how the delay of childbearing progressed, starting with the cohorts from the late 1970s and ceasing among the birth cohorts from the 1980s. Furthermore, recuperation of fertility may be noted, starting with the 1970s cohorts, at ages between 27 and 34 (see Figures 2c, 3 and 4).

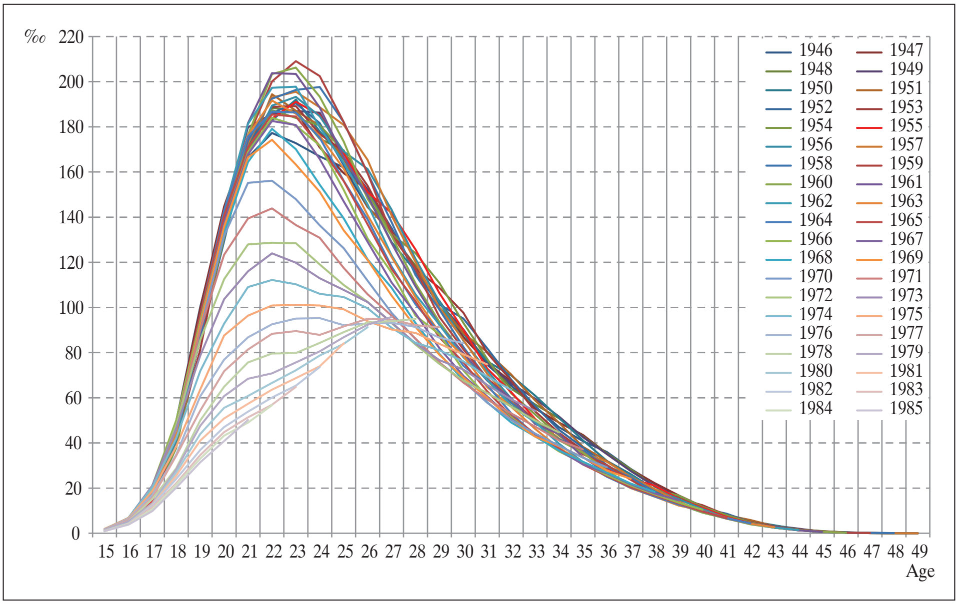
It is worth noticing that the trends are not smooth from one year to another. At the beginning of the 1980s, an increase in the level of age-specific fertility rates occurred among all women (born in different generations) and was very visible in the age group of 22–32 years (see Table 2). This increase was also visible in older age groups, but not so distinctly. It is worth mentioning that in 1980 the paid parental leave was introduced for women, who had a child under three years of age, instead of unpaid leave. At that time many families decided to have their first or next child sooner than planed previously. As Figure 3 shows, the economic incentive (upbringing benefit) had a short term influence on cohort fertility.

Table 1. Age-specific cohort fertility rates – selected cohorts, (births per 1,000)

Age	Cohort born in:								
	1940	1945	1950	1955	1960	1965	1970	1975	1980
15	–	–	1.33	1.06	1.32	1.42	1.49	1.76	1.27
16	–	7.29	4.94	4.12	5.35	5.49	6.36	6.67	4.52
17	–	24.11	16.43	14.36	17.78	19.46	19.89	18.59	12.79
18	–	59.46	43.49	41.11	43.84	48.81	46.05	38.35	26.90
19	–	118.27	90.32	86.41	90.25	96.44	89.97	63.65	43.99
20	–	163.80	140.57	133.82	136.48	140.75	131.71	87.54	55.52
21	191.84	190.68	173.95	168.71	176.39	170.83	155.18	96.36	60.82
22	203.88	201.92	182.81	183.63	203.33	185.45	156.11	100.85	66.59
23	201.02	196.91	192.05	191.04	206.24	184.54	147.93	101.10	72.14
24	186.82	185.45	177.94	185.19	193.35	171.58	136.37	100.85	78.70
25	170.22	164.54	165.68	168.21	173.42	155.94	126.23	99.19	83.90
26	149.10	147.57	149.20	151.10	148.11	136.79	111.80	93.91	91.28
27	132.80	128.55	128.85	141.81	131.65	117.01	97.61	90.23	
28	115.91	121.07	116.10	125.65	110.64	102.75	86.04	88.72	
29	102.67	106.26	102.74	106.35	93.56	86.77	75.55	83.92	
30	97.59	91.94	88.34	90.01	79.25	75.74	67.36	79.23	
31	83.68	79.67	76.13	72.94	67.68	62.84	57.81	74.74	
32	70.09	66.38	69.93	62.58	56.57	51.99	50.20		
33	64.28	56.64	60.92	50.65	49.98	44.05	44.17		
34	54.10	49.64	51.14	41.69	41.16	37.52	38.82		
35	46.15	40.47	41.18	35.72	35.68	30.48	33.47		
36	38.49	35.69	32.02	28.85	27.82	25.37	29.27		
37	29.71	29.91	26.19	24.05	21.00	20.40			
38	23.73	23.68	19.46	21.14	16.82	16.78			
39	19.11	17.80	15.01	15.24	12.95	13.21			
40	13.76	13.25	11.29	11.33	9.12	9.64			
41	10.30	8.85	8.18	7.21	6.51	6.76			
42	7.39	5.84	5.37	4.49	3.94				
43	4.32	3.47	3.56	2.51	2.44				
44	2.40	1.81	1.75	1.38	1.40				
45	1.29	0.92	0.66	0.67	0.65				
46	0.57	0.35	0.33	0.27	0.29				
47	0.29	0.15	0.11	0.09					
48	0.16	0.07	0.04	0.05					
49	0.13	0.03	0.01	0.00					

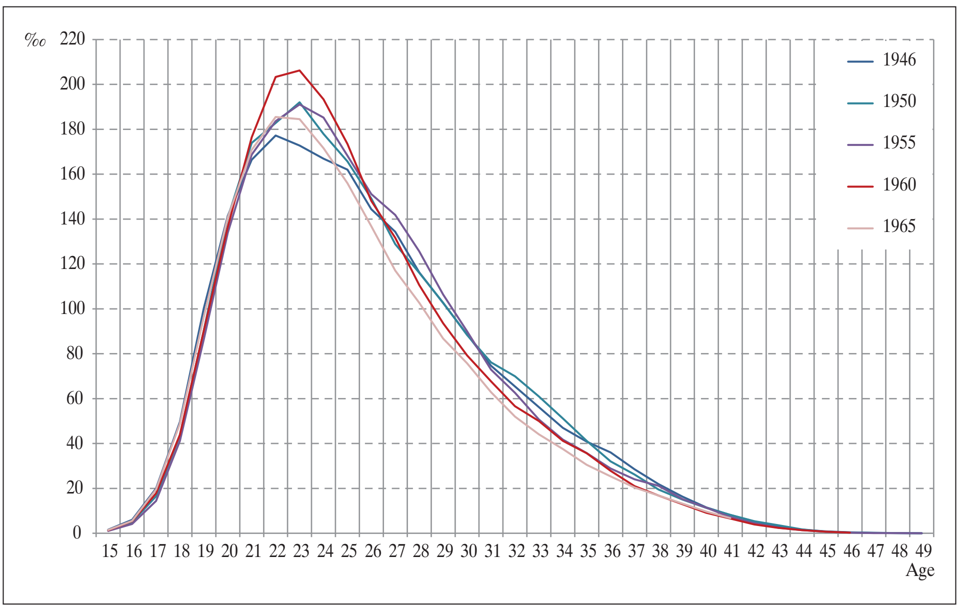
Source: Own calculations based on the CSO data.

Figure 2. Age-specific cohort fertility rates: cohorts born in 1946–1985



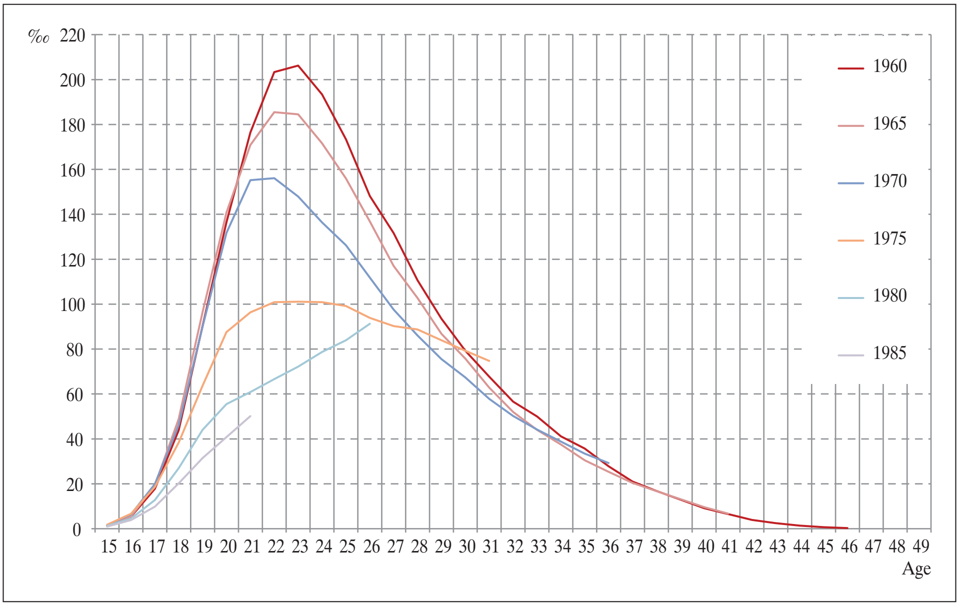
Source: Own calculations based on the CSO data.

Figure 2a. Age-specific cohort fertility rates: cohorts born in 1946–1965



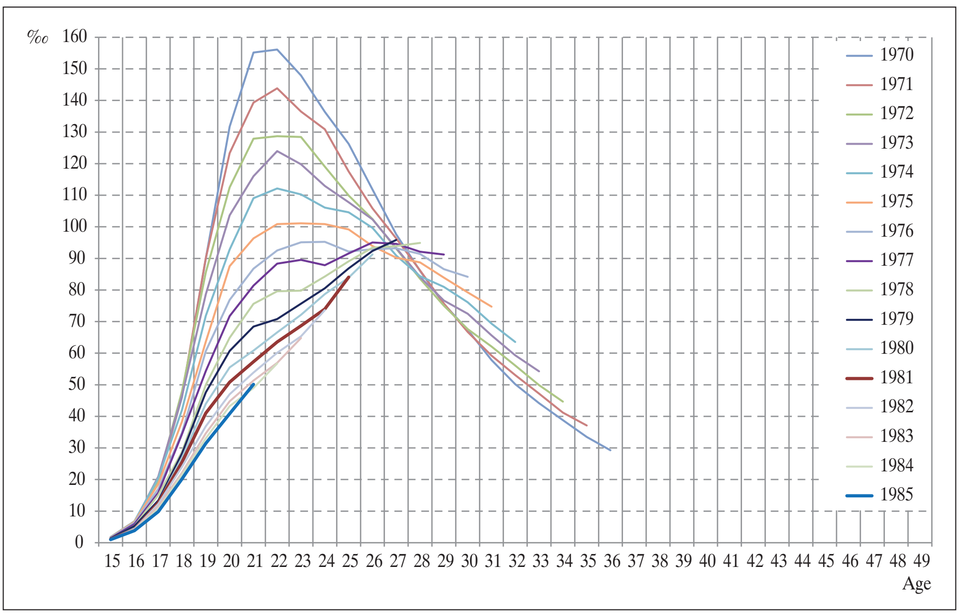
Source: Own calculations based on the CSO data.

Figure 2b. Age-specific cohort fertility rates: cohorts born in 1960–1985



Source: Own calculations based on the CSO data.

Figure 2c. Age-specific cohort fertility rates (cohorts born in 1970-1985)



Source: Own calculations based on the CSO data.

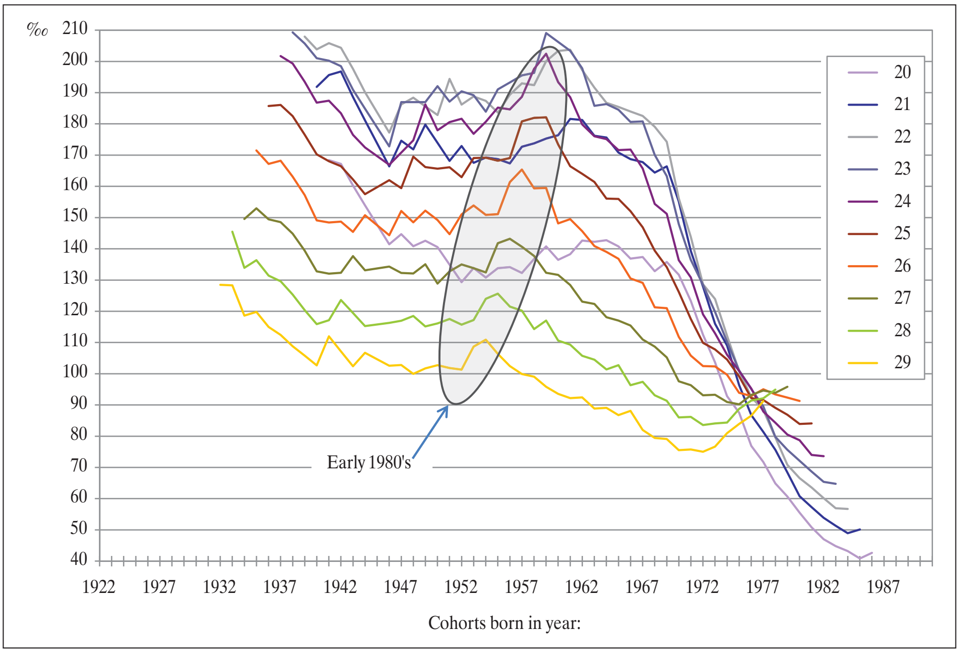
Table 2. Age-specific cohort fertility rates, selected cohorts* (births per 1,000)

Age	Cohort born in:											
	1930	1935	1940	1945	1950	1955	1960	1965	1970	1975	1980	1985
15–19	–	–	–	–	31.3	29.3	31.2	**34.3**	32.8	25.8	17.9	13.2
20–24	–	–	–	187.7	169.8	170.9	**183.1**	169.9	145.5	97.3	67.3	–
25–29	–	–	134.2	130.6	132.1	**138.7**	131.9	119.9	99.5	92.3	–	–
30–34	–	77.3	72.0	68.9	**69.3**	63.7	58.9	54.4	52.2	–	–	–
35–39	39.4	35.3	31.4	29.5	26.8	25.0	22.9	21.4	–	–	–	–
40–44	8.9	8.8	7.6	6.7	6.0	5.4	4.8	–	–	–	–	–
45–49	0.8	0.5	0.5	0.3	0.2	0.2	–	–	–	–	–	–

* Women who gave birth in 1980–1984

Source: Own calculations based on the CSO data.

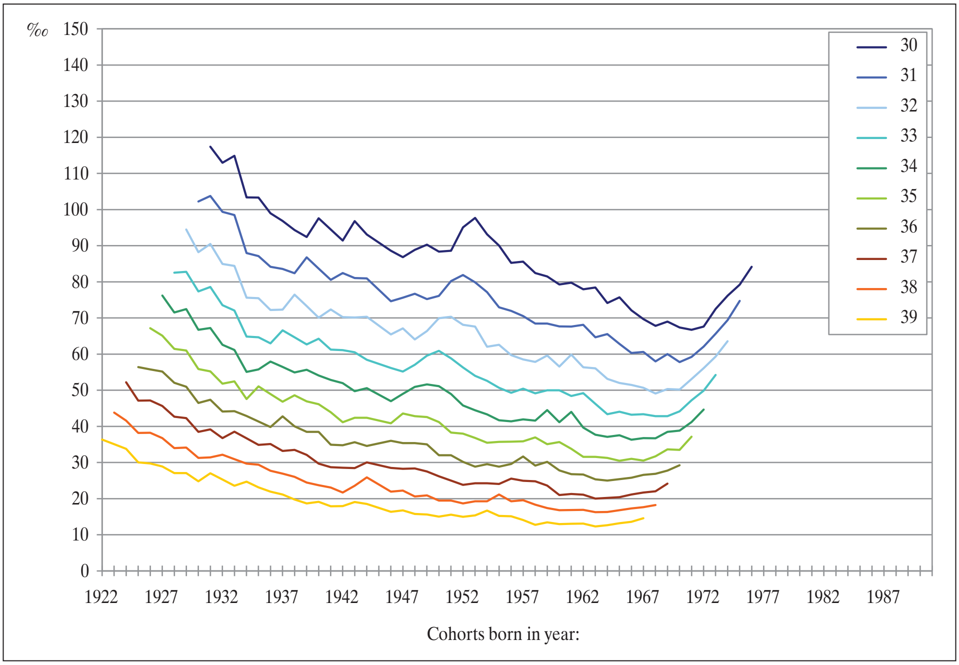
Figure 3. Age-specific cohort fertility rates – ages 20–29



Source: Own calculations based on the CSO data.

This short-term rise in the level of fertility was followed by a major decrease in age-specific fertility rates. The traditionally most fertile age group, aged 20–24, noted a 65–70 per cent decrease in the level of fertility rates after 1984. This falling trend continued in this age group until 2005, when it seems that the trend was curbed and age-specific fertility rates began to stabilize. Whether this is a lasting change – time will show. The older age groups, 25–34, also noted a major fall in the level of age-specific fertility rates after 1984 (see Figure 3 and 4). However, in this age group, the declining trend reverted in 2001 and therefore, the fertility level of contemporary cohorts for this age group is lower by only 28–55 per cent, when compared with the same age group of cohorts that gave birth in the early 1980s. Furthermore, in the period 2000–2005, the level of fertility in the age group 25–29 became higher than the one for the traditionally highest fertility age group of 20–24. This may be treated as evidence of the changes occurring in the fertility patterns and as confirmation of the hypothesis stating that the highest intensity of births will move from the age group 20–24 to the age group 25–29.

Figure 4. Age-specific cohort fertility rates – ages 30–39



Source: Own calculations based on the CSO data.

COMPLETED FERTILITY RATES

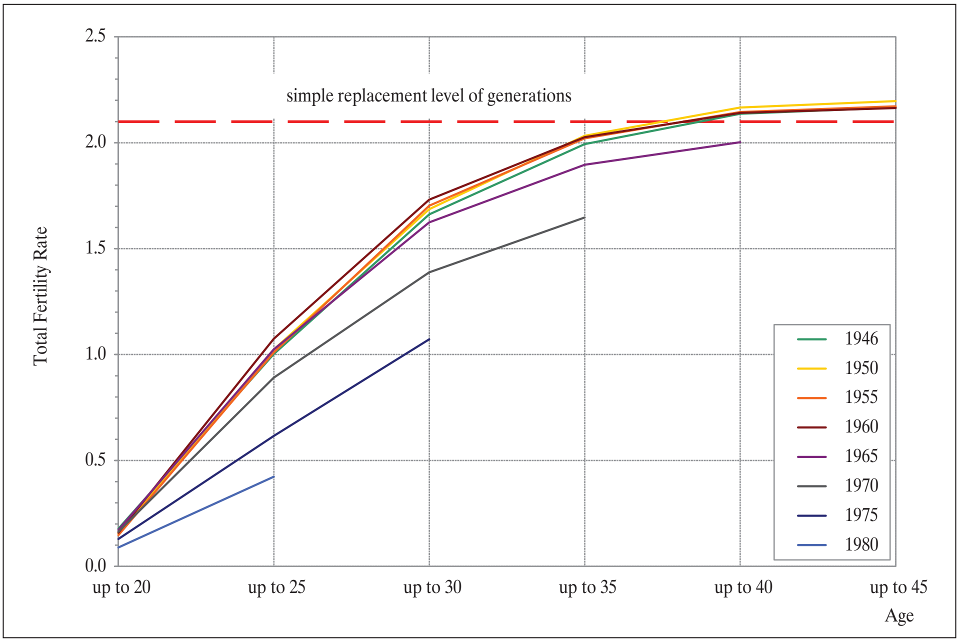
The cohort total fertility rate represents the average number of children born by women from a single birth cohort. Many cohorts under observation have not reached the end of their reproductive age, but it is possible to calculate the TFR that has been actually achieved up to a certain age. Therefore we have calculated the cohort TFR at different ages (20, 25, 30, 35, 40 and 45) for generations of women born in 1946–1985. There are only twelve cohorts, born in 1946–1957, for which complete data on births by the age of the mother were available. For cohorts born earlier the data on births was missing and so we could not calculate the cohort TFR and for those born later we could only calculate the TFRs for younger ages since these women have not reached the age of 45.

Table 3. Completed fertility rate, selected cohorts

Age	Cohorts born in:								
	1946	1950	1955	1960	1965	1970	1975	1980	1985
Up to 20	0.18	0.16	0.15	0.16	0.17	0.16	0.13	0.09	0.07
Up to 25	1.00	1.02	1.01	1.07	1.02	0.89	0.62	0.42	
Up to 30	1.66	1.69	1.70	1.73	1.62	1.39	1.07		
Up to 35	1.99	2.03	2.02	2.03	1.90	1.65			
Up to 40	2.14	2.17	2.15	2.14	2.00				
Up to 45	2.17	2.20	2.17	2.16					

Source: Own calculations based on the CSO data.

Figure 5. Completed fertility rate, selected cohorts



Source: Own calculations based on the CSO data.

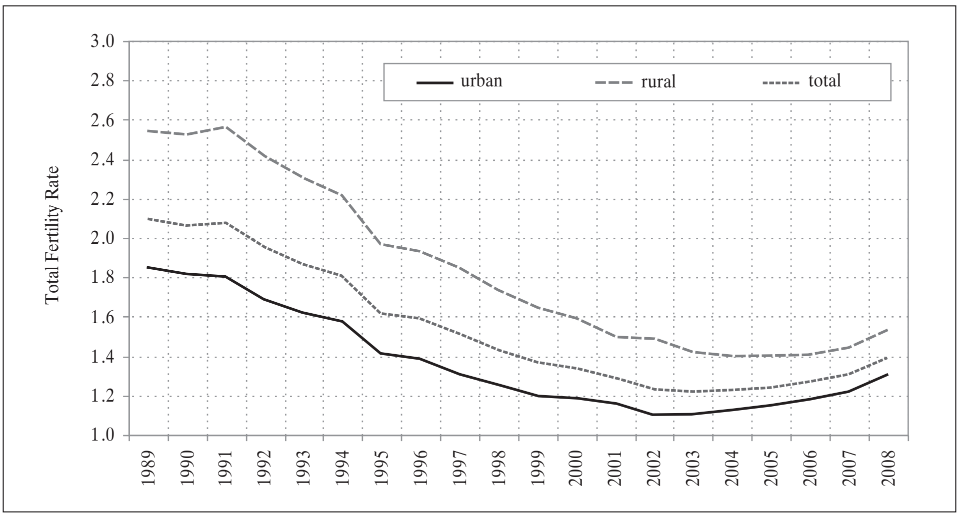
The analysis of the calculated cohort TFRs shows that the first cohort of women, who on average had not given birth to the first child by the age of 25, was the one born in 1968. The subsequent cohorts are characterised by a continuous drop in fertility rates, for ages up to 25 and also up to 35, and the first cohort of women who on average had not had two children by the age of 35 was an even older cohort, born in 1962. On the other hand, it is worth mentioning that at age 35, the generation of women born in 1946 had on average 1.99 children per woman, and yet by reaching the age 45 the cohort TFR increased to 2.17, which guaranteed simple replacement of generations. However, with the contemporary low levels of cohort fertility of women aged 20–24, to achieve replacement-level fertility, the fertility rates of older women would have to be higher than those prevailing in the 1980s in the most fertile age group. It is highly improbable that today's generations will achieve such high level of fertility. Therefore, one may expect that the near future will be characterised by a below-replacement total fertility rate.

CHANGES IN PERIOD FERTILITY

PERIOD TOTAL FERTILITY RATES

Our analysis of fertility changes in Poland from a period perspective starts with the total fertility rates. As it may be noticed in Figure 6, a long-lasting decline of the TFR was halted in 2003. From the level of 1.22 in 2003 TFR slowly grew up to 1.39 in 2008 (thus, by 14 per cent).

Figure 6. Period total fertility rate of Polish women, 1989–2008



Source: Own calculations based on the CSO data.

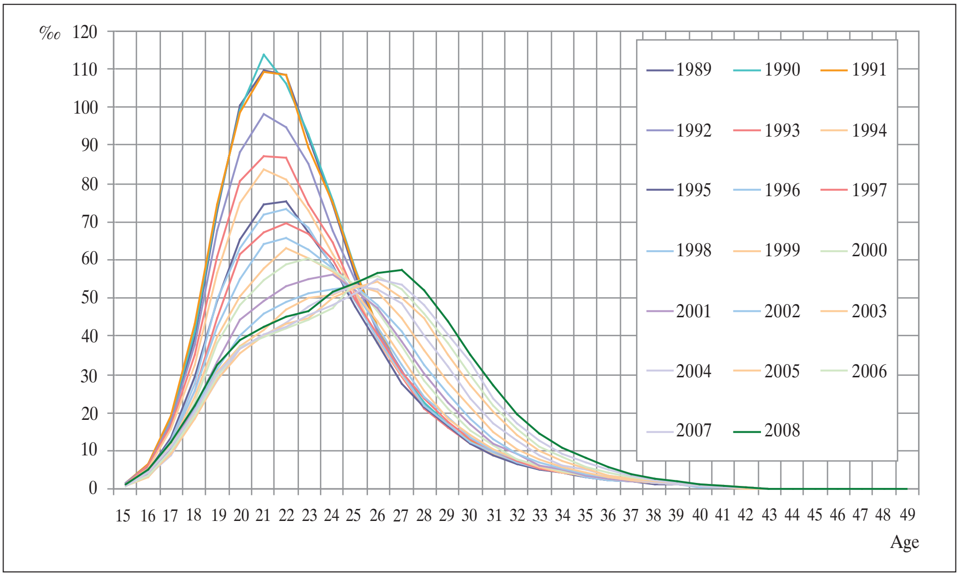
Especially over the last two years, the growth of the TFR has been particularly visible. If we compare 2006 to 2007, the TFR grew by 3.0 per cent, and from 2007 to 2008, by 6.7 per cent. Interestingly, the growth was slightly faster in urban areas. The TFR in the urban areas grew by 7.0 per cent in 2007 comparing to 2006 and in rural areas by 5.5 per cent. This recent shift in the period rates of fertility might be related to the fact that large cohorts born in the 1980s are entering the reproductive age. However this may not necessarily be the case, since the analysis of the cohort total fertility rate, presented in the Figure 5, shows that the cohort born in 1980 is following a significantly lower path of reproduction than the cohort born in the 1975. An explanation might be related to the so-called *recuperation effect*. From the beginning of the transformation period a constant increase in the age of first childbearing can be observed. Women were postponing entry into motherhood, therefore we have observed a simultaneous increase in the age of first reproduction and drop of fertility rates. Thus, the recent increase in the period TFR might be driven by those women who were postponing childbearing after 1989. In order to test this hypothesis a very detailed analysis is needed. In the next section the approach proposed by Bongaarts and Feeney (1998) is used to decompose the TFR to the quantum and tempo effects. Quantum component is defined as the TFR "that would have been observed in the absence of changes in the timing of childbearing during the period in which the TFR is measured" (Bongaarts and Feeney 1998, 272). On the other hand "tempo component the tempo component equals the distortion that occurs due to timing changes" (Bongaarts and Feeney 1998: 272).

AGE-AND PARITY-SPECIFIC PERIOD FERTILITY RATES

Analysis of the period age-specific fertility rates reveals the pattern of fertility change in Poland after 1989. From Figure 7 it can be noticed that the drop in age-specific fertility rates for first births, during the period 1989–1994 could be attributed to the quantum effect. For this period the mean age at first childbearing remained relatively stable. A drop in the quantum was driven by the postponement of childbearing, which manifested itself in the gradual shift of the reproductive path to the later age of first childbearing at the turn of the 21^{st} century. Over the past five years (2003–2008) only minor changes in the age at first childbearing could be observed, while the quantum of reproduction is steadily rising. The age pattern for 2008 covers the first-birth fertility rate of 0.69, which is essentially identical to the value for 1994 (0.7). However, the timing of fertility shifted significantly, which results in higher age at first childbearing. Therefore, in 2008 an almost identical TFR for the whole population can be observed (1.39), as it was in the years 1999 and 2000 (1.37 and 1.34, respectively), although the timing of fertility has changed significantly.

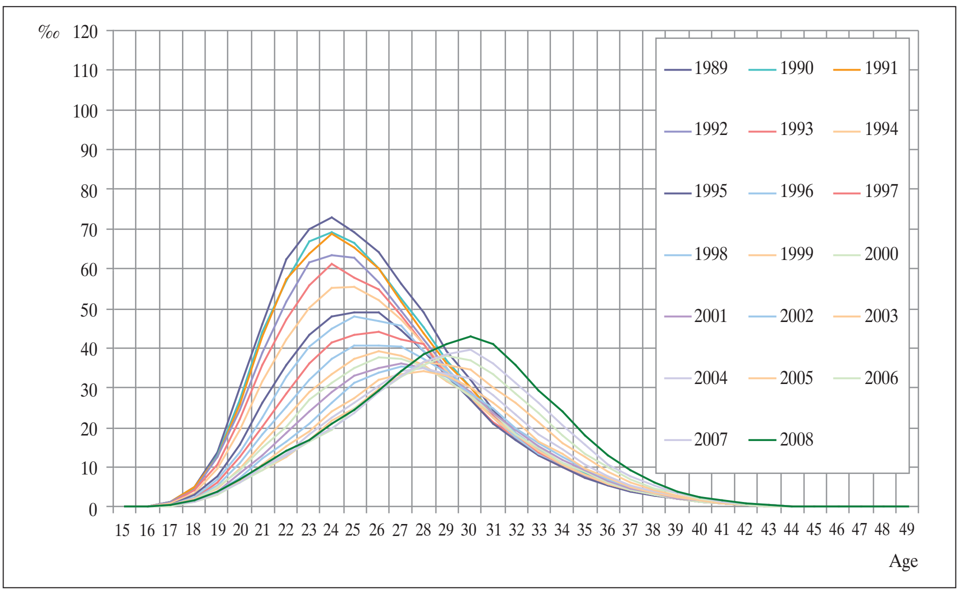
Almost the same story can be told with respect to age-specific second-birth rates of fertility, presented in Figure 8. After 1989 we observed a significant reduction in the quantum. However, over the last five years we observe a slow process of recuperation which is manifested by an increase in the quantum of second births as well as an increase in age at birth of the second child. Overall rates of second births are much lower, though the underlying mechanism of change is almost identical. Since 2003 a constant increase in the fertility rates for second births can be observed. From the lowest level of 0.38 in 2003, the rate reached 0.47 in 2008 which is this same level as the value for the year 1997.

Figure 7. Period age-specific first-birth fertility rates (births per 1,000)



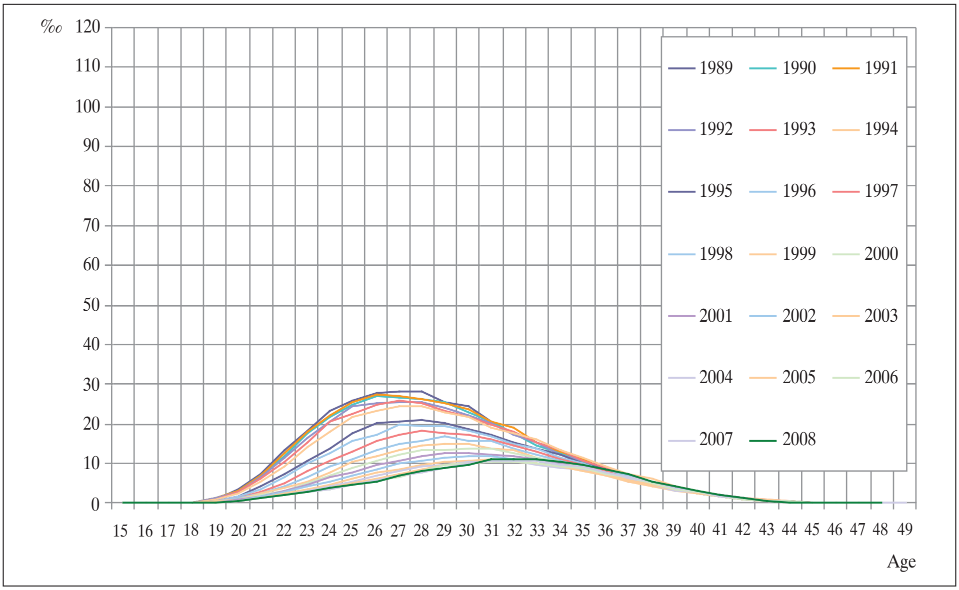
Source: Own calculations based on the CSO data.

Figure 8. Period age-specific second-birth fertility rates (births per 1,000)



Source: Own calculations based on the CSO data.

Figure 9. Period age-specific third-birth fertility rates (births per 1,000)



Source: Own calculations based on the CSO data.

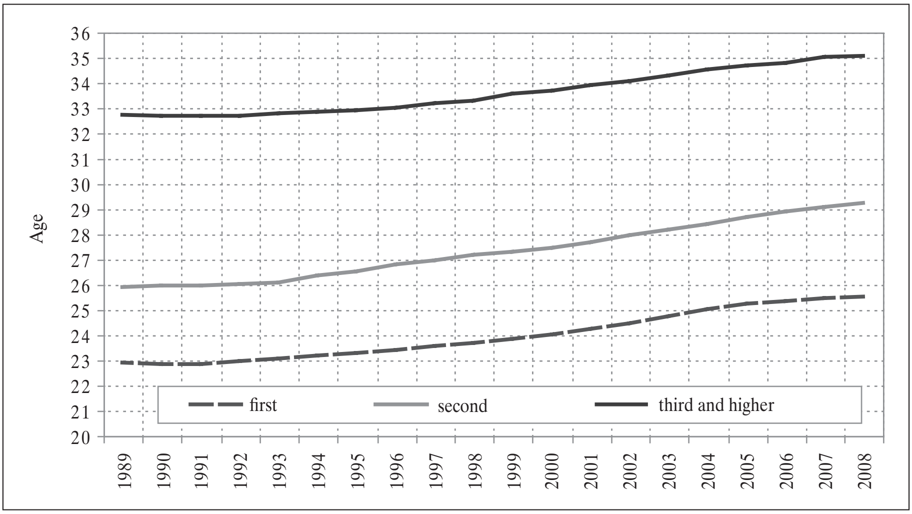
The age-specific third-birth fertility rates have also increased slightly over the past five years. In 2008 the rate was 0.14 – an increase by three per cent in comparison to 2004. However, this is still very low comparing to the value for 1989, when the third birth fertility rate reached 0.33. Changes in the third-birth rates show that most of the Polish women do not progress to third and higher parities. This might be partially responsible for the overall drop in the TFR observed over the whole period after 1989. Adding the effect of decreasing second-birth rates, it may be assumed that even a significant increase in the first-birth rates might not compensate the decline of the total fertility rate.

MEAN AGE AT CHILDBEARING

The changes described above are strictly related to the mean age of childbearing. Figures 10–12 present the respective values for total, urban and rural populations of females, separately for the first, second and higher-order births.

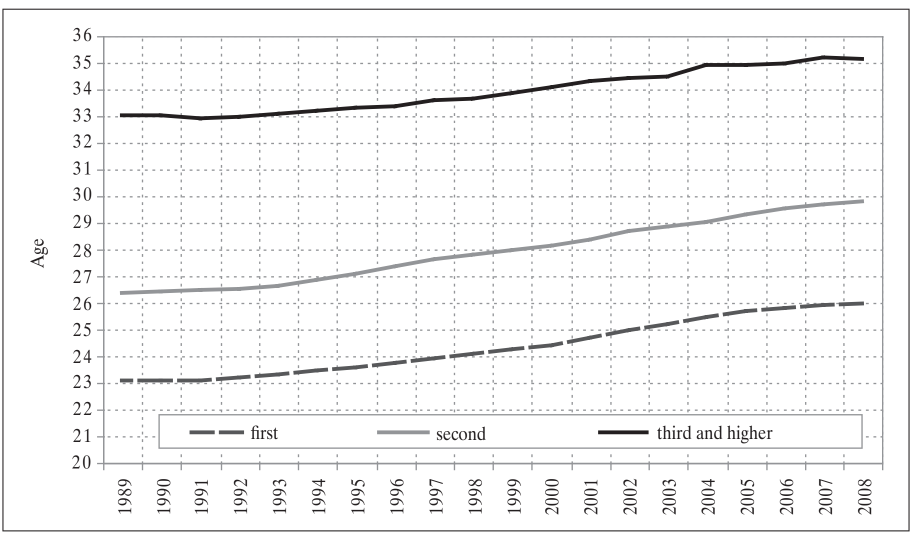
Irrespective of the population under study, mean age of childbearing for each parity exhibits a constant increase since 1989. This is related to the postponement of fertility. However, there are significant differences with respect to parity. The age at first childbearing has been undergoing the most significant changes since 1989. In the past five years this age seemed to be marginally decreasing, to reach 25.5 years in 2008. This might be related to the fact that the postponement has stopped or at least has slowed down. For the whole period under analysis, the mean age at first childbearing grew by 11.5 per cent between 1989 and 2008 for the total population (12.5 for urban and 9.8 per cent for rural). In the case of second-birth rates there still is an increase in the age at birth of the second child. In 2008, the mean age at second birth for the total population was 29.2 years, which indicates a 13 per cent increase in comparison to the value from 1989. In urban areas this age increased by 13.1 and in rural areas by 12.6 per cent, which shows smaller differences with respect to the place of residence than for the mean age at first birth.

Figure 10. Mean age at childbearing by parity for period 1989–2008, Poland



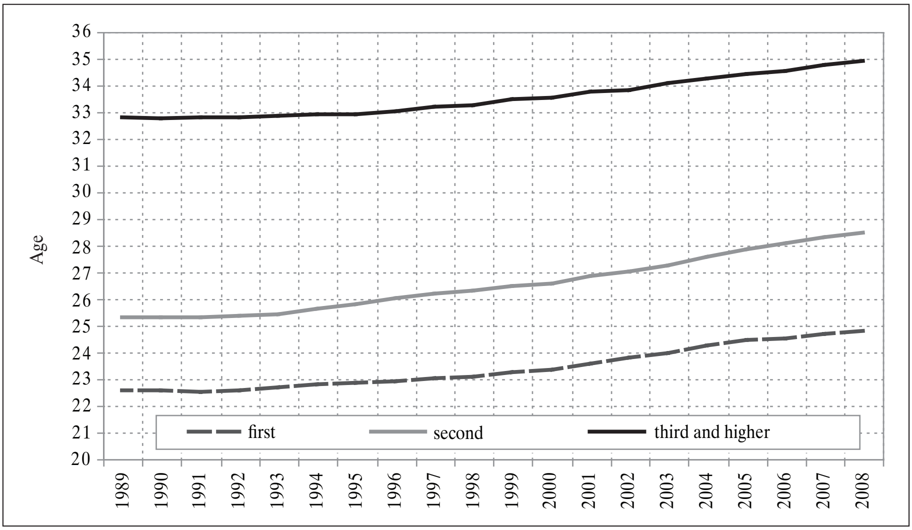
Source: Own calculations based on the CSO data.

Figure 11. Mean age at childbearing by parity for period 1990–2008, the urban population.



Source: Own calculations based on the CSO data.

Figure 12. Mean age at childbearing by parity for period 1990-2008, the rural population.



Source: Own calculations based on the CSO data.

Even smaller differences between mean age of reproduction could be found in the case of third and higher-parity births. In this case, between 1989 and 2008 a growth by seven per cent was observed, irrespective of the population under study.

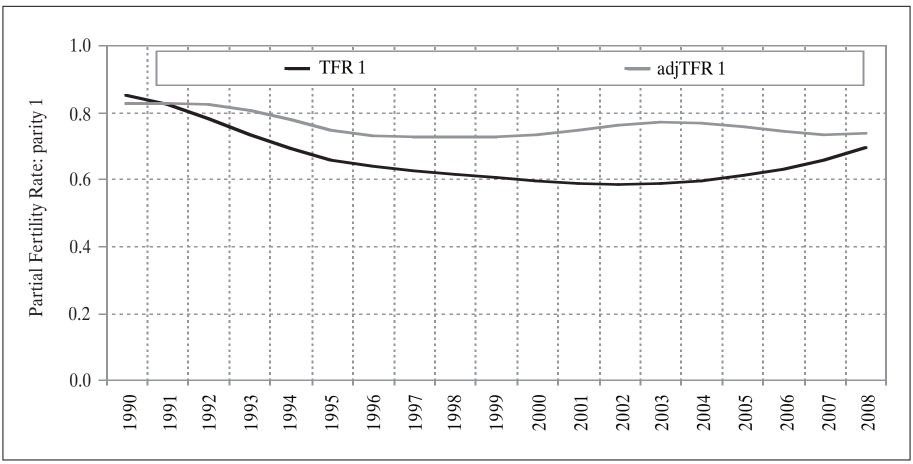
ADJUSTED TOTAL FERTILITY RATES

Bongaarts and Feeney (1998) have critically analysed the ability of the TFR to describe fertility under dynamic changes of the mean age at reproduction. Their critique is mostly related to the use of period TFR as a synthetic measure of cohort reproduction. In their view, period TFR might underestimate actual reproduction, due to the process of postponement. In fact, we might observe higher fertility due to so-called *recuperation effect* which might cause an increase in the number of births at higher ages. Therefore, Bongaarts and Feeney (1998) have proposed a method which makes period TFR more sensitive to changes in the mean age at reproduction. This hypothetical recuperation of births lost due to postponement of reproduction is possible by discounting the observed TFR with the index of change in mean age at childbearing. This operation is performed for all parities and the sum of parity-specific adjusted TFR gives an adjusted total fertility rate, adjTFR. Therefore, if there are no changes in mean age at childbearing TFR = adjTFR. If the mean age is increasing, there is adjTFR > TFR, and consequently if the mean age is declining, adjTFR < TFR. In understanding the adjustment procedure it is important to note that it only accounts for the effect of postponement, which is also called a tempo effect. Therefore, adjusted TFR stands for the value of period TFR in the absence of postponement of reproduction (i.e. removes the tempo effect). It does not, however, remove the quantum effect, which is the drop in the number of children born.

The description of the method presented in the paper is by no means exhaustive. Detailed discussion of the method and critique of the period TFR may be found in the original paper by Bongaarts and Feeney (1998). Moreover, there are many refinements proposed by other authors in response to shortcomings of the original adjustment procedure (Kohler and Ortega 2002a, Kohler and Ortega 2002b, Kohler 2001, Ortega and Kohler 2002). It has to be noted that method proposed by Bongaarts and Feeney is not free from limitations and simplifications (e.g. van Imhoff and Keilman 2000, Kohler and Phillipov 2001). However, for the descriptive purpose of this article we find the adjustment procedure proposed by Bongaarts and Feeney sufficient.

The results of TFR adjustment analysis are presented in the Figures 13–15. Total fertility rate and its adjusted version have been calculated separately for total fertility rates at parity 1, 2 and 3 for the period 1990–2008[1].

Figure 13. Smoothed adjusted and non-adjusted fertility rates for parity 1



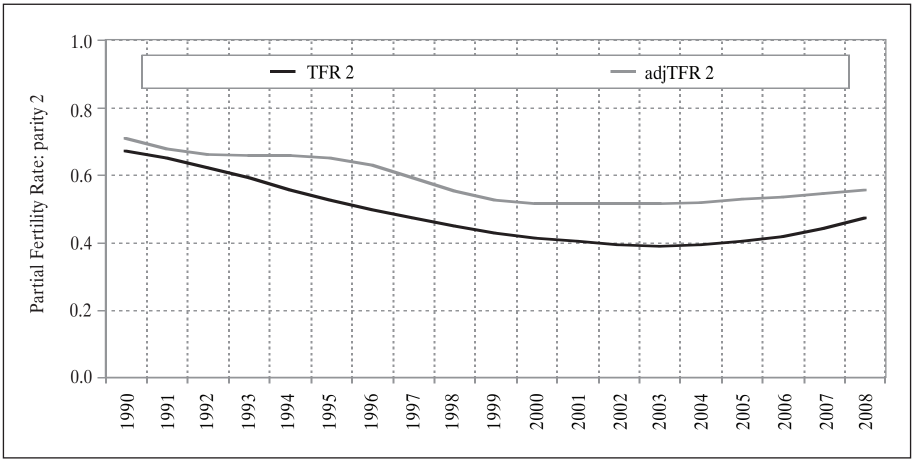
Source: Own calculations based on the CSO data.

The trends in the TFR and adjusted TFR for parity 1 seems to summarise results discussed in the previous sections. From the beginning of the transformation period constant postponement of childbearing could be observed, which resulted in lower TFR as compared to the adjusted version. During the last five years, the adjusted and non-adjusted TFR seem to have been converging. This might be treated as evidence to support a hypothesis about a recent decline in postponement. This might also serve as indirect evidence for the recuperation effect, mentioned in one

[1] Both measures were smoothed after the adjustment procedure using the robust running median smoother known as 43RSR2H, which allowed removing some random fluctuations from the time series. The smoothing procedure is available in STATA software under command “smooth” (see: http://www.stata.com/help.cgi?smooth).

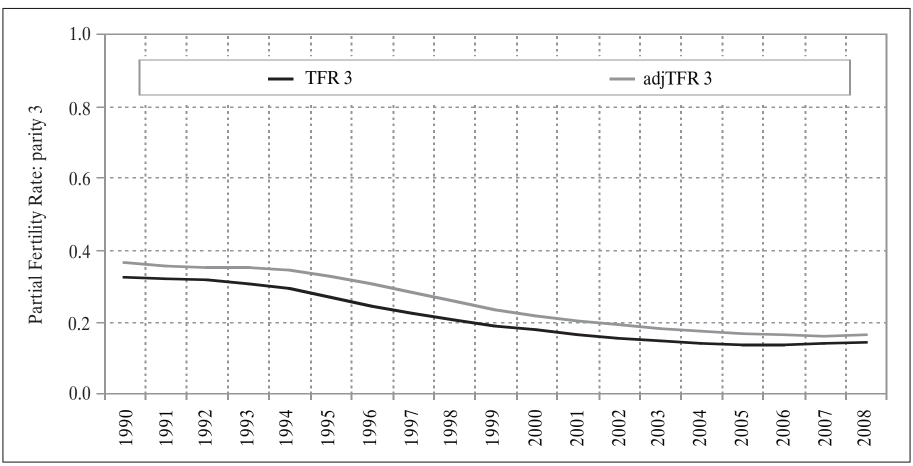
of the earlier sections. The recuperation effect seems to be slightly weaker for the partial fertility rate for parity 2. We also observe convergence of adjusted to non-adjusted TFR however there is still space for an increase in the fertility rate as an effect of recuperation. Comparison between values of adjusted and non-adjusted third birth rates (Figure 15) clearly show that over the whole period under study there was almost no postponement.

Figure 14. Smoothed adjusted and non-adjusted fertility rates for parity 2



Source: Own calculations based on the CSO data.

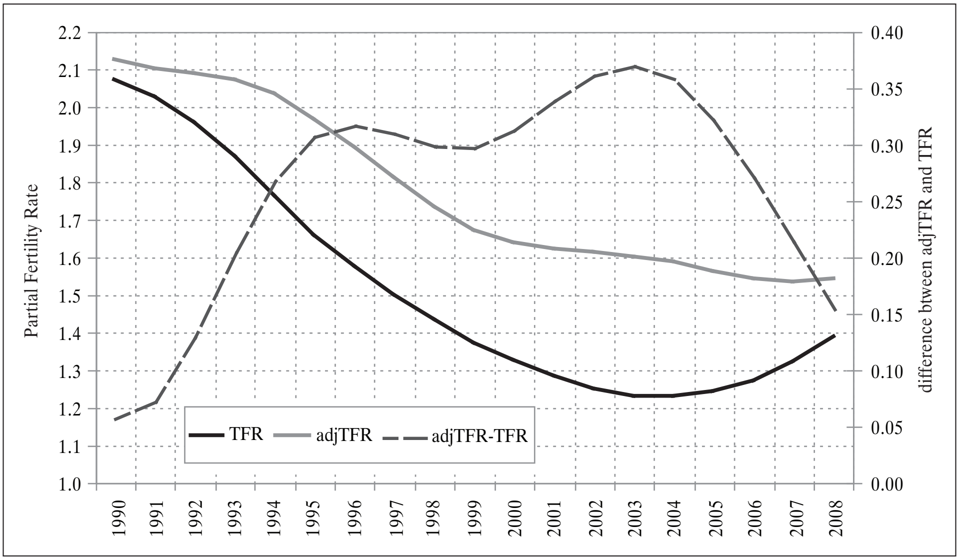
Figure 15. Smoothed adjusted and non-adjusted fertility rates for parity 3



Source: Own calculations based on the CSO data.

Figure 16 summarises the previous findings by presenting the TFR and adjusted TFR and the difference between these two measures for the whole period under study. The adjusted TFR presents a hypothetical situation if there was no fertility postponement over the whole analysed period. In other words, if reduction of fertility of Polish women was only due to postponement, in 2008 TFR would be equal to 1.54 (compared to non-adjusted value of 1.38).

Figure 16. Adjusted and non-adjusted total fertility rate with plotted difference



Source: Own calculations based on the CSO data.

Therefore, the drop of adjusted TFR could be attributed only to the quantum effect, which is the reduction in the number of births (transitions to subsequent parities). The line, which represents the difference between the adjusted and non-adjusted TFRs, shows that between 1989 and 1996 significant postponement of fertility was observed. Afterwards, the postponement effect weakened until the beginning of the economic crisis in Poland around the year 2000. This trend continued until 2003, and in later years a decline in postponement and a slow recuperation can be observed, resulting in the convergence of adjusted and non-adjusted measures.

CONCLUSIONS

This article presents the cohort analysis of fertility in Poland after the Second World War. The calculation of cohort fertility rates for the whole period was difficult due to the fact that not all of the detailed data was available, and also because the definition of a live birth changed over time. Estimates presented here were done on the unified entry data and with the use of one methodology, which allows to analyse occurring changes on comparable rates. The results obtained extend remarkably the findings on cohort fertility available due to Holzer and

Holzer-Żelażewska (1997), as well as by Frejka and Sardon (2006, 2007). The 1971 birth cohort of women was the last one included for Poland in the study by Frejka and Sardon.

During the years 1945–2000 the cohort fertility pattern changed significantly. Age-specific fertility rates decreased and the highest fertility shifted beyond 25 years of age. For the generations of women that were born before 1960, the cohort total fertility rate at age 35, guaranteed the replacement of generations. However, due to the decreasing trend in fertility rates, for women born after 1960 this is not the case any more. One cannot, however, completely eliminate a possibility of more radical changes in the fertility pattern in the near future, such as recuperation of births owing to the continued increase in fertility of older women. Yet, it is still improbable that contemporary cohorts will attain a high enough level of fertility at older ages, which would recuperate 'lost' births at younger ages and guarantee the replacement of generations.

The period analysis of fertility presented in the second part of the paper adds more evidence to fertility trends in Poland after 1989. Taking into account that each decline of fertility could be decomposed into the *tempo* and quantum effects, a postponement of fertility resulting in reduction of the quantum component was observed. It has to be noted that the tempo and quantum effects are interrelated and in fact it is very difficult to separate them. In the period 1989–1994 there was a strong decrease in the TFR related to the quantum effect mostly due reduction in births of 2^{nd} and 3^{rd} order accompanied by a slow but persistent increase in age at birth of the first child. Therefore, a shift of the age schedules of fertility was observed however, the mean age at birth of the first child in Poland is relatively low as compared to other western European countries.

As noted earlier, a recent increase in the TFR might be a result of the recuperation process and/or the increasing number of women entering the reproductive period. This hypothesis is partially supported by the adjusted measures of the TFR (Figure 16). It is clear that the postponement is not that strong as in the past. The only question remains: How far will the recuperation go? From the perspective of an increase in the TFR in Poland, it seems that not only progression to the first birth is critical but also transition to the second and even third births. Although we observe a significant increase in the first-birth rates and the recuperation effect is strongest, this is still not the case for second-birth rates, not to mention the third-birth rates. From the perspective of presented data, we may argue that the main obstacle in the increase of TFR in Poland is the transition to second and higher births rather than to first births. Yet, in order to convincingly support this hypothesis much more detailed analysis with use of the micro-level data is needed.

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COHORT AND PERIOD FERTILITY OF POLISH WOMEN, 1945–2008

In the article, changes in the reproductive behaviour in Poland, especially after 1989, are discussed in terms of both cohort and period measures of fertility. The article consists of two complementary parts. The first part essentially replicates cohort analyses published by Holzer and Holzer-Żelażewska (1997) with an extension to women's cohorts born in 1946–1990, who themselves gave birth in the years 1961–2008. The new data used in the analysis comes from the registration of births for the years 1985–2008, provided by the Central Statistical Office in Warsaw. The analysis includes age-specific cohort fertility rates (for cohorts born in 1946–1985), as well as the total cohort fertility rates.

The second part of the paper adds a period perspective to the analysis of fertility changes in Poland after 1989. Here, focus is on the period total fertility rate, fertility rates by parity, and age-specific fertility rates. Moreover, using the Bongaarts-Feeney adjustment (Bongaarts and Feeney, 1998), attempt is made to account for changes in the TFR related to quantum and tempo effects.

Profound changes, both in cohort and period fertility rates after 1989, were found to be mostly resulting from the decrease in the quantum (reduction of higher order births), and to a smaller extent were affected by the tempo, which was manifested by a slow, but persistent increase in the age at birth of the first child. Recent upward changes, both in cohort and period fertility, result from the recuperation effect shown by an increased intensity of births among large cohorts born from the mid-1970s to the mid-1980s. Yet, it is still improbable that contemporary cohorts will attain completed fertility, high enough to guarantee the replacement of generations.

Keywords: cohort and period fertility, quantum and tempo effects in Poland