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Measures of cohort fertility in Bulgaria

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Abstract. This research work represents a multifaceted and detailed study of the changes observed in the age-specific fertility model in Bulgaria over the last few decades. The focus here is on the cohort approach, because cohort fertility in our country has not been studied since the middle of the last century, and the transition to birth postponement can be clearly captured and measured precisely from a cohort perspective.

This study deals with identifying the course of transition to birth postponement, its beginning and current stage of development, all this based on data analysis. The scale and influence of delayed births on the observed low fertility during the last three decades in Bulgaria was assessed in a cohort and period perspective. We focused some of our efforts on making a forecast of the levels of completed cohort fertility rate for women of the generations born before 1990 in Bulgaria who are still within fertile age.

Keywords: fertility, age-specific fertility, postponed births, quantum effect, tempo effect, completed cohort fertility, lowest-low fertility, forecasts

Introduction

Since the end of the last century, all European countries have observed fertility decrease and retention below the level necessary for the simple generation replacement, provided that in many of them, until the 1980s, the total fertility rate (TFR) featured some average values above 2.0. The most significant change in Europe's fertility pattern over the last few decades concerns the birth postponement against the background of low and declining fertility rates.

In many European countries, the average age of women at childbirth is already over 30. Such a late fertility model was not unusual in the past, when families were large and women often bore children until the end of their reproductive lives. However, the main difference between the said fertility model and the modern fertility model, which expresses the most radical change having occurred in it, is related precisely to the late start of family formation and, even more precisely, to the average age at which women give birth to their first child. Today, women in most countries of Western, Northern and Southern

Europe become first-time mothers when they are over the age of 30, whereas in the 1970s this first-childbirth age range used to be 23-25. The postponement of the first childbirth in some countries has continued without interruption for more than four decades and seems to be one of the most visible features of the fertility pattern typical of developed societies. The development of this process has a major contribution to the emergence of the so-called lowest-low[1] fertility rate since 1990, and has been quite widespread across the southern and eastern European countries. Such achieved low TFR levels seen in Bulgaria ranks this country in the group of countries with the lowest-low fertility rates in the period 1995-2005, and these critically low values of the cross-sectional coefficient may be largely explained by changes in the fertility age pattern coupled with the emergence of a transition to postponement of births for later fertile ages.

It is precisely the **thesis** that the low fertility rate in Bulgaria is caused by the change in the fertility rate regime that emerged after the middle of the last century, in combination with the start of a transition to birth postponement, that is supported by the present study. Moreover, there are some non-demographic driving forces that would also contribute to the phenomenon of very low fertility rates: the significant economic and social transformations of society since the 1990s, the limitation of pronatalist policies and some other prerequisites, with the latter, however, remaining outside the scope of this study.

In the countries of Central, South-Eastern and Eastern Europe, the transition to postponing births started relatively later, that being after the transition to a market economy, and it has mainly affected the generations of women born after 1970. As these countries are characterized by a relatively early fertility pattern, the postponement process begins from relatively young ages of mothers at the birth of the first child, which process again started later, if compared to other European countries.

The birth postponement process has entailed a number of consequences at both the societal (macro) and individual (micro) levels. One of the main micro-level consequences of the current birth postponement has a bearing on the fact that a later start, other conditions being equal, may lead to a reduction in a woman's final offspring. Ultimately, voluntary postponement can also lead to involuntary infertility due to women's biological capacities for reproduction, which, basically, tend to be negatively affected by increasing age. As a result, the postponement of individual births would typically affect the general level of fertility rate and lead to the reduction thereof.

The main macro-level effects relate to the impact of postponement of births on the completed cohort fertility (CCF) among women, on the size of the cohorts of children born, and on the changes, occurring in the characteristics of the very age-specific pattern of fertility typical of the respective cohorts. What is more, birth postponement also has specific effects on the development of the processes of population ageing, on the modification of population's demographic structures and on population's reproduction. Last but not least, it should be

[1] This term was introduced by Kohler, Billari, and Ortega and designates TFR values below an average of 1.3 children per one female in fertile age (Kohler, Billari, Ortega 2002).

noted that the transition to birth postponement also has an impact on the way fertility is measured at an aggregated level. The identification and accurate measurement of postponed births is crucial for the study of current and future fertility, not merely because of the correctness of the analytical conclusions, but also because of their possible economic, social and political consequences. In the presence of widespread birth postponement, traditional periodic fertility rates must be interpreted neatly and carefully.

The process of birth postponement in Bulgaria appears to be poorly studied, with Bulgaria having only been included in just a limited number of large-scale international comparative studies. In Bulgaria, studies on the cohort fertility are practically absent, mainly owing to the high requirements posed to the information base. Studying fertility only on the basis of cross-sectional measures, such as the total fertility rate, would never open any space to study in depth all fertility's characteristics and determinants. This may well lead to distortions in the summary and conclusions regarding the current and, even more so, the future fertility mode and demographic reproduction mode.

This article presents the results of a multi-faceted and detailed study of the changes observed in the age-specific fertility model in Bulgaria over the last few decades[2]. Its main goal is to study the cohort and periodic-related aspect of the changes occurring in the fertility in Bulgaria in the context of the ongoing transition to birth postponement and the changes observed in the age-specific fertility model.

Research approach applied in this study

The complexity of the examined phenomena coupled with the multi-layered period of this study determined the need to apply a systematic and complex approach, which would make it possible to build a comprehensive picture of the ongoing processes in Bulgaria. The results obtained demonstrated the great cognitive and analytical potential of the adopted complex approach in the process of studying the dynamics of fertility through cohort and period-related methods. Unlike basically period-related studies, where it would prove difficult to distinguish between a real reduction in the number of children born (quantum effect) and a reduced number of births due to the tempo effect, the distinction and measurement of quantum and tempo changes in cohort fertility is clearly defined. In addition, cohort analysis is particularly important for assessing how long-term and predictable the observed trends are.

The **target** of research in this study will be the fertility rate in Bulgaria among the cohorts of women born after 1932, and the **subject matter** will be the size and structure of delayed births: firstly, in total and by rank of the child born, for the calendar period 1980-2018; and secondly, the cohorts of women, born over the period 1932-1990.

[2] The theoretical problem statement, a full description of the methodological part, and a detailed description of all the obtained results of the conducted research were published in the monograph entitled *Postponement parenthood transition in Bulgaria* (*Prehodat kam otlagane na razhdaniyata v Bulgaria*) (Moraliyska-Nikolova 2021).

For the purposes of this study were used: statistical information on the fertility rate from the National Statistical Institute (NSI) - population censuses conducted in Bulgaria in 1992, 2001, 2011, and statistical yearbooks for the period 2009-2018. Another main source of statistical information was the Human Fertility Database (HFD) of the Max Planck Institute for Demographic Research[3].

The limitations to the study presented were mainly of informational nature. Reconstruction of data on the distributions of women by single year of age and parity requires detailed information on births and deaths of women by age, parity and generation. Data on age or parity are not published in our country. Therefore, deaths and births were modelled in this study, covering the period 2009-2018.

To ensure maximum comparability of the cohort fertility dynamic series, the methodology of the Human Fertility Database was applied in the data reconstruction. Since the cohort fertility model adopted by the HFD only includes the dynamics of births and deaths, migration was also out of the scope of consideration in this study. Moreover, Bulgarian statistics has never collected or published any data on migrant women by single year of age or parity.

Against the background of the multitude of perspectives from which the low fertility rate in developed countries has been studied in recent decades, this study would rather focus on the demographic aspects, without commenting on the sociological, economic, psychological, or any other determinants, which remain outside the objectives of this research work.

Another limitation of the present study stems from its objective. Insofar as it is focused on the question of whether the persistence of low fertility rates in our country is due to the transition to birth postponement and on the possibility of assessing its burden on low fertility rates, the factors, although of primary importance, were not considered here.

Theoretical and methodological foundations of the study of delayed births and low fertility

The research conducted showed that the main theoretical concepts relevant to the process of birth postponement are the Second Demographic Transition (SDT) theory (Van de Kaa 1987, 4; Lesthaeghe 2010; Lesthaeghe 2020; Dimitrova 2005 and others), some economic theories (Becker 1960) and the Postponement Parenthood Transition (PPT) theory (Kohler, Billari, Ortega 2002). Based on analysed fertility data in the countries of Central and Eastern Europe after 1990, Kohler, Billari, and Ortega provide evidence of a self-sustaining transition, the so-called postponement parenthood transition[4].

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[3] Human Fertility Database. Max Planck Institute for Demographic Research (Germany) and Vienna Institute of Demography (Austria) (www.humanfertility.org [Accessed: 2020]).

[4] A systematic analysis of the consequences of the changes in the age-specific period-related fertility was authored by Kohler, Billari, and Ortega, who introduced the term *postponement parenthood transition* (Kohler, Billari, Ortega 2002).

At the time of their study, three countries in Southern Europe, five in Central and Eastern Europe, and six in the former Soviet Union had TFR values below 1.3 children. The authors proved that these low levels of TFR were owed to birth postponement, which was leading to a sharp decline in the values of the period-related fertility rate. The authors concluded that the main driving factor leading to postponement of fertility in the countries of Southern, Central and Eastern Europe and some former Soviet countries was the generated more general economic uncertainty rather than the transition to a new political regime or the severe economic crisis. While the main driving force of SDT is the self-fulfilment of individuals (which main driving force in economic theories is meeting financial needs) it is the uncertainty behind PPT that postpones the creation of a family and the birth of a child to a suitable future moment (Billingsley 2010 et al.). The results from the review of the relevant literature show that the theory of transition to birth postponement provides a good explanatory framework for the very low fertility levels reached in Eastern, Central and parts of Southern Europe. The application of the theoretical framework of PPT to the changes occurring in the fertility rate in Bulgaria over the reference period made it possible to put the focus on the significance of delayed births and to study their extent, severity, specificity, stages of transition and prospects for their development.

The demographic events observed will depend simultaneously on two types of factors: conditions of the period in which they occur, and conditions and events that were in place in the past. In order to understand the reasons for the occurrence of a demographic phenomenon and to predict how it will develop in the future, what must be taken into account is both the conditions during the period of observation and the conditions under which the people involved in the phenomenon lived in the past. This is where the two approaches to analysing demographic data come from: cross-sectional analysis and longitudinal analysis (i.e., by cohort).

The main advantage of longitudinal analysis (i.e., cohort analysis) is that it makes it possible to examine the so-called birth calendar (i.e., the distribution of births within the life cycle of the cohorts). This is particularly essential because modern fertility patterns are instantiated by widespread family planning, and the appearance of each child would largely depend on a couple's parity already reached, as well as on the calendar of previous births. Longitudinal analysis makes it possible to calculate more detailed indicators characterizing the fertility rate of a real cohort. At the same time, the cohort approach in a longer-term perspective is the only reliable way to analyse what part of the supposed "delayed" births are only delayed in time and what part of them will never come into being. A major disadvantage of longitudinal analysis is the need to resort to a very detailed information base.

The focus in this study lies on the cohort approach, because cohort fertility in our country has not been studied since the middle of the last century, and, consequently, it is precisely from a cohort perspective, from which the transition to birth postponement can be clearly captured and measured. The period-related approach was used in the study to highlight and correct the shortcomings of period-related measures, which are distorted in periods of change in the

age-specific fertility pattern and due to the impact of the transition to birth postponement.

Regarding the methodology applied in this research work, several main groups of methods can be summarized that were used to achieve this work's objectives. These are ***methods for adjusting*** period-related fertility measures in a period of transition to birth postponement. Because of the difficulty arising when trying to distinguish between the "true" decline (quantum effect) from a period-related perspective and the temporally decreasing influence of the shift in the timing of child births (tempo effect), it became necessary to adjust period-related measures of fertility to a better approximation to the real processes. The two methods of adjusting applied: that of Bongaarts and Feeney and that of Kohler and Ortega, allowed us to cleanse all sorts of distortions that are typical for the conventional (i.e., TFR) and the parity-age specific TFR (PATFR)[5] in conditions of birth postponement (Bongaarts, Feeney 1998; Kohler, Ortega 2002a).

Applying the ***decomposition methods***, an assessment was made of the quantitative aspect of the transition to birth postponement and the weight of fertility changes of a given rank on the total fertility change in a given year, a given period or for a given generation of women (Kohler, Ortega 2002b; Sobotka, Lutz, Philipov 2005). What was calculated in a period-related perspective, was the absolute number of "missing" and "added" births in a given year or period due to changes in the average age of childbirth, changes in the composition of the groups of women in fertile age by age and parity, and due to quantitative changes in the fertility rate. The changes observed in the cohort fertility level using the decomposition method were decomposed into effects of changes in successive transitions to higher parity (Zeman et al. 2017).

For the purposes of making ***forecasts of the completed cohort fertility rate***, the reference cohort method was selected (Frejka, Calot 2001; Frejka, Sardon 2004; Lesthaeghe 2001; Sobotka et al. 2011). Deferral and recovery of births were measured and the magnitude of these processes was analysed by maternal generation and rank of the child born. Based on this analysis, predictive scenarios were developed for the level of completed cohort fertility in women that are still within childbearing age.

For the application of the above methods of cohort analysis, the Fertility Database (HFD) for Bulgaria was supplemented for the generations of women born after 1960. In order to reconstruct the real fertility history of these cohorts, the distributions of women by single year of age and number of children for each calendar year from 2009 to 2018 were reconstructed by further processing of data from the 2011 census and from current statistics, using a reconstruction method adapted by the author (Moraliyska-Nikolova 2021, 75). The reconstruction of the cohort fertility history of the generations born between 1960 and 2011 covers both the fertility and mortality processes. After performing the necessary disaggregation and aggregation of the initial data to obtain the baseline age and parity distributions, a time-shift was performed needed to obtain the cohort data.

[5] This is summary index of period fertility controlling for age and parity.

Main results of the period-related analysis of delayed births and low fertility rates

The international comparative analysis made for European countries, covering the period 1960-2018 shows that the changes observed in the fertility rate in Bulgaria are part of a more global change in the mode of reproduction. While there is a variety of demographic contexts and different levels of socio-economic development the changes in the fertility pattern across the individual European countries do follow a common direction (Fig. 1). The results definitely show that there is gradual homogenization of fertility models and unification of TFR values among the European countries over the period 1970-2018.

There are clearly visible four waves of the onset of the transition to birth postponement in Europe. This transition to birth postponement in Western, Northern and Central Europe started in the 1970s. The second wave, which started in the 1980s, already covered the countries in South Europe. And in the 1990s, the same transition to birth postponement saw its onset across the countries of Southeastern Europe and in part of Eastern Europe. Around and

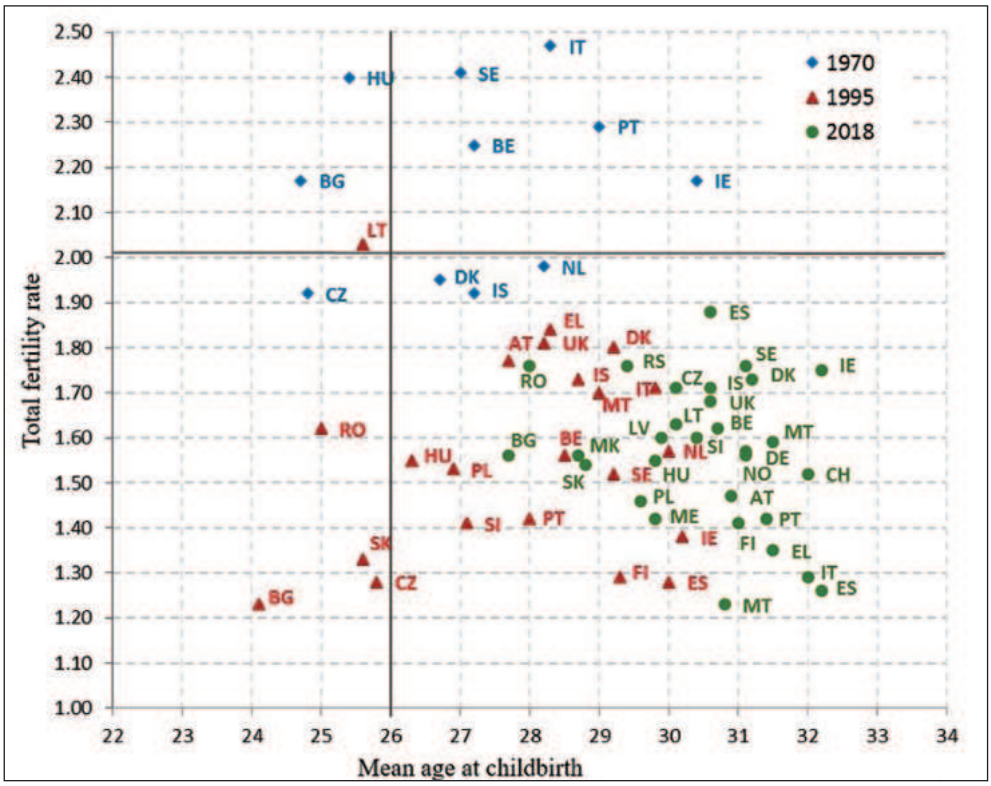


Fig. 1. Positions of European countries according by TFR values and by the mean age of mothers at childbirth in 1970, 1995 and 2018

Source: Eurostat data [Accessed: 16, November 2020].

after the mid-1990s, the last wave of the transition to birth postponement in Europe started in Eastern European countries. The results of the analysis show that the pattern of age-specific fertility is still undergoing changes at the moment in all the countries studied, and therefore it cannot be determined whether the transition to birth postponement has finally been completed in any of them.

The dynamics in the TFR values, the age-specific fertility rates and the average age at childbirth show a significant transformation in the fertility pattern in Bulgaria over the last three decades. The declining fertility of the third and higher ranks is responsible for the gradual decline in the fertility rate, which started as early as in the 1980s. First- and second-rank fertility suffered a sharp decline after 1990.

Along with the birth decline process, a transition to birth postponement also started after 1992. The result of this was the emergence of unprecedentedly low fertility featuring TFR values below 1.3 over the period 1995-2004. The previously firmly established 'two-children-per-family' model coupled with early fertility was displaced by the late fertility model where the prevailing share was that of first births. Births occurred within a large age range with a centre displaced toward the high fertile ages.

According to the schematization of the transition process of Frejka (2010), by 2018 Bulgaria was positioned at the third stage and that was when there was a temporary stabilization in the period-related fertility levels (Fig. 2). The processes of postponement and recuperation continue at approximately similar paces of reduction and increase and this is how they compensate each other, with the period-related levels finding a temporary stabilization.

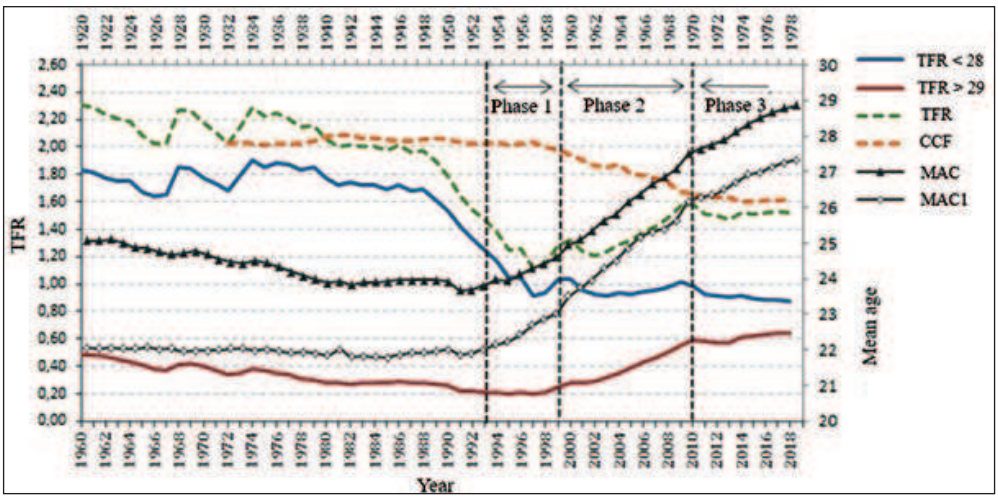


Fig. 2. Model of development of transition to birth postponement in Bulgaria: period-related and cohort fertility, mean age of mothers at childbirth (MAC) and mean age of mothers at first childbirth (MAC1) over the period 1960-2018

Source: Eurostat data [Accessed: 16, November 2020].
Note: CCF - completed cohort fertility; TFR < 28 - cumulative period-related fertility for women aged 15-28; TFR > 29 - cumulative period-related fertility for women within the age group 29-49.

A number of features were identified of the transition to birth postponement in Bulgaria. Regardless of the increase in average age of mothers at childbirth, the indicator still remains one of the lowest in the European Union. The analysis of the age-specific fertility model by rank in the period 1960-2018 showed that, despite the changes in the fertility model, a high early-fertility rate was preserved among part of Bulgaria's population. The traditional pattern of relatively high and early-fertility rates was replaced by a polarized pattern, in which the share of births to women aged under 20 was maintained, while at the same time the share of births among women at higher childbearing ages increased significantly.

The adjusted indicators, *adj. TFR* and *adj. PATFR*, which remove the tempo effect and the influence of changes in the age-parity distribution of the groups of women in fertile age, display higher values than conventional indicators. The results obtained from the analysis of the calculated adjusted fertility measures in the period 1977-2018 indicate that the low values of the cross-sectional fertility rate can be partly explained by delayed births.

The decomposition of the missing births in Bulgaria during the period 1980-2019 made it possible to decompose the changes in the number of births into the following effects: changes in the age-parity distribution of the groups of women in fertile age (index I_G), quantitative changes in the fertility levels (quantum effect I_Q) and tempo-changes (index of tempo distortion I_T), owed to changes produced in the age-specific fertility model. The results show that the number of births that would have been observed provided supposedly there were no tempo effect,

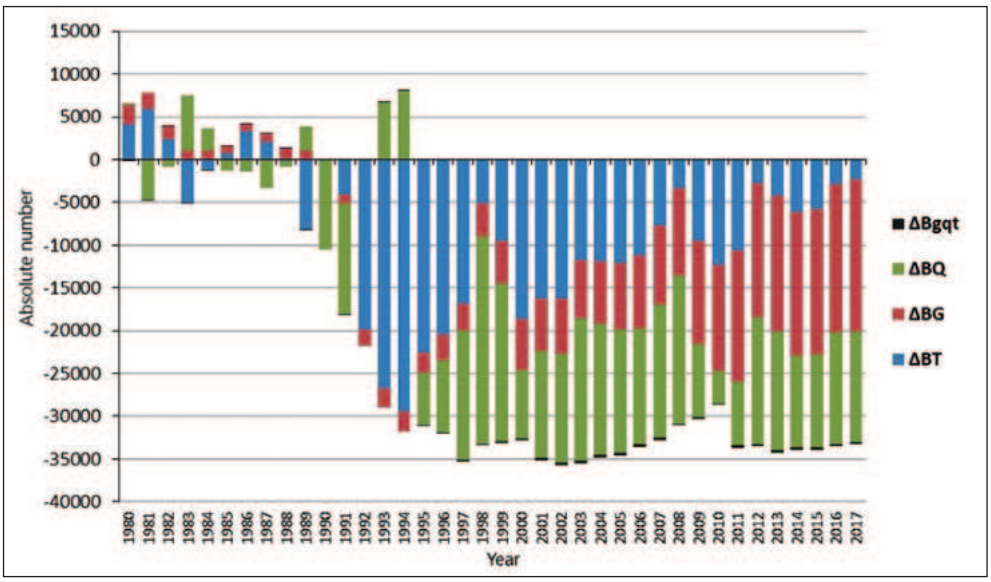


Fig. 3. Distribution of the annual number of "missing"/"added" births by reason of their occurrence in Bulgaria during the period 1980-2017

Source: Eurostat data [Accessed: 16, November 2020].

significantly outnumber the real quantity of children born over the reference period. The analysis of the three effects on the cross-sectional measures of the total fertility rate shows that in the 1990s the tempo effect had the strongest negative impact (Fig. 3). Over the next decade, the tempo and quantum effects equalized their negative impact, and at the end of the period the impact of the tempo and quantum effects decreased and the negative driving force for the observed low fertility became the generational effect due to the deteriorating age-parity structure of the groups of women in fertile age.

Main results of the cohort analysis of delayed births and low fertility rates

The results obtained from the cohort analysis testify to a significant similarity in the course of the decline in the cohort fertility rate in the second half of the last century among European countries. Bulgaria is not an exception to this long-lasting and stable trend of significant changes in the patterns of age-specific fertility, which occurred among the generations of women born after the first third of the last century. Calculations show that the completed cohort fertility rate of women in Bulgaria is decreasing. The generations born in the 1930s, 1940s and 1950s have relatively stable completed cohort fertility rate with values above 2.1. Women born in 1959 are the first generation for which the value of the completed cohort fertility rate falls below the threshold necessary for simple reproduction. As to the generations of women born in the 1970s, the cohort fertility rate calculated by the age of 40 for women is just over 1.6.

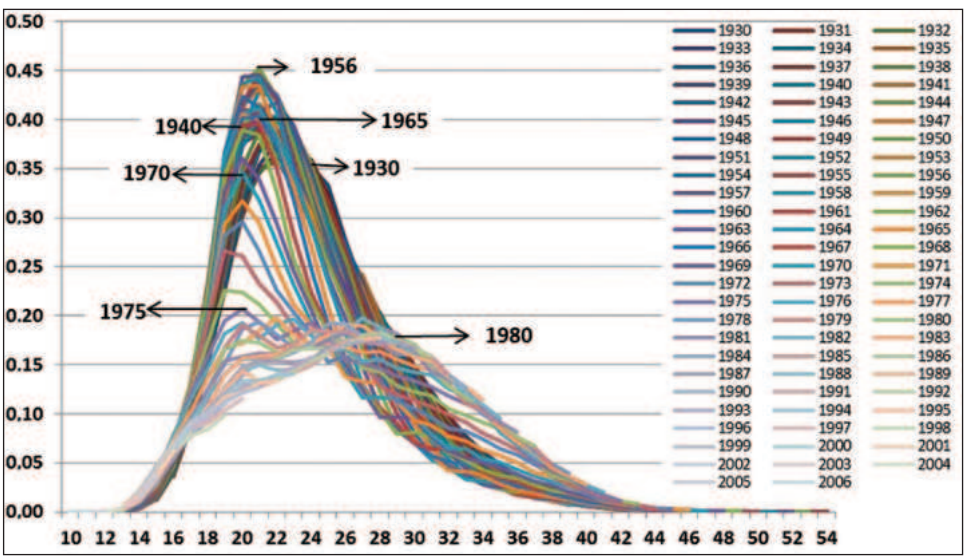


Fig. 4. Age-specific cohort fertility rates for the generations of women born over the period 1930-2006

Source: Eurostat data [Accessed: 20 October 2020].

The age fertility pattern characteristic of women belonging to the generation of the 1960s displays a distinct peak of fertility in the young fertile ages. The results obtained showed a significant reduction in the fertility rate in the cohorts born in the 1970s, and in addition - quite a visible shift of births toward higher reproductive ages (Fig. 4).

The reduction established in the completed cohort fertility rate in a quantitative aspect is mainly due to a significant reduction in the level of cohort fertility of the second rank and to the reduction in births of the third and higher ranks. First births across generations retain their positions in the formation of the completed cohort fertility rate and feature a relatively stable level, as a large proportion of postponed first births would recover at later fertile age.

Moreover, the results obtained also clearly show a tendency towards a significant increase in the indicators typical of middle age. There is a marked increase in the mean age at first childbirth, which in the 1970 cohort got up to 23, i.e., almost a year higher than among the generations born only five years earlier. The postponement of higher-ranking births would be associated with a significant increase in the mean age of mothers at birth of a second child, videlicet, from the age of 24.5 in the 1965 cohort of women up to the age of 26.1 in the generation of women born in the early 1970s.

The results of the analysis made would suggest that the transition to birth postponement in the long-term perspective started in the cohorts of women born after the mid-1960s in Bulgaria, with postponement initially observed in second-ranked births and above, while among the generations of the mid-1970s the postponement could already be observed in the first-ranked births.

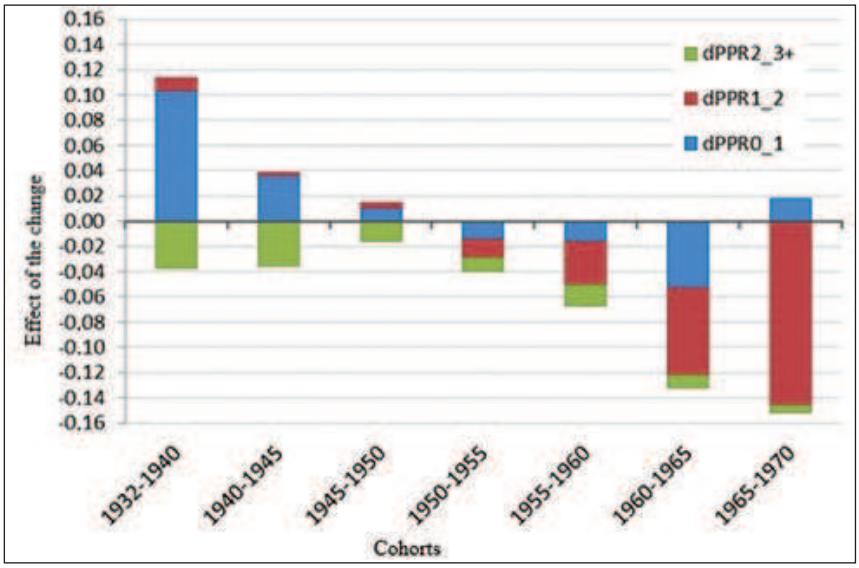


Fig. 5. Effect of changes in the transition to first childbirth ($dPPR_{0,1}$), second childbirth ($dPPR_{1,2}$) and third and subsequent childbirths ($dPPR_{2,3+}$), as calculated by groups of generations born at five-year intervals in Bulgaria

Source: Eurostat data [Accessed: 20 October 2020].

The specific rank changes in the cohort fertility model were studied based on a method of decomposing the reduction in CCF by parity components. The specific rates of transition to childbearing/subsequent childbearing were calculated for all studied generations of women born in the period 1932-1970 (Fig. 5). On the basis of the analysis made, it could be summarized that the decrease in the values for the CCF and the very low levels reached of this indicator in Bulgaria (below 1.75) would mainly come as a result of a contraction in the number of second-rank births among the generations of women born after 1969. The results of the analysis of the rates of transition showed that the rates of transition to first childbirth remained high and almost stable for all generations of women considered.

The most significant impact on the declining cohort fertility rate in Bulgaria would be that of second-rank childbirths, since second births are delayed, but not only, they also fail to recover to a sufficient extent subsequently until the end of women's reproductive lives. Their participation in the reduction of the cohort fertility rate came to slightly more than 70% for the generation of women born in 1970. In contrast, in the case of the first births, the process of postponement proceeded intensively, however the recovery also remained high for them.

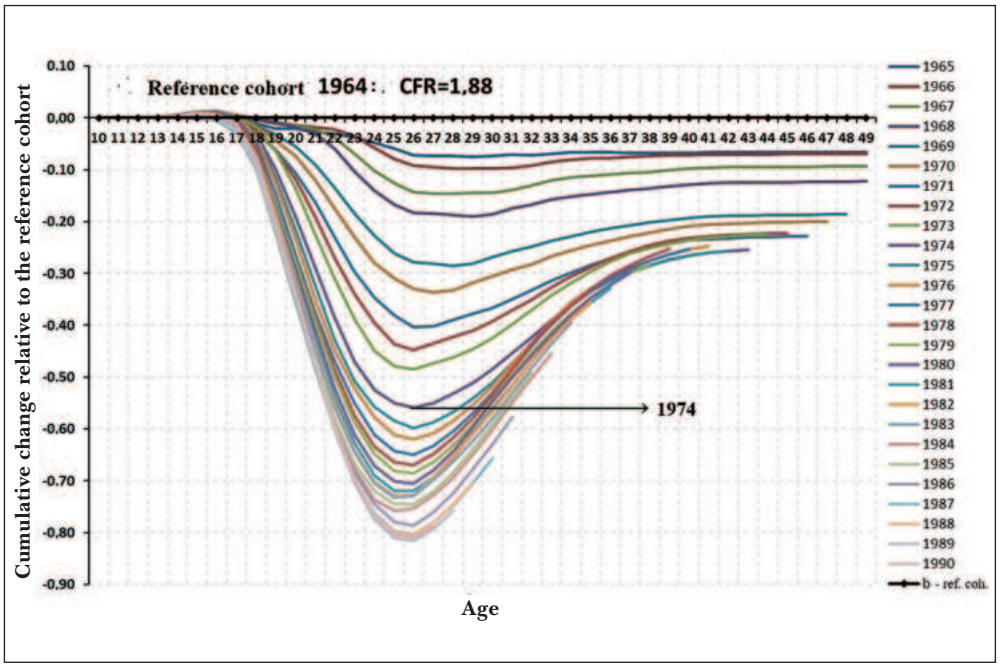
Main results of the forecast for the cohort fertility in Bulgaria

There are no forecasts for the completed cohort fertility rate in Bulgaria; therefore, a forecast was prepared for the cohort fertility of women that are still in fertile age using the method of the reference cohort, with the main differentiating factor for the forecast options being the degree of recovery of delayed births, disaggregated by rank.

The selected method of forecasting consists of two forecasts: first, of the recovery indices by rank and, second, of the completed cohort fertility - total and by rank. The cohort of women born in 1964 was chosen as a reference, because after that the mean age at first childbirth has been increasing continuously. The final fertile age in the forecast, 49 years, was chosen as the commonly accepted upper limit of the fertile age. The age of maximum decline was defined for each cohort and birth rank.

The postponement process affects births of different rank in varying ways for various generations of women. The birth postponement was most intense for the generation of women born between 1965 and 1975 (Fig. 6). There is hardly any recovery of postponed births among the generations born before 1970. Moreover, there is a higher rate of recovery among the younger generations. The process of postponing the first childbirths affected the generations of women only slightly until 1968, after which there was a significant increase in postponement.

Second-rank births marked a significant delay until the 1980 generation, and thereafter the delay slowed down. Until the generation of women born in 1975, almost no recovery of delayed second births was observed. Among subsequent generations, the proportion of restored births marked an increase, but nonetheless it was only about half of the "missing" second births that were fulfilled by the end of women's reproductive life.



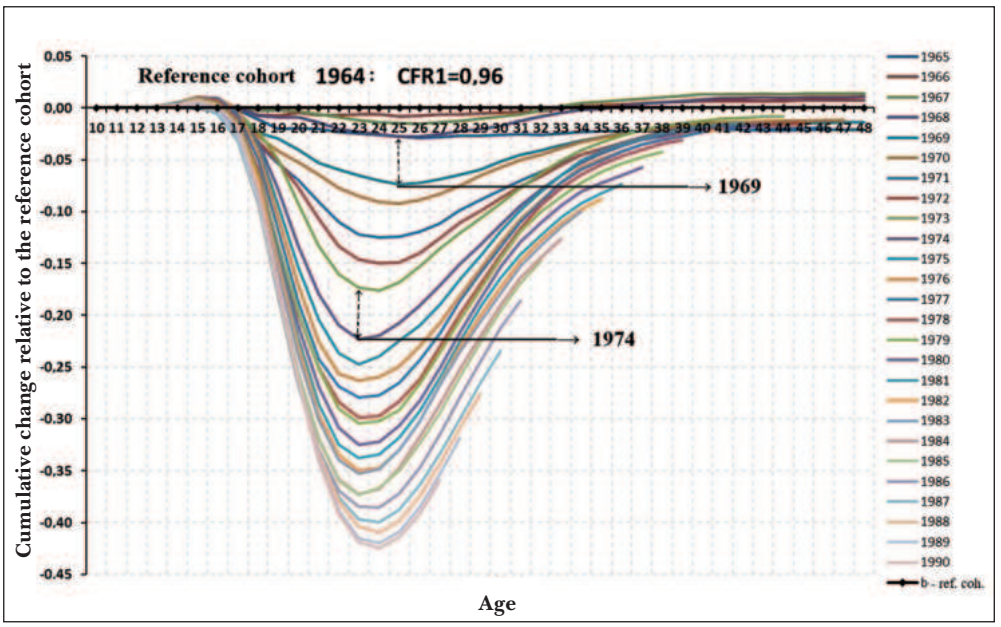
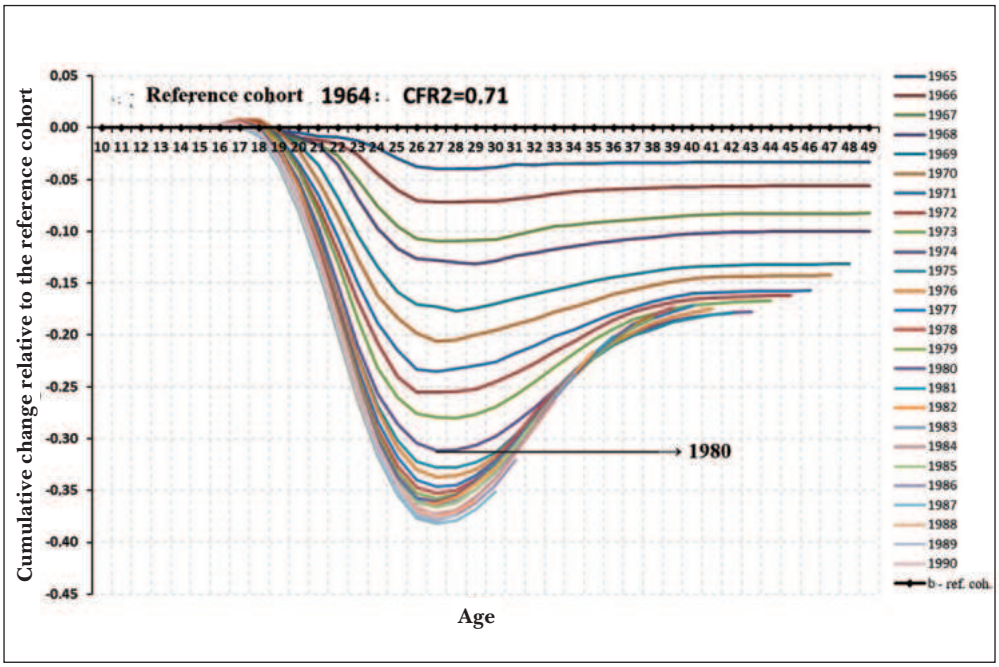


Fig. 6. Cumulative differences between age-specific fertility rates: total, first, second, third and higher ranks of the studied cohort and of the reference cohort (in absolute value)

Source: Author's calculations.



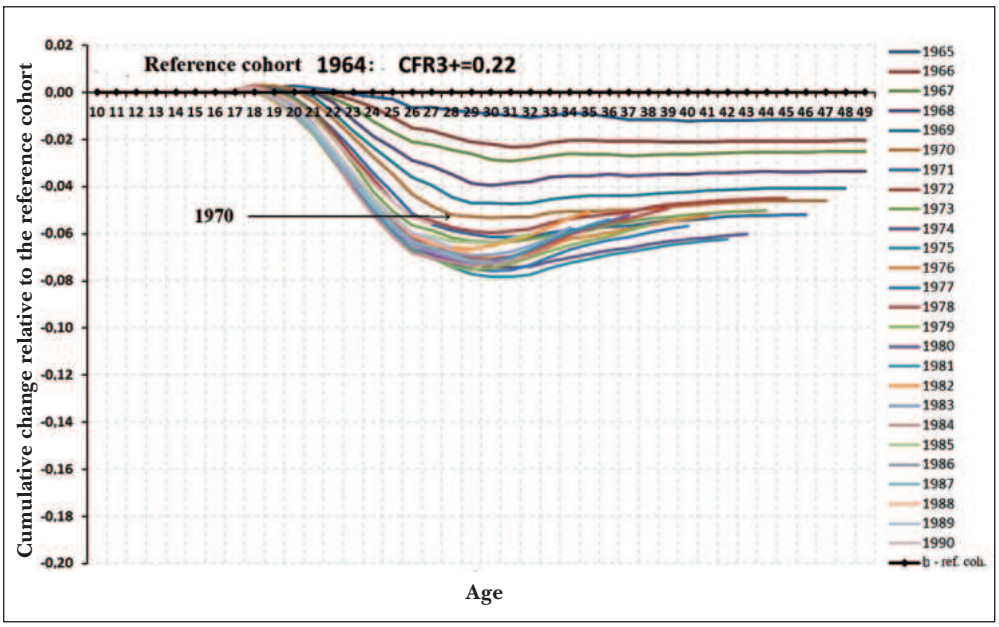


Fig. 6. Cumulative differences between age-specific fertility rates: total, first, second, third and higher ranks of the studied cohort and of the reference cohort (in absolute value)

Source: Author's calculations.

The results obtained show that there was an increasing trend in the recovery index values and a corresponding increase in the share of recovered births. The recovery index reached 43% for 49-year-old women of the 1970 cohort, meaning that less than half of delayed births were recovered by the end of the reproductive life of women of that generation. The recovery index for first births reached 87% for 49-year-old women of the generation born in 1970. The results obtained come as a proof that, regardless of the significant scale of the process of first-birth delaying, more than 90% of such delayed births were fulfilled at a later stage of women's fertile life. Second births saw an increase in the recovery rate, but it still remained low at just 31% and at a mere 14% for 49-year-old women from the 1970 generation.

Against the background of the slowing process of birth postponement and improvement in indicators of recovery of postponed births, it is not surprising to see an increase in indicators for completed cohort fertility in the last generations under consideration. The chosen method of forecasting the completed cohort fertility is based on playing out different scenarios for the development of the recovery index: overall and by rank (Fig. 7).

The obtained results testify that, in contrast to first births, the recovery of all postponed second births would lead to a significant increase in the level of CCF and bringing the estimated values for the completed cohort fertility of the generation of women born in 1990 closer to values of the reference cohort.

Based on the obtained estimated results for the recovery index of total births and births by rank, eight variants of the completed cohort fertility forecast of the studied generations of women were developed. Six variants were modelled, including a variety of combinations of the hypotheses developed for each rank. The remaining two variants, the zero variant and the optimistic variant, were included mainly for the purposes of comparative analysis, as they are rather a mathematical expression of the marginal possibilities for changing the estimated

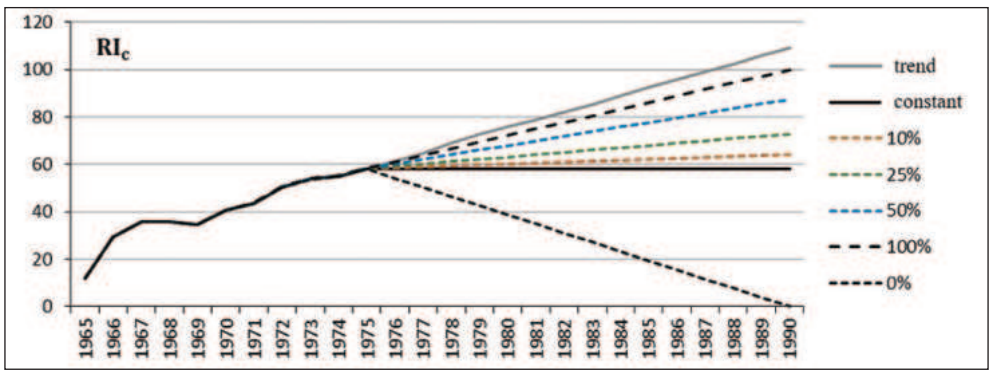


Fig. 7. Estimated variants for the development of the delayed births recovery index for the cohorts born over the period 1975-1990 (in %)

Source: Author's calculations.

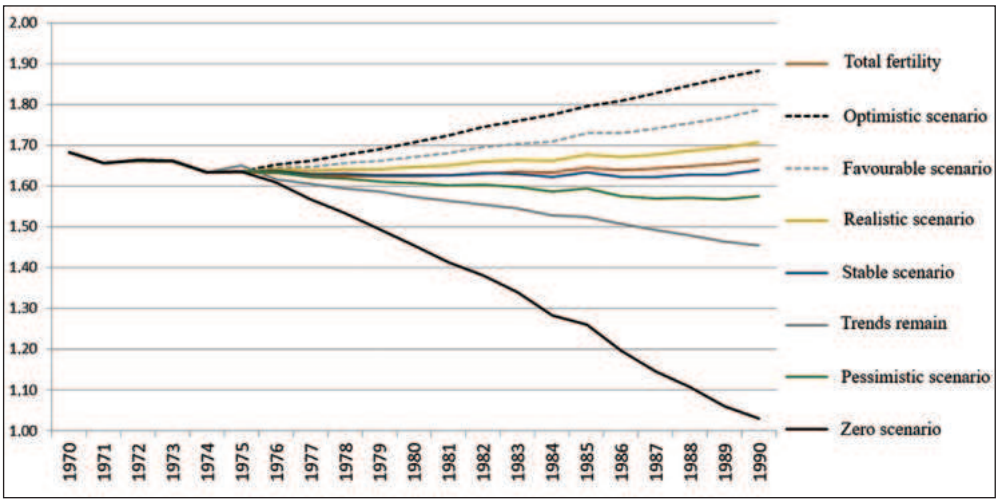


Fig. 8. Estimated results for the completed cohort fertility for the generations of women born in the period 1975-1990 in Bulgaria

Source: Author's calculations.

indicator. The hypotheses of all estimated variants are a combination of different but possible and realistic (for Bulgaria) alternatives to the future change in the processes of birth postponement and recovery. All variants of the forecast were developed separately: for total births and for births of the corresponding rank.

The results of the forecasts indicate that, regardless of the positive assumptions made, the cohort fertility remains below the value of the reference cohort in all the scenarios developed (Fig. 8). Given also that cohort indicators are relatively slow to change compared to the more sensitive periodic indicators, a sharp increase in completed cohort fertility in the generations of women coming out of the reproductive age in the next few years cannot be expected, other conditions being equal.

The results obtained from the completed cohort fertility forecast provide grounds for the following conclusions. Firstly, despite the upward tendency in the recovery rates of postponed births, the postponement process is still very intense, especially in the case of first childbirths. This would mean that the shift of births toward higher fertility ages, and in particular the postponement of first-rank births, will in turn reduce women's opportunities to have second-rank and higher-rank births.

Secondly, the estimated results obtained vary in a somewhat wide range of values, ranging from 1.4 to 1.8, excluding the two borderline variants of zero recovery and full recovery. Cohort fertility is not as dynamic a process as changes in cross-sectional fertility rates, and, consequently, it is more stable and changes more smoothly over time. Therefore, the completed cohort fertility of the considered generations would hardly approach the values for simple generation replacement of one single generation within the forecast period.

Similar to those obtained in the present study are the estimated results and expectations for the cohort fertility rate in most European countries.

Thirdly, it would be realistic to expect that cohort fertility rates may start to increase at a later stage when the postponement process is complete. With its completion, postponement will decrease and recovery will be sufficiently achieved at older ages. The chance of accumulation of births and even over-recovery leading to a marked increase in cohort fertility rates shall not be excluded.

Fourthly, the results obtained show that the postponement process is most intense in the generations born between 1965 and 1975, after which it slows down. First-rank births marked a high rate of recovery of postponed births to the end of the fertile life of the generations. In contrast, there is hardly any recovery process in second births among the first generations after the start of the transition, with the recovery rate remaining low among subsequent generations. Therefore, the low levels of completed cohort fertility rates typical of the generations considered were mainly due to unfulfilled second births and, to a much lesser extent, to higher rank births.

Conclusion

The results of the international comparative analysis of cross-sectional fertility rates show that the transition to postponement of births has been spreading across all European countries since the 1960s. The transition to birth postponement in Bulgaria started in 1992-1993. The fertility model in Bulgaria before the transition to birth postponement featured a low average age of mothers at childbirth, high marital fertility, a stable two-child family model, etc. Since the early 1990s, the transition to birth postponement has played a major role in the country's declining and low fertility rate. It was the missing births of the second rank that were mainly responsible for the low fertility rates reached.

Cohort analysis of fertility shows that cohort fertility models in Bulgaria were undergoing significant changes for generations born after the mid-1960s. The results obtained show that the transition to birth postponement started with the generations of women born within the period after 1964, with its influence increasing in subsequent generations. A decrease in the level of the completed cohort fertility rate was observed even before the transition to birth postponement in Bulgaria. The co-occurrence of both processes led to a significant reduction in the cohort fertility rate. The most significant transformation in the cohort fertility model could be seen in the generations of women born in the 1970s. In addition to the quantitative aspect, a significant change was also noted in the age-specific fertility model. The results obtained clearly testify that the most significant influence of the second-rank births was on the low levels of the completed cohort fertility in the studied generations of women.

The decomposed reduction of the CCF showed a different weight of births by rank on the formation of the final values of the indicator. In the case of the generations of women born after 1965, the decrease in the values of CCF and the very low levels of this indicator reached in Bulgaria were mainly produced by a contraction in the size of second-rank births.

Changes in the cohort fertility model continued over the projected generations. They were expressed in a slight decrease in the recovery rate of first births, which was mirrored by the increasing levels of childlessness. At the same time, the recovery rate of second births is expected to continue to rise. The results show that since these have the greatest weight on the completed cohort fertility, a certain increase in the completed cohort fertility of these generations could be assumed in the conditions of transition to birth postponement.

Based on the results of the conducted research, recommendations were made to improve the understanding of the changes in fertility rates observed over the last three decades, of what their future development would be and of what would mitigate their consequences. They are particularly crucial for Bulgaria, where the transition to birth postponement is poorly studied, where the fertility rate is relatively low, and where the population is ageing and there are no immigration flows of sufficient size and sufficient age structure.

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