RESEARCH ON THE FERTILITY OF BULGARIAN WOMEN*

- Analysis of the statistical distribution of fertility rates by age group

T. KALOYANOV
University of National and World Economy
Department of Statistics and Econometry

Abstract

The research on the dynamics of fertility for women in Bulgaria has been carried out through analyzing the distributions of the age-specific fertility rates. For this purpose we have used all four parameters of the statistical distribution - the arithmetic mean, the standard deviation, the coefficient of asymmetry and the coefficient of excess. The experimental research has been carried out as an aggregate for all children and separately for the first, the second and the third birth-order.

Key words: Fertility, Age specific fertility rate, Distribution, Parameters of statistical distribution

***

According to the demographic transition theory, at the end of this process the fertility will stay at the level necessary for minimal population reproduction - approximately 2100 children per 1000 women. In fact, over the last decades the total fertility rate in many countries has fallen below 1.5 children.

Bulgaria is among the countries in which fertility has reached extremely low levels. This is especially true during the initial years of transition to market economy. The crisis in which the country found itself upset the natural course of the demographic transition and intensified the negative consequences. To predict the population's rate of reproduction has become a really difficult task. One of the major reasons for this is the fact that 1990 marked the beginning of a radical change of the social, economic, political and cultural structure of the country. After the critical years, the country is not going back to something old, familiar and well-known, but takes a totally new direction. Deep, radical changes have been taking place in our society and new types of relationship are taking over in all areas of life; these are bound to affect the reproductive

---

* Research conducted for the period 1961 - 2008

behaviour of women. Furthermore, the group of women in reproductive age has a new intake of women born at the beginning of the 1990ies whose value system is thought to be quite different from that of the previous generations. The new situation necessitates research approaches that will be able to better reveal the changes happening in the reproductive behaviour of women.

***

The total fertility rate is one of the indicators favoured by researchers Frejka and Sardon (2004, 2005, 2006, 2007). The information this measure provides is valuable, but, like all general methods of measuring, it does not reveal how its value has been formed (Hajnal (1947); Ni Bhrolchain (1992). In some cases this mechanism is of no interest and some of the researchers typically restrict their analyses to interpreting only the total fertility rate. When the purpose is to determine what changes occur in the reproductive behaviour of women from different generations, other instruments of analysis are needed. One of the possible approaches for performing such a task is to study the distributions of the age-specific fertility rates. Most often this is carried out by analyzing the differences and the dynamics of the average age of giving birth to a child - first, second or third. The arithmetic mean is an important characteristic of the distribution, but it is insufficient for revealing the differences between the statistical distributions. We need to use the other parameters as well - the standard deviation and the asymmetry and excess coefficients, since they are essential characteristics of the statistical distribution. This, in the language of demography, means that they reveal important aspects of the reproductive behaviour of women. Penetrating into the mechanism of shaping women's behaviour will help to find suitable activities by which to reach specific purposes - to increase or decrease the levels of fertility.

In this research, the study of the current situation along with the dynamics of having a child is performed through analyzing the distribution of the age-specific fertility rates. This is done by using all four parameters - mean, standard deviation, the coefficient of asymmetry and the coefficient of excess. To estimate the joint effect of the changes on the values of these parameters a special diagram has been developed - Kaloyanov(2008). It is a further development of the diagram used for financial analyses in the part dealing with risk assessment and portfolio choice assessment (Harvey, Liechty, W. Liechty and Muller (2004), Williams and Ioannidis (2002).

DYNAMICS OF THE OVERALL DISTRIBUTIONS OF
ALL LIVE BIRTHS

The distributions shown in Fig.1. can be divided into two parts. The first part includes these for the period 1961-1990, and the second those from 1995 to 2008. The distributions for the first group have a distinct peak, modal value for the age between 20-24, which considerably exceeds that of the second group. In addition, in the distributions after 2005 the modal value is seen in the age range 25 -29, which is a signal for the changes in the behaviour of women in Bulgaria. These changes involve, first of all, a rise in the average age of giving birth. According to table 1. the average age of giving birth in 1961 is 24.62 years, and in 2008 it is 25.94; in other words, there is a rise of 1.32. This increase comes after a previous decrease by 1.23 down to 22.48 years in 1980. The increase starts after 1980 and continues to 2008 with a slight decrease to 23.44 in 1990. This substantial increase in the average age of having a child in our country has taken place over a period of 18 years, including the years from 1990 to 2008. The average age of having a child is now 25.94, which is an increase of 2.5years and is almost twice as high as the increase marked over nearly fifty years from 1961 to 2008. It is clear that during this period there must have been factors contributing to the change of the stable trend of average age increase that had started prior to 1961. As indicated, after 1980 the decline in the average age comes to an end and an increase begins, which is to a great extent the effect of the crisis in the 1990ies. The data shows that it can be assumed that the tendency will continue until a specific level is reached and then will stabilize around that level. Why is this hypothesis acknowledged? If the increase is due only to births delayed or deferred from the time of the crisis in the 1990ies, then during the period 2000 -2008 these should be completed and the increase should come to an end. However, this is not so. The average age has been increasing during the last several years of the period under research, which is unlikely to be caused by delayed births. This is more likely due to a change in the behaviour of part of the women such as having aspirations to continue studying for a degree of higher education; starting work; building a career; achieving financial independence and only then having a child. In support of this hypothesis are the changes in the degree of variance. The margin between the standard deviation in 1961 and that in 2008 is 0.45years. In the same way as the average age, the factors which determine the reproductive behaviour of women over these almost 50 years have changed as regards their significance. Initially, they contributed to reducing the differences between women and the result is a standard deviation of 4.95years in 1980 which registers the lowest age at giving birth. After this

year the difference changes and grows steadily until 2008 by more than one (year). It is clear that the factor (factors) which had been dominant during the years before 1980 is decreasing its influence. Other factors may have appeared or conditions for their increased influence may be available. What has been said about the prospect of the average age is also valid for the variance. The differentiation among women old enough to give birth is increasing, which means that groups of women with different behaviour, and different value systems, have started to appear. It is obvious that the various groups of women are under the influence of different factors and they require specific treatment and measures for their reproductive behaviour.

Age-specific fertility rates for the women in Bulgaria - total, for all live-births during the period 1961 - 2008

Fig. 1
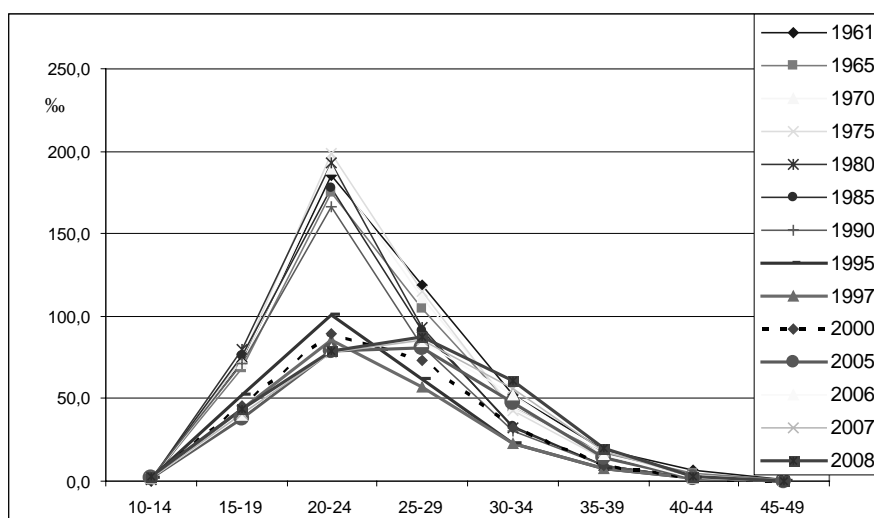
The analysis becomes more concrete using the asymmetry coefficient. According to the value of the latter, the distributions initially have slight positive asymmetry. This means that births are concentrated in the younger age groups, mainly between the ages of 20 - 24. Unlike the previous two parameters, the mean and the standard deviation, the asymmetry coefficient here shows greater fluctuation - an increase in 1965, a decrease in 1970, and then another increase of up to 0.90 in 1980. After another fluctuation the value of the asymmetry coefficient starts to fall steadily and reaches 0.18 in 2008. This means that the distribution of the age-specific fertility rates is almost symmetrical when the disparity is increasing

between women as regards the method of their reproduction. The value of the fourth parameter - the excess coefficient - also supports the growing differences. The fluctuation in the value of the changes is evident for this measure, too. It is typical for the distributions that, despite the course towards change, 1980 marks the peak in the excess coefficient - 1.18. This means that, on the whole, the women follow the same model of behaviour - giving birth at a relatively younger age as a result of the stronger impact of one or several different factors. With positive excess there should be greater concentration of women around the centre of distribution, which, in this case, is the particular average age. A relatively smaller part of the women gives birth younger or older. 1980 marks a turning point. On the one hand the distributions come close to the symmetrical; on the other - the excess goes through a zero value and becomes negative, showing a tendency toward greater "over-spreading. What does this mean? The symmetry, combined with a greater degree of spreading and a negative excess, is an indication for greater disparity in the behaviour of women, the influence of more and diverse factors, different models of reproduction in the set which is being studied. As can be seen in Fig.1, these changes are due to the decrease of the fertility for women in the younger age groups -15-19 and 20-24 and the increase in fertility for women in the older age groups of 25-29 and 30-34. When speaking of increase in the level of fertility, the following should be taken into consideration: for both groups the increase is against the very low level reached in 1997. For the first group, i.e. for ages 25-29 the level in 2008 is higher than that over the years after 1990 and is lower than the corresponding levels during all other years of the period under research. The fertility level for the second group, the one for ages 30-34, is the highest level reached during the whole period. The value of the fertility rate is 60.8‰, which is one of the reasons for the decrease of the asymmetry and the negative excess. The closest value for this age-range - 56.1‰,- reached in 2007 is followed by 52.2‰ for 2006 , and 52.1‰ reached in 1961.

This fact deserves more attention because the real question is: What is the meaning of this proximity of the values of the fertility rate? In this case the question cannot be answered accurately, because the analysis is done by distributions for all live-born children, not by orders. Nevertheless, it can be assumed from this fact that in 1961 the value achieved is most likely related to the birth of a second or third-order child, whereas in 2006, 2007 and 2008 with the birth of a first or second child. Or perhaps we have considerable differences, modifications, which have affected the behaviour of women from different generations over this 50-year period. While the changes in the average age imply changes in the attitudes of the studied group as a whole, the standard deviation and the asymmetry and the excess coefficients reveal the complexity and diversity of the modifications which take place in the behaviour of women within the childbearing group.
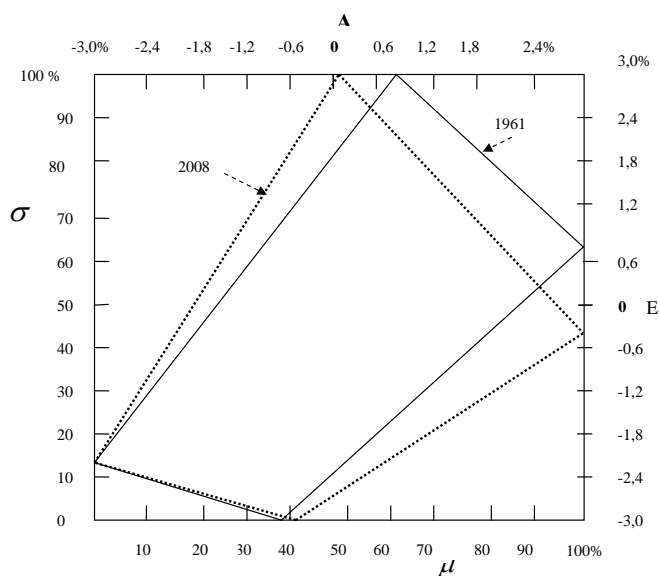
Parameters of the distribution of the age-specific fertility rates for the women in Bulgaria - total, for all live-born children between 1961 and 2008

Table 1

Year	Parameters			
	Average age in years	Stand. Deviation In years	Asymmetry coefficient	Excess coefficient
1961	24,62	5,61	0,82	0,69
1965	24,38	5,51	0,86	0,83
1970	24,16	5,24	0,79	0,72
1975	23,96	5,09	0,80	0,85
1980	23,39	4,95	0,90	1,18
1985	23,48	4,99	0,78	0,76
1990	23,44	5,05	0,82	0,84
1995	23,62	5,30	0,70	0,51
1997	23,91	5,43	0,65	0,38
2000	24,47	5,53	0,50	0,07
2005	25,51	5,78	0,26	-0,32
2006	25,65	5,84	0,23	-0,38
2007	25,84	5,97	0,20	-0,41
2008	25,94	6,06	0,18	-0,45

Parameters of the distributions of the age-specific fertility rates for women in Bulgaria - overall for all live-births in 1961 and 2008

Fig. 2

A general idea about the changes of the parameters of the distributions can be obtained from the diagram in Figure 2. It is drawn on the basis of the values of all four parameters, where these values are converted into percentages so that comparative analyses can be carried out. The diagram shows the rectangles of the first and the last years of the study period. The lengths of two of the sides are growing, and these of the other two are diminishing. The first side, whose value is increasing, is the one connecting the average age and the standard deviation. This is the result of the increasing values of the two parameters. In each particular case this increase can have positive or negative consequences for the birthrate. They will be positive if the average age goes up as a result of more births of children in a higher order - second, third, fourth. On the contrary, they will be negative if the reason for the higher average age is a tendency of giving birth to a first and second child respectively at an older age. As a rule, this leads to a decrease in the family size, which is the case in our country. A more precise answer could be given if the analysis is performed by orders. The same should be said about the standard deviation. If the increase in its value is due to an increase in births of a higher order and at a later age, this will have a positive effect on the level of fertility as a whole. However, in reality this is not so. The higher level of dispersion combined with almost asymmetrical distributions and a negative excess is due to decreasing levels of fertility within the lower age ranges: increasing levels of fertility within the higher age ranges - 25 -29 and 30-34 over the last several years, i.e., 2006, 2007 and 2008. As shall be seen in the analysis later on, this increase is due to first- and second-order births which, prior to 2000, occurred at a younger age.

The length of the side connecting the standard deviation and the coefficient of asymmetry in 2008 is smaller than the respective one for 1961. This is a result of a growing variance and its getting close to the normal distribution. As explained above, within the context of the phenomenon under study, i.e. fertility, this cannot be evaluated as positive because of the manner in which these changes happen - through reduction of the level of fertility as a whole, not through an increase of fertility in all age groups at once.

The length of the side connecting the asymmetry coefficient with the coefficient of excess has grown. The distribution in 2008 is almost symmetrical to the negative excess; this is a combination which may mean that considerable changes in the behaviour of women have started under the influence of the respective factors. **There is an on-going process of dislocating the centre of the distribution along with a bigger "stratifying" of the set. New and more diverse groups of women with varied reproductive behaviour are being formed. Every group reacts in a different way to the economic, social, political and cultural situation in the country. Every**

group needs a specific approach and policy of influence. Individual groups react differently to the same influences. All this requires taking into consideration the circumstances, personalities, value systems and attitudes of each respective group of women.

The length of the side connecting the coefficient of excess and the average age is getting smaller. This can be interpreted as a sign of worsening of the situation as far as fertility is concerned. The older age for giving birth to a child, especially a child of a lower order, combined with "over-spreading" for women with lower level of fertility can be taken as a sign of the formation of a new, un-homogenous society with new attitudes towards the family unit and the model of reproduction.

A broad picture of the aggregate changes in the values of the four parameters of the statistical distribution can be obtained from the areas of the rectangles. In 1961 they are 44.10% of the total area of the square (which is 100%), and in 2008 the respective area is 47.23%, i.e. there is an increase of 3.13%. As pointed above, each of the parameters participates differently in the modification of the area of the rectangle. The contribution of each order for the shaping of the respective modification will be argued further in the paper

DYNAMICS OF THE DISTRIBUTIONS FOR A FIRST LIVE-BORN CHILD

The diagramme shown in Fig. 3. reveals some peculiarities in the distributions of the age-specific fertility rates for women having a first child.

The first peculiarity is related to the maximum value of the rate**.** It is recorded in 1970 for women in the 20-24 years age range. The year of the peak is not accidental. Only two years have elapsed since the introduction of the measures aimed to encourage birthrate and they are bearing fruit. The age range for which the peak is registered is most naturally 20-24. It turns out that prior to 1990 (including 1990) the fertility level within this age range is relatively high - around 90‰. The sharp fall is registered during the following years of transition to market economy.

The second peculiarity is related to the rather low values of the fertility rate for the age range 25-29, the values that refer to the distributions prior to and in 1990. This fact can be explained with the traditional reproduction model in our country - getting married at the age of 20-24 and then giving birth to a first child. As a rule, the birth of a first child is not delayed and the effect of the factors that can defer the birth of a first child is very weak. The modal value is distinctly revealed, and the shoulders of the distributions are acute, especially the left one.

The next peculiarity is related to the distributions in the years 1995 and 2000. These are transitional distributions within which two segments can be established. In the first segment they are near each other for the younger age groups of 10-14, 15-19 and 20-24, and come close to the distributions than they do in the following years - from 1997 to 2000. For the older age groups the two distributions diverge: the one for 1995 follows the model of the distribution prior to 1990 and the fertility levels almost overlap. At the same time what can be said about the distribution of 2000 is that it prepares the transition towards a new behaviour model. The values of the age-specific rates are located between 'the old" and "the new" reproduction model - in Fig. 3. The old model's distinctive feature is lower fertility in the older age range, while exactly the opposite is true for the new model - higher birthrate at an older age.

The fourth peculiarity refers to the distributions in the period after 2000. For these what is characteristic is almost half the modal value and lower fertility at a younger age and higher fertility in the over 24 age groups.

Age-specific fertility rates for the women in Bulgaria for a first live-birth in the period 1961-2008

Fig. 3
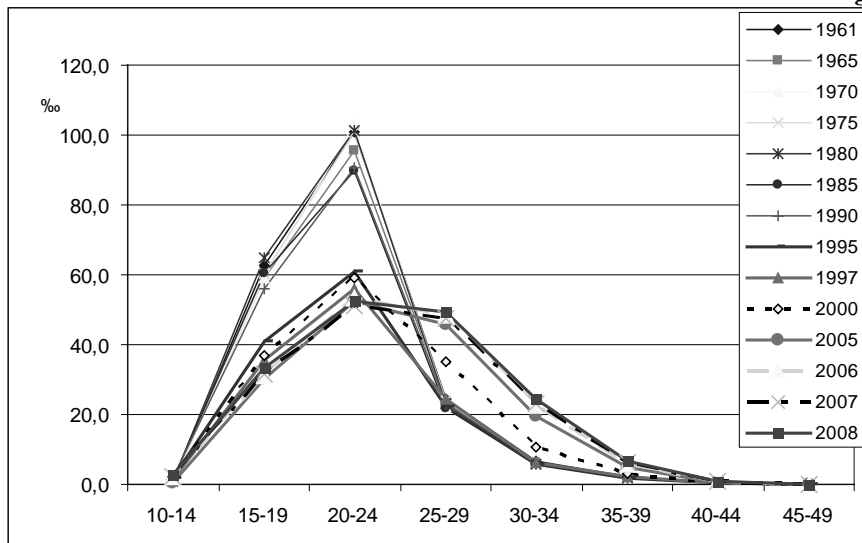
The distributions under research are changing, which is a sign of a change in the intensity of the factors at work till then and of the appearance of new factors of influence. The first change in the distributions of the age-specific fertility rate for women for first-born children is connected to the

increase of the average age. The absolute growth of its value over the whole period under study from 1961 to 2008 is 2.8 years. As can be seen in table 2, the changes in the values of this parameter vary - there are both periods of rising and periods of falling. The lowest level is registered in 1985 - it is 21.35. This fact can hardly be explained by the influence of the Decree from 1968. It is more likely that the birth of a first child at a relatively early age is determined by the existing conditions in the country. For instance, to be able to buy a home the family had to have a child; the size/area of the home also depended on the size of the family. At that time there were other material and non-material conditions which, to a different extent, stimulated the birth of a child. The "contribution" of the transition period after 1990 to the average age of having a first child should, on the whole, be considered generally negative. Data shows that for merely 18 years the average age has increased from 21.55 in 1990 to 24.46 in 2008, which is a 2.91 growth. The scale of this growth is bigger than that commented above concerning the whole period (1961-2008) under study. Clearly, the trend has changed its direction as a result of the change in the model of reproduction as regards the size of the family and the age for giving birth to a first child. The increase in the average age is the result of a doulble-sided process. On the one hand, there is a fall in the level of fertility for the younger age ranges, especially that from 20-24; on the other, there is a rise for the older age-ranges. The increase of the age at which women have a first child leads to giving birth to a second child later in life at an older age and often to not having a second child at all. While the increase of the age for a first birth prior to 2002-2003 can be explained by births delayed and deferred from the end of the twentieth century. The persistence of this tendency over the last years of the research period supports the hypothesis that serious changes in the reproductive behaviour of women in our country are under way. Naturally, these tendencies are defined by the impact of a number of factors on the value system of the contemporary family.

The presence of a powerful, dominant factor (factors) prior to 1980 is also evident in the values of the other three parameters of statistical distribution. Prior to 1980 the variance of the age-specific fertility rates, which are a reflection of the reproductive behaviour of women, marks a tendency towards a slight decline or rather a fluctuation within tight margins. After 1985 the variance starts to increase, and the process shows no signs of termination. Rather, over the following years it can be expected to slow down and then to stabilize at a certain level. What it will be is hard to predict because of the numerous factors determining the level of fertility and the complexity of their correlation. What the dynamics of the values of the standard deviation imply is that the process of differentiation among Bulgarian women within child-

bearing age according to how they build their families is still ongoing, i.e. it has not ended yet.

What does the dynamics of the values and of the coefficients of excess and of asymmetry in Table 2. reveal? The distributions prior to 1990 have a characteristic moderate right-slanted positive asymmetry. This results from a clustering of the births around the centre of the distribution, a very acute left shoulder and a relatively little number of first-child births at an older age. There is an over-concentration of births within one age interval, evidence for which are the rather high values of the coefficients of excess - 3.01 in 1970 and the maximum of 3.33 in 1980. In the years after that the trend is reversed, very pronounced after 1990. The distributions become almost symmetrical due to the change in both shoulders - the left already shows a less significant tilt, and the right shoulder is more heavy and shows a more gradual decrease of the fertility in the age-ranges 25-29 and 30-34.

As a result of the changes at the apex - a substantial fall, becoming more gradual, and the changes at the tails of the distributions- we observe a change in the value of the coefficient of excess. During the last four years of the research - 2005, 2006, 2007, and 2008 - this coefficient is already negative; this fact means "over-spreading' of women in relation to the respective normal distribution. When analyzing the standard deviation we have expressed the opinion that the differentiation in the set is still continuing and there are no signs for its completion.

The values of the last two measures - the coefficients of asymmetry and of excess for 2006, 2007 and 2008 are beginning to fluctuate around one value - 0.34 for the former and around 0.19 for the latter. There are good reasons to believe that because of their construction these measures are more sensitive, so they detect the advancing changes. **In this case their stability can be seen as a signal that the process of differentiation of the set under research has almost concluded. Most probably the various groups of women have already been established, each with its own model of reproduction. What can be expected is to have various corrections to the direction, which will result in some fluctuation. It seems that, in general, the distribution of the age-specific fertility rates for a first birth has most probably come to its final stage.** If it stays like this for a longer term, the prospects for the reproduction of our population will not be optimistic. The reasons for this conclusion are the following:

-the value of the fertility rate in the modal group is rather low;

-the level of fertility registers a considerable fall in the age-range 15-19;

-the increased fertility in the age-ranges between 25-29 and 30-34 cannot make up for the decrease in the other age-ranges;

-the birth of a first child at an older age restricts the likelihood of giving birth to a second child;

-the presence of considerable differentiation in the set of women means it will be more difficult to return to a higher level of fertility and more difficult for the government to carry out its pro-natal policy.

Parameters of the distribution of the age-specific fertility rates for women in the Republic of Bulgaria for a first live-birth between 1961 and 2008

Table 2

Year	Parameters			
	Average age In years	Stand. deviation In years	Coefficient of asymmetry	Coefficient of excess
1961	21,58	4,24	1,17	2,41
1965	21,61	4,29	1,20	2,59
1970	21,51	4,11	1,20	3,01
1975	21,53	4,17	1,17	2,84
1980	21,37	4,14	1,23	3,33
1985	21,35	4,19	1,08	2,27
1990	21,55	4,30	1,04	2,15
1995	21,89	4,66	0,92	1,45
1997	22,27	4,82	0,86	1,25
2000	22,99	5,14	0,70	0,64
2005	24,30	5,38	0,43	-0,18
2006	24,43	5,61	0,34	-0,20
2007	24,48	5,74	0,34	-0,19
2008	24,46	5,79	0,32	-0,23

The diagram in Fig. 4 clearly illustrates the negative changes of the age-specific fertility rates for a firstborn child. The rectangle for 1961 is almost a parallelogram while that for 2008 is very different from its original form. The reason for this difference is due to the changes that occurred in the lengths of all sides. The increase of the average age combined with the increase of variance is the first negative change in the reproductive behaviour of women in our country. The graphic expression of this change is the increase in the length of the side which connects the values of these two parameters. The length of the second side connecting the standard deviation with the asymmetry coefficient decreases. This change is the result of the increase of dispersion in decreasing asymmetry. The resulting combination is interesting and for a different phenomenon it would be good but the approximation to symmetrical distributions at lower levels of fertility and increasing average age of a first

born child should be viewed as rather unfavourable for the reproduction of the population. The excess coefficient proves to be the most sensitive measure of the undergoing changes. The reason for this high sensitivity is its construction which hugely intensifies the changes in the differences and in the behaviour of women respectively. The absolute magnitude of the difference between its maximum and minimal value is 3.15 and is close to the one for the average age – 3.13 years. In this case it should be noted that the excess coefficient is expressed in units of standard deviation while the average age is expressed in years and they cannot be compared directly.

Parameters of the distributions of the age-specific fertility rates for women in the Republic of Bulgaria for a first live-birth in 1961 and 2008
Fig.4
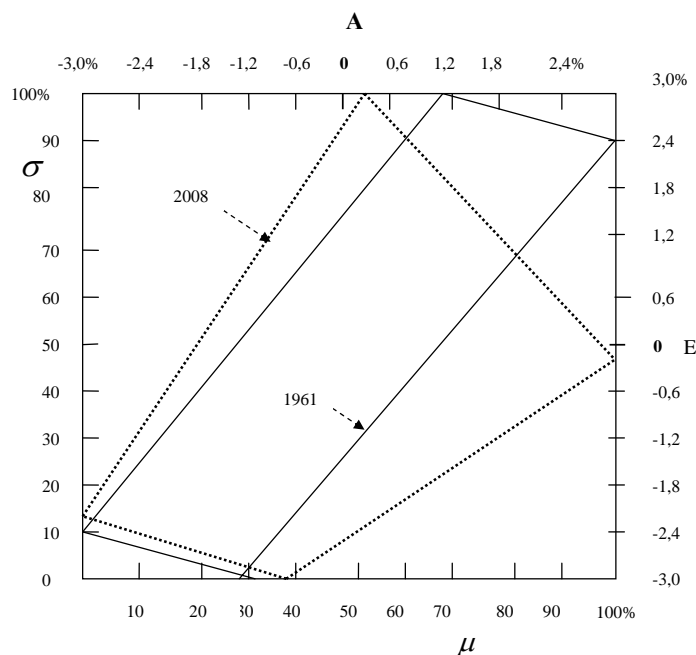
The asymmetry and excess coefficients characterise quite well the changes in the reproductive behaviour of women as regards the birth of their first child. The two coefficients not only reflect the growing differences resulting from the changed conditions, but also show the change of direction and the scope of these changes. The decrease in asymmetry means relatively more uniform distributions of the units which, in another case, would be a positive phenomenon. But the combination with negative excess means not only a rejection of the benefits of giving birth and raising a child at a younger

age but also a decrease in the general level of fertility. This is reflected in the diagram by a significant elongation of the side connecting the values of the two coefficients.

The shortening of the side connecting the excess coefficient and the average age is the result of two negative changes – a decline in fertility level and an increase in the age of giving birth to a first child. The increase in the areas at the shoulders fits perfectly in the definition of excess given by Balanda and MacGillivray (1988; 111) as "free from its place and scale movement of the probability mass from the shoulders of the distributions". But the levelling of the peak in this particular case results in a sharp decline in the general level of fertility and shows the existence of a process of differentiations of the units of the total set **under** research.

The area of the first rectangle is 33.92%, of the second 47.70%, which is an increase of 13.82%. The difference established in the previous analysis about all live births amounts to 3.13%. The comparative analysis also shows that while the area of the rectangles in 1961 differs significantly – for all live births it is 44.1%, and for the first child – 33.92%, in 2008 the areas are very close in size. For all these children the area is 47.23%, and for the first child – 47.70%. The conclusion that can be drawn is that the model of giving birth to a first child determines to a significant extent the general model of fertility in the country. This fact can be explained with the tendency of establishing an only child family model in our country in recent years which is confirmed by the changes in the relative share of life births in a sequence of births. During the last year of the period studied, 2008, the relative share of live births of the first order among all live births is 56.38%, and those of the second order 31.40%, and of the third only 6.03%. In comparison, in 1961 these shares are as follows: for a first child 42.50%, for a second child 36.56% and for a third child – 10.11%. As can be seen the proportion of first children significantly increases while the proportions of the other two decrease, for a second child by 5.16 points, and for a third chid by 4,08 points.

DYNAMICS OF THE DISTRIBUTIONS OF SECOND LIVE-BIRTHS

If we have to describe briefly the dynamics of distributions of the age-specific fertility rates for the second order it would be instability. This characteristic applies predominantly for the values of the measure for the age groups of 20-24 years and 25-29 years. This instability could be explained with the high sensitivity of women to the living conditions when deciding to give birth to a second child. In relation to this it should also be noted that while the maximum for the first order was reached in 1970 the maximum for the second

order was reached in 1975 which is perfectly reasonable. The measures for encouraging birth rate, adopted in 1968, had their initial effect on the birth of a first child. With a certain lag women who have a first child also give birth to a second child and a period of 3 to 5 years is necessary for this.

Very interesting is the behaviour of women at the age of 25-29. As can be seen in Fig.5 the interval within which the values of the fertility rate for the period 1961-1990 are very broad – from 42.6 to 66.8‰. This once again confirms the hypothesis of the greater sensitivity of women when deciding to have their second child.

In the analysis of Diagrams 2, 3 and 4, which can be seen in Fig. 6 as well, a very important characteristic is established. As was mentioned previously, the lowest level of fertility in our country was reached in 1997. The biggest decrease in size and significance regarding the reproduction of the population was registered in the period 1990-1997. Its significance is determined by the fact that this decrease concerns predominantly the age groups 20-24 and 25-29. In fact, this period sets the stage for the transition to another model of reproductive behaviour whose formation starts in the following 2-3 years. There comes the question „Will at least a small portion of the gap between the values for 1990 and 1997 be filled?" The answer is "probably yes", but expectations should not be too high. It can be said that if the conditions in the country had not deteriorated so rapidly in 1996 and 1997 fertility would have settled at the level reached during the period 1990-1995. This is confirmed by the fact that for the age group 20-24 years the decrease continues until 2006 when it bounces back to the level reached in 2005 and in the following years it fluctuates within very narrow margins. Similar is the situation with the age group of 25-29 year-olds where the decrease continues until 2005. In the following three years the value of the coefficient increases.

Somewhat different are the changes for women in the age group 30-34 years. After reaching the minimum in 1995 and maintaining this level in 1997, the value of the fertility rate begins to grow – Fig.5. Why do these women have a different behaviour? Are they not affected by the changes in the conditions in the country? Obviously, they are also affected by the changes and this is reflected in the measure applied, but these women have no time to postpone the birth of a second child. The part of these women who seriously want to have two children ignore the living conditions, because in a few years' time they would not be able to give birth to a second child. Or at least they are fully aware of the greater the risks that such late pregnancy and birth entail.

What should also be noted, along with the above characteristics of the distributions of the age-specific fertility rate for a second child is the change in the modal value in the past four years – 2005-2008 . For all preceding years the modal

interval is 20-24 years. For the past years it is in the age range of 25-29, followed by the age range of 30-34 years, which is extremely important. This importance comes from the fact that the likelihood of deciding not to have a second child after reaching a relatively advanced age such as 34-35 years is growing.

Age-specific fertility rates for women in the Republic of Bulgaria for a second live birth in the period 1961-2008

Fig. 5
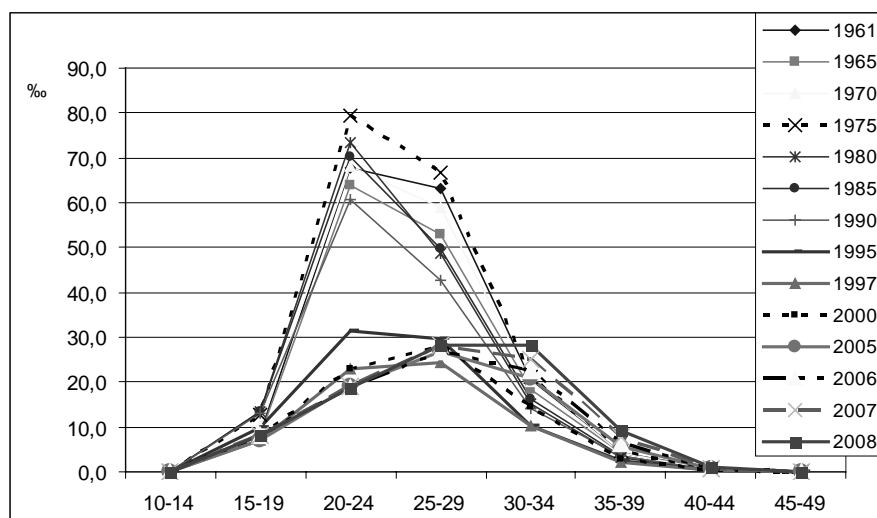
The multiple decrease in birth-rate in the age ranges 20-24 and 25-29, together with the shift of the modal interval, significantly affects the parameters of age-related coefficients. The values of parameters and their dynamics confirm and support this conclusion. They make it possible to reveal the mechanism of the ongoing changes. The modification in the modal interval is carried out in the period from 1997 to 2000. The average age of giving birth shows a twenty-five-year-long tendency of decrease - from 1961 to 1985 - and becomes stable in 1990. During the first ten years of the transition period (1990-2000) the value of this parameter grows by 1.28 and for the following eight years it adds 1.89. In other words, the overall increase from 1990 to 2008 is 3.17 years. In comparison, the increase in the first order is 2.88 years, i.e. the changes are of almost the same size. Two more age groups contribute to the increase of the average age. The first one is the age range from 20- 24 years, in which women's fertility rate decrease significantly. The second is the interval from 30-34 years, when women increase their fertility rate. Will this tendency be sustained or will it come to an end shortly? In order to find an answer to this

question the following two circumstances should be taken into account:

- the increased average age is partly due to the fact that delayed births of a second child are taking place , and should come to an end soon. It can be expected that this factor will soon stop to contribute to the increase of the average age;

- the increase of the average age of giving birth to a second child should have its biological limit, which, when reached, will stop the increase.

It is logical to expect the increase of the average age for the birth of a second child to come to an end, but mentioning any value is too risky.

Unlike the values of the mean, those of the standard deviation increase almost constantly. Everything else being equal, this can be viewed as positive if it wasn't for the fact that the growing disparities between women as regards their reproductive behaviour is registered in a highly decreasing fertility, which is a negative phenomenon. While in terms of the average age the measures adopted for encouraging the birth-rate have led to a fall in the mean, such a change is not observed in the standard deviation. The most probable reason is the slight increase of fertility in 1970 and 1975 among women at the age groups 25-29 and 30-34. The subsequent growth in the differences reflects the reaction of women to the changing living conditions in our country.

The asymmetry and excess coefficients give more information about the specific changes in women's behaviour in relation to the birth of a second child. Prior to 1990 distributions are characterised by a slight positive asymmetry. It reflects the prevailing model of giving birth to a second child at a relatively young age and a relatively smaller number of births at a later age. Evidently before 1990 the combination of factors did not change its intensity and direction of influence. If there is any deviation, it refers to 1980 when the maximum value of the asymmetry coefficient is registered. But the truth is that it does not exceed significantly the others and is not the result of significant changes in women's behaviour. After 1990 the asymmetry decreases, the distributions rapidly come closer to symmetry and even a minor negative asymmetry is reached. The reasons for this change are the decline in births for women aged 20-24years and 25-29years, and a slight increase in those for the age groups 30-34 years and 35-39 years. The analysis of the asymmetry requires the coefficient of excess to be analysed. Why? If we draw a parallel with the distributions for the first child we can see that in the distributions for two children both coefficients – of asymmetry and of excess - have lower values. This is applicable to a lesser extent to the standard deviation. The reason is the degree of concentration of the units. During the period of transition there is "over- concentration" in the distributions for a first child in the age range 20-24, while the births of a second child are distributed relatively more evenly in the age range 20-24 and 25-29, which is perfectly normal. But similarly to the way women

react to giving birth to a first child they react to the changing conditions and to giving birth to a second child. Distributions become not only symmetrical, but their peak becomes lower, there are re-distributions along the shoulders and the result is a negative excess. The left shoulder is a little more acute and the right one more oblique. This process of re-distributions develops in a more varied manner than the one for the first child. In fact the process of re-distribution is an expression of the ongoing differentiation of women, the formation of various groups with their own behaviour and attitude to having a second child. The negative excess is a sign that the role of the dominating factor(s), which presumes a well defined modal interval, has already been lost, thus manifesting the unified behaviour of women. At the same time it shows that there are reserves for increasing the level of fertility up to the present „leader" – the age range 20-24 years. The reasons for such assumptions are the extremely low values of the age-specific fertility rate during the last years – around 19‰. This reserve might be utilized only if these women have their first child at a younger age – around their 20s. The distributions for 2008 give reasons for some optimism, albeit slight. These reasons can be found in the slight rise in the left shoulder for the age group 34-39, which shows the existence of a tendency in Bulgarian for women to give birth to their second child later in life after certain conditions are met.

Parameters of distributions of the age-specific fertility rates of women in the Republic of Bulgaria for a second live birth in the period 1961-2008

Table 3

Years	Parameters			
	Average age In years	Standard deviation In years	Asymmetry coefficient	Excess coefficient
1961	25,37	4,39	0,61	0,61
1965	25,26	4,48	0,68	0,65
1970	25,20	4,48	0,57	0,42
1975	25,05	4,47	0,61	0,59
1980	24,52	4,44	0,72	0,84
1985	24,62	4,49	0,63	0,56
1990	24,62	4,64	0,65	0,57
1995	24,95	4,90	0,46	0,25
1997	25,40	5,00	0,34	0,01
2000	25,90	5,13	0,23	-0,16
2005	27,05	5,49	0,04	-0,42
2006	27,16	5,62	-0,02	-0,53
2007	27,43	5,66	-0,05	-0,53
2008	27,79	5,77	-0,09	-0,51

The diagram in Fig. 6 clearly shows the changes which took place in the distributions of the age-specific fertility rates of women giving birth to a second child in the period from 1961 to 2008. Compared with the diagram for a first child, the scope of the changes here is smaller. The difference in the area of the two rectangles is 4.52%, whereas for the first child it is 13.82%, i.e. it is three times as big. The explanation for the greater difference is probably in the women's reaction to the changing conditions, especially of the younger women – to postpone, wait for improvement of the conditions to give birth. One more factor should be taken into consideration. At the time of crisis and serious transformations which are taking place in our society, stating a family is also delayed, which leads to the delay of the birth of the first child. The family already exists when the second child comes, the first child is already born, and the choice is whether to have another child or not.

Parameters of distributions of the age-specific fertility rates for women in the Republic of Bulgaria for a second live birth in 1961 and 2008.

Fig.6
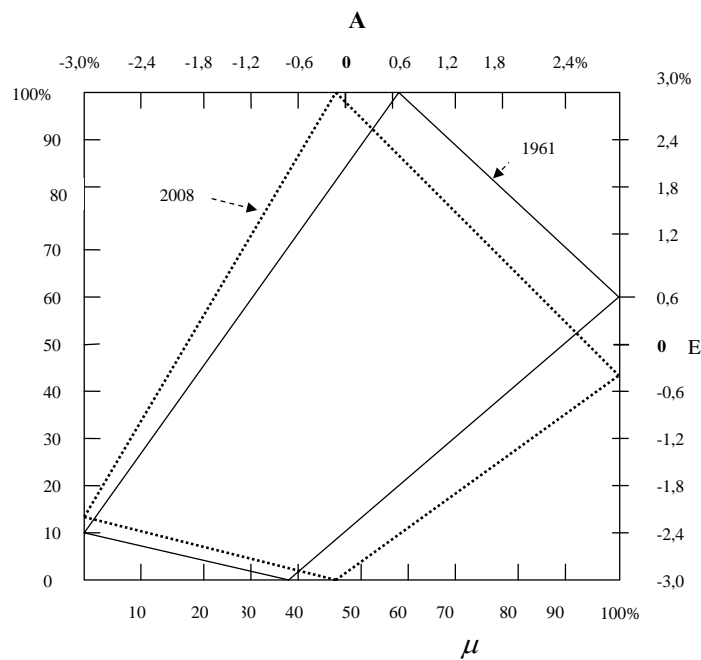
The change in the form of the rectangle is determined by the changes in the values of the four parameters. The increase of the average age and the standard deviation result in the elongation of the side which connects them.

The combination of increasing dispersion with the decreasing asymmetry leads to the contrary, shortening of the side connecting them. Especially interesting is the decreasing asymmetry and the transition from an acute to obtuse excess. This is so due to the fact that , everything else being equal, a symmetrical distribution shall mean more comprehensive use of the existing resource. But the negative excess means that this resource is used at a much lower level and a great part of its potential remains unutilised. Having in mind the nature of the phenomenon under research, the question of its comprehensive use becomes especially „painful" in all its aspects – economic, social, cultural, etc. The negative excess is the sign which clearly shows the change in the model of child birth. This has been established for the first and the second child.

## DYNAMICS OF THE DISTRIBUTIONS OF A THIRTH LIVE BIRTH

Low and extremely low fertility as regards a third child - thus can be described the situation at the beginning and the end of the period studied – 1961 and 2008. The fertility rate in the modal interval 25-29 is 18.2‰ and 4.7‰. This level has been reached after the "correction" resulting from the Decree of 1968 was accomplished, which interrupted the tendency for decline in the level of fertility – Fig.7. Analogous are the changes in all other age ranges, but the possible variations are smaller because of the very low values of the fertility rates.

One of the most important changes is related to the change of the modal interval. Prior to 1975 this is the group of women at the age of 25 - 29, but after this year the modal interval becomes 20-24 years and this is preserved until 2008. The most probable reason for this shift is that primarily women from some minority groups are inclined to have a third child, especially in recent years. As a rule, they start to have children at an early age – around 16-17 and have the possibility to give birth to a third child before they reach the age of 20-24 years. Supporting this assumption is the fact that in the period from 2005 to 2008 only a slight increase is registered compared to the level for 2000 for women aged 30-34 and 35-39. This can be due to the decision of a small proportion of Bulgarian women to have a third child. But it should also be noted that the observed changes are extremely small.

Another fact which stands out is that the distributions for the last three years almost completely coincide with one another. The stability is at an extremely low level which is very difficult to alter.

Age-specific fertility rates for women in the Republic of Bulgaria for a third live birth from 1961-2008

Fig.7
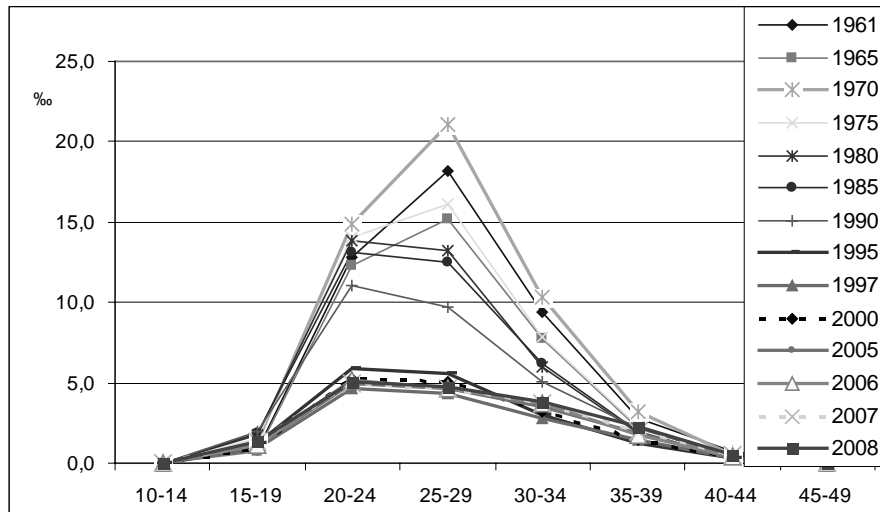
When comparing the first and the last value of the mean we can see that they are very close. The average age for giving birth to a third child in 1961 is 27.31 years and in 2008 – 27.62 years – see Table 4. The increase is 0.31 years. In fact, prior to 1980 with some fluctuations the average age decreases to 26.11 years. After this year the age begins to increase. The real increase is 1.51. Compared with the average age of giving birth to a first and second child (where the difference between the minimum and maximum values is 3.27 years for a second and 3.13 years for a first child respectively) the change is half as big. Obviously, there is a group among Bulgarian women who at a certain age gives birth to a third child, irrespective of the circumstances. As far as there is a definite change, it is due to a change in the behaviour of a very small proportion of women who are influenced by the changes in the socio-economic environment. A sign of such influence are the changes of the values of standard deviation – Table 4. After a slight decrease in the period 1961- 1965 the dispersion of the values of the age-specific fertility rates according to the behaviour of women from different age groups and the fertility level is growing. The basic reason for this increase is the decline in the birth rate for women at the age of 25 to 29. Although the level of fertility at this age range is not high at the beginning of the period, there is still certain concentration of births, unlike the situation at the end of this period. The values of the other two parameters support this. According to the asymmetry coefficient the distribution from

slightly positively asymmetrical becomes almost symmetrical. This change is due to the changes of the slant of both shoulders. They are already very acute with a slight dip defined by the extremely low values of the age-related fertility rate in all age ranges. Women in the age ranges 20-24, 25-29 and 30-34 years contribute primarily to this asymmetry. These are the intervals whose changes define the transition from acute to negative excess. The negative excess means that while at the beginning of the period under research there is one factor or more factors which influence a certain concentration and relatively unified behaviour of women regarding the birth of a third child, over time the impact of these factors rapidly decreases. As can be seen in Fig. 7 the differences in the values of the age-related fertility rates in 2008 for the age ranges from 20 to 34 years fluctuate from 3.9 to 5.0‰. This means that in this case the "age" factor does not play any role.

Parameters of distributions of the age-specific fertility rates for women in the Republic of Bulgaria for a third live birth in the period 1961-2008

Table 4

Years	Parameters			
	Average age In years	Standard deviation In years	Asymmetry coefficient.	Excess coefficient
1961	27,31	4,92	0,60	0,30
1965	26,98	4,82	0,63	0,35
1970	27,07	4,86	0,52	0,25
1975	26,61	4,93	0,57	0,27
1980	26,11	4,97	0,63	0,34
1985	26,22	5,09	0,58	0,20
1990	26,25	5,42	0,58	-0,02
1995	26,46	5,64	0,57	0,03
1997	27,05	5,86	0,46	-0,32
2000	26,96	5,69	0,49	-0,20
2005	27,34	5,96	0,32	-0,56
2006	27,31	5,98	0,36	-0,50
2007	27,44	6,20	0,33	-0,55
2008	27,62	6,23	0,29	-0,63

Parameters of distributions of the age-specific fertility rates for women in the Republic of Bulgaria for a third live birth in 1961 and 2008

Fig.8
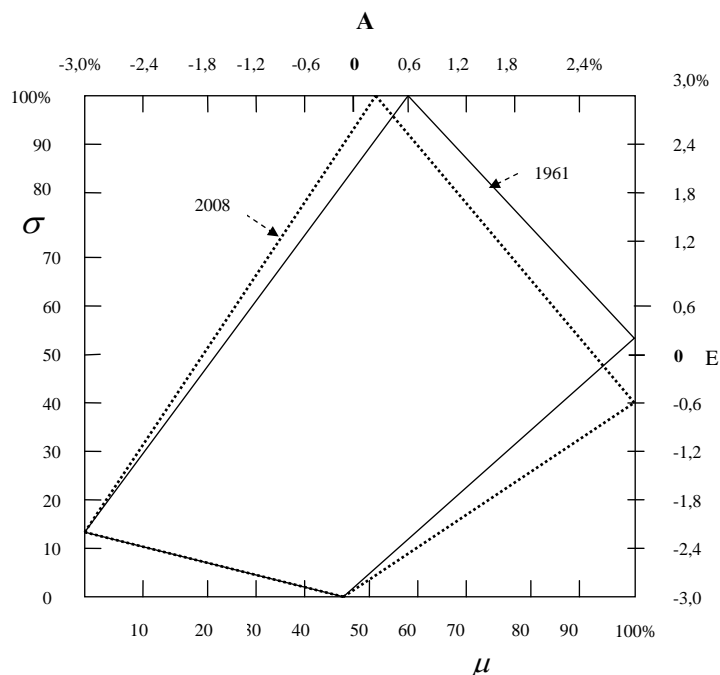
The significance of the three-children family model is minimal in our society. This conclusion can be drawn on the basis of the area and the form of the rectangle presented in Fig.8. The change in the area is 2.11% and it is due to the growing difference combined with the "obtuseness" of the distributions. In fact, it is exactly this „flatness" of the distributions coupled with the approximation to symmetry which are the main characteristics of the distributions of the age-specific fertility rates. The lack of motivation for giving birth to a third child by women at the age of 25-29 has determined the changes in the distributions as a whole. Actually, changes in the motivation of women can be observed not only in this age group. There are changes in the motivation and the behaviour of almost all women. To have a third child the woman must have given birth to a first and a second child. If she gives birth to her first child at the age of 25-29, it is impossible to expect her to have her third child at the same age or at the age of 30-34. In fact, the conclusion drawn in the previous section that the delay of giving birth to a first child will affect the births in the higher orders – the second and third orders - has been

confirmed. In practice, there is not only a delay in giving birth to a second and a third child, but they are, in effect, never born. This applies to a much greater extent to the third child.

The changes in distributions and the values of their parameters respectively show that having a third child is not very popular with the Bulgarian family. There are almost no factors which can motivate women to give birth to a third chid. This can be the objective of Bulgarian society for the distant future. Now efforts should be made to encourage the birth of a first and second child where there have been significant "foregone benefits". These have already had their impact and it will be felt even more significantly in the coming decades in all possible aspects of our social and economic life.

REFERENCES
- CAMBELL R. HARVEY, JOHN C. LIECHTY, MERRILL W. LIECHTY and PETER MULLER. (2004): "Portfolio Selection With Higher Moments", SSRN, Electronic Paper Collection, December 13, p.5.

- FREJKA, T. and JEAN-PAUL SARDON. (2004): Childbearing Trends and Prospects in Low-Fertility countries: A cohort analysis, Dorbrecht: Kluwer Academic Publishers, 2004.

- FREJKA, T. and JEAN-PAUL SARDON. (2005): "The direction of contemporary fertility trends in the developed countries: Further decline, plateau or upswing?" Proceedings of the XXV IUSSP International Conference, Tours, France.

- FREJKA, T. and JEAN-PAUL SARDON. (2006): "First birth trends in developed countries: A cohort analysis," Max Planck Institute for Demographic Research Working Paper, WP-2006-14.

- FREJKA, T. and JEAN-PAUL SARDON. (2007): Cohort birth order, parity ratio and parity distribution in developed countries. Demographic Research, Max Planck Institute for Demographic Research, Vol. 16, Article 11, Pages 315-374, 27 April 2007.

- WILLIAMS, J. and IOANIDIS, C. (2002):Higher Moments, Utility Functions and Asset Allocation, University of Bath.

- NI BHROLCHAIN, M. (1992): "Period paramount? A critique of the cohort approach to fertility", Population and Development Review 18: 599-629.

- KALOYANOV, T. (2008): A possibility for a graphic representation of the inter-relations among the parameters of statistical distributions. Economic Thought. Bulgarian Academy of Sciences, 99-118.

- MAC GILIVRAY, H.L., BALANDA, K.P. (1988): "The relationships between skewness and kurtosis", Austral. J. Statist. 30 (3), 319-337.