Reproductive Changes in the Population of the Republic of Croatia

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Knowledge of demographic trends is the basis for policy making, both economic, social, health, etc., as well as population policy. The Republic of Croatia has been facing demographic problems for many years, mainly an increase in the elderly population with a simultaneous decrease in the reproductive base and the number of young people. Croatia is one of the countries in the post-transition stage of population characteristics, characterized by the transition of the total fertility rate from a low positive rate to a level that no longer ensures the renewal of generations, and the mortality rate, which is determined by increasing life expectancy. In the Republic of Croatia, fertility is measured by the periodic total fertility rate, which indicates the average expected number of live births that a woman of fertile age (15 to 49 years) would give birth to. The total fertility rate of 2.1 children is often cited in the literature and among the public as the numerical level of generational change, while the Republic of Croatia has recorded a total fertility rate below this level for decades, i.e., 1.48 (2020). Another important characteristic of the post-transition period is late childbearing. The age limit for marriage and readiness to have a first child is increasing. The average age of a mother at the birth of her first child increased from 23.5 years (1960) to 29 years (2020), which significantly shortens a woman's reproductive time. Due to numerous factors, the number of live births has decreased from 95,560 children in 1960 to 35,845 children in 2020, a decrease of 59,715 live births. The subject of this work is a study of the reproductive determinants of population development in the Republic of Croatia, focusing on the determination of the factors influencing fertility and the quantitative presentation of demographic indicators. The aim of this work is to find the cause of declining fertility. Therefore, this work analyzes the factors that influence fertility. Due to the resulting birth deficit, it is necessary to take measures to promote births. Therefore, in the concluding remarks, recommendations are given for improving the demographic situation in the Republic of Croatia in the context of promoting births and increasing fertility.

Keywords: *reproductive changes, fertility, Republic of Croatia, total fertility rate*

Introductory Considerations

For a better understanding of the reproductive changes in the Republic of Croatia, the demographic changes in the phases of demographic transition are

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considered first. Research on the history of population development shows several stages of development characterized by certain relationships between the components of natural population movement (birth rate and mortality), specific trends in the movement of these components, as well as appropriate changes in various population structures (Wertheimer-Baletić 1999, p. 105). Before considering the stage of demographic transition in more detail, it is necessary to define basic demographic terms. The term natural population movement implies the presence of biological or natural factors and processes in the basic flows of this movement. The basic components of natural population movement are the birth rate and the death rate of the population, resulting in a natural increase (more births than deaths) or, conversely, a natural decrease in the population. The theory of demographic transition is a modern theory that presents the development of the population as a process of gradual development conditioned by the overall process of socio-economic and cultural development.

The first theorists who tried to generalize the resulting demographic changes in the first half of the 20th century were Thompson and Notestein (Wertheimer-Baletić 2016, p. 51). The changes they considered were related to the components of natural population movement (birth rate and mortality) in developed Western European countries. A significant contribution to demographic theory in the field of the historical process of demographic transition was made by the American demographer Ansley J. Coale with his empirical research on the example of Western European countries. The father of the theory of demographic revolution is the French demographer Adolf Landry, who considered the processes in France. Notestein and Thompson used the term "demographic transition" instead of the term "demographic revolution" for the process of changes in the numerical level of birth, mortality and natural growth occurring over time (Wertheimer-Baletić 2016, p. 54). The term "demographic transition" is considered to be more comprehensive in content and more scientifically appropriate for studying the process of applying the level of vitality rates. The American demographer F. W. Notestein presented a complete theory of demographic transition according to characteristic historical stages, which are recognized in the world demographic literature.
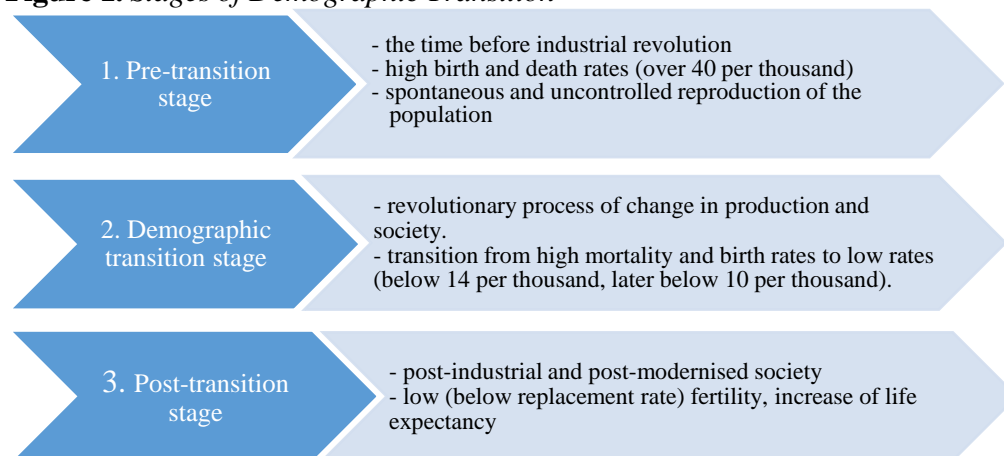
According to Wertheimer-Baletić (2016, p. 52), the theory of demographic transition considers population development as a process of staged development, i.e. a development process that takes place through characteristic stages of development and is conditioned by the overall process of socioeconomic development in the broadest sense of the term. The basic assumption of the theory of demographic transition is the interdependence of the process of modernization and economic development with the changes in the components of natural population movement. Wertheimer-Baletić (2016, p. 52) states that the demographic transition paradigm is based on empirical research that demonstrates a strong negative correlation between the numerical level of vital rates (births and mortality), on the one hand, and the level of socioeconomic development, as measured by the per capita income of these countries, on the other. Moreover, Notestein (1945, p. 36) notes that population growth is a dependent variable that is highly influenced by technological, social, economic, and political developments in the future. Numerous other authors also note that industrialization and

urbanization, as components of the modernization of society, are factors that lower the birth rate. Economic and social development, improvement of health care, expansion of education, increase in living standards, etc., have led not only to a decrease in mortality, but also to a decrease in birth rate and fertility as the main dynamic components of population development, changes in which clearly characterize the process of demographic transition.

Demographic transition is a process that began in Western European countries from the end of the 18th and 19th centuries and affected most other parts of the world in the second half of the 20th century. "The process of demographic transition in the narrow sense includes the consideration of changes in the direction and numerical level of the components of natural population movement, especially the birth rate and mortality, as well as their causes" (Wertheimer-Baletić 2016, p. 53). The process of demographic transition is usually considered using a three-stage model of population development through a significant reduction in the numerical level of birth and mortality rates (Wertheimer-Baletić 2016, pp. 53, 54). This process, as mentioned above, began in most Western European countries with a decline in the mortality rate at the end of the 18th century and in the first half of the 19th century, followed by a decline in the birth rate (end of the 19th and beginning of the 20th century).

Following Notestein (1945), Wertheimer-Baletić (2016, p. 55) lists the following characteristic stages of the demographic transition, shown in Figure 1.

Figure 1. *Stages of Demographic Transition*

1. Pre-transition stage
- the time before industrial revolution
- high birth and death rates (over 40 per thousand)
- spontaneous and uncontrolled reproduction of the population

2. Demographic transition stage
- revolutionary process of change in production and society.
- transition from high mortality and birth rates to low rates (below 14 per thousand, later below 10 per thousand).

3. Post-transition stage
- post-industrial and post-modernised society
- low (below replacement rate) fertility, increase of life expectancy

Source: Wertheimer-Baletić (2016, p. 55).

The pre-transition stage is characterized by high birth and mortality rates, leading to the dominance of the young population. Moreover, the broad child base of the age structure has the shape of a pyramid.

Since the demographic transition stage is the central stage in which the demographic transition process takes place, it is divided into three substages: a) the early transition stage, b) the middle (central) transition stage, and c) the late transition stage (after Bowen 1955, in Wertheimer-Baletić 2016, p. 56). The early transition stage is characterized by an increase in natural population growth, i.e. demographic expansion. It is caused by a sudden decrease in mortality rates with

unchanged high birth rates. The age structure has the shape of a pyramid with a numerically larger base of children. The central (middle) stage began in some Western European countries as early as the beginning of the 19th century, while in most countries it took place in the late 19th and early 20th centuries. It was characterized by a decline in the birth rate and a simultaneous decline in mortality. It should be noted that the decline in mortality was somewhat slower than the decline in the birth rate. The result is a decline in natural population growth. Then, the age structure undergoes radical demographic transitional changes; in it, the increase in the share of young people slows down, while the share of the working-age population grows and an increase in the share of the elderly population is observed (Wertheimer-Baletić 2009, p. 115). Notestein considered the process of declining birth rate as a direct consequence of the modernization process of society, which includes economic and social changes caused by numerous consequences of the industrial revolution and the social processes accompanying it (Notestein 1953, p. 54). The third stage within the demographic transition is the late transition sub-stage, in which the birth rate continues to decline, faster than the death rate. It is characterized by an aging population and an increase in the proportion of the elderly population in the total population, while the number of the working-age population continues to increase. "Natural growth began to decline, and the tendency to stabilize and balance the birth and mortality rates at a relatively equal numerical level, leading to the zero level of the natural growth rate, became increasingly evident" (Wertheimer-Baletić 2016, p. 57). During the process of demographic transition, there was also a change in the age structure of the population, i.e., a shift in the relative numerical majority from younger to older age groups. Empirical studies show that demographic transition in the area of change in age structure has a significant impact on the overall socio-economic development of the country. Wertheimr-Baletić (2009, p.116) states that in comparison to the overall development of the country, the age structure of the population is changing from a pyramid shape, which has a large and growing number of young people (0-14 years), to a hive shape, in which the number of young people is decreasing, and to the urn shape, which is characterized by a predominantly older population.

The basic characteristic of the post-transition stage in comparison with the demographic transition stage is the decrease in the birth rate due to the greater intensity of the effect of socio-psychological factors, while in the demographic transition stage the factors of economic development had the main influence. Already in the middle and late transition stages, socio-economic, socio-psychological, and socio-cultural factors begin to dominate the trend toward declining fertility and changes in family structure. In 1949, Blacker hypothesized that there are two substages of the post-transition stage. The first substage of the post-transition stage, or low stationary stage of the demographic cycle, is characterized by low birth and death rates. The second substage of the post-transition stage is characterized by an actual excess of deaths over births and, unless compensated by immigration, a decline in population numbers (Blacker 1949, pp. 95, 97).

In the context of the demographic transition, it is necessary to interpret the concept and characteristics of the second demographic transition. "The beginning of the second transition can be arbitrarily set to the year 1965. In between was World War II and the baby boom that followed. The key demographic feature of the second transition is a decline in fertility from just above the "replacement" level of 2.1 births per woman, which ensures that births and deaths balance and the population remains stationary in the long run, to a level well below replacement. Two key concepts characterize the norms and attitudes that underpinned the first and second demographic transitions and highlight the contrasts between them: altruistic and individualistic. The first transition to a low birth rate was dominated by concern for the family and offspring, while the second transition emphasized individual rights and self-realization" (Van de Kaa 1987, p. 5).

According to the formal demographic-statistical criteria adopted by the theory of demographic transition, the Republic of Croatia is in the post-transition stage of population development in terms of the numerical level of the components of population reproduction (birth rate and mortality).

After the introductory consideration of demographic changes through the stages of demographic transition, since the subject of this work is reproductive changes in the Republic of Croatia, it is necessary to define what population reproduction is. Population reproduction (according to Wertheimer-Baletić 1999) in a broader sense means the process of renewal of generations of the population, in which fertility and mortality are jointly involved. However, the narrower understanding of population reproduction refers only to the female population, i.e. the part of the population that is directly involved in the process of biological reproduction. For the purposes of this paper, reproductive changes are considered in the narrower sense.

Literature Review

Fertility Factors

This chapter presents an analysis of works dealing with fertility, i.e. factors that influence fertility. As part of the literature review, 30 relevant sources were evaluated. In identifying works dealing with the above topic, the Google Scholar database was used, and the works were collected through the portal of electronic resources for the Croatian academic and scientific community of the National and University Library in Zagreb. In identifying the papers for analysis, papers dealing with health/medical factors affecting fertility were excluded.

Table 1. *Literature Analysis - Chronological Presentation of the Published Works and Their Main Fertility Factors*

	Author (s)	Year of publication	Recognized fertility factors
1	Riemer, R.; Whelpton, P.K.	1955	Social and psychological factors
2	Schultz, P.	1973	Economic factors
3	Birdsall, N.; Jamison, D.T.	1983	Socioeconomic factors, cultural and institutional factors
4	Borg, O.M.	1989	Economic factors
5	Barro, R.J.	1991	Economic factors
6	Hakim, A.; Mahmood, N.	1994	Socio-demographic and cultural factors
7	Martine, G.	1996	Social and economic factors
8	Wertheimer-Baletić, A.	1999	Social and economic factors
9	Panopoulou, G.; Tsakloglou, P.	1999	Socioeconomic factors
10	Hoem, B.	2000	Economic factors
11	De Sandre, P.	2000	Socioeconomic factors
12	ESHRE Capri Workshop Group	2001	Social and economic factors
13	Wertheimer-Baletić, A.	2003	Socioeconomic factors
14	Pinnelli, A.; Di Cesare, M.	2005	Socioeconomic factors
15	Ghannam, A.R.	2005	Socioeconomic factors
16	Adhikari, R.	2010	Demographic, socioeconomic, and cultural factors
17	Sobotka, T.; Skirbekk, V.; Philipov, D.	2011	Economic factors
18	Čipin, I.; Međimurec, P.; Vlah Jerić, S.	2016	Socioeconomic factors
19	Nasrpour Parvin, R.	2016	Economic factors
20	Wang, Q.; Sun, X.	2016	Socio-political and economic Factors
21	Wertheimer-Baletić, A.	2016	Socioeconomic, socio-psychological, cultural, socioeconomic factors
22	Awad, A.; Yussof, I.	2017	Demographic and socioeconomic factors
23	Tropf, F.C.; Mandemakers, J.J.	2017	Social factors
24	Čipin, I.; Međimurec, P.	2017	Economic, cultural and social factors
25	Lutfiah, U., Besral, B.; Herdayati, M.	2017	Individual and regional factors
26	Anderson, B.A.	2017	Regional and cultural factors
27	Kurkin, R.; Sprocha, B.; Sidlo, L.; Kocourkova, J.	2018	Socioeconomic factors
28	Akrap, A.	2019	Economic factors
29	Lim, S.	2021	Socioeconomic factors
30	Aitken, R.J.	2022	Socioeconomic and educational factors

Based on the literature previously analyzed and presented in Table 1, the dominance of socioeconomic factors as influencing fertility is evident.

According to Wertheimer-Baletić (2003b, p. 404), it is necessary to analyze the demographic and social determinants of population reproduction in order to evaluate the potential of biological or sociobiological reproduction of the population, especially from the point of view of the need to ensure the renewal of generations. There are three important determinants that can be quantified:

1. trends in the total number of females of childbearing age (15-49), i.e., the childbearing contingent of the female population;

2. changes in the age structure of the childbearing contingent of the female population;
3. specific fertility rates by age.

The first two determinants are demographic determinants of population reproduction, while the last determinant is a social determinant influenced by various interrelated social conditions and factors - economic, social, cultural, political, and traditional. The demographic determinants of fertility are influenced by socioeconomic, health, political, and other factors. In the continuation of the work, exactly these determinants will be analyzed in order to present the reproductive changes in the Republic of Croatia.

Reproductive Changes in the Republic of Croatia

In this paper, the concept of reproduction in the Republic of Croatia is considered in the narrow sense, which implies the reproduction of the population under the influence of only the components of natural movement and includes only the female population.

Methodology

Quantitative data from secondary sources were used for the analysis of reproductive changes in the Republic of Croatia: Croatian Bureau of Statistics, Eurostat and published relevant scientific works.

It is important to note that the 2011 census data are not directly comparable to the 2001 census data or to data from previous censuses because the statistical definition of total population used in the 2011 census differs from that used in previous censuses. Data from the six censuses conducted after World War II, i.e., the 1948, 1953, 1961, 1971, 1981, and 1991 censuses, refer to the permanent population, i.e., persons residing in the Republic of Croatia, whether or not they were present at the place of residence at the time of the census and regardless of the duration of absence from the place of residence. The 2001 census applied the concept of "usual residence" for the first time in defining the total population and introduced a period of one year or longer as a basic criterion for including or excluding a person from the total population. The 2011 Census also applies the concept of "usual residence" and, for the first time, introduces intent to be absent/ present as an additional criterion for inclusion or exclusion of a person from the total population. Although the data from both censuses, 2001 and 2011, are based on the concept of "usual residence," they are not directly comparable. This is partly because of the intent of absence/presence, which was not collected in the 2001 census, and partly because the 2001 census included in the total number of residents persons who were absent for a year or more but returned to their permanent residence on a seasonal and monthly basis (these persons are not included in the total number of residents in the 2011 census) (Croatian Bureau of Statistics).

As mentioned earlier, there are three basic determinants of reproduction, and it is these that will be analyzed in this chapter. The following sections analyze quantitative data on trends in the total number of females of childbearing age according to the 1961 to 2021 censuses, changes in the age structure of the childbearing proportion of the female population (according to the 1961 to 2021 censuses), and specific fertility rates by age (from 1961 to 2020). Finally, the assumptions for fertility rates by age and type of projection were analyzed for the Republic of Croatia for the period from 2030 to 2100.

Analysis and Discussion

Natural population movement (fertility-mortality, birth-mortality) is the dominant component of total population movement in most countries of the world. In a narrow sense, natural population movement refers to the birth rate and mortality in a given population group. In a broader sense, natural movement includes the movement of married and dissolved marriages, the separate recording and analysis of marital and nonmarital live births, family structure, birth order, and the frequency of births in the family and associated population, multiple births, maternal age at the time of birth, movement in the number and proportion of stillbirths, abortions, infant deaths, deaths by age and sex, and cause of death (Gelo et al. 2005, p. 35). In this paper, population reproduction is considered in a narrower sense by taking into account the components of natural population movement in the Republic of Croatia.

In populations where the process of demographic transition is complete, as in the case of the Republic of Croatia, an important dynamic component of natural population movement is birth rate/fertility, while mortality is a relatively stable variable under these conditions (Wertheimer-Baletić 1992, p. 277). From 1950 to 2020, there is a trend of decrease in the number of live births and natural population growth, which has a negative balance since 1991 (more deaths than births). The number of live births in the period from 1950[1] to 2020[2] decreased by 62.47%, i.e., by 59,655. At the same time, the number of deaths increased by 15,662 or 37.87%. This shows that the death rate is significantly lower compared to the decrease in the birth rate. If we consider the total population of the Republic of Croatia, the population growth in the second half of the 20th century showed a significant slowdown. The number of inhabitants increased until 1991, when the trend of negative population growth began. Thus, in 1991, 4,784,265 people lived in Croatia (Wertheimer-Baletić 1992, p. 291, according to the 1991 census), while the total number of inhabitants, according to the data of the State Statistics Office, was 4,047,680 in 2020, which means a decrease of 15.39%. The consequences of the natural population decline are partly reflected in the population losses due to the war and emigration during the homework in the first half of the 1990s, as well as in an unfavorable economic situation.

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[1]1950: live births 95,500, deaths 47,292 (Wertheimer-Baletić 1992, p. 277).
[2]2020: live births 35,845, deaths 57,023 (Croatian Bureau of Statistics 2021b).

According to the 2021 census, the total number of inhabitants of the Republic of Croatia decreased by 9.64% compared to 2011[3], i.e., it decreased by 413,056 people (Table 2), a negative trend is also observed in the number of children born (-11.38%), i.e. an absolute decrease of 4,689 children was recorded. Based on the presented trends, it is possible to calculate the time of population doubling, but in our case of the Republic of Croatia, a negative doubling would be the time when the population decreases to half of the current level.

Table 2. *Trends and the Doubling Time*

	2011	2021	% of change 2021/2011	T_{double}
Total number of population	4,284,889	3,871,833	-9.64	71.9
Number of births	41,197	36,508	-11.38	

During the ten-year period, the population declined by 9.64%, so for the purposes of this calculation, we can assume that the average annual rate of decline is 0.964%. It would take 71.9 years for the population of the Republic of Croatia to drop to half of its current level. The doubling time is calculated according to the following formula:

$$T_{double} = \ln(2) / (\text{year decline rate})$$

The trend in the total number of women of childbearing age followed the trend in the total number of the population. The total number of women increased by 292,150 (13.44%) from 1961 to 1991. From 1991 to 2021, the number of female population decreased by 18.32%. The above trends also apply to the number of women of childbearing age. From 1961 to 1991, the number of women of childbearing age increased from 1,064,914 women to 1,149,407 women (Table 3), and from 1991, there was a downward trend in the number of women of childbearing age. According to 2021 data, the number of women of childbearing age was 807,308, a decrease of 257,606 women of childbearing age from 1961. Moreover, the proportion of the childbearing contingent in 2021 decreased by 8.9% compared to 1961. This can be explained by the aging of the population and out-migration.

Table 3. *Number of Women of Childbearing Age in the Censuses from 1961 to 2021*

Year	Total number of female population	Women of childbearing age	Part of the fertile contingent (%)
1961	2,173,492	1,064,914	49.0%
1971	2,287,173	1,174,488	51.4%
1981	2,374,579	1,152,704	48.5%
1991	2,465,642	1,149,407	46.6%
2001	2,301,560	1,080,121	46.9%
2011	2,218,554	972,948	43.9%
2021	2,013,963	807,308	40.1%

Source: Wertheimer-Baletić (2003a, p. 36), Croatian Bureau of Statistics (2021a).

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[3]Censuses of 2011 and 2021 were selected because of the consistency of the concept which applies the concept of "usual residence".

  Table 4 provides an overview of the age structure of women from 1961 to 2021 according to the censuses conducted every 10 years.

Table 4. *Women of Childbearing Age by Age (Censuses from 1961 to 2021)*

Year	Women of childbearing age	Childbearing age				
		15-19	20-24	25-29	30-34	35-49
1961	1,064,914	145,320	165,623	177,634	174,997	401,340
1971	1,174,488	192,318	176,308	134,871	162,043	508,948
1981	1,152,704	165,133	178,791	181,347	167,840	459,593
1991	1,149,407	159,381	157,609	169,648	180,658	482,111
2001	1,080,121	145,930	149,892	145,831	147,511	490,957
2011	972,948	119,259	128,203	141,650	144,621	439,215
2021	807,308	92,215	103,607	105,816	113,408	392,262

Source: Wertheimer-Baletić (2003a, p. 38), Croatian Bureau of Statistics (2021a).

  Table 4 shows two important trends that point to the issue of female fertility in the Republic of Croatia. Regardless of the change in the census methodology from 2001 onwards, there is a decline in the number of women, as shown by a comparison between 2011 and 2021, where the number of women of childbearing age decreases by 17%. Looking at specific age categories of women of childbearing age, there is a decline in all categories, with the highest rates of decline in the 25 to 29 years (-40.43%) and 20 to 24 years (-37.44%) categories according to the 2021 census compared to the 1961 census.

  Table 5 shows the analysis of women of childbearing age from 1961 to 2021, on the basis of which conclusions can be drawn about the peculiarities of each period that have influenced the ratio of the age structure of women of childbearing age.

Table 5. *Age Structure of Women of Childbearing Age (Censuses from 1961 to 2021)*

Year/ Childbearing age	15-19	20-24	25-29	30-34	35-49
1961	13.6%	15.6%	16.7%	16.4%	37.7%
1971	16.4%	15.0%	11.5%	13.8%	43.3%
1981	14.3%	15.5%	15.7%	14.6%	39.9%
1991	13.9%	13.7%	14.8%	15.7%	41.9%
2001	13.5%	13.9%	13.5%	13.7%	45.5%
2011	12.3%	13.2%	14.6%	14.9%	45.1%
2021	11.4%	12.8%	13.1%	14.0%	48.6%

  The category of representation of the age structure of women of childbearing age from Table 5 provides important insight into the categorization of women by age structure and for each time period, and based on these data, a representation and analysis of each 10-year period can be made in terms of demographic policies, impacts, and actions related to fertility issues. In all observed census years, women of childbearing age between 35 and 49 accounted for the largest share, and this share increased significantly in 2021 compared with 1961. With the exception of 1971, the smallest proportion of women of childbearing age was between 15 and 19 years old. Looking at the proportions of women by age between the censuses, it

is clear that the proportion of women in the younger age group (from 15 to 34 years old) decreased, while at the same time the proportion of women in the older age group (from 35 to 49 years old) increased in 2021 compared with 1961. Based on the previous analyses, it can be concluded that the total childbearing contingent is decreasing and the childbearing contingent is ageing, i.e., the number of women with low fertility is increasing.

The specific fertility rate indicates the ratio between the number of live births to women of a given age and the estimated number of women of the same age. These rates are influenced by social factors and thus represent a social determinant of population reproduction. They are influenced by various interrelated social conditions and factors - economic, social, cultural, political, and traditional.

Table 6 shows specific fertility rates by maternal age (per 1,000) from 1960 to 2020, from which certain conclusions can be drawn for reproductive policy by specific age groups.

Table 6. *Specific Fertility Rates by Maternal Age (per 1,000)*

Maternal age/Year	1960	1970	1980	1990	2000	2010	2020
15-19	44.0	46.9	45.4	29.0	15.8	11.9	7.6
20-24	153.1	133.6	159.3	131.0	83.3	55.1	39.5
25-29	122.3	96.9	107.3	114.0	92.9	98.7	88.0
30-34	70.7	53.1	50.8	48.2	57.8	84.8	99.5
35-39	35.9	22.5	17.2	15.5	24.2	35.9	50.7
40-44	12.7	5.9	4.2	2.8	5.3	6.0	10.9
45-49	1.1	0.6	0.3	0.2	0.3	0.2	0.5

Source: Wertheimer-Baletić (1985, p. 268). Wertheimer-Baletić (2003a, p. 40). Croatian Bureau of Statistics (n.d.b).

Age-specific fertility rates declined in almost all five-year age groups (with the exception of ages 30 to 34 and 35 to 39) during the observation period from 1960 to 2020. The numerical level of specific fertility rates above the value of 100 is found until 1990, after which this rate does not exceed 100 in any age group of women. Numerical levels of specific fertility rates above 100 are visible only in the age groups from 20 to 24 years and from 25 to 29 years until 1990, with a larger share in the total number of live births held by the age group from 20 to 24 years of the mother. The increase in the specific birth rate in the 15-19 age group in the period up to 1980 can be explained by early marriage, the low age of women at the birth of their first child, and the increase in marriages in younger age groups. After 1990, the tendency for the total number of women of childbearing age to decrease intensifies, the aging process of the childbearing contingent continues, and there is a decline in specific fertility rates in the younger age groups of mothers. This can be partly explained by the wartime aggression against Croatia in the early 1990s, which certainly had an impact on the unfavorable demographic trends. In addition, Wertheimer-Baletić (2003a) notes that the post-transition feature of population reproduction came to the fore during this period, in particular the emergence of aging of the age structure of the fertile contingent and the impact of social determinants on the further reduction of specific fertility rates by age and the shift of the fertility focus to older age groups.

Considering the data on the number of children born according to the age of the mother based on the 2011 and 2021 census, Table 7 calculates the percentage change 2021/2011 and the Z-score to observe the reproductive changes under the influence of the age factor, i.e. the age of the woman. According to the 2021 census, there is an increase in births at older ages with a significant decrease in births at younger ages of the mother (up to age 30). The largest decrease is in the age group of mothers between 15 and 19 years (-55.3%), then between 20 and 24 years (-38.9%) and between 25 and 29 years (-26.9%). The reason for the decrease in the number of children born at a younger age among women can certainly be seen in the postponement of births, but it should also be taken into account that the Republic of Croatia is facing the problem of population aging, i.e., the population base at a younger age is decreasing. For the calculation of Z-score, the average and standard deviation were calculated taking into account individual data for the period 2011 to 2021 (10 years). Positive Z-score values indicate a deviation above the average, while negative values indicate a deviation below the average. A positive deviation (above average) was observed in the younger age groups of mothers in 2011, while a negative deviation (below average) was observed in the older age groups of mothers, which is also consistent with the observation of the absolute values of the number of children born, where it is obvious that they have more children mothers at a younger age (< 35 years) compared to mothers at an older age (> 35 years). The results for 2021 are exactly the opposite of 2011: women at an older age (> 35 years) gave birth to an above-average number of children, while women at a younger age (< 35 years) gave birth to a below-average number of children.

Table 7. *Z-score (Number of Live Births According to Mother's Age)*

Mother's age	Number of live births		2021/2011	Z -score		Average	St. dev
	2011	2021		2011	2021		
15-19	1,412	631	-55.3%	1.58	-1.83	1,050	229
20-24	6,902	4,288	-37.9%	1.75	-1.22	5,362	880
25-29	13,934	10,187	-26.9%	1.62	-0.83	11,456	1,534
30-34	12,678	12,360	-2.5%	0.05	-0.91	12,662	332
35-39	5,291	7,384	39.6%	-1.72	1.84	6,305	588
40-44	922	1,582	71.6%	-1.64	1.91	1,227	186
45-49	41	71	73.2%	-1.91	0.69	63	12

The total fertility rate is defined as the average number of live births that a woman would give birth to at her fertile age (15 - 49 years) under the conditions of the same specific fertility rates as in the observed year. According to the available data from Croatian Bureau of Statistics (n.d.a) the total fertility rate in 2020 was 1.48.

According to Baseline projections presented in Table 8 (Eurostat 2021a) the total fertility rate will remain unchanged (1.48), while a growth trend will then occur. The total fertility rate is projected to be 1.54 in 2050 and 1.68 in 2100, according to the baseline projections. The assumption for fertility rates according to the sensitivity test: lower fertility (Eurostat 2021b) is 1.23 in 2050 and 1.34 in 2100, respectively. From the presented analyses, it is clear that the rate of 2.1

children, which is often mentioned in the literature and in the public as the numerical level of generation change, will not be reached, i.e., the simple reproduction of the population is not guaranteed in the Republic of Croatia.

Table 8. *Assumptions for Fertility Rates by Age and Type of Projection*

Year	Baseline projections	Sensitivity test: lower fertility
2030	1.48	1.18
2040	1.51	1.21
2050	1.54	1.23
2060	1.57	1.25
2070	1.59	1.27
2080	1.62	1.29
2090	1.65	1.32
2100	1.68	1.34

Source: Creation of the author according to Eurostat (2021a, 2021b).

Conclusion

In Europe, the Republic of Croatia is one of the countries that have not renewed themselves for several decades. The total population is decreasing, the share of the old population is increasing with a simultaneous decrease in the reproductive base, which leads to a further imbalance between important functional age groups (young, able to work, old). Looking at the total population of the Republic of Croatia, there has been a significant slowdown in population growth in the second half of the 20th century. The number of inhabitants increased until 1991, after which a negative trend began. Moreover, the average age of a mother at the birth of her first child increased from 23.5 years (1960) to 29 years in 2020 (Eurostat 2022), which significantly shortened the reproductive time of a woman. Due to a number of factors, the number of live births decreased from 95,560 children in 1960 to 35,845 children in 2020, a decrease of 59,715 live births. An important feature of reproductive trends in the Republic of Croatia is the reduction and aging of the total fertile contingent and the decrease in specific fertility rates. Based on the analysis conducted, it is not possible to determine what factors influence the fertility of women in the Republic of Croatia. Therefore, the recommendation for future research is to conduct a comprehensive empirical study of the population of women of childbearing age in order to determine what factors influence their decisions on the willingness to have a child. In addition, because of the resulting birth deficit, it is necessary to adopt demographic measures to promote births. The author considers free public childcare, expanding opportunities for parents to work flexible hours, and one-year paid maternity and paternity leave as effective demographic measures to increase births and fertility. In addition, policy makers are recommended to introduce various financial incentives that would facilitate the financing of children.

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