POPULATION STRUCTURES

The dynamically changing structure of the population in space and time has been shaped by past and present demographic, cultural, economic and political processes. As demographic processes and structures are changing very slowly - apart from unexpected social and political crises (e.g. epidemics, wars, forced

migrations) – the current structure of the population can be assessed as the effect of processes in the past. And the current situation very much determines future conditions for the same reasons.

The various characteristics of the population structure are usually divided into three major groups and

presented accordingly: 1. biological (demographic) characteristics (e.g. sex, age, family), 2. cultural characteristics (e.g. ethnicity, language, religion, education, qualifications), 3. socio-economic characteristics (e.g. economic activity, occupation, social structure).

SEX AND AGE COMPOSITION

Laura Szabó, Károly Kocsis, Dóra Gábriel, László Kulcsár, Csilla Obádovics

Population structure according to sex

Humanity can be divided, according to the anatomical and biological differences between men and women, into *biological sexes* and *sociological (social) sexes* resulting from a later gender socialisation 1. Concerning the former, there are spatial data from demographic and geographical surveys conducted around the world. The distribution of the population according to sexes is of high importance in the study of fertility and childbearing, but its role is also crucial in the gender analysis of labour market conditions.

eral indicators. Although it is possible to express the ratio of each sex to the total population as a percentage, the most common indicator is the number of women per thousand men, the so-called *femininity index*. Its reversed version is the *masculinity index* (number of men per thousand women). It is also possible to analyse these indicators by the main age groups (0-14)years, 15–64 years and 65 years and older). These are all justified by the fact that the sex ratio is basically determined by the *male birth surplus* and the *difference* in mortality of the sexes. It is recognised that more boys are born than girls worldwide and that the mor-

STRUCTURE (1910-2020)

67.0

67.6

65.7

67.4

64.6

66.2

26.0

24.9

25.4

21.1

21.9

20.5

1941

1949

1960

1970

1980

1990

tality rate of men compared to women increases with age. However, the change in the sex ratio - in addition to certain cultural and economic factors (e.g. the status of women, one-child families) - has also been significantly influenced by the fact that voluntary migration and wars disproportionately affect workingage men.

Globally, the ratio of the two sexes is almost balanced: there were 3,865 million women for 3,930 million men in 2020, resulting in a femininity index of 983. In most European countries, however, there is now a surplus of women. In Europe, a male surplus Sex distribution is generally studied through sev- can only be observed in areas with high fertility and thus significant childhood male surplus (e.g. in countries largely inhabited by Albanians: Albania, Kosovo, North Macedonia, and in countries with large immigrant populations: Sweden, Luxembourg, Malta). As a result of African-Asian immigration, which is still characterised by a high proportion of young men, the femininity index in Europe is likely to fall from 1,070.7 to 1,016.6 between 2020 and 2100, thereby approaching a sex balance.

> The population of the Carpathian Basin was characterised by an almost perfect sex balance 150 years ago, at which time there were 1,002 women per 1,000

> > 1042.6

1080.9

1073.5

1062.9

1064.0

1081.2

men. As a result of the disproportionate loss of males through international migration, the femininity index increased to 1,019 in 1910. By 2019, it had risen to 1,067, owing to the losses of the world wars, mass emigration and accelerat-



1 Distribution of the population by sex

ed aging in the wake of declining fertility. In the present-day area of Hungary, the sex ratio imbalance in 1910 was even smaller (1,007 women/1,000 men) than the aforementioned value for the Carpathian Basin as a whole (1,019). This discrepancy reflects the fact that male-dominated emigration particularly affected the peripheral areas of the Carpathian Basin VI. 1. 1. In the last century, for the reasons stated above and the early occurrence of natural decrease (it first occurred in Hungary in 1981) and accelerated aging, the value of the femininity index in Hungary increased above the average of the Carpathian Basin and reached its current maximum (1,105.2) in 2010. Since then, mainly due to the improvement in male mortality rates (cf. life expectancy at birth, 2), the sex ratio has also become more favourable (1,087.2 women/1,000 men in 2020, VI. 1. 1.)

The upset of the sex balance has several negative consequences: the chances of choosing a partner and

FEMININITY INDEX BY MAIN AGE GROUPS (1910–2020)



Voar	Main age groups (%)				Women pe		
rear	0-14	15-64	65-	Male	Female	Total	1,000 men
1910	34.8	60.3	5.0	27.2	27.3	27.2	1007.2
1920	30.6	63.8	5.6	28.5	28.9	28.7	1061.6
1930	27.5	66.1	6.3	29.3	30.2	29.8	1044.3

31.0

31.5

32.5

34.3

34.6

35.5

32.1

33.3

34.8

37.0

37.7

39.0

31.6

32.4

33.6

35.7

36.2

37.3

7.0

7.5

8.9

11.5

13.5

13.2

1 CHANGES OF SELECTED INDICATORS OF SEX AND AGE

2001	16.6	68.3	15.1	37.1	41.1	39.2	1102.7
2010	14.7	68.6	16.6	38.7	43.0	40.9	1105.2
2011	14.6	68.7	16.7	38.9	43.2	41.1	1105.0
2012	14.5	68.6	16.9	39.3	43.5	41.5	1102.1
2013	14.4	68.4	17.2	39.5	43.7	41.7	1101.1
2014	14.4	68.0	17.5	39.7	43.9	41.9	1100.1
2015	14.5	67.6	17.9	39.9	44.1	42.1	1098.8
2016	14.5	67.2	18.3	40.0	44.2	42.2	1096.7
2017	14.5	66.8	18.7	40.2	44.4	42.4	1095.6
2018	14.5	66.5	18.9	40.3	44.5	42.5	1093.2
2019	14.5	66.1	19.3	40.5	44.7	42.7	1090.1
2020	14.5	65.6	19.9	40.6	44.8	42.8	1087.2
				^	^		·
1							



of marrying decline, reproduction is reduced, the number of singles increases, and workforce shortages may occur in either sex. In addition, the male/female balance may be upset in certain age groups as well, laying a heavy burden on the state and its social welfare system. The 0–14 age group was always characterised by a surplus of boys, as among newborns boys outnumber girls VI. 1. 2. The 15–39 age group has only been characterised by a male surplus since 1970, while among those aged 40-59, the same occurred only once, in 1910. However, there were always more women than men in the population aged 60 and over, and the rapid rise in the value of the index since 1970 reflects the higher mortality of men in old age. The improvement in sex ratios over the past decade and the decline in the femininity index are striking primarily among older age groups.

The femininity index in the Carpathian Basin is close to the European average (1,067) but conceals remarkable spatial differences. The European average sex ratio is exceeded significantly in Hungary (1,090) and considerably in Pannonian Croatia and in Zakarpattia (1,081 and 1,079 respectively). The figure (1,048) for Slovakia and for Transylvania is relatively favourable; only in the 1930s was a comparable figure recorded in the present-day area of Hungary. Apart from a few dozen districts, urbanised districts in the Carpathian Basin are characterised by a surplus of women. The

femininity index is particularly high in the major cities, from which in recent decades young families with children in male surplus moved in large numbers to the neighbouring suburbs (in the course of so-called suburbanisation migration) VI. 1. 3. The capital cities and regional centres are also at the forefront: Budapest (1,149), Uzhhorod (1,147), Zagreb (1,136), Bratislava, Cluj-Napoca/Kolozsvár, Sibiu (1,125), Timişoara Age composition of the population (1,119) and Novi Sad (1,111). In some rural areas how ever, a relatively more favourable sex ratio and even a male surplus can be observed. In such areas, a male surplus resulting from the high fertility of the local population has not been balanced by a female surplus resulting from male emigration (VI. 1. 3. and 5). This favourable phenomenon can be observed in the northeastern mountainous regions of the Carpathian Basin. Albeit located in this northeastern zone, Zakarpattia, despite its traditionally high fertility rates, has a large surplus of women, owing to high emigration, which affects predominantly men. A similar situation can be observed throughout western Ukraine.

The aforementioned study of sex ratios in Hungary also supports the above. Due to suburbanisation, a highly significant surplus of women has arisen in all major and medium-sized cities (VI. 1. 4. cf. 15 16 17). A similarly high femininity index can be observed in the target areas of old-age migration, which often involves foreigners (e.g. the Lake Balaton region, 6), and





in rural areas hit by out-migration (mostly of young men), which have been left with ageing populations (e.g. in Northern Hungary and in the inner peripheries of the Alföld). However, it is also a fact that in almost a third of settlements in Hungary - especially in small and tiny villages - the number of men exceeds that of women. In some of these cases, the phenomenon may be caused by the above-average fertility of the Roma population. In Hungary, in most villages with a Roma majority a male surplus was registered VI. 1. 4., cf. VI. 3. 8.). In this regard, it should be noted that in many villages with an ethnically mixed population, a male surplus in the Roma population is balanced by more women in the aging local non-Roma population.

Almost all demographic structures and processes are fundamentally determined by the age (and sex) distribution of the population, which is of particular importance in ascertaining the chances of marriage, of establishing a household or a family, and of having children. It also facilitates the estimation of the care requirements of children and the elderly and assists in forecasting demand for kindergarten and primary school places, the number of jobseekers entering employment, and more general analyses of the labour market situation.

The age structure of the population is mainly the result of live births and deaths (i.e. it is determined by the natural population change) and it is strongly influenced by cultural factors. At the same time, the voluntary migration of the working age population, which mainly involves young people, also plays an important role in this respect, resulting in a younger age structure of the population in the target areas and amplifying the ageing process in the areas of origin. Migration in old age can have an opposite effect, contributing to an ageing of the local population in the target areas.

When speaking of age, humans are usually divided fundamentally on a biological basis - into children, adults and the elderly. In statistics, these categories



2 The meeting of three generations

Average age: arithmetic mean of the age of the population in a given area.

tion into two exactly equal groups.

Billeter index: where *P* is the number of the population. The numbers in the subscript indicate the population that is not yet fertile (0-14), no longer fertile (50+)and in fertile age (15–49 years). The index provides information on the ratio of generations relative to each other and the expected development trends of the pop*ulation according to the age structure. The higher the* value of the index, the younger the population. A negative value indicates that the number of those aged 50 and over is higher than that of those aged under 15 years.

ple of non-working (unproductive) age to the working *Median age:* the age that divides the studied popula- (productive) age population. Since the non-working age population consists of two components (children and the elderly), the dependency ratios of children (0-14)*years) and the elderly (65+ years) can be distinguished.* Ageing index: the ratio of the elderly to children. It meas*ture trends.*

> ture of the population by sex. A detailed population *pyramid can also be seen as a joint imprint of the fer*tility, mortality and migration processes of recent decades. A pyramid shape represents a young population. Bell-shaped population pyramids represent a stagnant

Dependency (age-dependency) ratio: the ratio of peopulation characterised by a relative increase in the number of older people. An urn or onion-shaped pop*ulation pyramid refers to a decreasing population with* a low number of children.

Ratkó era: a period of population policy (1950–1956) named after Anna Ratkó (1903-1981), weaver, communist union leader, and Minister of Welfare and ures the ageing process, so it is also used to predict fu- Health between 1949 and 1953. Strict prohibitions on pregnancy termination (induced abortion) and the in-**Population pyramid:** a bar chart showing the age struc- troduction of a tax on childless people in the first half of the 1950s, led to a significant increase in the number of births in Hungary. Those born at that time are usually called Ratkó children, and those born in the first half of the 1970s are called Ratkó grandchildren.

correspond to the groups of 0-14, 15-64 years, and 65years and older 2. In sociological research, additional categories include people of working age (15–64), of childbearing age (women aged 15-49) and of conscription age (men aged 18-50/60).

For the spatial and temporal research of age structure, several simple and more complex data, metrics, indices, and representations are used, which can be classified into three groups. The first includes the simplest, easily accessible data and single-component indices (e.g. the ratio of people belonging to each age group as a percentage). More complex, multi-component indices are classified in the second group (e.g. average age, median age, the Billeter index, the age-dependency ratio, and the ageing index). The third – and visually most spectacular way of presenting the age structure – is the so-called population pyramid.

The negative consequences of a distortion of the age structure include a gradual increase in the ratio of the elderly. This, in turn, results in labour shortages in ageing societies, such as those experienced in most European countries. As a result, there is considerable pressure on the pension, health and social care systems, with increases in the cost of maintaining such systems. Ageing also significantly distorts the sex ratio – due to higher male mortality – resulting in an increasing surplus of women. These negative consequences force the governments of ageing societies to reorganise pensions and the healthcare system, to review employment laws, financial services and family policy, and, in some cases, to take measures to increase fertility.

Due to declining fertility and increasing life expectancy, the ageing of the population - to varying degrees – is being observed worldwide. As a result, the ratio of children fell from 34.3% to 25.4% between 1950 and 2020, in parallel with the increase in the ratio of the elderly from 5.1% to 9.3%. In the case of Europe, the ratio of 0-14 year-olds fell from 26.3% to 16.1%, and that of those aged 65 and over rose from 8.4% to 19.1% over the seven decades. The rate of



6 AGE STRUCTURE OF POPULATION (1949, 1990, 2020, 2070) 80+ 00,000 00,000 00,000 00,000 000 000 000 000 000 00,000 10,000 20,000 100,000 00,000 00,000 00,000 0 00,000 0 000,00 000,000 000,000 Males Females









ageing in the Carpathian Basin between 1910 and 2018 was similar to that in Europe: the ratio of children was 35.5% in 1910 and 15.0% in 2018, while the ratio of the elderly was 5.0% in 1910 and 17.5% in 2018. The global average of the dependency rate for children is currently much higher (39) than for the

elderly (14.3). In Europe, the situation is reversed (children 24.8, elderly 29.5). Other demographic indicators also show a particularly high rate of ageing relative to the global average: median age (2020: world 30.9, Europe 42.5), Billeter index (in 2020: world 2.5, Europe -53.1), ageing index (2020: world 36.7, Europe 119).

In the Carpathian Basin in 1910, only 16.7% of the population was aged over 50, while 35.5% was 14 years old or younger, resulting in a Billeter index of 39.5, far better than in 2018 (-46.3). The dependency rate of children fell from 59.9 to 22.3 between 1910 and 2018, while that of the elderly increased from 8 to 25.9. Accordingly, the striking increase in the ageing index (from 14.2 to 116) points to the changes that have taken place in the age structure of the Hungarian population over the past 100 years.

In terms of ageing there are significant differences among the countries and regions of the Carpathian Basin. The ratio of children is highest and that of the elderly is lowest in Zakarpattia (20% and 11.8% respectively) and in Slovakia (15.7% and 16% respectively). Compared to them, the indicators in Vojvodina, Hungary and Pannonian Croatia are much less favourable (14.4-14.8 and 19.2-19.7). The median age in the countries of our region has generally increased at the same rate as in Europe over the last seven decades, with the difference being that in the third quarter of the 20th century the rate of ageing still lagged behind the European level due to an influx of guest workers (e.g. in Austria) and population policy interventions (e.g. in Romania, Hungary and Slovakia). The value of this indicator is currently the lowest in Slovakia and Ukraine, which have the youngest age structure (41.2 in 2020), while in Slovenia and Croatia, the median age is 44.5 and 44.3 years, respectively. Similar differences are reflected in the change of the ageing index between 1950 and 2018 VI.1.5. Until the 1980s, the indicator showing the ratio between the elderly and child populations reached its highest value in Austria and Hungary, while Serbia, Croatia and Slovenia subsequently caught up with those countries as a result of the Yugoslav Wars in the 1990s.

Hungary's population pyramid was clearly pyramidal in 1910, but the census in 1920 already showed the lack of births associated with World War I. This deficit can be seen even in the population pyramid of 1949, where the number of those aged 30–33 years is conspicuously low VI. 1. 6. A further observation in Hungary is that, in contrast to the trend in World War I, the number of births hardly decreased during World War II 1, and thus the number of children did not shrink significantly. The effects of accelerated ageing in the second half of the 20th century and the state population policy interventions of the 1950s (the socalled Ratkó era) are reflected in the population pyramid of 1990. The large numbers of Ratkó children born in the 1950s and of their children, born in the 1970s, are particularly striking. The deficits of World War I are still visible here at the top of the population pyramid, among those aged 70-73 years. Yet, these signs have disappeared from the population pyramid of 2020. The shape of the population pyramid of 2020 is clearly an imprint of a declining population. According to population projections, the Hungarian population pyramid will become urn-shaped by 2070. This shape is typical of a declining and ageing population with a low number of children.

Changes in the above mentioned indicators on the present-day territory of Hungary in the last century are quite similar to the averages for the whole population of the Carpathian Basin. The share of children fell from 34.8% to 14.6% between 1910 and 2019, thereby reducing the dependency ratio of children from 57.7 to 22 during this time VI. 1. 7. At the same time, however, the share of the elderly increased from 5% to 19.4%, and the dependency ratio of the elderly increased from 8.3 to 29.3. According to a 2018 forecast issued by the Hungarian Demographic Research



3 Children, the hope of the future

Institute of the Central Statistical Office, whereas in 2011 four working-age people supported an elderly person, in 2070 two working-age people will support an elderly citizen. According to the forecast, the dependency ratio of children will not change significantly; the number of children will be about a quarter of the (adult, active) middle-aged group. As the more populous group of the Ratkó era is currently leaving middle age and their children will reach retirement age in 30 years, this will lead to a significant change in the ratios. Indeed, another demographic ageing wave will reach Hungary in the next 50–60 years. The Billeter index, which examines large age groups on a fertility basis, also indicates similar age structure changes: its value decreased from 37.6 to -52.4 between 1910 and 2019. The value of this indicator has been in the negative range since 2001, which means that the number of people older than fertile age is higher than that of those before fertile age. During this time, the average age of the population in the present-day area of the country increased from 27.2 to 42.8 years, and the value of the ageing index, which compares the ratios of children and the elderly in relation to each other, increased from 14.4 to 133, thereby even exceeding the average for the Carpathian Basin (116).

The age structure of the population in the Carpathian Basin also shows a characteristic regional pattern. The ratio of *children* (0-14 years old, 3) to adults and the age-dependency ratio, as well as the crude live birth rate have a broadly similar spatial distribution VI. 1.8 5. In areas with persistently high fertility and above-average birth rates, the ratio of the population aged 0–14 and the associated financial burden are naturally high. Such areas can be found as a historical heritage - in the northern and northeastern areas of the Carpathians inhabited by Slovaks, Rusyns and Romanians, in the Croatian Međimurje region, in Eastern Slavonia, and in areas inhabited by poorly educated (often Roma) populations (e.g. in Eastern Slovakia, northeastern Hungary, the Central Tisza Region, the Transylvanian Basin and Partium). The proportion of children is similarly high in the vicinity of certain major cities (e.g. Budapest, Bratislava, Košice, Oradea/Nagyvárad, Arad, Timişoara, Cluj-Napoca/Kolozsvár, Sibiu, Braşov, Novi Sad and Zagreb). In 24 settlements in Hungary (mostly with a Roma majority) the ratio of children is more than 30%, or twice as high as the national average (14.6%). At the same time, however, seven villages do not have any children at all, and their ratio is less than 5% in 43 villages. According to the settlement-level map VI. 1.9., the ratio of those aged 0-14 years is above average in areas inhabited by large numbers of disadvantaged and poorly educated Roma (e.g. Northeastern Hungary, Central







Tisza Region, and southwestern Transdanubia), in the agglomeration of Budapest and around county centres.

The *ratio of the elderly population* (65 years and older, **4**) per 100 people, the elderly dependency ratio, and the *median age* (which divides the population into two equal parts) show almost the same regional pic-

ture VI. 1. 10. VI. 1. 11. The value of these indicators is particularly high in the inner peripheries and border regions, which are particularly hit by the out-migration of young people (e.g. Burgenland, Prekmurje, the Dinarides, the Transdanubian Hills, Northern Hungary, the Körös–Maros Midland, southern and eastern



4 In Hungary, elderly people have outnumbered children since the turn of the millennium

Banat and the Apuseni Mountains). The ratio of the elderly is more than twice the national average (2018: 18.9%) in 26 villages in *Hungary*, but it remains below 5% in 20 settlements with a young age structure. The map with settlement-level details VI. 1. 12. shows the peripheral areas affected by out-migration, where the ratio of people aged 65 and over is above average: remote villages in the North Hungarian Range inhabited by fewer Roma people, in the Körös-Maros Midland, in the southern part of the Danube-Tisza Midland, in the common border regions of Baranya, Tolna and Somogy and in southwestern Zala. In addition, the ratio of the elderly population is much higher than average in the popular target areas of migration in old age (e.g. near Lake Balaton and in the Buda Mountains: districts I, II, XII).



5 People aged 15–64 have made up two-thirds of the population for a century

In line with the above, the ratio of the population *aged 15–64* (young and active adult population, **5**) is high in less youthful and less ageing regions, as well as in the target areas of recent migration and the core areas of urbanisation (i.e. in major cities, county centres and their vicinity) VI. 1. 13. VI. 1. 14.

The *ageing index* is lowest where the ratio of those aged 0-14 years and the birth rate are the highest VI. 1. 15. VI. 1. 8. 5. Such areas can be found in the eastern part of Slovakia, in the agglomerations of Bratislava and Budapest, in the northeastern periphery of Hungary, in the Central Tisza Region, in southern Transylvania, in the major cities of the Banat and Partium regions (e.g. in Timișoara, Arad, Oradea/Nagyvárad and Satu Mare/Szatmárnémeti). A high degree of ageing is indicated by a high value of this index, similarly to the particularly high proportion of the elderly in some northwestern, mountainous parts of Slovakia, in Burgenland in Austria, in Budapest, in Northern Hungary, in the peripheral areas of the southern Alföld of Hungary, as well as in the southwestern half of Transdanubia VI. 1. 16. There are 790 settlements in Hungary where the number of children exceeds that of the elderly, so the value of the ageing index is below 100. At the same time, in 263







villages ageing is so severe that this indicator is more than double the national average (133).

The *Billeter index*, which compares those of fertile age to the difference between the numbers of people younger and older than the fertile age, is negative throughout Hungary, which means that the number of people beyond their fertile age exceeds those who are still before their fertile age everywhere. The most favourable values are observed in the northeastern districts of Abaúj, Zemplén and Szabolcs, which are mostly inhabited by Roma people, as well as in certain parts of the Budapest agglomeration VI. 1. 17.

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