Selected Indicators of Population Ageing in New Member States of the European Union

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Abstract: Nowadays, many European countries are faced with the serious problem of ageing populations. The goal of this article is to highlight and identify these demographic trends through some indicators of population ageing in new member states of the European Union. Based on data from the United Nations (UN), their section "Population Division, Population Estimates and Projection Section" and the topic "World Population Prospects: The 2012 Revision", this paper considers some of the indicators of the ageing of the population in new member states of the EU. Statistical methods and mathematics evaluations are utilized to compare different parameters of age structure (e. g. ageing index, old age dependency ratio, potential support ratio and parental support). The ageing index was expressed as the percentage of the number of persons in 65 and over age group per 100 persons in 0-14 years old. Potential support ratio was obtained as the number of people in the working ages of 15-64 per every person 65 or older. Parental support is defined as the ratio of the number of persons in the age group of 85 years and older and the number of persons in the age group of 50-64. An old age dependency coefficient represents the number of people in 65 and over per 100 people in 15-64 years old. The forecast of research covers the period from 2015 to 2050. Proportions of the population will be examined, as well as their transformations in age categories: 65 and over, young-old (65-74), old-old (75-84) and oldest-old (85 and over). Results: As shown in the forecast from 2015 to 2050, the proportion of the productive population (20-64 years) dropped in new member states from 63.6 % in 2015 to 52.9 % in 2050 (medium variant). There are substantial regional differences across the new member states with respect to the share of the population of productive age. The decreasing proportions of youth and productive persons have been accompanied, in most European countries, by constant increases in the proportion of older persons. The proportion of the population in the age category young-old will increase from 9.1 percent in 2015 to 14.5 percent in 2050. This means that, by 2050, almost 14 million young-old retirees will require Medicare and Social Security in new member states of the EU.

Key words: Population Dynamics · European Union · Forecasting · Health Status Indicators · Age Groups · Aged · 80 and over

INTRODUCTION

The goal of the paper is to compare the demographic ageing processes in new member states of the EU. Changes in the age structure resulting in population ageing or rejuvenation were evaluated using comparisons of different indicators – ageing index, old age dependency ratio, potential support ratio, parental support ratio and dynamic economic ageing index. The most significant result of these changes from the demographic viewpoint has been population ageing from the top or increase the number/proportion of older persons.

Demographic ageing and proportions of the population have been analyzed by many authors [1-3]. Migration and natural dynamics – the birth rate and mortality – are the components that influence the phenomenon of population ageing or a disproportion among youth, active and post- productive age groups.

Primary indicators, which represent the first group of one-component indexes, have been analyzed through comparison of different age groups. According to previous studies, [4-10] the findings represent a typical disproportion between age groups for the populations of European countries.

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The current paper is focused on classifying the divergences of ageing of the populations in new member states of the EU. Population ageing and rejuvenation depend on the fertility and mortality rate and life expectancy of European populations. Mortality and fertility will more significantly affect the quality of life of a different age groups across Europe. To identify the position of population ageing in new member states of the EU, a collection of various age-related coefficients will be calculated, including ageing index, the old age dependency coefficient, potential support ratio, parental support ratio and proportion of elderly of the total population.

The European Union (EU) was established as a group of European countries that shared general principles of democracy, the rule of law, human rights, respect for and protection of minorities, the existence of a functioning market economy and a single market, through a standardized system of laws.

We will evaluate the process of ageing according to the UN projections for 2050. A long-term analysis of a phenomenon such as ageing will enable us to understand several relationships and regulations that may be connected to the dynamics of change in the age structure of the population. The study investigates 13 new member states of the EU, which joined in the period 2004-2013. On 1 May 2004 eight Central and Eastern European countries (Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia), plus two Mediterranean countries (Malta and Cyprus) were able to join. On 1 January 2007 Romania and Bulgaria joined the EU. Following the ratification process by all other EU countries, Croatia joined the EU on 1 July 2013.

MATERIALS AND METHODS

The aim of the paper is to present a spatial projection of the dynamics of change in the age structure of the population in new member states of the EU. We used a medium variant of age structure according to the UN projection database for 2015 and 2050. As a basis for our research, several coefficients describing the process of ageing have been adopted: ageing index, the old age dependency coefficient, potential support ratio, parental support ratio and the changing balance between age groups.

The decreasing proportions of youth and productive persons have been accompanied, in most European countries, by constant increases in the proportion of older persons.

To interpret the spatial diversity of ageing in new member states of the EU, we will use several charts for improved diagrammatic illustration of a set of data. All selected data are accessible from the United Nations (UN), their section "Population Division, Population Estimates and Projection Section" and the topic "World Population Prospects: The 2012 Revision".

Software application was used – STATGRAPHICS Centurion – for evaluating the ageing index, the old age dependency coefficient, potential support ratio and parental support ratio, especially the possibilities of the "territorial series clustering" classification system. Finally, the data set was calculated using the method of cluster analysis, which seeks to build a hierarchy of clusters.

This method has created 3 groups from the 13 observations supplied (new member states of the EU). The clusters are groups of observations with similar characteristics. To form the clusters, the procedure began with each observation in a separate group. It then combined the two observations that were closest together to create a new group. After recomposing the distance between the groups, the two groups next closest together were combined. The process was repeated until only 3 groups remained.

Two main indicators are applied to research on ageing. The first one encompasses one-component indicators defining one age category, for instance relative or absolute prevalence of age categories such as population in the post-productive and productive age (e.g., 65 and over, 85 and more, 65-74, 75-84).

In many cases, it is comfortable to operate with the relative weight of the ageing process. The second category of indicators is usually represented by the corresponding expression, i.e., coefficients or ratios comparing three basic age groups. The following factors were used in our analysis:

✓ Ageing index represents the number of persons in the 65 and over age group per 100 persons from 0 -19 years old.

$$I(AGE) = \frac{p(65+)}{P(0-19)} \times 100$$

✓ Old age dependency ratio – the coefficient represents the number of persons 65 and over per 100 persons from 20-64 years old.

$$C_D(old) = \frac{P(65+)}{P(20-64)} \times 100$$

✓ Potential support ratio defines the number of persons 20-64 years old per 100 persons 65 and over.

$$I(PSR) = \frac{P(20-64)}{P(65+)} \times 100$$

✓ Parental support – defines the number of people aged 85 and over per hundred people aged 50-64.

$$I(PR) = \frac{P(85+)}{P(50-64)} \times 100$$

✓ Dynamic economic ageing index assumes positive values; it means that the population is growing older. If the index assumes negative values, this indicates that the population is rejuvenating.

$$I_{(ead)} = (P_{(0-19)t} - P_{(0-19)t+n}) + (P_{(65)t+n} - P_{(65+)t})$$

RESULTS

As shown in the forecast from 2015 to 2050, the proportion of the productive population (20-64 years) dropped in new member states from 63.6 % in 2015 to 52.9 % in 2050 (medium variant). There are substantial regional differences across the new member states with respect to the share of the population of productive age. The lowest proportion of persons 20-64 years old will be observed in 2050 in Southern Europe, in countries like Slovenia (50.5 %), Bulgaria (51.8 %) and Croatia (52.2 %). These countries will be faced with a serious issue when these productive persons become pensioners. It will create a tremendous impact on social services and pension funds.

In 2015, the proportion of persons aged 65 or over in the new member states of the EU will be 16.3 %. This will be slightly lower than the proportion of youth below 19 years of age (20.1 per cent). By the year 2050, the share of the post-productive population is expected to increase to 28.0 % while the proportion of youth is projected to decline to 19.1 % (Figure 1).

The percentage of persons aged 65 years and over in the new members of the EU will nearly double by 2050, compared with 2015. The highest proportions of elderly citizens (aged 65 or over) in 2050 will be observed in Slovenia (30.4 %), Malta (29.3 %) and Croatia (29.2 %). The growth in the proportion of elderly persons is connected with trends reflecting the fertility cycles and subsequent reduction in proportions of the productive category. It is important to appreciate that the spatial structure of the age cohorts will influence particular demographic processes in the next decades, related to the inhabiting of South-East Europe.

When discussing the elderly population, we should be aware of the subgroups of this population. We can divide the overall elderly population into young-old
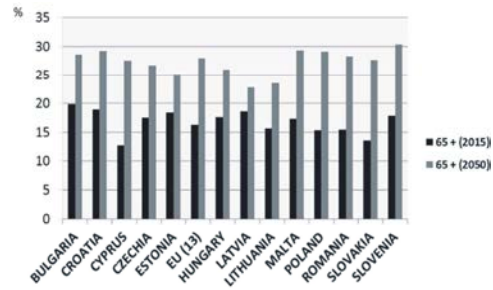

Fig. 1: Projection of post-productive age group 65 + in new member states of EU

Source: Compiled by the author based on UN "World population Prospects: The 2012 Revision – medium fertility variant."
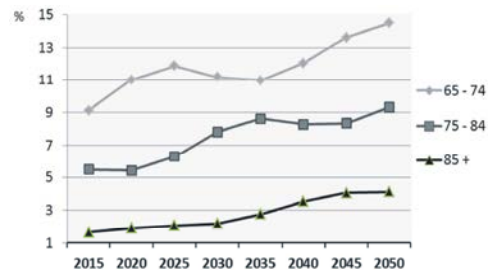

Fig. 2: Projection of post-productive age groups in new member states (EU 13), share in total population %.

Source: Compiled by the author based on UN "World population Prospects: The 2012 Revision – medium fertility variant."

(65-74), old-old (75-84) and oldest-old cohorts (85 and over). The proportion of the population in the age category young-old will increase from 9.1 percent in 2015 to 14.5 percent in 2050. This means that, by 2050, almost 14 million young-old retirees will require Medicare and Social Security in new member states of the EU.

By the year 2050, the share of the old-old (75-84) subgroup is projected to increase to 9.3 percent of the total population. For the next 35 years, the size of the old-old group in the total population of new member states of the EU will grow from 5.9 million in 2015 to 8.9 million inhabitants at the end of 2050. It will be caused by rapidly increasing life expectancy and the aftermath of the wave of aging Boomers who were born in the 1970s.

The population of the oldest-old age group, over 85 years, will record a proportional growth from 1.7 percent (2015) to 4.1 percent (2050). This oldest-old age group will be the fastest-growing segment of all three post-productive evaluated groups in the forecast for 2015-2050 (Figure 2).
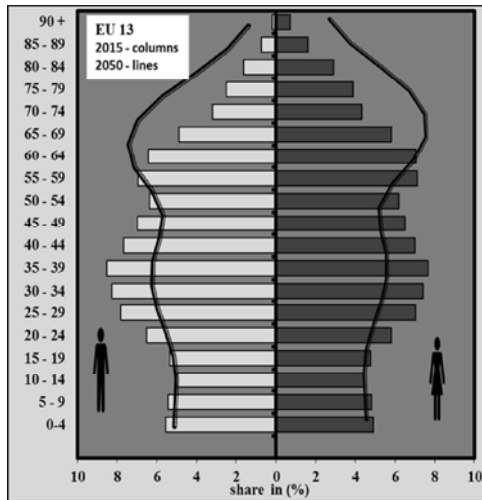
Fig. 3: Projection of age structure pyramids in new
member states of the EU (2015 and 2050)
Source: Compiled by the author based on UN
"World population Prospects: The 2012 Revision
– medium fertility variant."

Table 1: Variable analysis of ageing index (%) in new member states of EU
(2015, 2050)

	Minimum	Lower quartile	Average	Upper quartile	Maximum	Standard deviation
2015	55.4	75.2	83.6	93.5	107.4	13.6
2050	103.2	127.3	140.7	157.1	174.3	20.7

Source: Author's calculations

Table 2: Variable analysis of old-age population dependency ratio (%) in
new member states of EU (2015,2050)

	Minimum	Lower quartile	Average	Upper quartile	Maximum	Standard deviation
2015	19.9	24.3	26.8	30.5	32.2	3.8
2050	41.3	48.1	51.2	55.2	60.2	5.5

Source: Author's calculations

Table 3: Variable analysis of potential support ratio (%) in new member
states of EU (2015,2050)

	Minimum	Lower quartile	Average	Upper quartile	Maximum	Standard deviation
2015	310.1	331.3	380.2	417.1	501.3	61.1
2050	166.2	181.5	197.1	209.2	241.9	22.5

Source: Author's calculations

Table 4: Variable analysis of parental support ratio (%) in new member
states of EU (2015,2050)

	Minimum	Lower quartile	Average	Upper quartile	Maximum	Standard deviation
2015	4.2	8.3	8.2	9.4	10.4	1.8
2050	15.6	18.1	21.6	25.2	34.2	5.7

Source: Author's calculations

The pyramids that were constructed from the data set
projection for new member states of the EU have a sharp
regression (Figure 3). For that type of the population
pyramid, we can observe typical patterns like low birth
and death rates and long life expectancy, where the
population is generally older on average. With respect to
gender, females are less numerous than men in all youth
groups between 2015 and 2050 (0-4, 5-9, 10-14, 15-19).
There is a considerable gap in the proportion of males to
females in the age category 75-79. It represented 1.4
percentage points in 2015. Among all categories, the
proportion of women in 2015 will dominate in cohorts
older than 55-59 years. Since women live longer than men,
they have a dominant representation in the oldest age
groups [11, 12].

The population forecast suggests that, in new
member states of the EU, the ratio of people aged 65 or
over to the youth population younger than 19 will almost
double, from 81 per hundred in 2015 to 146 per hundred in
2050 (Figure 4). The ageing index will range in 2050 from
103.2 for Latvia to more than 150 for Romania (153),
Croatia (157), Poland (158), Slovenia (159) and Malta (174).
The population projection for 2015 indicates that all new
members of the EU (except Bulgaria) will constantly have
a higher percentage of youth than elderly persons. But,
due to a low birth rate in the next few decades, the number
of youth will be significantly decreased in all new
members of the EU.

We found three different categories as a result of the
cluster analysis according to the ageing index. The first
group includes the regions with the highest values on the
ageing index in 2050 ($\geq 149 \leq 174$). These countries
include Slovakia, Romania, Croatia, Poland, Slovenia
and Malta. The second group represents a cluster
with moderate rates on the ageing index ($\geq 127 < 149$).
These countries include the Czech Republic,, Hungary,
Cyprus and Bulgaria. The third category aggregates
countries with the lowest values on the ageing index in
2050 ($\geq 103 < 127$). The best situation will be in Latvia,
Lithuania and Estonia.

Relatively more countries with the highest values on
the ageing index will be observed at the end of the
forecast period in southern Europe. This trend may have
a severe impact on changing society's resources as they
are shared between productive and post-productive
cohorts of citizens.

An important measure of population ageing is the
old-age population dependency ratio. The old-age
dependency ratio is the number of persons 65 and over
per one hundred persons 20 to 64 years. It is a significant
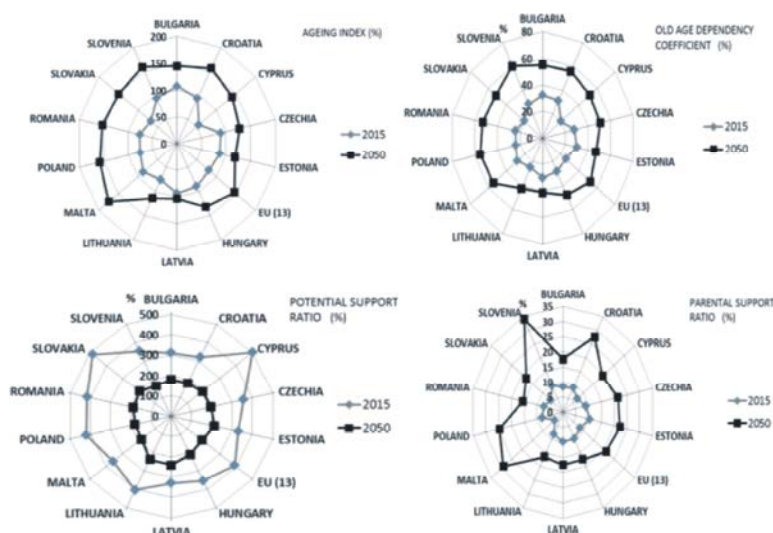indicator, which provides trends in the level of potential

Fig. 4: The projection of selected indicators of ageing in new member states of EU
Source: Compiled by the author based on UN "World population Prospects: The 2012 Revision – medium fertility variant."

Table 5: Selected parameters of population ageing in new member states of EU 2015

2015	Parameters							
	65 + (%)	65-74 (%)	75-84 (%)	85 + (%)	AI (%)	OADC (%)	PSR (%)	PS (%)
Bulgaria	19.9	11.7	6.5	1.7	107.4	32.2	310.1	8.3
Croatia	19.0	9.9	7.1	1.9	93.5	31.2	320.6	8.9
Cyprus	12.8	7.6	4.0	1.2	55.4	19.9	501.3	6.9
Czech rep.	17.6	10.9	5.0	1.7	89.1	28.0	356.5	8.8
Estonia	18.4	9.6	6.7	2.0	87.4	30.3	330.2	10.4
Hungary	17.7	10.0	5.7	1.9	88.8	28.3	353.8	9.8
Latvia	18.6	9.8	6.8	2.0	93.1	30.2	331.3	9.8
Lithuania	15.7	8.5	5.6	1.6	75.2	24.8	403.6	8.1
Malta	17.4	10.4	6.0	0.9	86.2	27.9	358.7	4.2
Poland	15.3	8.5	5.1	1.7	75.4	23.8	419.8	8.2
Romania	15.4	8.3	5.7	1.4	76.2	24.0	416.6	7.6
Slovakia	13.6	8.2	4.1	1.3	66.8	20.6	484.9	6.2
Slovenia	17.8	9.5	6.3	2.1	93.7	28.3	353.6	9.7
European Union (13)	16.3	9.1	5.5	1.7	81.0	25.6	390.5	8.3

Table 6: Selected parameters of population ageing in new member states of EU 2050

2050	Parameters							
	65 + (%)	65-74 (%)	75-84 (%)	85 + (%)	AI (%)	OADC (%)	PSR (%)	PS (%)
Bulgaria	28.6	14.9	10.3	3.4	145.1	55.2	181.2	17.5
Croatia	29.2	13.8	10.0	5.4	156.8	55.9	179.0	27.6
Cyprus	27.5	14.2	9.0	4.3	139.9	52.1	192.1	19.2
Czech rep.	26.7	13.5	9.4	3.8	127.5	50.9	196.4	21.4
Estonia	25.2	12.4	8.7	4.1	118.0	47.1	212.4	22.2
Hungary	26.0	13.7	8.9	3.4	131.7	47.8	209.0	17.4
Latvia	22.8	11.7	7.8	3.3	103.2	41.3	241.9	17.5
Lithuania	23.5	12.1	8.1	3.4	113.6	42.2	237.0	16.3
Malta	29.3	14.2	8.9	6.3	174.3	54.5	183.6	28.9
Poland	29.1	15.2	9.0	4.9	157.9	55.4	180.5	24.7
Romania	28.2	14.9	10.2	3.2	152.8	53.0	188.6	15.6
Slovakia	27.7	15.2	8.9	3.7	148.8	51.5	194.1	17.9
Slovenia	30.4	13.8	10.5	6.0	159.3	60.2	166.2	34.2
European Union (13)	28.0	14.5	9.3	4.1	146.2	52.8	189.3	21.0

NOTE: AI (%) – Ageing index, OADC (%) – Old age dependency coefficient, PSR (%) – Potential support ratio, PS (%) – Parental support
Source: Compiled by the author based on UN "World population Prospects: The 2012 Revision – medium fertility variant"
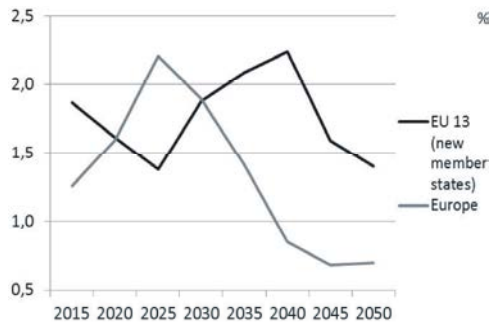
Fig. 5: Projection of Dynamic Ageing index
Source: Compiled by the author based on UN "World population Prospects: The 2012 Revision – medium fertility variant."

support needs between generations. According to the population forecast in new member states of the EU, the high shift will be accomplished by 2050, with more than 53 individuals in the post-productive age (65 and over) per hundred persons in productive age (20-64). The increasing trend in the old-age dependency ratio in our forecast implies serious growth of elderly persons from 2015 to 2050 in all new member states of the EU (Figure 4). From 2015 to 2050, the old-age dependency ratio will increase from 26 to 53. Similar trends will be found in other countries across Europe; this is the consequence of the substantial growth in the proportion of elderly persons, which is the result of diminishing productive cohorts in society. Regional differences in old-age dependency ratios in new member states are distinct. The highest values will be recorded in Poland (55 elderly persons per hundred persons 20 to 64 years), Croatia (56) and Slovenia (60).

The potential support ratio is an alternative method for expressing the mathematical relationship between the post-productive or dependent population and those who are economically productive. Using this method, we can perceive the substantial burden of risk of the ageing process; this ratio can be used as a measure of the burden of threat. The potential support ratio will show a dropping trend, affirming the ageing of the population. By 2015, this indicator in new member states of the EU will represent 391 people of working age (20-64) per 100 persons 65 or over (Figure 4). The projection suggests this indicator will decrease to as low as 189 people of working age (20-64) per 100 persons 65 or more by 2050. The declining trend in the potential support ratio does not necessarily mean that the number of elderly is increasing, nor that the productive population is decreasing. Rather, the pattern

is caused by advanced medical and social improvements through which the proportion of elderly persons will significantly increase in the next decades. Therefore, these results predict that the economically productive population will diminish day by day.

The first group, with the highest values of potential support ratio in 2050, is represented by two Baltic countries, Latvia and Lithuania (($\geq 237 \leq 242$). The second group includes countries with moderate rates of potential support ratio ($\geq 189 < 237$). These are Romania, Cyprus, Slovakia, the Czech Republic, Hungary and Estonia. The third cluster represents countries with the lowest value of the indicator ($\geq 166 < 189$) in 2050. Countries like Slovenia, Croatia, Poland, Bulgaria and Malta, will be described in 2050 as having the worst potential support ratios in the region.

The parental support ratio reflects significant social groups and the relationship between the oldest-old (85 and more) and their supposed descendants, who were born when the older persons were in their twenties and thirties. The projection of the relationship between the generation of "parents" (85 and more) and their "children" (50-64 years) validates the ageing of new member states of the EU. Because of special care, family or social support, people are living longer and thus we can expect growth in this indicator. It is predicted that, in new member states, the parent support ratio will rise from 8 oldest-old persons per 100 people age 50-64 in 2015, to 21 oldest-old persons per 100 people age 50-64 years in 2050 (Figure 4).

The dynamic economic ageing index in the 13 new member states of the EU, as well as in Europe, during the forecast period, will reflect positive values; this indicates that the population will be ageing.

In the years 2015 – 2050 the range of values of the dynamic index economic ageing index will vary in new member states of the EU from 1.9 to 1.4 per cent. The highest value will be reached in 2040 (2.2 per cent).

DISCUSSION

The article attempts to provide answers to questions about changes in the age structure and processes related to population ageing. Ageing is a process ongoing in new EU members; therefore, it is necessary to understand its consequences with respect to the particular needs of non-working oldest-old cohorts and issues of access to social and health services for older persons. Elderly people must have a chance to participate in activities that help them build confidence and intergenerational relations.

Most of the published studies dealing with population ageing; refer to a significant relationship between socioeconomic and ageing indicators [13-16]. There are also papers, which come to similar outcomes as in our study. These analyses evaluate the impact that ageing is having in the World; examines trends, impacts and responses within the next few decades [8, 17].

Population ageing is one of the most typical features of the second demographic transition [19]. Authors [20-27] offers an interesting view of ageing, comprises the changes of age structure, which are indicated by the decrease in the number and proportion of children in the population and increase in the number and proportion of the higher age population cohorts. They are also dealing with the socioeconomic transformation of region's and geodemographic polarization processes in selected regions.

Unfortunately, ageing forecasts for new member states of the EU are very pessimistic. Both the ageing indicators and trends show that the process of ageing will accelerate by 2050. For the EU, it is crucial to prepare action plans that offer real political solutions successfully to eliminate the negative aspects of population ageing for its inhabitants.

During the transformation period in Central and Eastern Europe, social inequality and regional disparities have led to changes in demographic behavior. The consequences of these changes have affected labour and housing markets. Increasing unemployment and real estate prices have also contributed to a decrease in the fertility rate and an increased number of abortions.

CONCLUSION

The primary and synthetics indexes of an ageing population, according to the forecast (medium fertility) do not seem to be very optimistic for continents in our survey. The swift transformation of the age structure in new member states of the EU the "decampment" of youth people and the rapid increase of elderly cohorts give rise to essential health and social issues, among others; awkward tension on health and social services like the encouragement of healthy habits and health status monitoring, treatment and long term medical services to meet the ageing society's demands.

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