



old age. Thus, the entire structure of the time spent by each cohort changes, or with the increase in the total number of years of life, the number of years lived in the working age and older ages, increases even more rapidly [17].

The importance of changing the age structure of the population and its consequences for social and economic development was recognized in the Program of Action adopted by the International Conference on Population and Development in 1994. Subsequently, the Madrid International Plan of Action on Population Aging [14] was adopted to ensure dignity, social integration and the improvement of living conditions for this large age group.

Developing social policies for older people has to be a central task of policy-making in aged societies. Thus, the importance of developing of demographic aging plays a special role. Therefore, it is important to see the main determinants that have led to the evolution of this process, in order to understand the priorities of this phenomenon. It is necessary to make a comparison between countries where the level of socio-economic development is much higher and faced demographic aging earlier and successfully managed to cope with this phenomenon, positively addressing the growth of the elderly population.

The aim of the research is to observe which are the peculiar factors, that led to demographic aging in the Republic of Moldova and in the European selected countries, from the perspective of the main drivers of aging. Given the fact that many of European countries are at the last phase of demographic transition and others are at early stages, and demographic dynamics are different, the division of the countries has been made. Among the Western European countries can be mentioned: Germany, Italy and Czech Republic and from the Eastern European countries: Belarus, Bulgaria, Ukraine and the Republic of Moldova. This division was made in order to understand better the evolution of the main determinants of demographic aging.

Population ageing has an important interest among researchers. The most discussed works are of Sanderson W. C. and Scherbov S. [9, 11, 10], who proposed to substitute traditional indicators for measuring demographic aging with new indicators, based on a new forward-looking age measure.

Among Russian researchers the most known are the works of Scerbacova E., Vasin S., and Vishnevskii A. [18, 15, 16], they are interested in the changes in the age structures of worldwide populations, as a result of extremely low proportion of population at younger ages and a high proportion of working and old age populations. The author approaches the topic of retirement taking into account the dynamics of the life expectancy indicator, they discuss about the need to rise the retirement age, relying on the experience of other countries [15].

The research of demographic ageing process has evolved in the Republic of Moldova, especially in the last few decades. The latest report that includes information about population aging [1], describes the demographic crisis from the Republic of Moldova, which is manifested through the process of depopulation. According to the report, population aging in the Republic of Moldova takes place due to fertility decline (1.6 children per woman in 2014) and the percentage redistribution of the three large age groups (children, adults and elderly) in the total of population (18.5% – children, 64.4% – adults and 17.2% elderly for 2014). The forecasts on distribution show an increase of population aged 60 years and over of 23.4% in the total of population.

A special interest has demographic aging from the perspective of new measuring indicators [2]. The author, by calculating prospective age for the Republic of Moldova, got to the conclusion that this indicator decreased considerably for both sexes during the period 1970-2014 [2, p. 7]. Thus, the researcher underlines the importance of monitoring the new prospective indicators for ensuring the mitigation of the negative economic consequences of this phenomenon.

#### **Methods and used data**

For analysis of demographic ageing process, the countries were divided as it follows: Western European countries (Germany, Italy and Czech Republic) and Eastern European countries (Belarus, Bulgaria, Ukraine and the Republic of Moldova). Italy and Germany currently are at the highest level in European countries. Belarus, Bulgaria and Ukraine were chosen because of their similarities of demographic trends with the Republic of Moldova, as a result of demographic transition which occurred later than in Western European countries.

Research data is based on Human Mortality Database. For the Republic of Moldova data from the life tables provided by the working paper "*Producing reliable mortality estimates in the context of distorted population statistics: the case of Moldova*" by O. Penina, A. D. Jdanov and P. Grigoriev is used [6].

Data from Human Fertility Database was used for the analysis of the impact of fertility on demographic ageing. For the Republic of Moldova, present population was used for the calculation of TFR, which does not include migrants who have been absent from the country for more than 12 months [9].

To compare migration patterns of Western European countries and Eastern European countries data from World Population Prospects, 2015 revision, were used. ISTAT database was used to analyze which age groups mostly emigrate to EU.

As methods of research, classical approaches of demographic analysis of aging have been used. The analysis was made for the period 1970-2014, 1980-2015 – due to lack of data on the numbers of births provided by NBS of the Republic of Moldova.

**The main results.** Ageing results from the demographic transition, a process whereby reductions in mortality are followed by reductions in fertility. Ageing is a dynamic process, determined by the relative size of the younger and older cohorts in the population at different moments in time.

McCracken and Phillips [5] gave a description for the age structure of countries during each demographic transition phase (table 1). It is an explanation for using the demographic transition theory for explaining the spatial variations in population ageing.

Table 1

**Age structure of countries during each demographic transition phases**

Demographic Transition Phases	Age structure of countries during each demographic transition phases
<i>1. High stationary phase:</i> Birth rates and death rates are high. Population growth is kept at a low level by high death rates largely caused by famines, diseases and/or wars.	<i>During this phase, the population was young with fewer than 4 per cent of the population aged 65+</i>
<i>2. Early expanding phase:</i> Stable birth rate and rapidly declining death rate. Population growth is stimulated due to declining death rates as a result of improved nutrition, sanitation and access to medicine.	<i>During this phase, the population initially became younger before shifting into a process of contraction of the youth segment. When a country or region is in this phase it is expected that between 4 per cent and 6.9 per cent of the population will be aged 65+</i>
<i>3. Late expanding phase:</i> Declining birth rate and stable death rate at a low level. Population growth slows and is associated with urbanization of societies, shifts in attitudes to birth control and family planning and changing patterns of marriage.	<i>During this phase, the youth segment of the population contracted and the working age population expanded. During this phase, the proportion of the population aged 65+ will be between 7 per cent and 19.9 per cent.</i>
<i>4. Low stationary phase:</i> Stable low birth rate and stable low death rate. Population growth is very slow and there is little fluctuation in the death rate. The birth rate might fluctuate, caused largely by the influence of social and/or economic policy.	<i>During this phase, ageing would exist in a continuing pattern. During this phase, the proportion of the population aged 65+ will be between 20 per cent and 30 per cent.</i>

Source: McCracken and Phillips [5].

Thus, according to McCracken and Phillips's division, many European countries are in the fourth phase of demographic transition. In 2015 Italy, had a population aged 65 years and over of 22%, meaning that entered in the fourth phase of the demographic transition (table 2). In 2015, Germany had a population aged 65 years and over of 21%, being in the fourth phase of demographic transition. Czech Republic, in 2015, was in the third demographic transition phase, having a population aged 65 and over of 18%. It took 5 years for Italy and Germany to pass from a phase of demographic transition to another one.

Eastern European countries are still in the third phase of demographic transition, except Bulgaria which entered in the fourth stage of demographic transition in 2015, having a population of 65 years and over of 20%. Ukraine and Belarus had almost the same share of population aged 65 and over in 2015. In the Republic of Moldova, the proportion of the population 65 and over constituted 11% in 2015, meaning that the country is still in the third phase of demographic transition. The population of the Republic of Moldova needed almost 40 years to pass from the second stage of demographic transition to the third one (table 2).

Table 2

**Proportion of population by broad age groups (%),  
the Republic of Moldova and selected European countries, 1970-2015**

	Italy			Germany			Czechia			Belarus			Bulgaria			Ukraine			Moldova		
	0-14	15-64	65+	0-14	15-64	65+	0-14	15-64	65+	0-14	15-64	65+	0-14	15-64	65+	0-14	15-64	65+	0-14	15-64	65+
1970	25	64	11	23	63	14	21	67	12	29	62	9	23	68	10	24	66	9	32	61	6
1975	24	64	12	22	63	15	22	65	13	26	65	10	22	67	11	23	67	11	29	64	7
1980	22	65	13	19	66	16	23	63	14	23	66	11	22	66	12	22	67	12	27	65	8
1985	19	68	13	16	70	15	24	65	12	23	67	10	22	67	11	22	67	11	27	65	8
1990	17	69	15	16	69	15	22	66	13	23	66	11	20	67	13	21	67	12	28	64	8
1995	15	69	17	16	69	15	19	68	13	22	66	12	18	67	15	20	67	14	26	64	9
2000	14	68	18	15	68	16	16	70	14	19	68	14	16	68	17	17	69	14	24	66	10
2005	14	66	20	14	67	19	15	71	14	16	70	15	14	69	17	15	69	16	20	69	11
2010	14	66	20	14	66	21	14	70	15	15	71	14	14	68	18	14	70	16	19	70	11
2015	14	64	22	13	66	21	15	67	18	16	70	14	14	66	20	15	70	15	18	71	11

Source: *World Population Prospects, the 2015 Revision*, \*calculated based on Penina O., Jdanov D. A., Grigoriev P. [6].

Since 1980s it was observed a new demographic division among Western European countries and Eastern Europe, presenting different trends of fertility and mortality rates. For Western European countries are specific high levels of life expectancy, more and more people survive to older ages, thus, recording low mortality rates. Another specific feature of West European countries are extremely low fertility rates.

For Eastern Europe, the slow growth of life expectancy and high level of mortality rates, especially among ex-soviet countries are specific. Such development resulted in several European countries having a natural decrease in population when total number of deaths started outnumbering the total number of live births [7].

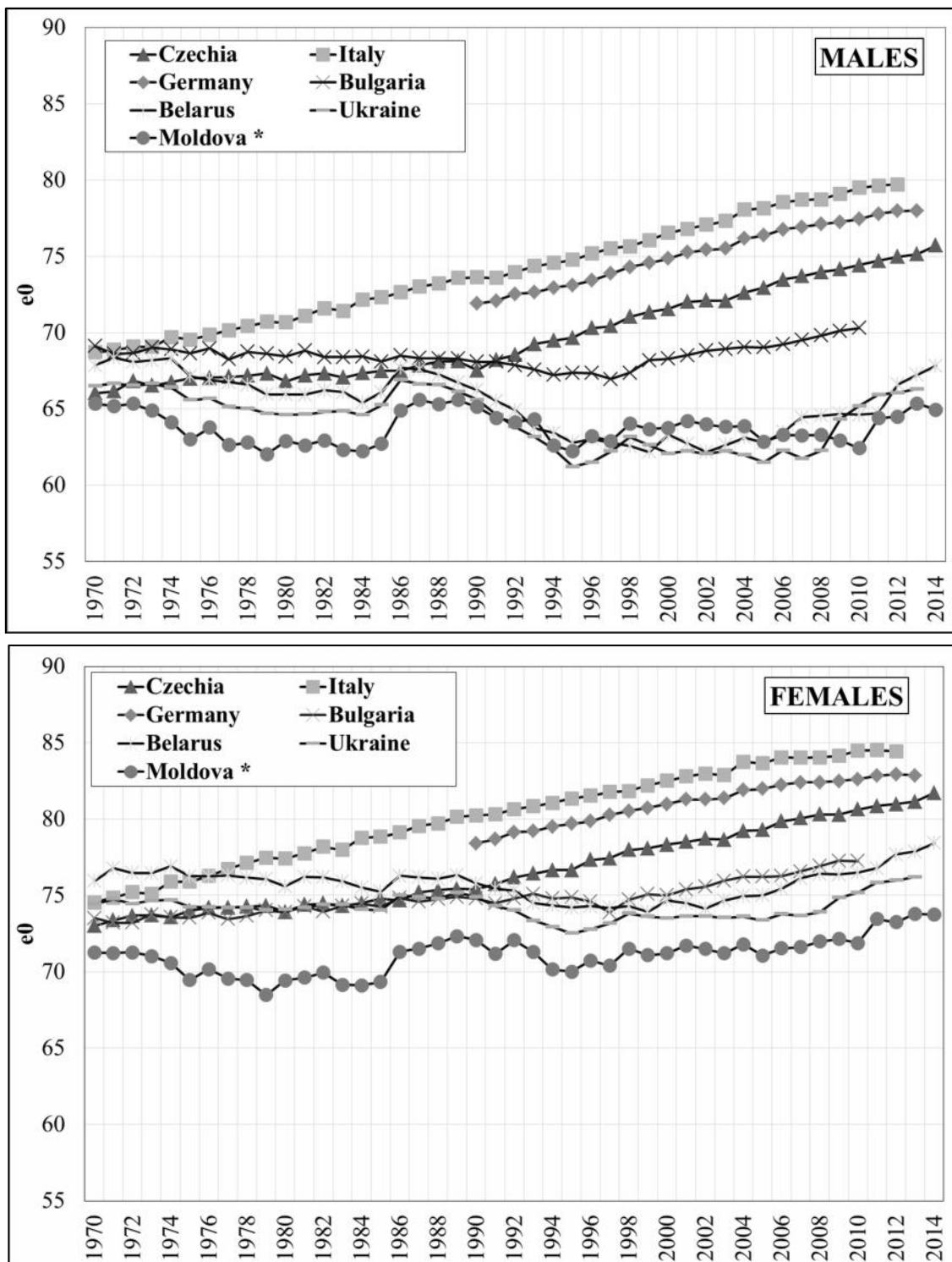
**Mortality contribution to ageing.** Economic development, improved lifestyles, advances in healthcare and medicine, including reduced infant mortality rate, have resulted in a continuous increase in life expectancy at birth across Europe during the last century. This process has been going on for longer in Europe than in most other parts of the world, placing the European countries among the world leaders for life expectancy.

The improvements in European countries were greater. Thus, Italy, as one of the most aged countries from Europe, recorded an increase of life expectancy at birth. During the period 1970-2012, life expectancy at birth for female population in Italy increased almost 10 years, male life expectancy at birth increased by 11.02 years. An increase of female life expectancy at birth about 9 years is observed in the Czech Republic, and almost 10 years for male population, during the period 1970-2014. Germany presents also high levels of this indicator, thus, for the period 1990-2013, female life expectancy at birth increased by 4.44 years and male life expectancy at birth increased by 6.08 years (figure 1).

The population of the Republic of Moldova has made gains in life expectancy, although life expectancy at birth is still low. The gap in life expectancy between the Republic of Moldova and the rest of Europe remains sizable. The countries from Eastern Europe face a low level of life expectancy at birth comparing to the rest of Europe. Thus, Bulgaria records an increase of female life expectancy at birth of 3.74 years, during the period 1970-2010. Belarus had an increase of just 2.48 years for female population, during the period 1970-2014, the same as in the Republic of Moldova. The lowest values for female life expectancy are recorded by Ukraine, which had an increase of just 1.78 years.

If for female population life expectancy at birth had a small increase, than for male population there is another situation. Thus, just in Bulgaria the values of this indicator grow up by 1.20 years. For Ukraine, Belarus and the Republic of Moldova life expectancy at birth reduced by 0.19, 0.05 and 0.39 years (figure 1). The slow growth of life expectancy at birth in the Republic of Moldova is due to the reduction of infant and child mortality, in a smaller measure at advanced ages, and the increase of mortality of working age population, especially for men [7]. During 1965-2014, the infant mortality rate

decreased almost five times, while child mortality decreased three times. Currently, infant mortality rate constitutes 9.7 deaths to 1000 live births (2014), which is close to the level recorded by Ukraine (8,9 – in 2012), and it is still higher than EU (3.8 – in 2013) [1].

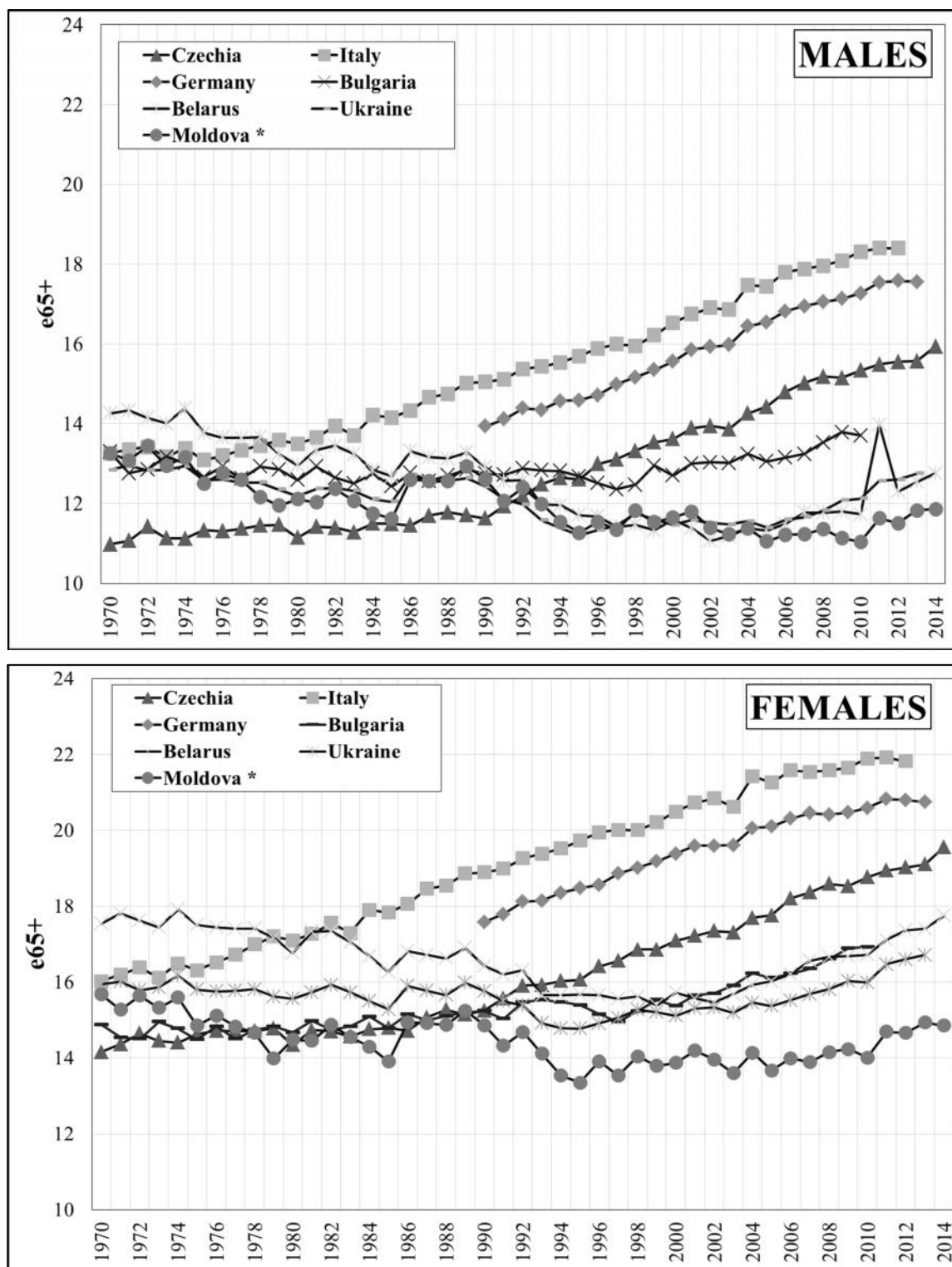


**Figure 1. Life expectancy at birth, both sexes, the Republic of Moldova and selected European countries, 1970-2014**

Source: Human Mortality Database, \*Penina O., Jdanov D. A., Grigoriev P. [6]

Demographic aging is a phenomenon that takes place due to a significant increase in the proportion of elderly people aged 60 (65) and over and the increase in life expectancy, fertility decline and migration of young people. In the last 40 years, the life expectancy of people aged 60 (65) years increased

by more than 20% in developed European countries, exceeding 20 years. During the period 1970-2012, female life expectancy at 65 in Italy increased by 5.80 years, while for male population the increase was about 5.14 years. Czech Republic recorded almost the same results for female life expectancy at 65 years as Italy, during 1970-2014. For male population the increase was about 5 years during the same period. Germany had an increase of life expectancy at 65 years for both male and female population about 3.39 years during the period 1990-2013 (figure 2).



**Figure 2. Life expectancy at 65, both sexes, the Republic of Moldova and selected European countries, 1970-2014**

Source: Source: Human Mortality Database, \*Penina O., Jdanov D. A., Grigoriev P. [6]

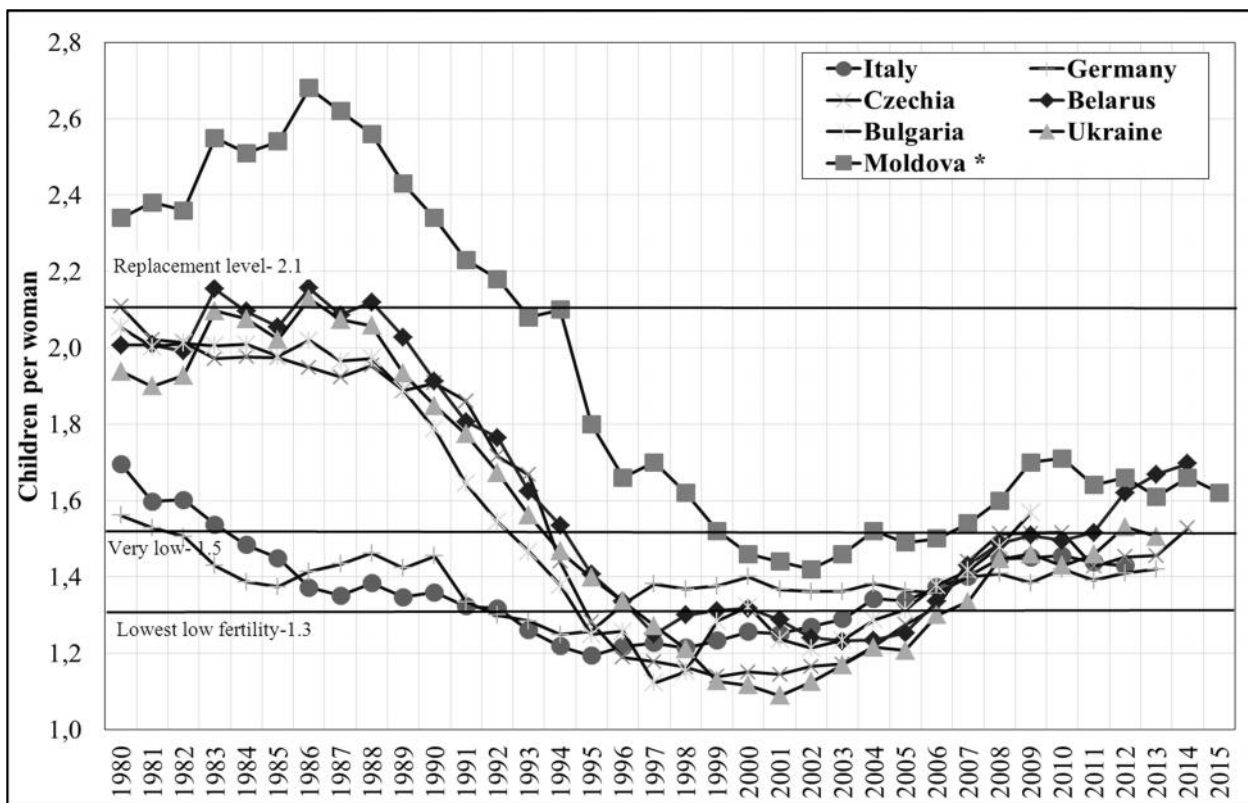
Demographic aging in Italy, Czech Republic and Germany takes place due to reduced mortality at older ages and significant increase of life expectancy. Thus, in these countries takes place demographic ageing from the 'top'.

Eastern Europe presents a different picture. The Republic of Moldova has the lowest values of life expectancy at age 65 for both women and men. Thus, during the period 1970-2014, this indicator recorded a decrease for females by 1.01 years and for males by 1.75 years (figure 2). Ukraine, Belarus and Bulgaria present a life expectancy at 65, of 1.86, 2.90 and 2.07 years for female population. For male population, Ukraine and Belarus has almost the same values of life expectancy as the Republic of Moldova. Bulgaria has lower values for male population, by 1.85 years comparing to Moldova.

In the Republic of Moldova the high level of elderly mortality and low life expectancy are an impediment for demographic ageing. The natural growth of population to the advanced and very advanced ages does not take place [1]. The high mortality of working age population lead to the loss of human potential, thus less population reaches old ages. Thus, the maintaining of a high level of population mortality slows down the increase of the number of elderly people in the total of population.

**Fertility decline.** Another factor that influences the deepening of demographic aging is low fertility. European countries have experienced a decrease in fertility below the level of 1.5 in 1982 in Germany, in 1984 in Italy and ten years after, Czech Republic has passed the level of 1.5 children per woman. For Germany and Italy, it took almost ten years to pass the level of lowest-low fertility – 1.3 children per woman. For Czech Republic, the fertility decline below 1.3 children per woman took one year. Currently, Germany and Italy are over the lowest low threshold of 1.3 children per woman, while it took about 9 years to pass it. For Czech Republic, the passing over the lowest low fertility level took about 11 years (figure 3).

The main vector in the evolution of fertility in European countries constitutes the transition from the early to the late model and the restructuring of birth calendar. The phenomenon of low fertility and lowest-low fertility in European countries was caused by fertility transition [12].



**Figure 3. Total fertility rate, the Republic of Moldova and European selected countries, 1980-2015**

Source: Human Fertility Database, \*calculated based on Penina O., Jdanov D. A., Grigoriev P.[6] and NBS of Moldova.

While all European societies experienced lowest low fertility rates, Eastern European countries are over very low (1.5) threshold of fertility rates. Thus, the period of maintaining under the threshold of 1.5 and even 1.3 for these countries is very short. Ukraine, Belarus and Bulgaria were under 1.5 level during a period of about 5 years. Currently, all these countries are over the threshold of 1.5 years children per woman.

The Republic of Moldova passed the replacement level in 1993 and 6 years later, the fertility decline was below 1.5. During the period 2000-2004, TFR remains with small fluctuations over the threshold of 1.5 children per woman. Beginning with 2007, TFR for the Republic of Moldova did not passed below 1.5 fertility threshold. During the period 2006-2015, the highest TFR for the Republic of Moldova was in 2010 – 1.71 children per woman.

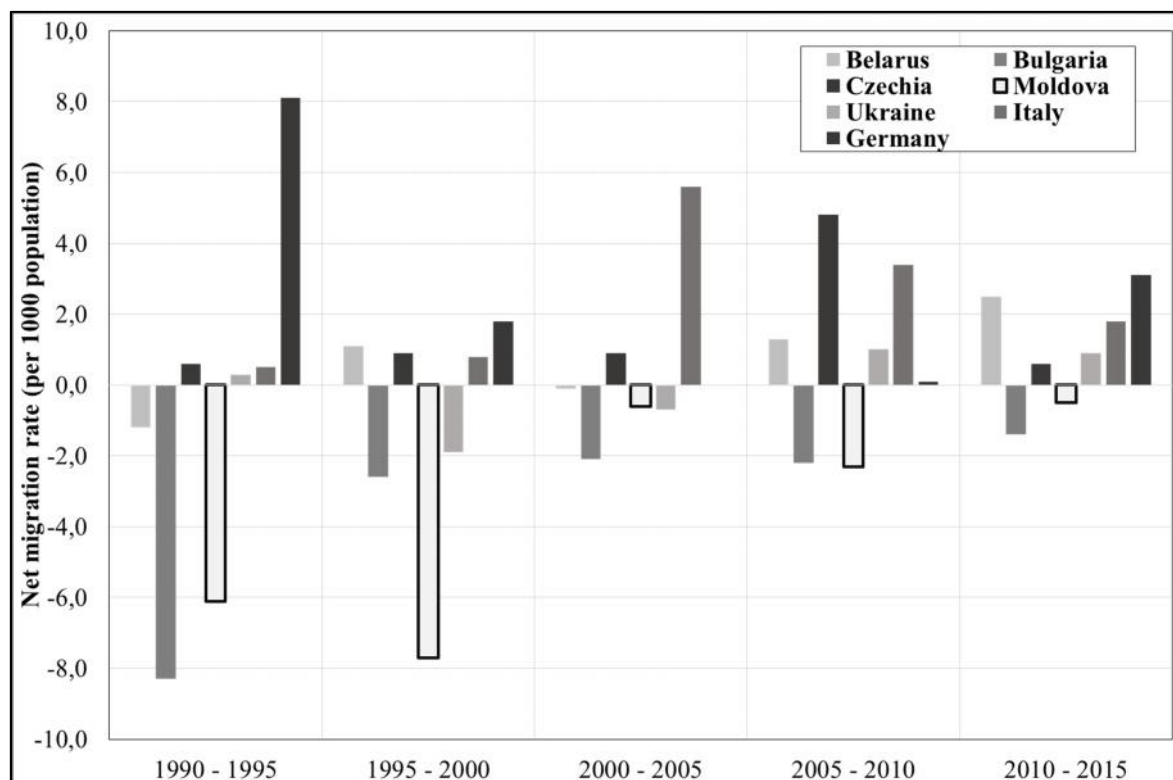
In perspective, even if TFR will have an increasing trend, the number of births will be very small and will not be able to offset the population decline caused by the growth of deaths as a result of demographic ageing [3].

In the Republic of Moldova, demographic ageing takes place due to fertility decline and percentage redistribution of the three age groups (youth, working age people and elderly). The reduction of mortality and the increase of life expectancy have an insignificant effect on this process. Thus, in the Republic of Moldova demographic ageing takes place from the 'bottom'.

**Migration contribution to aging.** Migration is a process that contributes to the population aging due to two factors: 1) the nature of migration (emigration or immigration) and 2) the age structure of migrant population.

Positive net migration in Germany, Italy and Czech Republic, during the period 1970-2015, has prevented these countries from experiencing the depopulation (figure 4), even if they face low fertility rates, and decreased share of young population.

Eastern Europe countries face the problem of emigration. This demonstrates the negative migration rates recorded by these countries. Belarus recorded negative migration rates during 1990-1995. Currently, among Eastern selected European countries, the Republic of Moldova and Bulgaria face massive population departures (figure 4), especially of working age adults, which accelerated population ageing.



**Figure 4. Net migration rate, the Republic of Moldova and selected European countries, 1970-2015**

Source: World Population Prospects, the 2015 Revision.

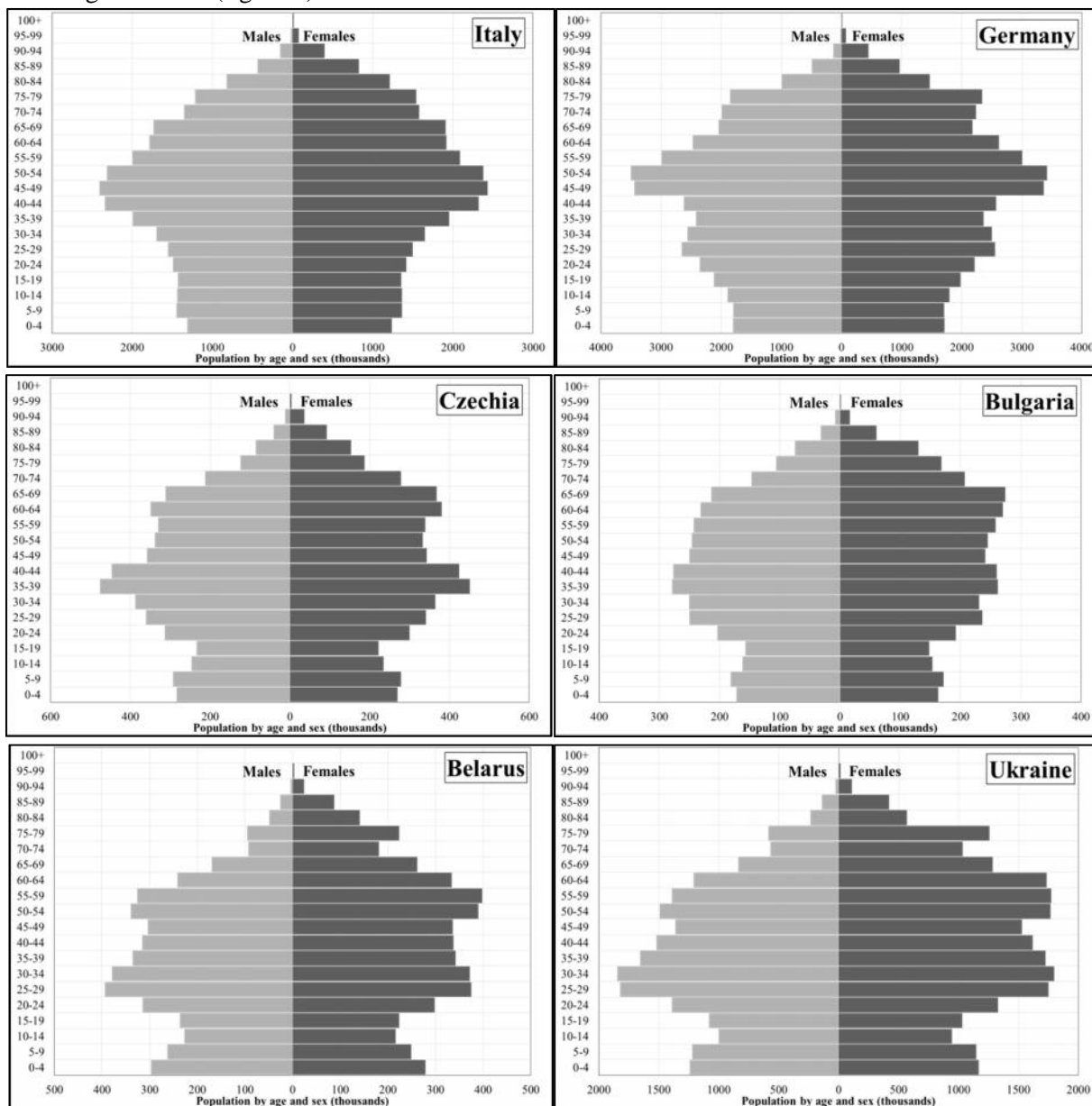


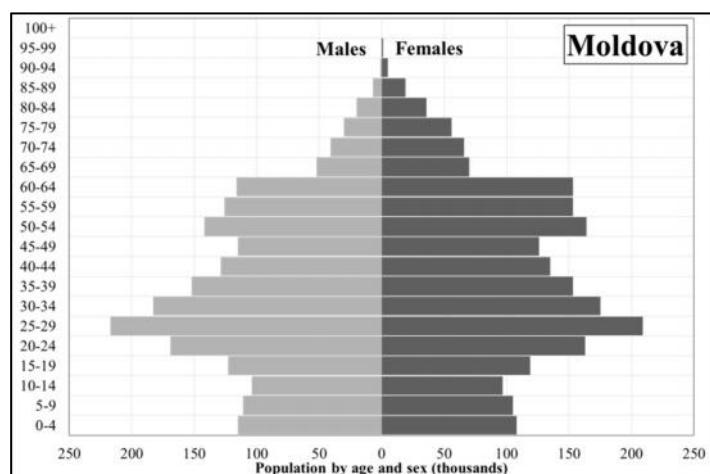
The vast majority of emigrants from the Republic of Moldova are youth and working age population. According to data, in both 2001 and 2011, the highest share of emigrants was between the ages 25 and 39, and constituted 11 and 12.5% from the total of emigrants. Only very few older people aged 60 years or older emigrated from the country [13].

It should be noted that migration statistics are notoriously imprecise. In many cases, just permanent changes of residence can be registered, thus it is impossible to know for sure how many people actually emigrated from or immigrated to a particular country. What is certain that the maintaining of negative net migration rate lead to the depopulation of the countries, respectively fewer births and the increase of share of older people [4].

**Age structure.** The main factor of population dynamics is the age structure, which was formed in the previous period as a result of the natural evolution of demographic processes and the impacts of the various historic cataclysms of the past (wars, famine etc.).

The age structures of the analyzed countries are characterized by some particularities. Thus, the age structure of Italy, Germany and the Czech Republic is more uniform, without enormous differences in the number of different generations, especially those of young and adults (figure 5). While the population structure of Belarus, Ukraine, Moldova is very irregular, with significant differences in the population of different generations (figure 5).





**Figure 6. Age structures by age group and sex, Italy, Germany, Czechia, Belarus, Bulgaria, Ukraine and the Republic of Moldova, 2015**

*Source: World Population Prospects, the 2017 Revision.*

Although, countries such as Belarus, Ukraine and the Republic of Moldova differ from Italy, Germany and the Czech Republic by the higher proportion of working-age population (table 2), in the near future they will reach the advanced age of the population and will complete the elderly population.

In Belarus, Ukraine and the Republic of Moldova, the age distribution of population is very irregular, reflecting the results of past events (wars, economic crisis), as well as policies effects promoted in the previous period. For example, the most numerous generations are those born after the war years and those born in the 1980s and early 1990s when the pronatalism policies were promoted.

The number of generations born at the end of the 1990s and early 2000s is low, which will determine the number of low births in the coming decades and will contribute to the deterioration of the population structure [1, p.68].

**Conclusions.** The study shows a considerable cross-national variation in ageing experiencing process. By providing comprehensive welfare state coverage for their older populations, in terms of pension payments, as well as in terms of health care, long-term care and social services protection, European countries as Italy and Germany have contributed to increasing the life expectancy of the population and reducing of mortality among elderly, leading to the increase of the proportion of older people. Czech Republic has also made a visible progress in the field of demographic policies, which have become more connected to the changes in the population structure.

The situation in Bulgaria, Ukraine and the Republic of Moldova is completely different. Although, aging populations increase, demographic policies being not yet being adapted to the extent that changes are previewed in the coming decades. The situation is relatively more favorable in Belarus, but this country is also going to take a set of measures in this area. For this group of countries, one of the major goals is to reduce mortality and increase life expectancy.

Developing social policies for older people has to be a central task of policy-making in an ageing society. But this is only part of the equation for securing a sustainable demographic development in the future.

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