

DEMOGRAPHIC CHANGES
AND THEIR IMPACT ON THE LABOUR
MARKET

Eva Grmanová

Centre of Sociological Research, Poland, 2021

The main goal of the scientific monograph *Demographic Changes and their Impact on the Labour Market* is to specify the impact of demographic changes on the labour market and to assess the impact of demographic changes on the labour force and employment rate. It was also the aim of the monograph to define the positive and negative effects of demographic changes on the labour market. This scientific monograph is intended for the professional public. Several scientific methods and approaches have been used in it. The author presents many of her own findings and conclusions on the issues researched.

Author:

doc. RNDr. Eva Grmanová, PhD.

Reviewers:

doc. PhDr. Ing. Aleš Gregar, CSc.

doc. PhDr. Jana Marie Šafránková, CSc

Approved as a scientific monograph in the Editorial Plan of the Faculty of Social and Economic Relations of the Alexander Dubček University of Trenčín in 2020.

The monograph is one of the scientific outputs of the VEGA project 1/0357/21 *Multiplier effects of human capital quality on economic performance and competitiveness of the Slovak economy*.

First edition, 2021

Publishing House: Centre of Sociological Research

<http://www.csr-pub.eu>

Szczecin, Poland 2021

All rights reserved.

Year of publication: 2021

ISBN 978-83-963452-3-3

DOI 10.14254/978-83-963452-3-3/2021

CONTENT

INTRODUCTION	5
1. POPULATION DEVELOPMENT	9
1.1 Development of population size in the EU	10
1.2 Population projections in the EU	12
2. LABOUR SIZE, ECONOMIC ACTIVITY AND INACTIVITY OF THE POPULATION	16
2.1 Size of labour force in the EU	19
2.2 Economic activity rate in the EU	27
2.3 Forecast of labour force size in the EU.....	29
2.4 Economic inactivity in the EU	33
3. ECONOMIC BURDEN ON THE PRODUCTIVE POPULATION	44
3.1 Development of the economic burden on the productive population in the EU.....	44
3.2 Trend of the economic burden on the productive population in the EU	51
4. POPULATION AGEING AND ITS IMPACT ON THE LABOUR MARKET	65
4.1 State and development of an ageing population in the EU ..	68
4.2 Comparison of population ageing in EU countries using the multi-criteria evaluation method	77
4.3 Population ageing and its consequences.....	80
4.4 Future changes in the structure of employment in connection with the change in population structure	85

4.5	Position of the elderly in the EU labour market	90
4.5.1	Employment of the elderly in the EU	90
4.5.2	Risk of poverty and healthcare for the elderly in the EU .	96
4.6	The impact of ageing on selected professions in the EU	98
4.6.1	Ageing of physicians in the EU and in Slovakia	99
4.6.2	Ageing of teachers in the EU	102
4.7	Active ageing in the EU	105
4.7.1	The state and development of active ageing in the EU .	105
4.7.2	An alternative approach to the evaluation of active ageing by data envelope analysis models	113
5.	MIGRATION	122
5.1	Development of immigration in the EU	122
5.2	Employment of migrants in the EU	126
6.	PRACTICES LEADING TO INCREASED ECONOMIC ACTIVITY	134
SUMMARY	137
DATABASE EUROSTAT	143
REFERENCES	146
ANNEX 1	154

INTRODUCTION

The current period is marked by significant demographic changes, which affect many areas of economic life. Last but not least, they affect the labour market and trigger quantitative and qualitative changes. The current demographic development, accompanied by declining birth rate, change in the population structure, population ageing and migration, is causing an imbalance in the labour market. Several changes are taking place, especially in the size and structure of the labour force and the structure of employees. Demographic development also affects the reproduction of labour force and the burden on the productive component of the population. Changes in the quantity and quality of labour force and changes in employment affect the country's economic performance. Therefore, addressing the changes in the labour market resulting from demographic development is becoming a current issue.

The aim of this scientific monograph is to specify the impact of demographic changes on the labour market and to assess the impact of demographic changes on the labour force and employment rate. Chapters of this publication summarise the positive and negative effects of demographic changes on the labour market and proposals for possible measures. This scientific monograph is intended for the professional public.

The resulting publication was drawn up after a long study of the issues and was preceded by the publication of professional scientific articles included in international databases (Grmanová, 2017, 1; Grmanová, 2017, 2; Koišová, Grmanová, Škrovánková, Kostrová, 2019; Navickas, Grmanová, Gajda, 2020; Grmanová, Ivanová, 2021) and the publication of a monograph written by a team of authors (Grmanová et al., 2018). In this monograph, the author presents many of her own

findings and conclusions based on empirical research into the impact of demographic changes on the labour market, especially in the EU. The impact of demographic changes on the labour market is analysed using a wide range of indicators.

We deal with trends in the development of time series and we monitor the dynamics of the changes. We analyse the dependence of changes in selected demographic processes and changes in the labour market. We compare changes in the context of the European Union and monitor the specifics at national levels (EU27 is an abbreviation for 27 EU countries). Special attention is paid to the position of the Slovak Republic in the EU. As part of the development analysis, we determine the tendencies of EU countries to convergence or divergence. We discuss forecasts of further demographic development and specify the possible future effects of demographic changes on the labour market.

Empirical research is based on a wide range of domestic and foreign sources. Own analyses and conclusions use data from available databases, mainly statistical offices.

Several scientific methods and approaches were used in the monograph. These include a wide range of mathematical and statistical methods. Regression and correlation analysis were used to determine trends in time series. Regression models were used to evaluate autocorrelation using Durbin-Watson statistics. The quality of forecasts based on time series trends is analysed using forecast accuracy measures. We use sigma convergence to analyse tendencies to convergence. Multi-criteria evaluation of variants is used in the analyses and basic data envelope analysis models are used. For a better graphic presentation, the publication contains charts, which were output from the statistical software Statistica or Microsoft Excel.

The monograph consists of logically related chapters. The first chapter focuses on population development in the EU. It discusses the issue of population development in detail. Much of the chapter deals with population projections and the changes that future demographic development may cause in the labour market. We discuss the decline in the size of labour force in the future. The second chapter deals with labour and economic activity, or economic inactivity of the population. Special attention is paid to the forecast of the size of labour force in certain areas depending on changes in the structure of the population. A significant part of the second chapter focuses on the reasons for economic inactivity. The third chapter deals with the economic burden on the productive component of the population. It includes an analysis of the development trend of the economic burden on the productive component of the population using regression analysis. The next chapter deals with population ageing and its impact on the labour market. Special attention is paid to the ageing of teachers and the ageing of physicians. One of the subchapters deals with active ageing and its importance for increasing the employment rate. In the penultimate chapter we examine the impact of migration on the labour market. We focus on the employment of migrants. The last, sixth chapter discusses in more detail the practices that lead to increased economic activity.

The purpose of all chapters of the monograph is to point out the need to prepare for changes in the labour market, which are and will be the result of demographic development. Thus, we draw attention to practices and measures in some EU countries that mitigate the negative effects of demographic changes on the labour market. Such findings may allow adequate action to be taken in other countries now, as well as in the future.

In conclusion, we would like to thank the reviewers of this monograph as well as other colleagues who contributed to improving the quality of the monograph and made suggestions for its improvement.

Author

1. POPULATION DEVELOPMENT

Changes in population development and demographic composition of the population put the issue of population development at the forefront of the public interest and have been the subject of political debate. They are reflected in many social and economic areas. Examining past demographic developments, their current and future state is important in several respects. One of them is the link between demographic changes and current labour market development. The search for interrelationships as well as the identification of measures aimed at mitigating some of the negative effects of demographic changes on the labour market is constantly increasing. In particular, the slowdown in population growth and the ageing process bring with it a number of challenges which are currently being addressed at national and international levels.

According to the European Commission (2018), the labour market is marked by demographic development. Changes in the size and structure of the population affect mainly labour productivity, the size and structure of labour force, labour reproduction, employment and unemployment. They affect expenditures on pensions, education, long-term social care, healthcare and employee benefits. They affect interest rate changes. On the other hand, population size is the result of the impact of several demographic processes. The most important are fertility, mortality (or life expectancy) and net migration.

As population development has a significant impact on the size of labour force, the first chapter deals with the issue of population development. In the first subchapter, we discuss the development of the population size in the EU. It contains analyses performed in the EU. EU countries are divided into groups according to their population development. The

period analysed is the period 2000-2020. In the second subchapter, we deal with population projections and their connection with the labour market. We follow the dynamics of possible changes in the population in the EU until 2100.

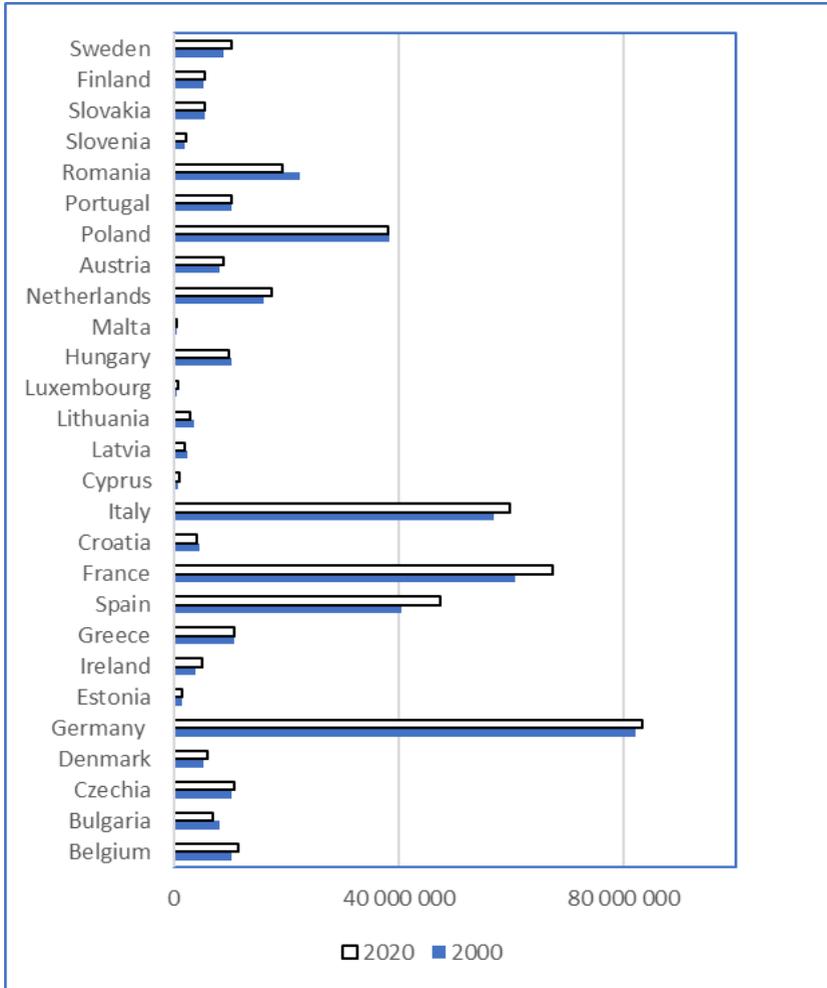
1.1 Development of population size in the EU

The size of the EU population has had a long-term growing trend. According to Eurostat (2021, 5) [demo_pjan], in the period 2011-2020 the EU27 population grew by 1.68%. However, it should be emphasized that although the EU's population is growing, its share of the total world population is declining. This is because the growth of the EU27 population is slower than the growth of the global population.

When analysing the changes in the size of the population in individual EU countries, we will focus on a longer period, i. e. 2000-2020. Population values in 2000 and 2020 are depicted in Chart 1. The size of the EU27 population increased by 4.40% during the period analysed. However, the EU countries did not have the same trends during this period. Based on population development, they can be divided into three groups:

- 1/ countries in which the population grew during the period analysed;
- 2/ countries in which the population decreased during the period analysed;
- 3/ countries in which the population decreased only in certain years of the period analysed.

Chart 1 Population in EU countries



Source: Eurostat (2021, 5) [demo_pjan]

The first group includes Belgium, Denmark, Ireland, France, Luxembourg, Malta, Netherlands, Austria, Slovenia (except 2008), Finland and Sweden. These countries are characterised by positive

economic development. On the other hand, not all economically strong countries are included in this group. For example, Germany is missing from this group.

The second group includes Bulgaria, Estonia, Latvia, Lithuania, Hungary, and Romania. These are countries with below-average economic growth. At the same time, according to Eurostat (2021, 5) [TPS00019], these countries had negative or very little positive net migration.

The third group includes all the other states. This group consists of countries with both below-average and above-average economic growth. It is therefore a group of very diverse EU countries, including Slovakia and the Czech Republic.

As the country's population and labour force are highly interlinked, it is likely that in countries experiencing a long-term population decline and not taking appropriate measures the size of labour force is shrinking as well. The long-term trend of declining population size may have a significant impact on the labour market.

1.2 Population projections in the EU

Analysis of the future impact of demographic changes on the labour market requires the projection of further population development. This makes it possible to anticipate possible future changes in the labour market and their dynamics. Thus, based on population projection, it is possible to look for ways to eliminate the negative effects of demographic development on the labour market in the following period.

Analysis of current demographic development and population projections can have a wide range of uses. They can serve as a basis in the labour market

- to estimate the size of the labour force;
- to estimate the change in the labour force structure by age;
- to estimate the degree of burden on the productive component by the non-productive component;
- to estimate changes in labour productivity;
- to estimate wage levels;
- etc.

Projecting further population development is a very difficult task. It is based on predetermined conditions, or assumptions. According to Klufová and Poláková (2010), a projection is always true (except for mathematical errors). It can serve as a warning. It models development by extrapolation, for example, on the basis of the development of the birth rate, mortality and other processes. Prognosis (forecast) is a special group of projections. It is unconditional.

In the next part of this chapter we will deal with the expected development of the EU population. In its evaluation, we use data from the Eurostat (2021, 5) database [proj_19np]. The database contains the last published projection (in June 2021) at five-year intervals. According to Eurostat (2021, 1), "population projections are 'what-if' scenarios that aim to show hypothetical developments of the population size and its structure based on a set of assumptions for fertility, mortality and net migration".

Based on the expected development of the population for the 27 EU countries (i. e. except for the United Kingdom), we can state that in the period 2019-2100 the population of the 27 EU countries will fall to 93.12%. However, the trend and dynamics of population development

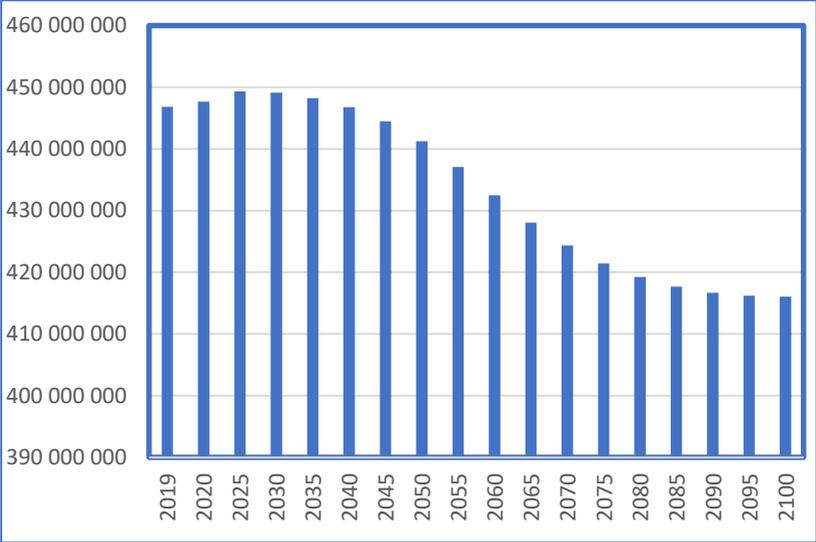
will change in the period analysed. Based on the population projections of the EU27 (excluding the United Kingdom), the population will increase slightly over the next decade. However, after 2030, the population of the EU27 is expected to decline. From the data at five-year intervals it is clear that the fastest declining dynamics in the EU27 will take place in the period 2055-2060. The second fastest decline will occur in the next five years. The graphical representation of the EU27 population projection is in Chart 2.

The projection shows that a more significant decline in the EU27 population can be expected in 30 to 40 years. Then, the trend of population decline will continue. For this reason, it can be assumed that unless appropriate measures are taken, a decrease in the size of labour force will occur in 30 to 40 years as well.

This trend could be significantly affected by:

- retirement age postponement;
- implementation of government support programs that will:
 - o favour companies employing people of post-productive age;
 - o favour people of post-productive age who remain in employment after exceeding the retirement age;
- increasing women's economic activity;
- introduction and expansion of alternative forms of employment;
- supporting labour immigration.

Chart 2 EU population projection until 2100



Source: Eurostat (2021, 5) [proj_19np]

2. LABOUR SIZE, ECONOMIC ACTIVITY AND INACTIVITY OF THE POPULATION

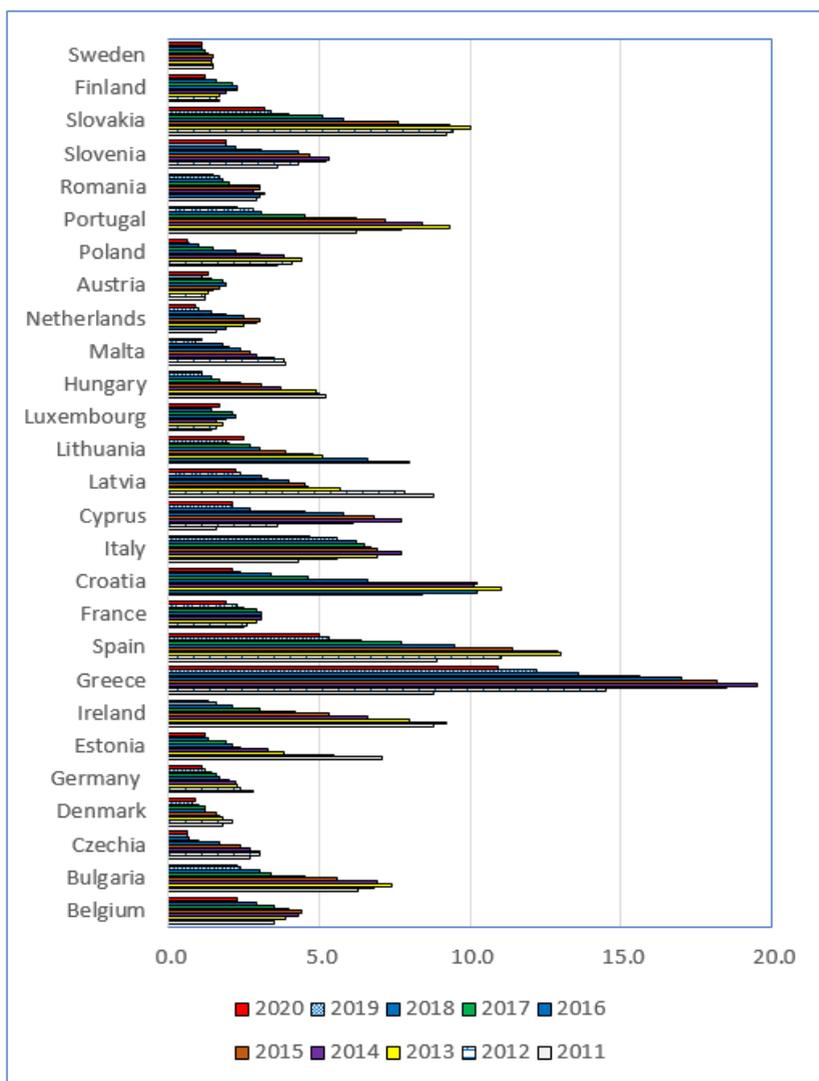
According to the European Commission (2016, 2), EU countries are currently burdened by a number of social problems that affect the labour market and need to be addressed in a long-term and systematic way. Such problems include long-term unemployment, youth unemployment, ageing labour force, shrinking labour force, early school leaving, limited labour mobility, gender differentiation and more. Most of these problems are very closely linked to demographic changes.

The first two subchapters of the second chapter analyse the development of the number of economically active people and the level of economic activity in the EU27 and in individual countries. The third subchapter deals with the forecast of the size of labour force based on the measures of economic activity. The last subchapter deals mainly with the reasons for economic inactivity and outlines possibilities of increasing economic activity.

Long-term unemployment

According to Eurostat (2021, 5) [une_ltu_a], long-term unemployment in the EU27 had a declining trend in the period 2011-2020 (decline from 4.2% to 2.4%). However, a large share of the long-term unemployed persisted. There were significant differences between EU countries. Greece had the highest long-term unemployment rate since 2012 - long-term unemployment was 14.5% in 2012 and 10.9% in 2020. Slovakia had above-average values of long-term unemployment throughout the period analysed (Chart 3).

Chart 3 Long-term unemployment in % of the active population in EU countries in the period 2011-2020



Source: Eurostat (2021, 5) [une_ltu_a]

Particularly at risk of long-term unemployment are young people (under the age of 35), low-skilled people and people working in declining sectors of the economy. Another group at risk is people of pre-retirement age.

Youth unemployment

Many current labour market problems in the EU are related to young people. Employers often require young people entering employment to have work experience and be practically ready to work in the field. Due to little work experience, the youth unemployment rate is higher than the average unemployment rate. It responds more sensitively to the economic cycle than the unemployment rate of other employees. Young people (under the age of 24) who are not employed and not participating in the educational process form a large share in economic inactivity.

Early school leaving is another persistent problem in relation to employment and unemployment. People who do not complete school attendance have a high unemployment rate. EU countries have been aiming to reduce the share of young people not completing school attendance. This goal is also formulated in the Europe 2020 strategy, which stated that by 2020 the share of young people not completing school attendance should fall to 10%. People not completing school attendance often do not find employment and therefore do not contribute to the employment rate.

Unemployment of people of pre-retirement age

As the population ages, the share of people of pre-retirement and retirement age is constantly increasing. People of pre-retirement age who become unemployed find it more difficult to find a new job and often become long-term unemployed. One of the reasons is that they

have less digital and language skills. At the same time, they are less willing to participate in retraining courses to change their current job orientation, or employers are not willing to invest in their education.

In all EU countries, activities aimed at mitigating the negative trends related to unemployment are taking place. It is becoming necessary to develop new incentives aimed at building a positive environment leading to the creation of suitable jobs.

According to the European Commission (2016, 1, p. 8), the dynamics of employment growth varies depending on age. The largest increase in employment can be observed in the age group 55-64. One of the main reasons is postponing retirement age. The employment of young people and people of working age is growing slightly. The activity rate of people of working age is rather constant.

The dynamics of the employment rate also varies depending on qualifications. The employment rate of the highly qualified group is rising. On the contrary, the employment rate of the low-skilled labour force is declining.

2.1 Size of labour force in the EU

Labour force influences the social and economic development of each country. It can be characterised by several indicators. The basic indicators are its number and structure. We study the structure of labour force from several perspectives - according to age, gender, education, the share of workers and unemployed, as well as from other perspectives. The size and structure of labour force is influenced by population development. According to Infostat (2006), the demographic

processes of mortality and migration have a direct effect on labour force. Fertility affects labour force over a period of time (with a time lag of 15 to 25 years). It is important to note that the size of labour force is also influenced by political decisions, e. g. the retirement age, the length of compulsory school attendance etc.

In this subchapter, we will focus on the development of the size of labour force and on finding ways to reduce the economic inactivity of the population.

According to Infostat (2006), labour force is understood as the economically active population. The size of labour force is thus equal to the number of the economically active population. These are all persons aged 15 and over who are either employed or unemployed. „Economically inactive population by LFS are persons who have no job in the reference week because they are students and apprentices, pensioners, persons keeping household, persons in retraining course and therefore they were not seeking a job actively during the last four weeks or they are seeking a job but they are not able to start work within two weeks. Persons on parental leave, discouraged workers (they would like to work but are not seeking a job because they do not believe to find suitable job) and persons younger than 15 years are also included.” (Statistical Office of the Slovak Republic, 2017, p. 98).

In connection with the analysis of the development of labour force, we can currently observe the following specifics:

- the economic activity of women is increasing;
- the economic activity of young people is decreasing;
- the economic activity of people of pre-retirement age is decreasing (Infostat, 2006).

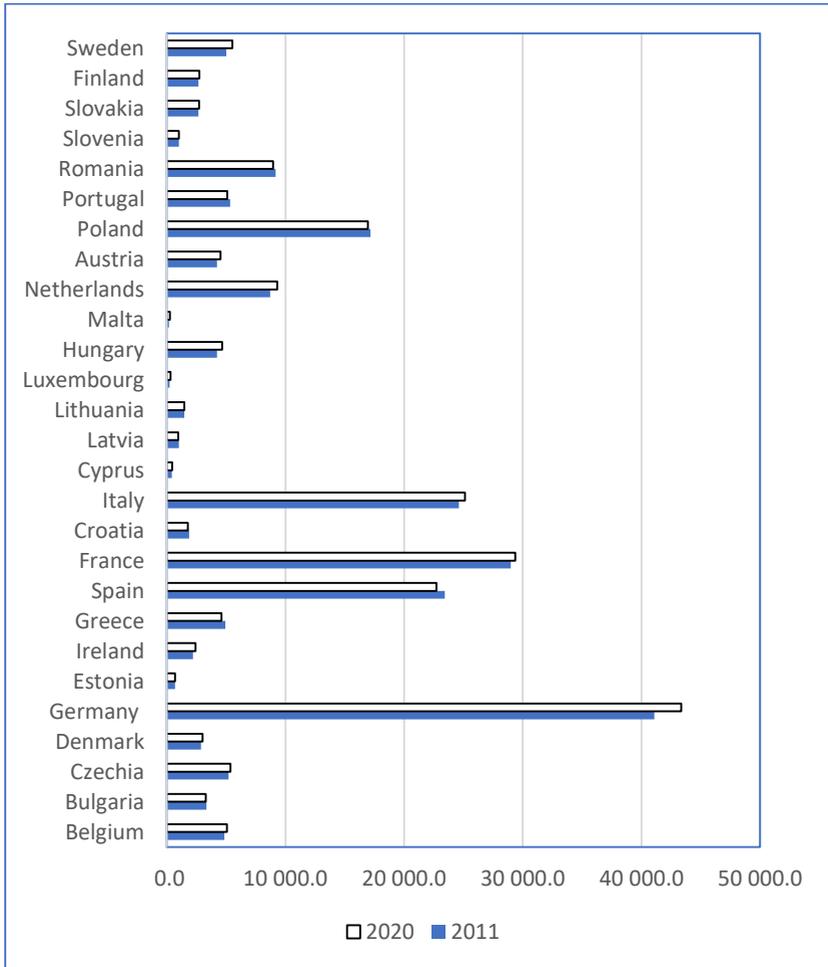
Number of the economically active population

When analysing the size of labour force in the EU, it is our intention to monitor the trends in the development of its size. We will focus on identifying differences in the size of the economically active population (i. e. in the number of economically active people) in individual EU countries and on finding connections with other factors.

When examining the state and development of the number of economically active people in the EU27 countries, we used data from Eurostat (2021, 5) [lfst_r_lfp2act]. We compared the development of the number of economically active inhabitants in thousands in the period 2011 and 2020. The age group are people aged 15-74. The number of economically active people in thousands in 2011 and 2020 is in Chart 4.

In most EU countries, the economically active population has grown. The largest percentage increase was in Malta, where their number rose to 153.38%. The second largest percentage increase was in Luxembourg, where the economically active population rose to 132.54%. The number of economically active people in the Slovak Republic was growing until 2017. Then it started to decline every year. Compared to 2011, a slight increase was recorded until 2020 (by 1.15%). The number of economically active people in the Czech Republic grew until 2018. Then it started to decline every year. However, compared to 2011, a slight increase was recorded until 2020 (by 1.14%).

Chart 4 Number of economically active population in thousands in 2011 and 2020 in the EU27



Source: Eurostat (2021, 5) [lfst_r_lfp2act]

Not all countries that have encountered a decline in population have encountered a decline in their economically active population. A decrease in population and at the same time a decrease in the number

of economically active people in the years 2011 to 2020 took place in the following countries: Bulgaria, Greece, Croatia, Latvia, Lithuania, Poland, Portugal and Romania. Spain has seen a decline in the economically active population, although the population itself has not declined. The largest relative decrease in the values of the indicator analysed was in Greece and Latvia. Greece and Latvia are characterised by an unfavourable social and employment situation. Greece has a high unemployment rate, youth unemployment rate and income inequality (measured by the S80/S20 indicator). Latvia is characterised by significant income inequality (European Commission, 2016, 1).

There are countries in the EU, where the population has declined and that have a disadvantageous social and employment situation at the same time. Nevertheless, there was no decrease in the number of economically active people. These include Lithuania and Hungary. It is clear that measures have been taken in these countries to reduce the decline in the economically active population despite unfavourable demographic and social developments.

We can therefore say that the size of labour force is currently increasing in most EU countries. The decline in the size of labour force is mainly in countries where the employment situation is unfavourable and a long-term decline in population is taking place. On the other hand, it is clear that the size of labour force is influenced not only by the size of the population, but by a range of other factors as well. Measures taken at government level can reduce the impact of negative population and economic development on the size of labour force.

Gender differentiation

The size of labour force is marked by gender differentiation. One of its main reasons is the fact that children are mainly taken care of by

women. Therefore, the number of economically active men outweighs the number of economically active women in all EU27 countries. In 2020, women formed the largest share of the economically active population in Lithuania (49.67%) and Portugal (49.48%). By contrast, women formed the lowest share in Malta (40.92%).

From 2011 to 2020, the number of economically active women in the EU27 increased. The number of economically active women decreased in Bulgaria, Greece, Croatia, Latvia, Lithuania, Poland, Portugal and Romania. In countries where the number of economically active women decreased, the number of economically active men decreased too. The exceptions were Romania and Lithuania.

The increase in the number of economically active women in the EU27 was greater than the increase in the number of economically active men. Thus, the number of economically active women is approaching the number of economically active men. And the gender gap in the number of economically active women and men in the EU is narrowing.

The number of economically active women is influenced by many factors. The important factors include: length of parental leave, equipment of preschool facilities, flexible forms of work organization and persistent habits. However, we must not forget the growing trend in the number of single mothers, who are often forced to start working earlier and thus provide for the material needs of themselves and their children.

In terms of gender differentiation, changes can be expected in the labour market. With increasing labour shortages, employers will become increasingly motivated to adopt approaches that support women's employment in companies. We assume that, in addition to the

flexible forms of work organization offered, other approaches will start emerging, such as home office, building children's centres directly in the company premises etc.

Economic activity in the age group 15-24

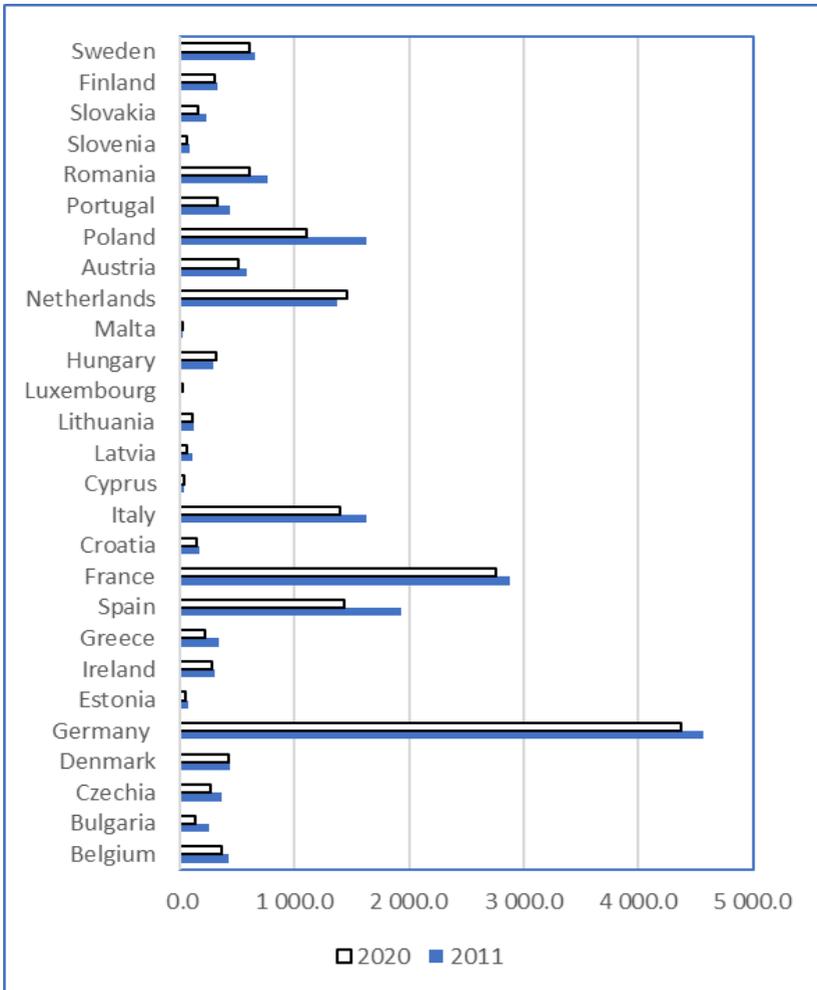
Based on data from Eurostat (2021, 5) [lfst_r_lfp2act], we focused on analysing the development of the number of economically active population in the age group 15-24 in the period 2011-2020. In most EU countries, the number of economically active people in the age group 15-24 declined. It increased in the following countries: Luxembourg, Malta, Hungary and the Netherlands. The largest percentage increase was in Luxembourg, where the number rose to 154.73%. The largest percentage decrease in the number of economically active population in the age group 15-24 occurred in Bulgaria (to 52.88%) and Latvia (to 54.73%). A declining trend of the indicator was also found in the Slovak and the Czech Republic. The number of economically active inhabitants in the age group 15-24 decreased in the period analysed to 69.01% in the Slovak Republic and to 71.23% in the Czech Republic. The number of economically active population aged 15-24 in thousands in 2011 and 2020 is in Chart 5.

The development of economic activity of people aged 15-24 is largely due to the positive trend in the number of young people participating in the educational process. Recent advances in a number of areas, notably technology, raise the need to increase education. As a result, more and more young people in the age group 15-24 participate in the educational process, and this is reflected in their level of economic activity.

We can therefore state that there is currently an absolute decline in the size of labour force in the age group 15-24 in the EU27 countries. This decline is mainly due to the declining population in the age group

15-24 and the higher number of young people participating in the educational process.

Chart 5 Number of economically active population aged 15-24 in thousands in 2011 and 2020



Source: Eurostat (2021, 5) [lfst_r_lfp2act]

2.2 Economic activity rate in the EU

The economic activity rate is expressed as the ratio of the economically active population to the number of inhabitants. The state and development of the economic activity rate and its gender differentiation are directly connected to the labour market.

The share of the economically active population in the total population can be affected by:

- population ageing. As the population ages, the share of the economically active population may decline. However, certain policy interventions, such as postponing the retirement age, can mitigate the decline in labour force and economic activity.
- by changing the size of the population years entering the labour market. The decline in the number of inhabitants in the individual population years entering the market may negatively affect the level of economic activity.
- the number of students who are involved in the education system. An increase in their number may cause a decrease in the labour market supply and a the economic activity rate.
- labour migration. The outflow of skilled labour force can cause an imbalance in the domestic labour market (Brožová, 2003).

We compared the economic activity rate in the age group 15-64 in EU countries using Eurostat (2021, 5) data (tepsr_wc130). This indicator expresses the share of economically active people in the population aged 15-64 in percent.

In 2020, the economic activity rate in the EU27 was 73.0%. The maximum values of the indicator analysed were significantly above the

EU average. The highest value of the indicator was reached by Sweden (82.5%). The second highest value was reached by the Netherlands (80.9%). On the other hand, Italy (64.1%) and Croatia (67.1%) had the lowest value. The economic activity rate of the Slovak Republic was below the EU average (72.4%). The economic activity rate in the Czech Republic was significantly higher (76.4%) and above the EU average.

By 2020, compared to 2011, the economic activity rate increased in all EU countries except Spain. The highest increase in the economic activity rate was in Malta, where the value of the indicator increased by 24.76%. In the Slovak Republic, the economic activity rate increased by 5.59%. In the Czech Republic, the increase in the period analysed was higher than in the Slovak Republic (by 8.37%).

The economic activity rate of men is higher than the economic activity rate of women. In 2020, the average economic activity rate of men in the EU27 was 78.3%. Malta (85.5%), the Netherlands (84.8%) and Sweden (84.6%) had the highest economic activity rate of men. In the Slovak Republic, the economic activity rate of men was 78.3%. In the Czech Republic, the economic activity rate of men was significantly higher (83.3%) and above the EU average.

The average economic activity rate of women in the EU27 in 2020 was 67.7%. Sweden had the highest economic activity rate of women (80.3%). The values were significantly above the EU average. Lithuania (77.2%) and the Netherlands (77%) had high values of economic activity rate of women. In the Slovak Republic, the economic activity rate of women was significantly below the EU average (66.4%). In the Czech Republic, the economic activity rate of women was higher than in the Slovak Republic (69.2%) and above the EU average. Gender gap varied considerably across the EU. This comparison shows that the economic activity rate in the Slovak Republic is below the EU average. The

situation in the Czech Republic is different – their values of the economic activity rates are above the EU average. Thus, we can state that the Slovak Republic does not use all possible measures to increase the level of economic activity rate to the same extent as the Czech Republic. An in-depth analysis of approaches in the Slovak Republic and in the Czech Republic could reveal possible shortcomings of the Slovak Republic and could lead to proposals for measures aimed at improving the situation in the Slovak Republic.

In our view, the share of economically active women in the EU is also affected by the parental allowance system and the length of parental leave. For example, in the Czech Republic, a woman can draw parental allowance up to 4 years of age of the child, but the amount of the allowance varies with the length of the allowance. In the Slovak Republic, it is not possible to change the amount of the allowance depending on the length of drawing the allowance. We consider the approach of the Czech Republic to be positive and if such an approach was introduced in other EU countries, the economic activity rate of women in the EU could increase.

2.3 Forecast of labour force size in the EU

According to Stephenson and Scobie (2002), labour supply in New Zealand is expected to decline. This trend will be the result of demographic trends, in particular the decline in the size of the working-age population. However, a similar trend will emerge in all developed countries of the world. The EU will be marked by it too. The amount of labour force reduction will depend on the future participation of all the

components in the labour market. In the next part we will estimate the change in the size of labour force in the Slovak Republic until 2050.

According to Bleha, Šprocha and Vaňo (2012), the method of economic activity rate is the most often used method to forecast labour force. The forecast economic activity rates are applied to the forecast population values. According to Infostat (2006), two variants are most often used to forecast the size of labour force - static and dynamic. In the stationary variant, the forecast number of the population in a specific age group and the last known value of the economic activity rate of the population for a specific age group are used to express the size of labour force in the structure by age. During the forecast period, the value of the economic activity rate remains unchanged. With the dynamic variant, a constant change in the economic activity rate is assumed. The forecast values of the population in individual age ranges are published by Eurostat.

In this way, the economically active population can be forecast by gender too. According to Infostat (2006), if the population forecast is available by gender (j) and age (k) and the economic activity rate by gender (j) and age (k) at time $t+x$, then the number of economically active people $EA_{j,k,t+x}$ by gender (j) and age (k) at time $t+x$ is the product of the population forecast $P_{j,k,t+x}$ by gender (j) and age (k) at time $t+x$ and the economic activity rate $MEA_{j,k,t+x}$ of the population by gender (j) and age (k) at time $t+x$.

Forecasting the size of the EU labour force

Model description:

- method used: economic activity rate method
- model type: static model
- object of research: EU27.

The forecast of labour force in the EU27 for 2050 is based on the year 2020.

We use the following published data:

- in 2020, the number of population aged 15-64 in the EU27 (as of 1 January) Eurostat (2021, 5) [demo_pjanbroad] amounted to **287730005**.
- economically active population from 15 to 64 years in 2020: **2071589000** (express according: Eurostat (2021, 5) [lfst_r_lfp2act], the share is 72%),
- the forecast number of people aged 15-64 for 2050 is: **250613506** (express according: Eurostat (2021, 5) [proj_19np], the share of people aged 15-64 will be 56.8% (Eurostat (2021, 5) [proj_19ndbi])).

Provided the level of economic activity from 2020 is maintained, it can be assumed that the number of economically active people in 2050 will be: **180441724**.

Thus, in the EU27 there would be a decrease in the number of economically active population aged 15-64 from 2071589000 (Eurostat (2021, 5) [lfst_r_lfp2act]) to 180441724, i. e. a decrease to 87.10%.

It follows from the above that, based on the static model, it can be assumed that by 2050, under the above assumptions, there will be a decrease in the number of economically active people in the EU27.

It is clear from the population forecasts that if we want to maintain the current number of economically active people, it is necessary to look for ways to reduce the number of economically inactive population.

In the Slovak Republic, a larger decline in labour force than the average values in the EU is expected by 2050.

Forecasting the size of the EU labour force

Model description:

- method used: economic activity rate method
- model type: static model
- object of research: SR.

The forecast of the size of labour force in the Slovak Republic in 2050 is based on the year 2020.

We use the following published data:

- in 2020, the population in the Slovak Republic aged 15-64 was **3688978** (as of 1 January) Eurostat (2021, 5) [demo_pjanbroad]
- economically active population from 15 to 64 years in 2020: **2671900** (express according: Eurostat (2021, 5)[lfst_r_lfp2act]), share is 72.4%),
- the forecast number of people aged 15-64 for 2050 is: **2939060** (express according: Eurostat (2021, 5) [proj_19np], the share of people aged 15-64 will be 57.1% Eurostat (2021, 5) [proj_19ndbi]).

Provided the level of economic activity from 2020 is maintained, it can be assumed that the number of economically active people in 2050 will be: **2127879**.

It follows from the above that based on the static model, it can be assumed that by 2050 there will be a decrease in the number of economically active population aged 15-64 in the Slovak Republic from 2671900 (Eurostat (2021, 5) [lfst_r_lfp2act]) to 2127879, i. e. is a decrease to 80% .

2.4 Economic inactivity in the EU

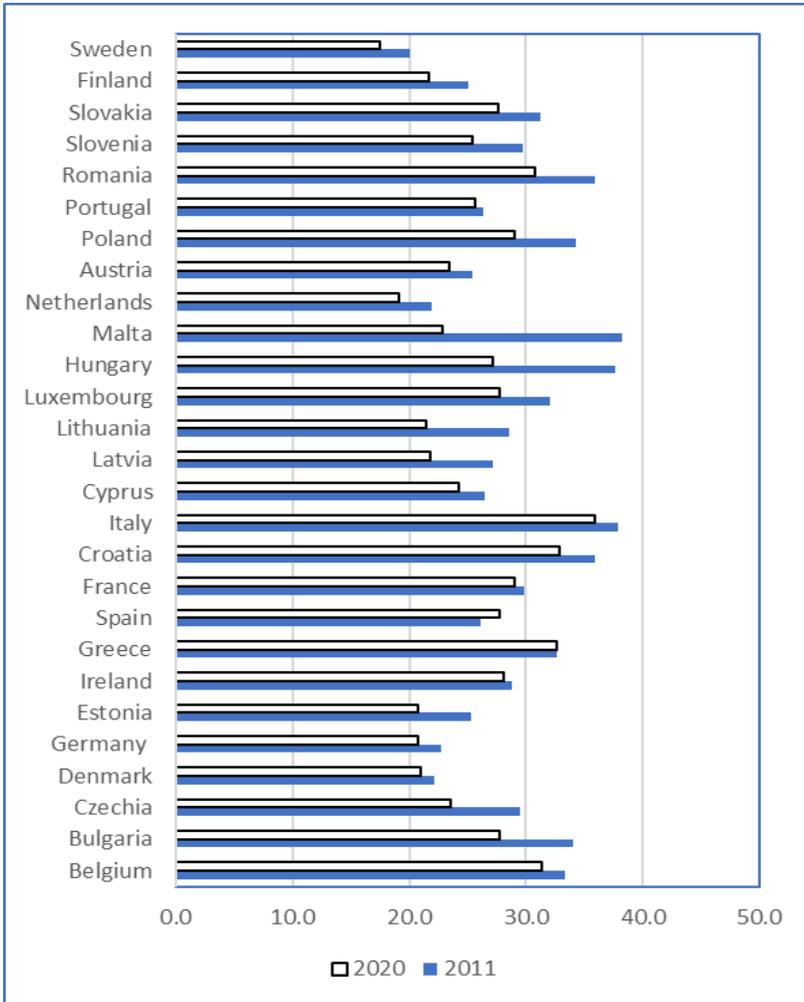
When looking for shortcomings in the economic activity of the population, it is very important to monitor the reasons for economic inactivity. From the point of view of the labour market, it is important to analyse the specifics of economic inactivity in individual EU countries. This can contribute to understanding which practices in certain countries have a positive effect on the size of labour force. In the next section, we will look at the share of economically inactive people in the EU and the reasons for their economic inactivity.

According to Eurostat (2021, 5) [lfsa_ipga], the share of economically inactive people aged 15-64 in the total EU27 population in 2011 was 29.5%. There were significant differences between genders. 23.1% of men and 35.9% of women were inactive. In 2020, there were 21.8% of inactive men and 32.5% of inactive women. Overall, the share of inactive people in the total population was 27.1%. It is clear from the development that the share of economically inactive people is decreasing. However, it should be emphasized that up to around 32% of people outside labour force aged 25-54 had never worked in 2020 (Eurostat, 2021, 3). We think this share is very high.

In the period analysed, women's economic activity in the labour market increased more significantly. From this it is possible to conclude that the differences in the values of the indicator analysed between the genders are decreasing. The largest share of the economically inactive people was in 2011 (up to 38.2%) and in 2020 in Italy, namely 35.9%. In the Slovak Republic, the share of the economically inactive people in the whole period analysed was above the average. The share of economically inactive people in the total population in 2011 and 2020 is in Chart 6.

In terms of age, the lowest economic inactivity is in the age group 25-54. In 2011, it was 15% in the EU27 and by 2020 it fell to 14.6%.

Chart 6 Share of economically inactive persons in the total population in 2011 and 2020 in %



Source: Eurostat (2021, 5) [Ifsa_ipga]

On the contrary, the largest share of economically inactive people is in the 15-24 age group. According to Eurostat (2021, 5) [lfsa_ipga], it accounted for 59.9% in the EU27 in 2011 and 62.2% in 2020. The relatively large differences in the inactivity of people aged 15-24 between EU countries are mainly due to the opportunities and needs of young people to combine study with participation in the labour market. For example, in the Netherlands, the share of economically inactive people aged 15-24 in 2020 was 31.3%, and in Greece this share was significantly higher - 78.8%. In the Slovak Republic, this share was 71.9% and significantly above the EU average (62.2%). **We can therefore conclude that practices in certain EU countries lead students in the age group 15-24 to be employed along their studies. This is then reflected in the degree of economic inactivity rate of people in this age group. It is much lower than in other countries.** At the same time, it should be noted that the share of young people living with their parents is increasing and these people are not forced to look for employment.

NEET rate

In connection with analysing population in the age group 15-24, it is important to monitor the share of unemployed persons and persons not participating in formal and non-formal education and training in the total number of young people in the age group 15-24 (NEET rate). In the next part of this chapter, we focus on analysing the NEET rate. The source of data is Eurostat (2021, 5) [edat_lfse_20]. Within the EU27, the NEET rate decreased from 12.7% to 11.1% between 2011 and 2020. Thus, within the EU, we can talk about a declining trend of the indicator analysed. It decreased by 12.6%.

The lowest values of NEET have long been in the Netherlands, where in 2020 the value of the indicator was 4.5%. Italy has the highest NEET values, where in 2020 the value of the indicator was 19%.

In the Slovak Republic, in 2011, the share of unemployed persons and at the same time persons not participating in formal and non-formal education and training in the total number of young people in the age group 15-24 was 13.8% and by 2020 it had fallen to 10.7%. Thus, in the Slovak Republic, the NEET rate decreased significantly and the values fell below the EU average. Thus, the decline was faster in the Slovak Republic. This trend can be considered positive.

In the Czech Republic, the share of unemployed young people not participating in formal and non-formal education and training in the 15-24 age group was 8.3% in 2011 and fell to 6.6% by 2020. The values of the indicator were significantly lower than in the Slovak Republic, both at the beginning and at the end of the period analysed. It is clear from this that there are still considerable shortcomings in Slovakia and in the near future it is important that the declining trend in the share of unemployed young people in the 15-24 age group not participating in formal and non-formal education and training continues and that its values approached the values in the Czech Republic.

It can be concluded from the above that the NEET rate for young people aged 15-24 is decreasing in the EU27. This trend is positive.

In the Slovak Republic, the share of young people aged 15-24 not working and not participating in formal and non-formal education and training is declining faster than in the EU27. The values in the Czech Republic are much lower and indicate that there are still shortcomings in this area in the Slovak Republic. It follows that the Slovak Republic has to look for other possibilities to increase the involvement of young

people aged 15-24 participating in formal and non-formal education and training in the work process.

The share of employed persons aged 15-24 participating in formal and non-formal education

In connection with the analysis of the population in the age group 15-24, it is important to monitor the share of employed persons participating in formal and non-formal education and training in the total number of young people in the age group 15-24. The source of data is Eurostat (2021, 5) [edat_lfse_18]. Within the EU27, their share increased from 12.5% to 14% between 2011 and 2020. In most EU countries, this share had a growing trend until 2019. However, in 2020, in all countries except Germany, the value decreased or did not change compared to 2019. This change in development in 2020 was caused by a change in the functioning of the economy in connection with the Covid 19 pandemic.

In some EU countries, the share of employed people in the age group 15-24 and in formal and non-formal education and training was over 40%. Within the EU, the highest share was in the Netherlands. From 2011 to 2020, its value increased from 44.4% to 46.9%. Denmark had a value of this indicator of over 40% too. This was in 2011 and later the values fell below 40%.

In 2020, the lowest values of the indicator were in Romania (1.8%) and Slovakia (2.2%). From this comparison it is clear that the share of employed people in the age group 15-24 participating in formal and non-formal education and training in the Slovak Republic is significantly below the EU average. In the Czech Republic, the values of the indicator were significantly higher in the period analysed. In 2011, the share was

5.2% and by 2018 it rose to 6.4%. Later, however, there was a significant decline and in 2020 its value was only 4.4%.

It is clear from the above analysis that there are significant differences between EU countries. In the countries of the former socialist bloc, but also in Greece, Spain, Italy, Cyprus and Portugal, the values are significantly below average. In our view, young people in these countries rely more on family support.

On the other hand, it should be emphasized that in countries where a large share of people aged 15-24 are employed and participating in formal and non-formal education and training, higher education is also more adapted to this. For example, the distance learning method is more common.

The share of employed people in the age group 15-24 participating in formal and non-formal education and training shows a long-term gender gap. The share of the indicator for men in the EU27 increased from 12.3% to 13.8% from 2011 to 2020. In the Slovak Republic, the values were the same at the beginning and at the end of the period analysed (1.8%), although they increased during the period. The share of the indicator for women in the EU increased from 12.7% to 14.2% from 2011 to 2020, in the Slovak Republic it increased from 2% to 2.6%. The share of employed women in the age group 15-24 participating in formal and non-formal education and training is greater than the share of employed men.

Apart from gender and age, the inactivity of people in the labour market is very closely linked to their education. In general, it can be stated that lower education means higher inactivity in the labour market.

Reasons for economic inactivity

Analysing and influencing economic inactivity can lead to increasing labour force. It is also necessary to know the reasons for economic inactivity. The following reasons for economic inactivity are monitored by survey of Eurostat (2021, 5) [lfsa_igar]:

awaiting recall to work (on lay-off),

own illness, education and training,

other family or personal responsibilities,

education and training,

care of adults with disabilities or children and other family or personal reasons,

care of adults with disabilities or children,

believing there is no job available,

retirement,

other reasons and no response.

The shares are monitored within the total number of inactive people and within the total number of population.

In the following part of this chapter, we will analyse the structure and development of the share of economically inactive people in the EU27 on the basis of the above reasons in the period 2011-2020. In the age group 15-64, the largest share of economically inactive people in the total number of inactive people in the EU27 was due to education and training. The share of the economically inactive people in the total number of economically inactive people in the EU27 was therefore growing from 2011 to 2019. In 2019, the share of economically inactive people in EU27 was about 35.7%. In 2020, it was 30.4% and Sweden had the highest values (44.1%).

Belgium has a large share of people aged 15-64 participating in education and training in the total population throughout the period

analysed. In 2020, its value of the indicator was 12.9%. Belgium had a large share of people participating in education and training in the number of inactive people too. This share was also high in Greece, Italy and France.

By 2016, the second largest share of economically inactive people in the total number of economically inactive people within the EU27 was due to the retired. The development of the number of economically inactive people for this reason was declining. The value of the share decreased by 7.7 percentage points between 2011 and 2020 (from 19.1% to 11.4%). In 2020, the share in the EU27 was about 11.4%. The share of these two reasons together was 41.8%.

By 2016, the third largest share of economically inactive people in the total number of economically inactive people in the age group 15-64 was due to taking care of adults with disabilities or children and other family or due to personal reasons. The share was growing until 2019. It increased from 14% to 17%. In 2020, however, it decreased to 14.3%.

The development of the number of economically inactive people due to own illness or disability was growing. The value of the share increased by one percentage point in the period analysed. In 2019, the share in the EU27 was 11.3% and in 2020 it was 12.3%.

With regard to retirement, it is clear that the share of economically inactive people is linked to retirement age. Since 2013, the retirement age has been postponed for both genders. According to Trading Economics (2021), in 2020 the average retirement age in the EU was 64.28 years for men and 63.44 years for women. At the same time, countries were similar in their retirement age. The difference between the retirement age has narrowed between EU countries. None of the EU countries has a retirement age under 60 years.

Due to the unfavourable economic situation and high indebtedness, some EU countries have made significant changes to their retirement age. Such countries include, for example, Greece, where the retirement age is 67 years.

The Slovak Republic (62.67) and the Czech Republic (63.83) had a retirement age below the EU average retirement age for both men and women. The retirement age limits in EU countries are in Table 1.

In some EU countries, even after increasing the retirement age, there was a large share of people aged 15-64 who were retired. Such countries clearly include Croatia, which had the largest share of retired people aged 15-64 in the total population in the EU in 2020, amounting to 9.7%. Other countries with a large share of people aged 15-64 in the total population include Slovenia (8.3%) and Austria (7.4%). These countries also have a large share of retired inactive population. It can only be assumed that both countries will have to take further measures to reduce the values of the indicator analysed.

Some EU countries are characterised by a relatively high share of people in the inactive group due to "homemakers", "disabled" and "non-education inactive". People in these groups and a large part of the student group are not even looking for a job. According to Dubois, 2017, Ireland, Luxembourg, Greece, Austria, Romania, Malta, Italy, Spain and Cyprus have a large share of "homemakers" Luxembourg, Greece, Austria, Romania, Malta, Italy, Spain and Cyprus. Ireland, as well as Estonia, Latvia, Lithuania, UK, Czech Republic, Belgium, Finland, Hungary, Denmark, the Netherlands and Poland have a large share of the "disabled". "Non-education inactive" are in Malta, Hungary, Romania and Italy.

There are several activation barriers that increase the inactivity rate of the population. It is important to monitor them and look for activation possibilities systematically. According to Dubois (2017, p. 16), important activation barriers include:

“low financial and overall incentives; less work available for lower skills, lack of work adaptation, lack of material resources and lack of access to information through social network and lack of confidence.” According to Dubois (2017), on the other side are „activation measure” particularly close attention to non-monetary benefits of work, upskilling, workplace or work arrangement adaptation, improved services, such as transport and access to computers, stimulating local social activities.

We can state that the share of economically inactive people in the total population is declining. The difference in economic inactivity between genders is narrowing. This is mainly caused by increasing women's participation in the labour market. The structure of the population is also changing depending on the reason for economic inactivity. Inactivity due to education and training remains in the first place. However, retirement is no longer in second place due to increasing retirement age, it is the care for adults with disabilities or children and other family or personal reasons.

Table 1 The retirement age limits in EU countries

GEO/TIME	M	F
Belgium	65	65
Bulgaria	64.33	61.17
Czech Republic	63.83	63.83
Denmark	66.5	66.5
Germany	65.83	65.83
Estonia	63.75	63.75
Ireland	66	66
Greece	67	67
Spain	66	66
France	62	62
Croatia	65	62.75
Italy	67	67
Cyprus	65	65
Latvia	63.75	63.75
Lithuania	64	63
Luxembourg	65	65
Hungary	64.5	64
Malta	63	63
Netherlands	66.67	66.67
Austria	65	60
Poland	65	60
Portugal	66.5	66.5
Romania	65	61.67
Slovenia	60	60
Slovakia	62.67	62.67
Finland	63.75	63.75
Sweden	62	62
United Kingdom	66	66
EU	64.28	63.44

Source: Trading Economics (2021)

3. ECONOMIC BURDEN ON THE PRODUCTIVE POPULATION

Population structure by age is one of the most important demographic structures. Its connection with the labour market is also reflected in the economic burden on the productive population, which is discussed in the third chapter.

The first subchapter deals with the development of the economic burden on the productive population in EU countries. The following subchapter analyses the development trend of the time series of the age dependency ratio through regression analysis and estimates further development in the short term.

3.1 Development of the economic burden on the productive population in the EU

The age dependency ratio (index of economic burden) is used to determine the economic burden on the productive component of the population by the non-productive component. It expresses the number of people in pre-productive and post-productive age per 100 people in productive age. Four basic variants of the indicator are expressed in Eurostat databases. They differ in the age range of the population components. In the first variant, the productive component includes the population aged 15-64. Non-productive components include the young population, i. e. people aged 0-14, and the elderly population, i. e. people aged 65 and over. In the second variant, the productive component includes the population aged 20-59. Non-productive

components include the young population aged 0-19 and the elderly population aged 60 and over.

The age dependency ratio, expressed by the first or second variant, has been used for a relatively long time to characterise the burden on the productive component of the population by the non-productive component. Currently it can be criticized.

This is mainly due to a significant increase in the share of young people studying at universities up to approximately 24 years of age. This component of the population burdens the productive part of the population and is not captured in the expression of the age dependency ratio in the first and second variants. The real burden on the productive component of the population is thus greater than the index of economic burden in the first and second variants. Therefore, we think that the burden on the productive component of the population by the non-productive is better described by the third and fourth variants.

In the third variant, the productive component includes the population aged 20-64. Non-productive components include the young population aged 0-19 and the elderly population aged 65 and over. In the fourth variant, the productive component includes people aged 25-64. The non-productive component includes the young population, i. e. people aged 0-24, and the elderly population, i. e. people aged 65 and over. However, the values in the fourth variant are published only from 2017. Therefore, we will not use this variant of the analysis of the development of the economic burden, but we will use the third variant. The age dependency ratio is the sum of the young-age-dependency ratio and the old-age-dependency ratio. The young-age-dependency ratio expresses in the first variant the number of persons aged 0-14 per 100 persons aged 15-64, in the second variant the number of persons aged 0-19 per 100 persons aged 20-59 years and in the third variant the

number of persons aged 0-19 per 100 people aged 20-64 years. The indicator therefore expresses the burden on people of working age by people of pre-productive age. The old-age-dependency ratio expresses in the first variant the number of persons aged 65 and over per 100 persons aged 15-64, in the second variant the number of persons aged 60 and over per 100 persons aged 20-59 and in the third variant the number of persons aged 65 and over per 100 people aged 20-64. As of the three options, the third option best takes into account the large share of young unemployed people, we decided to use the third option. We surveyed the status and development of the age dependency ratio in EU countries from Eurostat (2021, 5) sources [demo_pjanind]. We monitored the status and the development of the values of the indicator throughout the EU and analysed the extreme values within the EU countries. Then, we focused on the dynamics of change. We paid special attention to the development of the economic burden on the productive component of the population in the Slovak Republic and the Czech Republic.

The age dependency ratio in the EU27 in 2020 determined using the third variant was 69.1%. Thus, in the EU27, there are 69 people aged 0-19 and aged 65 and over per 100 people aged 20-64. France (80.2%), Finland (76.7%) and Sweden (76.3%) had the highest values of the age dependency ratio in the third variant in 2020. Luxembourg had the lowest values of the indicator (55.8%). The indicator had a growing trend in the EU. From 2011 to 2020, the age dependency ratio in the EU27 increased by 6.6%. From this we can conclude that the dynamics of development is fast. While in the first five years of the period analysed the increase was by 3.6%, in the next five years of the period analysed it was already by 4.4%. The indicator increased in all EU27 countries except Luxembourg and Malta. In Luxembourg, the value of the indicator decreased throughout the period analysed. In Malta, the value

had fallen since 2014. In our view, the decline in both countries may be due to the large number of immigrants.

The highest increase of the indicator was in the Czech Republic (by 22.4%) and in Slovenia (18.7%). Nevertheless, both countries had an age dependency ratio below the EU average. In Slovakia, the value of the indicator increased significantly (by 12.7%). The increase was well above the increase in the indicator in the EU (9.3%). Nevertheless, the values of the indicator were below-average (59.3%). The age dependency ratio in the EU27 in 2011 and 2020 is shown in Chart 7.

The analysis shows that the economic burden on the productive component of the population by the non-productive component is growing. The dynamics of the increase in the burden by the productive component of the population in the EU27 is accelerating. In Slovakia and the Czech Republic, the increase in the economic burden was significantly higher than the increase in the whole EU.

The young-age-dependency ratio in the EU27 increased from 34.2% to 34.3% between 2011 and 2020, which is an increase by 0.3%. Ireland had the highest value of the young-age-dependency ratio (45.5%). By contrast, Malta had the lowest value (27.8%). In Slovakia, the value of the indicator was below the EU average (32.9%). In most EU countries, the trend of the indicator was growing. Of the countries where the trend was declining, Malta recorded the largest decline. The value of the indicator fell to 81.5%.

The old-age-dependency ratio in the EU27 increased from 29% to 34.8% between 2011 and 2020, which is an increase by 20%. In the period analysed, the indicator had a growing trend in all EU countries. The highest values of the indicator were reached in 2018 by Italy and Finland

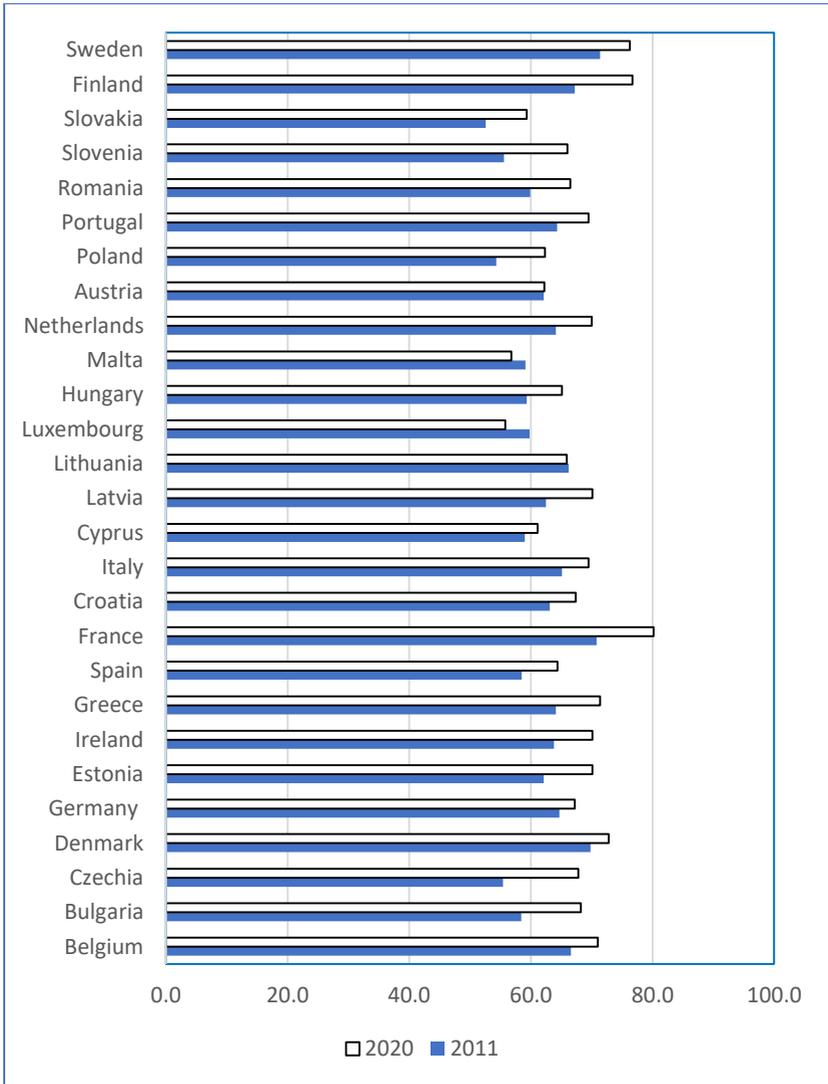
(39.4%). Luxembourg had the lowest values (22.6%). The largest growth of the indicator was in Poland (by 40.9%).

We can also include Slovakia among the countries with a large increase in the old-age-dependency ratio, where the value increased by 7.2 percentage points, i. e. by 37.5%.

By comparing the average growth coefficient expressed by the geometric average, we can state that the fastest dynamics of the growth of the burden on the productive component of the post-productive population is in Poland, Slovakia and the Czech Republic. The average annual growth in Poland is 3.9% per year, in Slovakia and the Czech Republic it is 3.6%. Such rapid dynamics of change require action to be taken at national level and solutions sought not only in prolonging retirement but also, for example, in introducing incentives for employees to remain at work even after retirement.

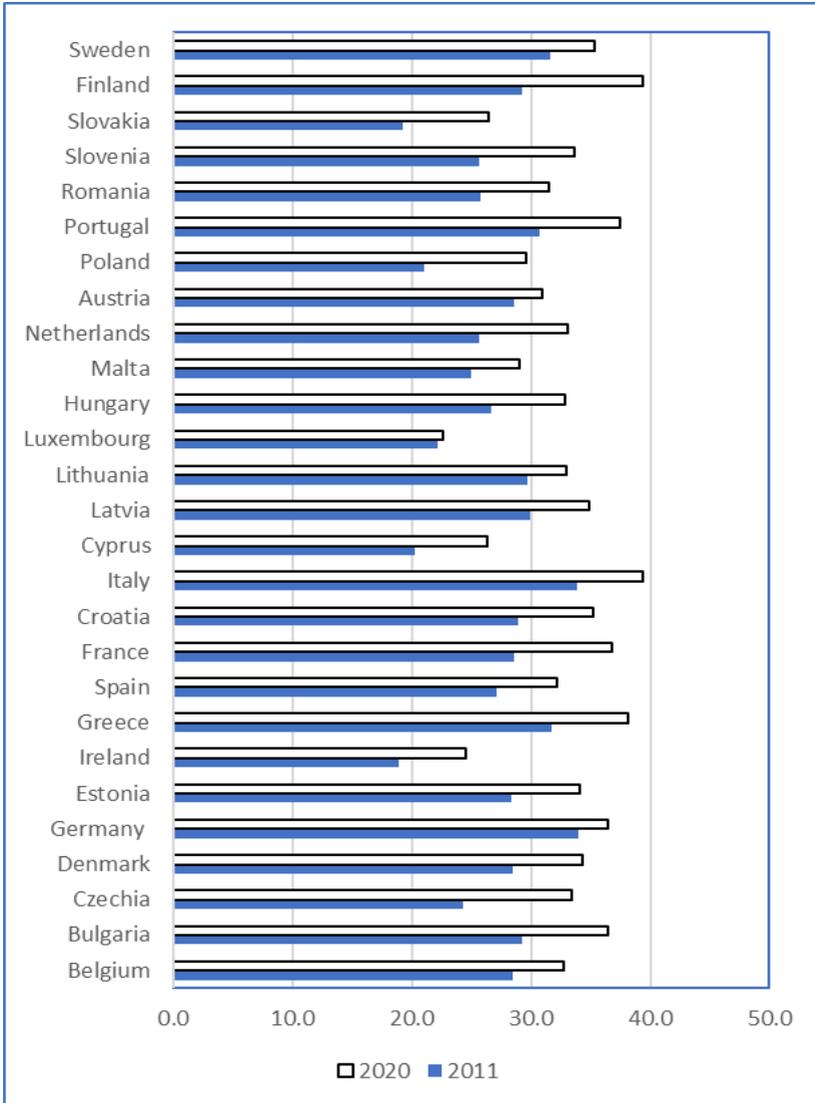
The analysis shows that the burden on the productive component of the population increases mainly with the increase in the post-productive component of the population. This trend is the same in all EU countries. The greatest dynamics of the growth of the burden on the productive component of the population by the component of the population in post-productive age is in Poland, the Slovak Republic and the Czech Republic. The values of the old-age-dependency ratio are in Chart 8.

Chart 7 Age dependency ratio in the EU27 countries in 2011 and 2020 in %



Source: Eurostat (2021, 5) [demo_pjanind]

Chart 8 Old-age-dependency ratio in 2011 and 2020 in %



Source: Eurostat (2021, 5) [demo_pjanind]

3.2 Trend of the economic burden on the productive population in the EU

In the following section, we will focus on estimating the trends of indicators of economic burden and their expected future development. Based on the trends of the time series, we want to determine whether we can expect constant changes or if the speed of the changes will change in the future within the EU27 and within the Slovak Republic. We will estimate the time series trend using regression analysis. We will find out the statistical significance of trend parameters. Using the coefficient of determination, we will determine what percentage of the total variability is explained by the model and test the autocorrelation of residues. We will analyse the accuracy of the forecast through the degree of forecast accuracy.

We will focus on the linear and quadratic time series trend. Based on the estimated trend, in the next step we will assess the expected changes in the short term.

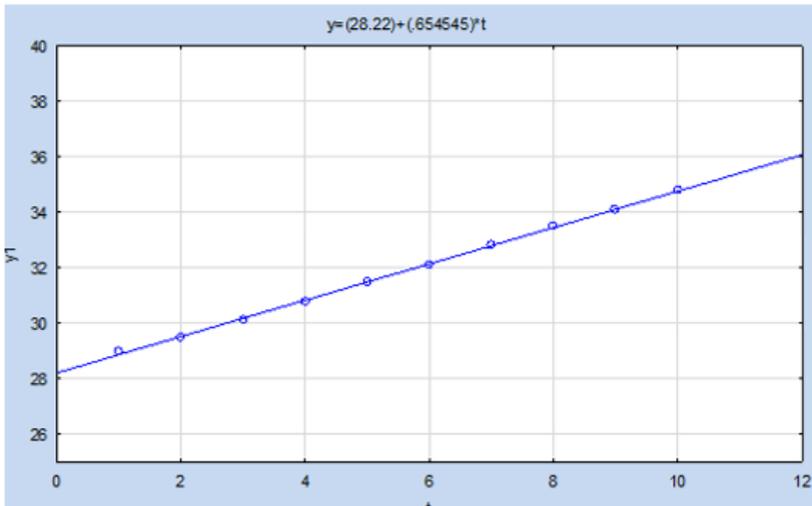
Trend of the old-age-dependency ratio in the EU

In the next step, we used Eurostat (2021, 5) data [demo_pjanind] to analyse the trend of the time series of the old-age-dependency ratio in the EU27. The linear trend of the time series in the period 2011-2020 expressed in the Statistica program is in Chart 9.

The linear trend of the time series is expressed as

$$y_t = 28.22 + 0.6545t, t = 1, 2, \dots, 10.$$

Chart 9 Linear trend of the time series of the old-age-dependency ratio in the EU



Source: own calculation

Estimates of the linear model parameters are in Table 2. 99.91% of the total variability is explained by the model. Durbin-Watson statistics (1.41) indicate a statistically insignificant positive autocorrelation. The mean absolute percentage error is low in the linear trend (0.14%).

Table 2 Parameters of the linear trend of the time series of the old-age-dependency ratio in the EU

The model is: $y = a + b * x$ Confidence level: 95.0% (alpha = 0.05)						
	Estimate	Standard error	t-value df = 8	p-value	Lower limit	Upper limit
a	28.22000	0.04221	668.5368	0.00000	28.12266	28.31734
b	0.65455	0.00680	96.2140	0.00000	0.63886	0.67023

Source: own calculation

We consider this model to be suitable for forecasting. It can be concluded from it that the speed of change will not change. Provided that the current development is maintained, we can assume that the burden on the productive component by the post-productive population in the EU will increase on average by 0.65 percentage points per year.

Trend of old-age-dependency ratio in the Slovak Republic

Based on Eurostat (2021, 5) data [demo_pjanind], we analysed the trend of the time series of the old-age-dependency ratio in the Slovak Republic in the period 2011-2020. The linear trend of the time series expressed in the Statistica program is graphically depicted in Chart 10.

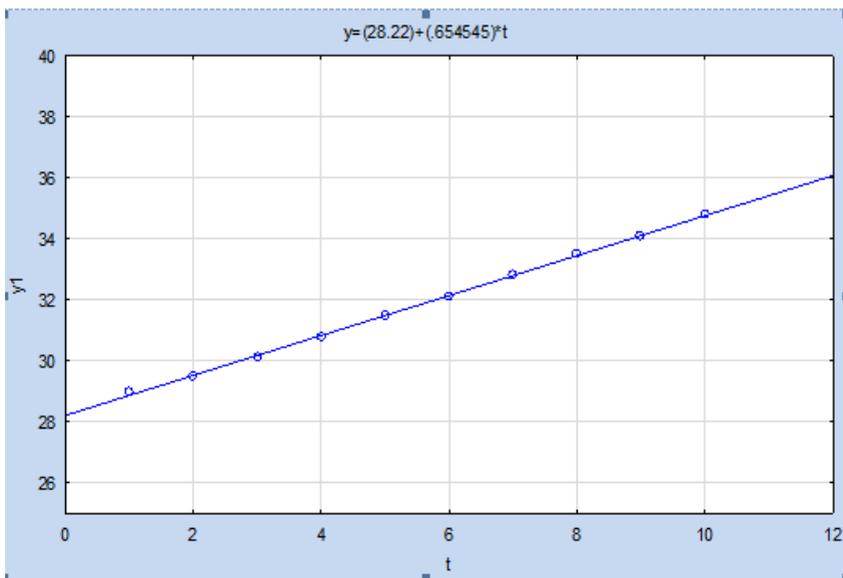
Estimates of the linear model trend parameters are in Table 3. The parameters of the linear trend are statistically significant. 99.91% of the total variability is explained by the model. We used Durbin-Watson statistics to determine the autocorrelation of residues. Durbin-Watson statistics (1.41) indicates a statistically insignificant positive autocorrelation of residues.

The linear trend of the time series is expressed as

$$y_t = 17.693 + 0.823t, t = 1, 2, \dots, 10.$$

Provided that the current development is maintained, we can assume that the burden on the productive component by the post-productive population in the EU will increase on average by 0.82 percentage points per year. The mean absolute percentage error in the linear trend is 1.42.

Chart 10 Linear trend of the time series of the old-age-dependency ratio in the Slovak Republic



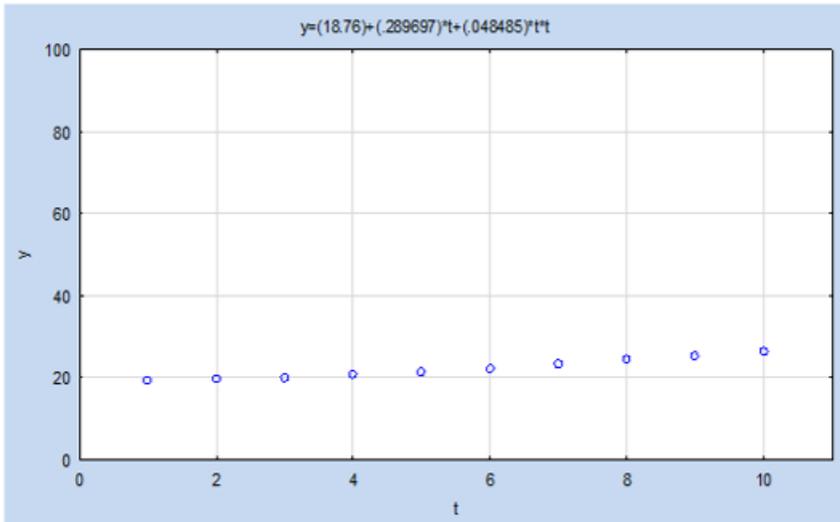
Source: own calculation

Table 3 Linear trend of the time series of the old-age-dependency ratio in the Slovak Republic

		R = .99956818 R2 = .99913655 Modified R2 = .99902862 F (1.8) = 9257.1				
N=10	b*	Standard error z b*	b	Standard error z b	t(8)	p-value
Abs.member			28.22000	0.04221	668.5368	0.00000
x	0.99957	0.01039	0.65455	0.00680	96.2140	0.00000

Source: own calculation

Chart 11 Quadratic trend of the development of the time series of the old-age-dependency ratio in the Slovak Republic



Source: own calculation

The quadratic trend of the time series is expressed (Chart 11) as

$$y_t = 18.76 + 0.2897t + 0.0485t^2, t = 1, 2, \dots, 10.$$

The coefficient of determination has a value of 99.88%. 99.88% of the total variability is explained by the model. Based on the value of the mean absolute percentage error, we consider the quadratic model to be more suitable to estimate further development. An increase in the old-age-dependency ratio can be expected. According to the quadratic trend, the estimated value of the indicator in 2023 is 30.72%. According to the linear trend, the estimated value of the indicator is 28.392%.

The above analysis shows that if the current development is maintained, the increase in the old-age-dependency ratio in the Slovak Republic will be faster than its increase within the EU. The labour market needs to

prepare for this. Gradual adoption of measures aimed at stabilizing the burden on the productive population, respectively reducing the rate of burden growth seems necessary.

Table 4 Quadratic trend of the time series of the old-age-dependency ratio in the Slovak Republic

The model is: $y_2 = a + b * x + c * x * x$ Confidence level: 95.0% (alpha = 0.050)						
	Estimate	Standard error	t-value df = 7	p-value	Lower limit	Upper limit
a	18.76000	0.11848	158.3421	0.00000	18.47984	19.04015
b	0.28970	0.04948	5.8547	0.000623	0.17269	0.40670
c.	0.04848	0.00438	11.0599	0.00001	0.03812	0.05885

Source: own calculation

Trend of the age dependency ratio in the EU

In the next step, we analysed the trend of the time series of the index of age dependency ratio in the EU27 in the period 2011-2020 based on Eurostat (2021, 5) data [demo_pjanind].

The linear trend of the time series is expressed as

$$y_t = 48.95 + 0.66t, t = 1, 2 \dots, 10.$$

The linear trend of the time series expressed in the Statistica program is graphically depicted in Chart 12.

Table 5 Linear trend of the time series of the age dependency ratio in the EU

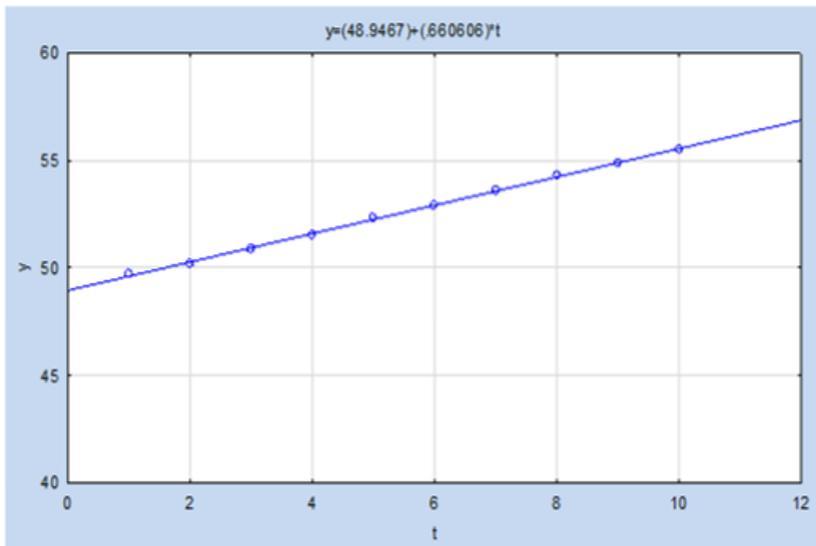
The model is: $y = a + b * x$ (Confidence level: 95.0% (alpha = 0.050)						
	Estimate	Standard error	t-value df = 8	p-value	Lower limit	Upper limit
a	48.94667	0.043855	1116.111	0.000000	48.84554	49.04780
b	0.66061	0.007068	93.467	0.000000	0.64431	0.67690

Source: own calculation

Estimates of the model parameters are in Table 5. All parameters are statistically significant. 99.95% of the total variability is explained by the model. Durbin-Watson statistics (1.958) indicate a statistically insignificant positive autocorrelation. The mean absolute percentage error is low in the linear trend (0.096%).

Provided that the current development is maintained, we can assume that the burden on the productive component by the post-productive population in the EU will increase on average by 0.66 percentage points per year. However, the rate of change will not increase in the short term. It can be assumed from the above forecasts, that the burden on the productive component will grow steadily in the EU.

Chart 12 Linear trend of the time series of the age dependency ratio in the EU



Source: own calculation

Trend of the age dependency ratio in the SR

In the next step, we analysed the trends of the time series of the age dependency ratio in the period 2011-2020 in the Slovak Republic.

The linear trend of the time series is expressed as

$$y_t = 36.88 + 1.038t, t = 1, 2, \dots, 10.$$

The estimated parameters of the linear time series trend in the Statistica program are in Table 6.

Table 6 Linear trend of the time series of the age dependency ratio in the SR

		R = .98349946 R2 = .96727118 Modified R2= .96318008 F(1.8)=236.43					
N=10		b*	Standard error from b*	b	Standard error from b	t(8)	p-value
Abs.member				36.88000	0.41894	88.03211	0.00000
x	0.98350	0.06396	1.03818	0.06752	15.37638	0.00000	

Source: own calculation

96.73% of the total variability is explained by the linear model. The parameters of the linear model are statistically significant. However, the Durbin-Watson value of the statistics (0.457) indicates positive autocorrelation.

The quadratic trend seems more appropriate.

The quadratic trend of the time series is expressed as

$$y_t = 38.5133 + 0.2215t + 0.0743t^2, t = 1, 2, \dots, 10.$$

The parameters of the quadratic model are statistically significant (Table 7). The quadratic model explains 99.89% of the total variability and

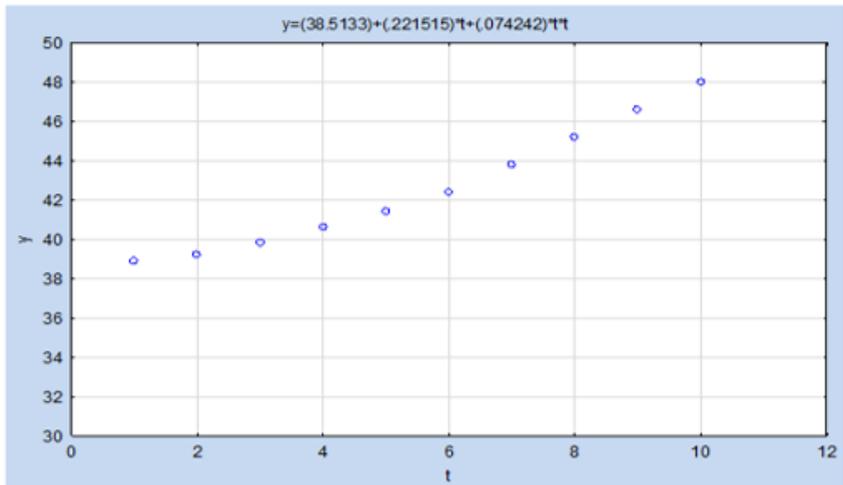
autocorrelation has not been demonstrated. The mean absolute percentage error is low (0.089%).

Table 7 Quadratic trend of the time series of the age dependency ratio in the SR

The model is: $y=a+b*x+c*x*x$ Confidence level: 95.0% (alpha = 0.050)						
	Estimate	Standard error	t-value df = 7	p-value	Lower limit	Upper limit
a	38.51333	0.13947	276.1504	0.00000	38.18355	38.84312
b	0.22152	0.05825	3.8031	0.00669	0.08378	0.35925
c.	0.07424	0.00516	14.3869	0.000002	0.06204	0.08644

Source: own calculation

Chart 13 Quadratic trend of the time series of the index of age dependency ratio in the SR



Source: own calculation

It can be assumed from the estimated quadratic trend in Chart 13 that not only the old-age-dependency ratio but also the age dependency ratio will grow faster in the Slovak Republic in the next period.

The burden on the productive population across the EU can be expected to increase in the short term. However, it seems that the economic burden on the productive component will not increase significantly faster.

However, in some EU27 countries, the economic burden on the productive population by the non-productive population will increase faster in the near future. These countries also include the Slovak Republic, and it is necessary to prepare the state economy for such development and to take appropriate measures.

Estimation of the development of the old-age-dependency ratio and the age dependency ratio until 2070

In the following section, we will focus on projections of the old-age-dependency ratio in the long term. We will use Eurostat data from the latest published projections. These date from 2019. Based on the Eurostat projection (2021, 5) ([proj_19ndbi]), we will compare the forecast values of the old-age-dependency ratio in individual EU countries in 2070.

Our next intention will be to evaluate the statements in the analysis of the source Analytici UMS (2018) on the development of the old-age-dependency ratio in the Slovak Republic and compare them with data published in Eurostat databases. It is stated in Analytici UMS (2018, p. 1) that “Slovakia will be one of the countries with the greatest impact of population ageing on the population age structure”.

Projection of the index of the old-age-dependency ratio in the EU

According to the latest projection published by Eurostat (2021, 5) ([proj_19ndbi]), the old-age-dependency ratio in the EU27 is expected to increase from 31.4% to 54% in the period 2019-2070, which is an increase to 172%.

In 2070, Poland is expected to have the highest values in the EU27 - 52.6%. The largest increase in the old-age-dependency ratio is expected in Luxembourg (increase to 249.3%), Slovakia (increase to 245.5%) and Poland (increase to 237.1%). Thus, Slovakia will record the second fastest dynamics of the change in the burden on the productive age population by the post-productive age population. By 2070, the value of the old-age-dependency ratio in the Slovak Republic will reach 57.7%. The projection of the old-age-dependency ratio in 2050 and 2070 in the EU countries is graphically depicted in Chart 14.

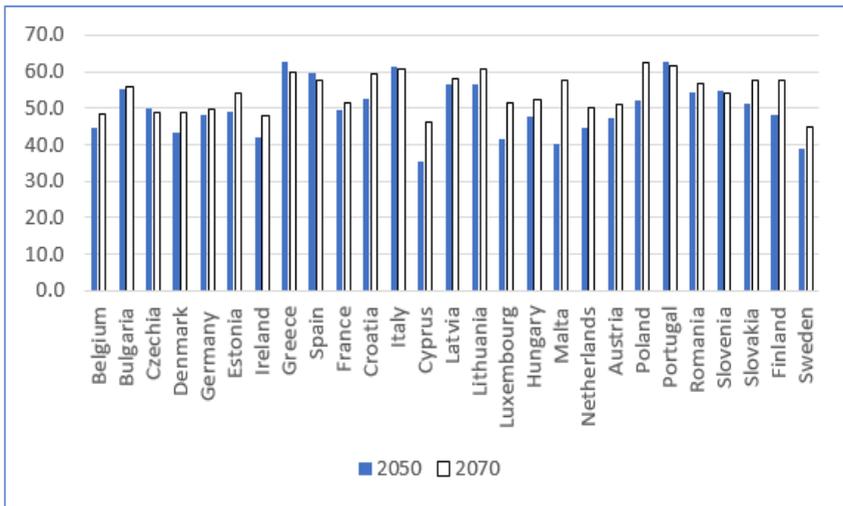
According to Analytici UMS (2018), “by 2070, the old-age-dependency ratio in the Slovak Republic will increase to 57%. Slovakia will be among the top 3 countries with the highest increase in this indicator, i. e. among the countries that will age the most”. The reason is that the generation born in the 70's and 80's will reach the post-productive age. Such a trend would mean that it is necessary to prepare the economy for a substantial change. In 2070, the indicator should have a value of 57%.

We can conclude from the analysis that by 2070 a dynamic change in the burden on the productive component is expected in Slovakia, especially by the population in post-productive age. Eurostat's projection assumes greater growth dynamics than Analytici UMS. Both sources agree on the fact that the burden on the productive component of the population by the non-productive component in Slovakia is

growing with significant dynamics and Slovakia will be among the three countries with the fastest change in the EU27.

The increase in the share of people of post-productive age can also significantly affect the sectoral structure of labour force. Labour market supply may change and the labour needs in individual sectors will change as well. The need for labour force in the area of social services, healthcare and nursing services can be expected to increase.

Chart 14 Projection of the old-age-dependency ratio in the EU in 2050 and 2070 in %



Source: Eurostat (2021, 5) [proj_19ndbi], Baseline projection

Projection of the age dependency ratio in the EU

The projection shows that in all EU27 countries the values of the age dependency ratio (3 variants) will increase. Within the EU27, the value

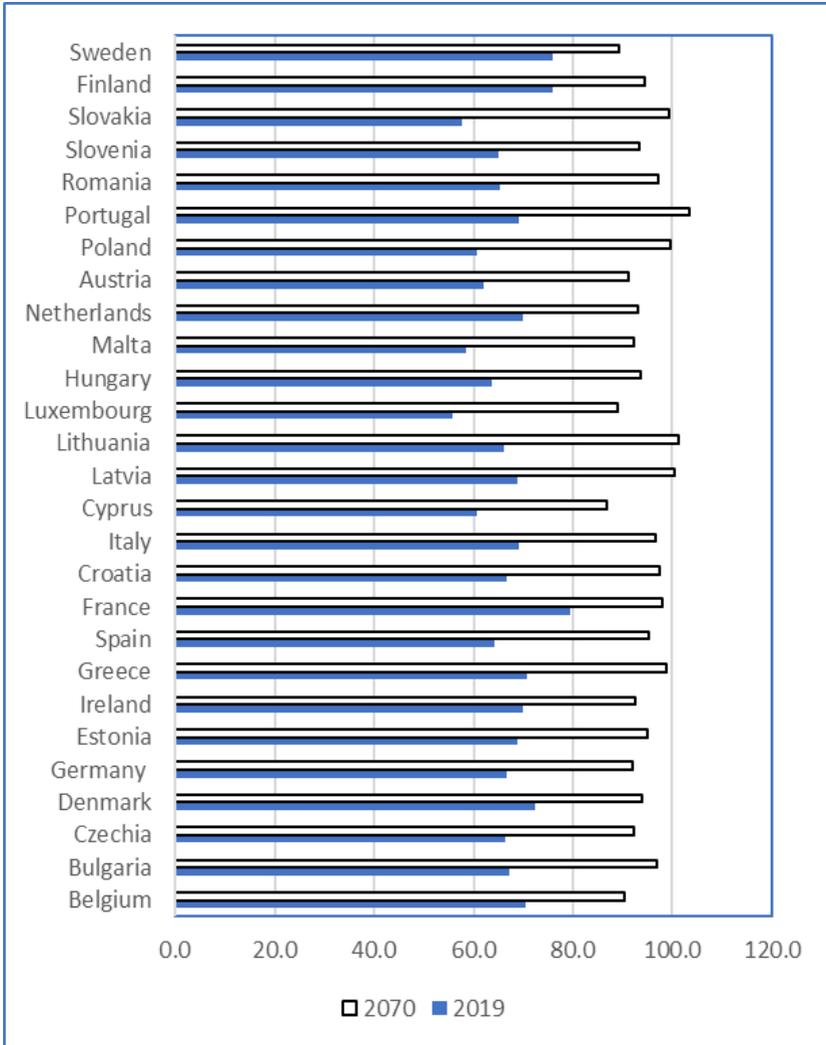
of the indicator will increase from 2019 to 2070 from 68.4% to 95.2%, which is an increase by 39.2%.

The highest values will be reached in 2070 by Portugal, Lithuania and Latvia. The values of the age dependency ratio will exceed the value of up to 100%. On the other hand, Cyprus will have the lowest values of the indicator.

From 2019 to 2070, the largest increase in the age dependency ratio is expected in Slovakia. By 2070, the value of this indicator will have increased by up to 71.8%. Thus, Slovakia will record the greatest dynamics in the change in the economic burden of the population in productive age by the population in non-productive age. Such a change will also significantly affect the economy and it is therefore necessary to prepare for it. Otherwise, the change could put pressure on a significant increase in the deductions of the productive component or pressure on a significant reduction in pensions of the post-productive age population.

EU countries also differ in the periods when they will achieve the greatest growth dynamics of the age dependency ratio. In Slovakia, the most dynamic growth will happen in the period 2030-2050. The forecasts of the age dependency ratio in 2050 and 2070 in the individual EU27 countries are in Chart 15.

Chart 15 Age dependency ratio – projection in %



Source: Eurostat (2021, 5) [proj_19ndbi]

4. POPULATION AGEING AND ITS IMPACT ON THE LABOUR MARKET

Changes in the quantity and quality of labour force

In some professions, the EU labour market is marked by a mismatch between labour supply and demand. Employers are experiencing a shortage of skilled labour. They are forced to seek labour force or to initiate various vocational training activities to change the professional focus of their already employed workers.

Professions facing a shortage of staff include professionals at all levels of education. Among these are professions with a university degree, such as physicians, physiotherapists, teachers etc., as well as professions with secondary and lower education, such as cooks, waitresses, cleaners, technicians etc.

Expert forecasts addressing population development and structure suggest that labour shortage will be even more pronounced in the future. The change in the population structure will be reflected in the quantity of labour force. The change in the population structure will change the structure of labour force. Its quality may change as well. The older labour force is characterised by less IT skills, less creativity and dynamism. However, it is characterised by greater loyalty to the employer (Škrovánková, 2020).

Ageing will also lead to changes in the structure of employment. Population ageing is associated with higher expenditures on health and social services. These are the areas where the need for labour force growth is expected.

There are still gender differences in the labour market. These are reflected in wages and the approach of employers. Gender wage differentiation is also reflected in the level of pensions and the growing risk of poverty for women. To reduce gender gaps, some Member States are introducing the so-called partial parental leave, which can be taken by both parents. We consider such an approach to be positive in terms of reducing the gender gap.

In connection with the structure of labour force by gender, the share of employed women is gradually increasing. This is also a consequence of the shrinking size of labour force. In view of the growing number of working and single women, it is essential to build services that make it possible for women to connect work and private life. These certainly include the construction of pre-school facilities in the workplace, the introduction of flexible forms of work and the expansion of job opportunities enabling teleworking. On the other hand, non-standard employment contracts, fixed-term work or flexible forms of work are often varied out by workers who conclude such contracts by coercion.

In the context of changes in the labour market, EU countries are focusing on reforms of social protection and pension systems. They are looking for other ways to prolong working life. In EU countries, retirement age has been increasing gradually. The retirement age gap between men and women is narrowing. Important incentives include the practice established in many EU countries by which pensions may improve when postponing the retirement age.

There are still large shortcomings in the field of labour mobility in the EU and measures need to be taken to increase it. Improving labour force mobility could reduce unemployment and increase employment.

According to the European Commission (2016, 1), the EU has been marked by a large influx of migrants. The integration of migrants has become an important challenge for EU countries. Immigrants, especially from third countries, are a group of people who are at greater risk of unemployment, poverty and social exclusion. It is important for immigrants to be integrated into social and economic life. Their social inclusion and involvement in work is becoming a necessity. Unemployed migrants burden the social system.

In the first subchapter of the fourth chapter, we analyse the state and development of population ageing in the EU. At the same time, we discuss changes in the development of labour force reproduction and their consequences. In the second subchapter, we compare population ageing in EU countries on the basis of several indicators, using methods of multi-criteria evaluation of variants. In the third subchapter we deal with the consequences of an ageing population. We analyse changes in pension provision, changes in the structure of consumption, changes in healthcare costs and changes in the age structure of labour force.

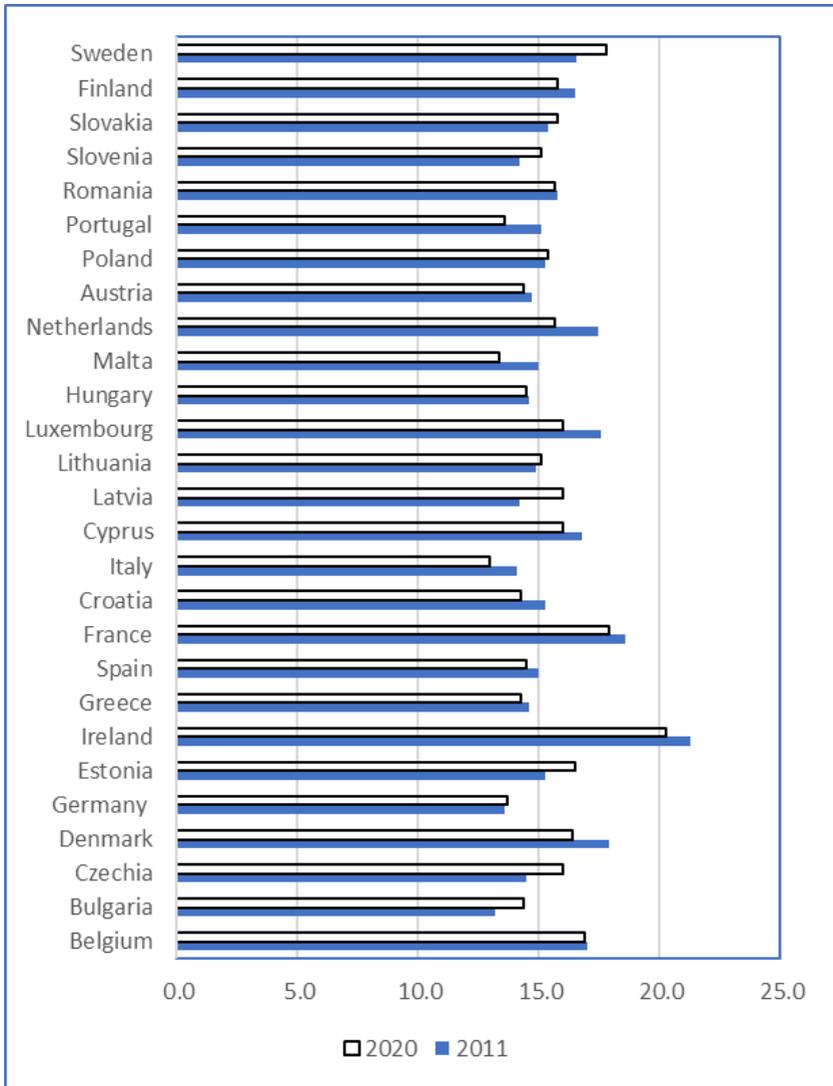
The fourth subchapter deals with the analysis of changes in the structure of employment due to changes in the population structure. In our analysis, we focused on consumer behaviour in individual age groups. The fifth subchapter analyses the position of the elderly in the labour market. We focus on the employment rate of the elderly, the employment rate of the elderly on a part-time basis, the self-employment of the elderly and the employment of the elderly according to selected economic activities. The sixth sub-chapter deals with the ageing of teachers and physicians in the EU. The last subchapter deals with active ageing.

4.1 State and development of an ageing population in the EU

Frkářová (2015) states that the labour market in EU countries faces several challenges. One of the most up-to-date challenges is population ageing. It is a process in which the age structure of the population is changing. The share of people of older age categories is increasing and the share of younger age categories is decreasing (Amado, São José and Santos, 2016; Káčerová, Mládek and Ondačková, 2012). Changes of the age structure of the population affect the age structure of labour force and its supply. At the same time, it has an impact on technological development, which is related to the demand for skilled workers. For this reason, it is necessary to identify the intensity of population ageing in each EU country and to respond to changes in the quality and quantity of labour force, which may ultimately affect the country's economic growth.

In the following section, we analyse the ageing of the EU population on the basis of the share of people aged 0-14 in the total population and on the basis of the share of people aged 65 and over in the total population in 2011 and 2020. We compared the values of indicators in individual EU countries and monitored the dynamics of change. Then, we analysed the ageing of the EU population on the basis of the age median and the index of ageing (ageing index). We monitored the changes in the values of the indicators and analysed their possible causes. We analysed the reproduction of labour force in individual EU countries using the exchange coefficient.

Chart 16 Share of people aged 0-14 in EU countries in %



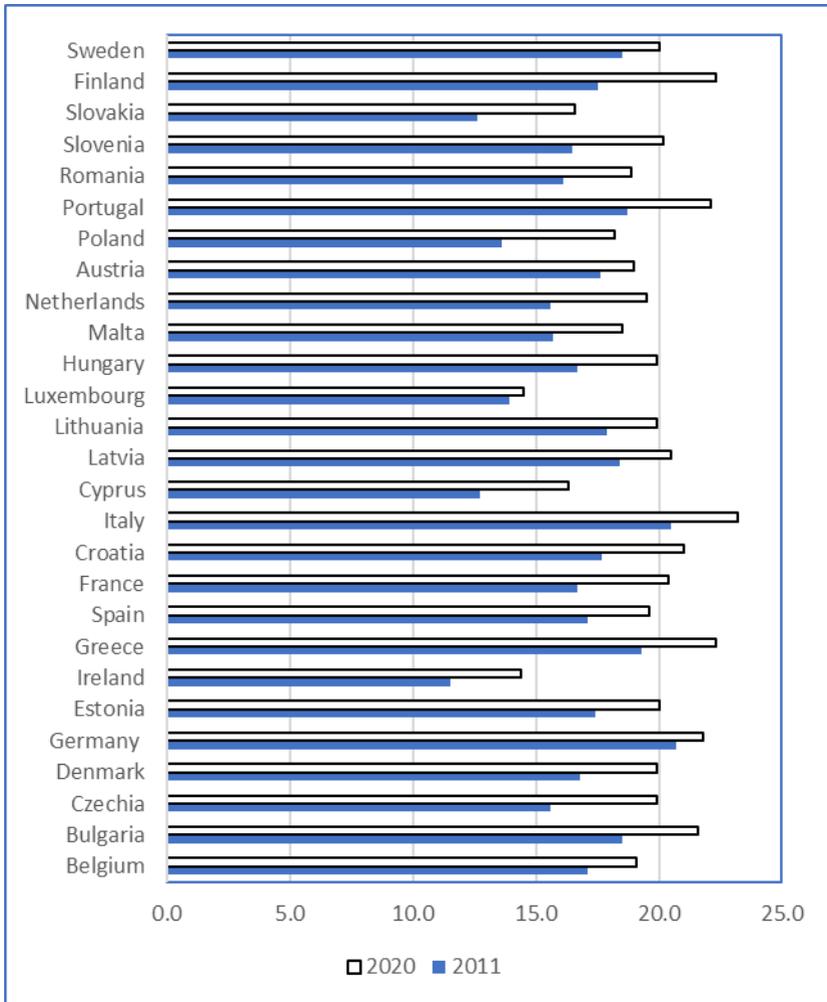
Source: Eurostat (2021, 5) [demo_pjanind]

According to Eurostat (2021, 5) [demo_pjanind], the share of people aged 0-14 in the EU27 will decrease. From 2011 to 2020, their share fell from 15.4% to 15.1%. EU27 countries differ significantly in their population structure. In 2020, Ireland (20.3%), France (17.9%) and Sweden (17.8%) had the largest share of people aged 0-14. Italy (13%) and Malta (13.4%) had the smallest share of people aged 0-14. The share of this population group did not have the same development trend. There was a significant increase in the share of people aged 0-14 in Latvia. Their share increased by 12.7%. The share of people aged 0-14 in the total population is in Chart 16.

In EU27, the share of people aged 65 and over increased from 17.8% to 20.6% in the period 2011-2020. The share of people aged 65 and over had a growing trend in all EU countries. Ireland (14.4%) and Luxembourg (14.5%) had the smallest share of people aged 65 and over in 2020. Italy (23.2%) and Greece (22.3%) had the largest share. For the share of people aged 65 and over in the total population see Chart 17.

In connection with the increasing share of people aged 65 and over in the total population, it should also be noted that the age structure of people aged 65 and over is changing. The share of people aged 80 and over is increasing. According to Eurostat forecasts, the share of people aged 80 and over in the EU will increase two and a half times by 2100. In addition to the population structure, the ageing of the population is also characterised by the age median. Half of the population is younger than the median age and half of the population is older than the median age. We determined the state and development of the median age from Eurostat sources (2021, 5) [demo_pjanind].

Chart 17 Share of people aged 65 and over in EU countries in %

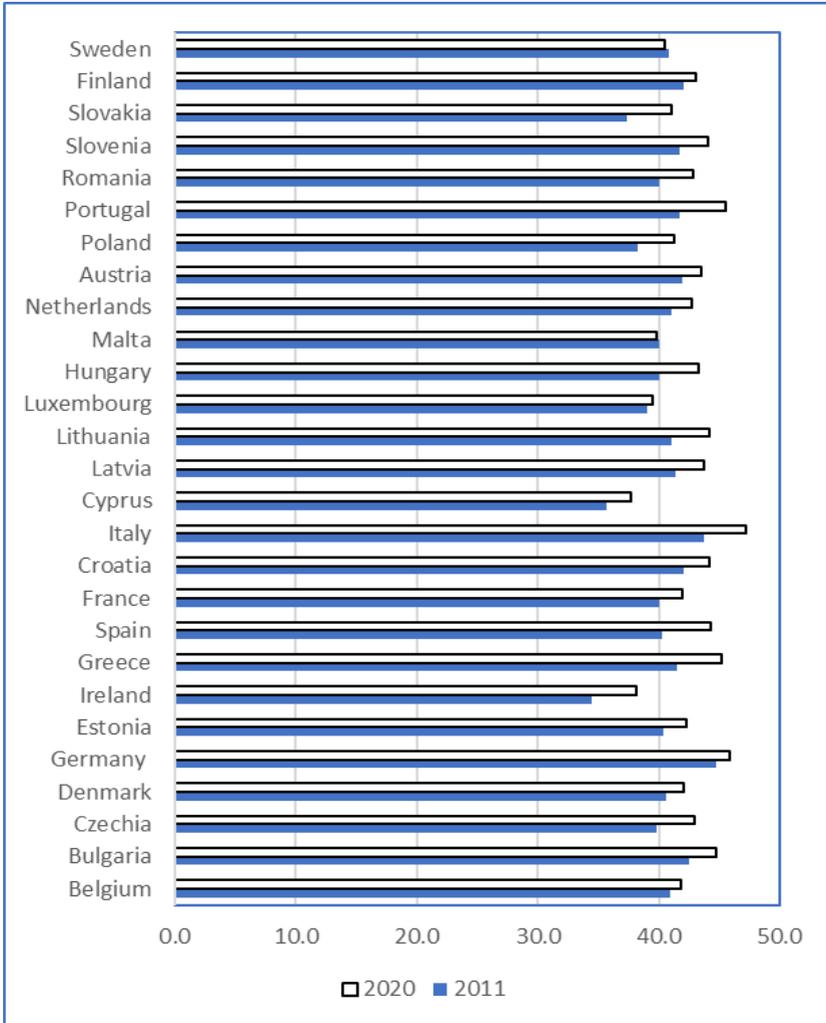


Source: Eurostat (2021, 5) [demo_pjanind]

In 2011, the median age in the EU27 was 41.6 years. By 2020, it had risen to 43.9 years. In 2020, the lowest values of the indicator were in Cyprus (37.7) and the highest in Italy (47.2). In most EU countries, the age

median increased. In Malta, it declined. In our view, the decline in the median in Malta was due to a large number of immigrant workers. The age median values in EU countries are in Chart 18.

Chart 18 Age median in EU countries in 2011 and 2020



Source: Eurostat (2021, 5) [demo_pjanind]

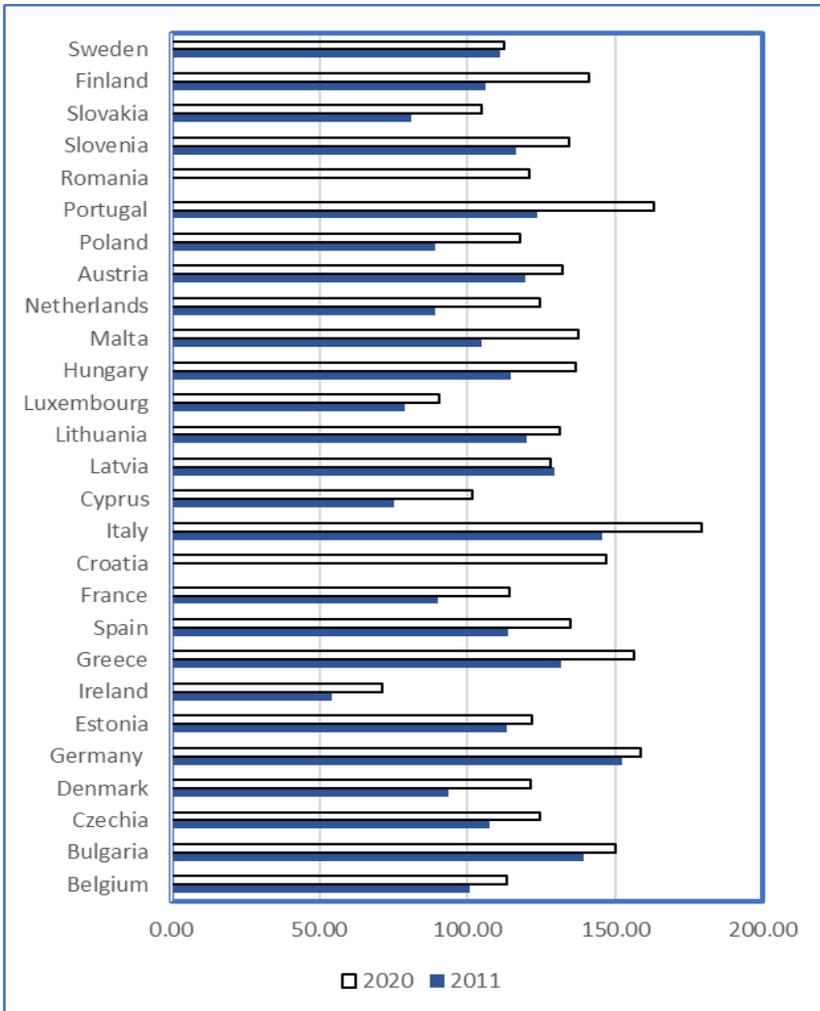
An indicator that is currently frequently used to evaluate the ageing process of the population is the ageing index (in %). It expresses the share of the number of people in the post-productive age per 100 people in the pre-productive age. The indicator is also known as the Sauvy index. As the post-productive component of the population is not defined by the same age limit in all EU countries, it is difficult to compare it from the international point of view. Therefore, when calculating it, it is always necessary to define the age limit of the post-productive component.

Based on Eurostat data (2021, 5) [migr_pop1ctz], we expressed the ageing index in % in 2011 and 2020 (Chart 19). We defined the post-productive component with an age limit of 65 and over.

All EU countries except Ireland and Luxembourg have an ageing index of more than 100%. Thus, for every 100 people of pre-productive age, there are more than 100 people of post-productive age. The countries with the highest values of the indicator in 2020 were Italy (179.35%), Portugal (163.24%) and Germany (158.81%). These countries have a significantly high share of people of post-productive age. Germany is characterised by a low number of children born. According to Káčerová, Ondačková and Mládek (2014), the liberalization of the abortion act of 1972 contributed to this fact. In contrast, the countries with the lowest value of the indicator were Ireland (71.19%) and Luxembourg (90.72%). Except for Latvia, the ageing index has been growing.

There was a significant increase in the ageing index during the period analysed, especially in Portugal. It increased by up to 39.34 percentage points. The second country where the indicator increased significantly was Finland. Its ageing index increased by 35.35 percentage points.

Chart 19 Ageing index in EU countries in %



Source: Eurostat (2021, 5) [migr_pop1ctz] Note: data in 2011 in Croatia and Romania were not published

Slovakia is one of the countries with a low value of the ageing index. Before 2017, it was less than 100% (Statistical Office of the Slovak

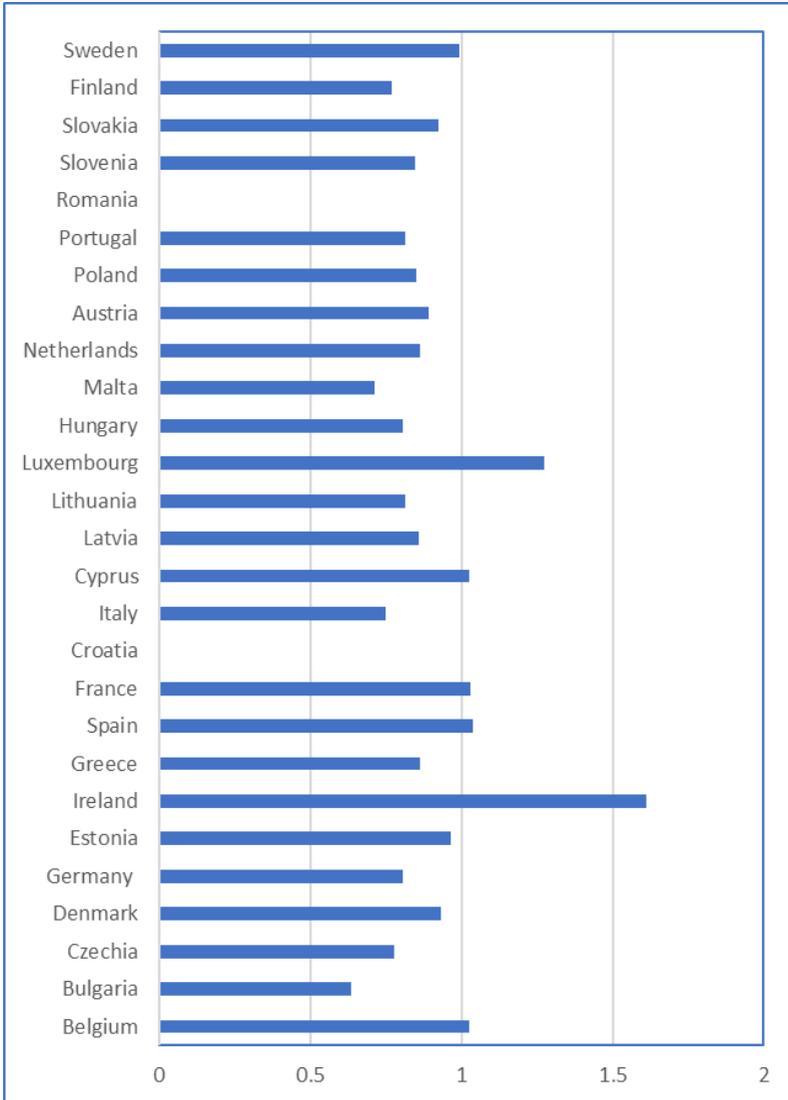
Republic, 2021). In 2020, its value was the fourth lowest (following Cyprus, Luxembourg and Ireland).

From these analyses we can conclude that the current EU is characterised by a process of population ageing. **In most EU27 countries, the post-productive population has already outweighed the pre-productive population. In some EU countries, the share of people of post-productive age is more than 1.5 times higher than the share of people of pre-productive age.**

Labour force reproduction

Important indices, which are based on the population structure by age, include the inflow coefficient, the outflow coefficient and the exchange coefficient. These indicators are directly linked to labour reproduction. The inflow coefficient in percent expresses the number of persons in the age group 10-14 per 100 persons aged 15-64. The outflow coefficient in percent expresses the number of persons in the age group 60-64 per 100 persons aged 15-64. The exchange coefficient is the ratio of the inflow coefficient and the outflow coefficient. It expresses the number of persons in the age group 10-14 per 100 persons aged 60-64. If its value is greater than 1, we speak of extended labour force reproduction. If its value is less than 1, we speak of reduced labour force reproduction. If its value is equal to 1, it is a simple reproduction of labour force. From the values of Eurostat (2021, 5) in 2020 [migr_pop1ctz], we expressed the exchange coefficient. The exchange coefficient was greater than 1 in Ireland (1.61) and Luxembourg (1.27). Thus, these countries were marked by extended labour force reproduction. The exchange coefficient was equal to 1 in Belgium, Greece, Spain and Cyprus. In other EU countries, the exchange coefficient was less than 1.

Chart 20 Exchange coefficient in EU countries in 2020



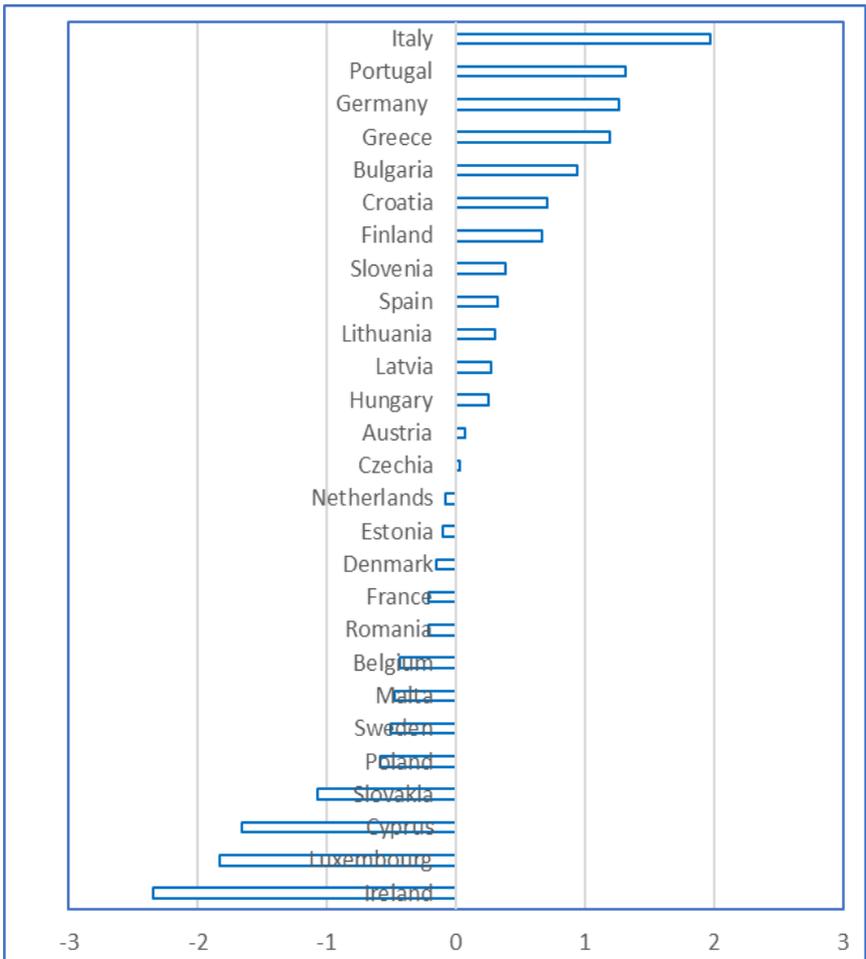
Source: Eurostat (2021, 5) [migr_pop1ctz] and own calculations

The exchange coefficient in the SR was 0.92. The exchange coefficient in the Czech Republic was lower than in the Slovak Republic. Its value was 0.78. Labour force reproduction reduced in both countries. If such a development persists, a shortage of labour force will occur, as in most EU countries the exchange coefficient is less than 1. As the trend is continuing, it is clear that there will be a labour force shortage in the labour market. This can be solved by hiring employees from abroad and increasing the share of people of post-productive age working. However, this requires a new approach at both government level and a new approach on the part of employers. Chart 20 shows the values of the exchange coefficient in EU countries. Data for Romania and Croatia have not been published.

4.2 Comparison of population ageing in EU countries using the multi-criteria evaluation method

As already mentioned, there are several approaches to evaluating population ageing. There are certain advantages and disadvantages to using each of them. The most frequently used indicators of population ageing are the age median, the share of people aged 65 and over in the total population and the ageing index. However, their separate use provides only a one-sided view of the ageing process. In the following analysis, we focused on the comparison of population ageing in EU countries by using multiple indicators and we used one of the methods of multi-criteria evaluation of variants - the standardized variable method. Multi-criteria evaluation of variants enables to compare variants on the basis of several criteria (i. e. on the basis of more than one criterion). In our case, the variants are EU27 countries and the criteria are the indicators of ageing.

Chart 21 Population ageing in EU countries - standardized variable method



Source: Eurostat (2021, 5)

We used the following indicators:

- index of ageing;

- the share of people in the age group 65;
- age median.

Indicators are directly related to ageing. We are talking about maximization indicators. The period analysed is 2020. The values of individual indicators in the EU27 countries are described in the previous sections. The data were taken from the Eurostat database.

In the first step, the values had to be transformed. In the case of maximization indicators, the following transformation is used:

$$z_{ij} = \frac{x_{ij} - \bar{x}_j}{s_{xj}}$$

where $j=1,..4; i=1,2,...27$ (Mládek, Káčerová, Stankovičová, 2018, p. 97). The transformed values are standardised and thus have an arithmetic mean of 0 and a standard deviation of 1. The resulting values of the composite variable (Chart 21) were obtained as the arithmetic mean of the transformed values.

Chart 21 shows that Italy had the highest composite indicator values in the EU in 2020. The population of Italy can be considered the oldest in the EU27. Other countries in the population ageing evaluation are Portugal, Germany and Greece. By contrast, the youngest population in the EU27 is in Ireland, Luxembourg, Cyprus and Slovakia. Slovakia is therefore one of the four EU countries with the youngest population. However, according to Eurostat projections, the ageing process in Slovakia will be very fast in the future. The values closest to the arithmetic average are in the Czech republic, Austria and the Netherlands.

By comparing the results of the ageing index and the standardized variable method, we can state that in both cases the oldest population seems to be in Italy.

The results in the second place are the same. The second largest value of the ageing index was in Portugal and the third in Germany. According to both methods, Ireland and Luxembourg have the lowest values of the ageing indicators.

Thus, we can conclude that Italy has the oldest population in the EU. The EU population with the lowest values of the ageing indicators analysed is Ireland and Luxembourg. Using both methods, Slovakia belongs to the group of countries with the lowest values of the ageing indicators. However, the dynamics of the ageing process should increase in the next period.

4.3 Population ageing and its consequences

Population ageing is very closely linked to economic and social changes (Infostat, 2006). It is manifested in several areas. One of the most important changes is the fact that prolonging life expectancy leads to an increase in population morbidity and thus to an increase in the costs of healthcare. Population ageing is therefore connected to increasing public spending on healthcare and social security. Another important aspect is the fact that an increase in the number and share of the post-productive population has the effect of reducing the effectiveness of the continuous pension system. The current interconnection of the pension system with life expectancy in several EU countries should contribute to intergenerational justice.

Healthcare costs

Healthcare costs vary from one EU country to another. They depend on several factors. They limit their economic performance and the share of

GDP reserved for healthcare. Healthcare costs depend on the age and gender of the insured. The average costs of healthcare per person in each age category are marked by an increasing trend from 41 to 82 years of age.

The analysis of the impact of the change in the structure of the population on the basis of its projections on healthcare costs was performed in the conditions of the Slovak Republic.

According to the data of the Ministry of Finance of the Slovak Republic, the Institute of Financial Policy (2016), the average annual healthcare costs in the Slovak Republic per man aged 41 were 454 EUR and per woman aged 41 were 581 EUR. The costs per man aged 82 were 2074 EUR and per woman aged 82 were 1997 EUR. Thus, the costs of healthcare per man aged 82 were 3.57 times higher compared to the costs per man aged 41. The costs of healthcare per woman aged 82 were 3.44 times higher than the costs per woman aged 41. As a result, the costs of healthcare will change significantly as the population structure changes.

On the basis of data from the Ministry of Finance of the Slovak Republic, the Institute of Financial Policy (2016), on healthcare costs in the Slovak Republic and based on population forecasts in the Slovak Republic by age and gender from Eurostat (2021, 5) (proj_19np), we expressed the expected healthcare costs in the Slovak Republic in 2050.

In our reasoning, we proceeded from the assumption that the costs will not change in the individual age groups and will be the same. Based on the values of healthcare costs for men and women and the expected population structure in individual age groups in 2050, we came to the following result:

The average costs of healthcare in the Slovak Republic will increase to more than EUR 5 billion in 2050 (calculation in Annex 1).

According to the Ministry of Finance of the Slovak Republic, the Institute of Financial Policy (2016), the healthcare costs of insurance companies were EUR 4 billion. **Thus, it can be assumed that by 2050 the average costs of healthcare in the Slovak Republic will increase by more than 25%.** Such an increase in costs will significantly burden the system of public expenditures in the Slovak Republic. Therefore, it is necessary to start seeking approaches to solving such rising healthcare costs now.

Our reasoning is based on the assumption that the costs of healthcare by age will not change until 2050. However, this assumption is unlikely to be met and an even greater increase in healthcare costs than we have calculated can be expected.

Our conclusions regarding one EU country point to the fact that the increase in healthcare costs caused by future changes in the population structure is not negligible and we need to deal with it now.

Pension provision

EU countries differ in their approaches to adjusting pension systems. There are also differences in access to retirement age between EU countries. At present, the lowest retirement age in all countries in the EU27 is equal to or over the age of 60 (Trading Economics, 2021). When speaking about increasing the retirement age, it should be emphasized that increasing the number of the economically active population by extending the retirement age has its limits. These vary by industry. In industries where manual labour predominates, it is difficult to find employment for people of advanced post-productive age. Even in many sectors where manual work does not predominate, relatively few jobs are currently reserved for people of post-productive age. Therefore, new approaches need to be introduced that could help increase the labour market participation of people of post-productive age. However, it should be emphasized that the state of health, which significantly

affects the employment potential of the elderly, also plays a major role in the employment of people of post-productive age.

The introduction of flexible forms of employment, such as working from home, part-time work, expanding the number of jobs where two or three workers take turns in one job, contributes to increasing the number of jobs for people of post-productive age. Certain policy decisions can contribute to increasing the share of people of working age remaining in employment too. One of them is the decision to increase old-age pensions if the retirees remain in employment after reaching retirement age, or supporting employers who employ people of post-productive age etc.

Changing the structure of consumption and social climate

The change in the population structure, which is reflected in population ageing, triggers changes in the structure of consumption. The demand for fashion goods and household equipment is declining. The demand for medical supplies is growing. Education costs are falling. The demand for all-day care services is growing.

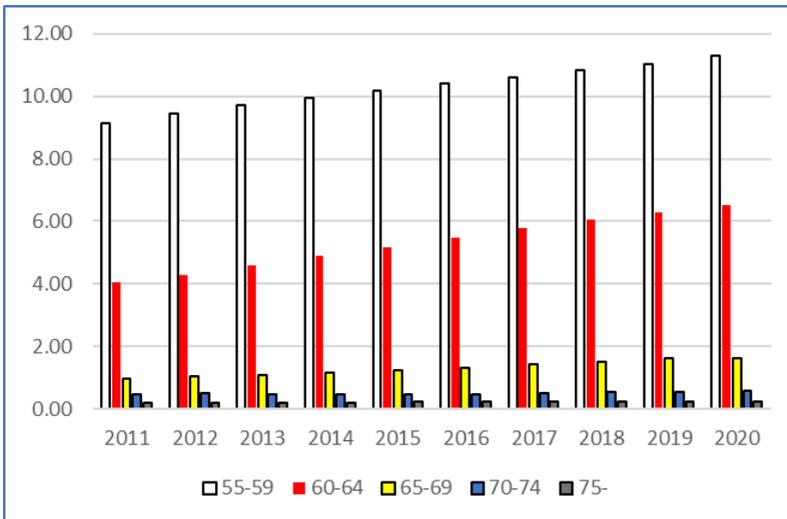
As the population ages, so does the social climate. The dynamics in society may decrease. On the other hand, the increase in life expectancy, which contributes significantly to population ageing, is a reflection of the advances in medicine. One could say that ageing is the result of progress.

A decrease in the share of the working-age population and an increase in the share of the post-productive age population may lead to a decrease in the size of labour force. This trend then directly affects the economic burden on the productive part of the population

Changing the age structure of labour force

Population ageing is reflected in labour force ageing. The share of labour force of older age is increasing. As is clear from Chart 22, the share of people aged 55-59, 60-64, 65-70 and 75 and over in the EU in the economically active population is increasing. The largest share of economically active people is in the first two groups. In 2020, of the number of economically active persons aged 15 and over, 11.03% were aged 55-59 and 6.31% were aged 60-64. The largest increase in the share was in the group of 65 years and over, where the share increased by up to 70.3%. On the contrary, the smallest increase in the share was in the group of 75 years and over.

Chart 22 Share of economically active people in individual age groups in the number of economically active people aged 15 and over in the EU in %



Source: Eurostat (2021, 5) [lfsa_agan] and own calculations

According to the International Labour Organization (2018), the older labour force has its own specifics. One of them is that older employees participate to a lesser extent in further vocational training. This is due to the fact that, on the one hand, older employees are less interested in education and, on the other hand, employers avoid incurring costs for further education and training. This reduces labour mobility. Older employees are unlikely to change professions or sectors.

Compared to younger employees, older employees are less willing to undergo changes. As a result, labour force ageing makes changes in the labour market slow down. Skills associated with the introduction of innovations may age and this can affect labour productivity.

In connection with population ageing, significant ageing of employees is already taking place in some occupations. These are mainly professions that are not attractive to young people, such as teaching, caring for the sick etc. Significant population ageing is also reflected in occupations where the limited number of students admitted does not cover the needs of the market, e. g. physicians.

4.4 Future changes in the structure of employment in connection with the change in population structure

As the age structure of the population changes, so does the structure of consumption expenditure. This is due to different consumer behaviours in different age groups. A change in the structure of consumption expenditure can cause a change in the structure of employment in individual sectors.

In the next part of this monograph we deal with the future change in the structure of employment in selected sectors of the economy, which may arise in connection with the change in the population structure. Our considerations about the expected future change in the structure of employment are based on the Boersch-Supan study (2003). According to this study, future changes in the employment structure can be estimated on the basis of forecasts of the development of the share of the population in different age groups and on the basis of consumer behaviour. Based on this assumption, the following analysis is focused on estimating changes in employment in selected sectors. As differences in consumption within the EU27 can be large, it is important to carry out analyses at national level. The following analysis is focused on the conditions of the Slovak Republic.

The shares of consumption expenditure in individual age groups are needed to estimate changes in employment in the Slovak Republic. In the analysis we used the average values of consumption expenditure from Eurostat in twelve groups of expenditure in 4 age groups - under 30, 30-44, 45-59, 60 and over. The source of data on consumer behaviour is Eurostat (2021, 5) [hbs_str_t225] (it is also possible to use Eurostat (2021, 5) [hbs_exp_t111], [hbs_exp_t135]).

Consumption expenditure shares are published in Eurostat every five years. The latest published data are from 2015. For this reason, we present the structure of consumption expenditure by age in % in 2015 (Table 8).

It is clear from the structure of consumption expenditure that at the age of 60 and over the share of consumption expenditure on basic necessities (housing, water, electricity, gas and other fuels, food and non-alcoholic beverages) increases. This is also due to the fact that people aged 60 and over lose their incomes and live mainly on pensions.

Table 8 Structure of Consumption Expenditure by Age in the Slovak Republic (2015) in %

	Under 30	30-44	45-59	60 or over
Food and non-alcoholic beverages	18.1	18.6	18.6	22.8
Alcoholic beverages, tobacco and narcotics	2.7	2.7	2.6	2.8
Clothing and footwear	4.3	5.5	5.2	2.7
Housing, water, electricity, gas and other fuels	30.5	28.7	29.0	40.8
Furnishings, household equipment and routine household	5.6	5.0	4.4	4.3
Health	2.3	2.3	2.4	4.2
Transport	11.4	11.5	12.7	6.5
Communications	5.6	4.9	5.1	4.1
Recreation and culture	6.5	6.6	6.1	4.6
Education	0.4	0.8	0.9	0.2
Restaurants and hotels	4.4	5.2	5.2	2.7
Miscellaneous goods and services	8.1	8.3	7.7	4.2

Source: Eurostat (2021, 5) [hbs_str_t225]

At the same time, it is clear that the share of consumption expenditure on health is growing as well. In the highest age group analysed, the share of consumer expenditure on transport, recreation and culture, restaurants and hotels, miscellaneous goods and services, education,

clothing and footwear, furnishing, household equipment and routine household is declining.

The starting point for further consideration is the assumption that consumer behaviour will not change over the next period. At the same time, we assume that if it is currently necessary to secure the goods or services of k employees and in n years the volume of goods consumed or services s will multiply, in n years s times k employees will be necessary.

In the next section, we describe the logical sequence of further steps to express the change in the employment structure in n years in relation to consumer behaviour according to Kostrová (2020), who based her approach on the Boersch-Supan procedure (2003). The author slightly modified the procedure. We will then state what conclusions on changes in the structure of employment she has reached.

Statistical data on the structure of consumer expenditure in % in age groups, on consumer expenditure in age groups in EUR, on the number of persons in the age groups, on the number of persons employed in the production of goods or provision of services. It also uses a prediction of the number of people in age groups in n years.

- Data on consumer expenditure shares in % for each expenditure group will be converted to EUR based on the average total expenditure per person in each of the 4 age groups.
- Then, the total consumption in the individual groups will be determined on the basis of the number of persons in each of the age groups analysed.
- In the next step, the number of employees in the production of the goods or services will be determined.

- Based on the prediction of the population according to age in n years, the prediction of consumption in individual groups is determined.
- By comparing the change in the volume of consumer expenditure in the groups in the current and the predicted period, we will find out how much the volume of consumption expenditure will increase or fall in the selected sector in the future.
- From this data we will express by how much the number of employees in the selected sector will increase or decrease (Kostrová, 2020).

Kostrová (2020) uses data on the structure of consumption expenditure from 2005, 2010 and 2015. She calculates their average values. To express the additional need for the number of employees, she focuses on the sector of housing, healthcare, transport and education. She predicts changes in the short term in 2022. She came to the conclusion that by 2022, more employees will be needed in the healthcare and housing sectors. On the contrary, the need for employees in the transport and education sector will decrease.

For data on the additional need for employees in individual sectors according to Kostrová (2020) see Table 9.

Based on the above results and without changing the assumptions, it is possible to expect an increase in employment in the health sector as the population ages. At the same time, employment can be expected to fall in the education and transport sectors.

Table 9 Additional need for employees in selected sectors based on consumer behaviour in individual age groups in 2022

Sector	Additional need for employees
Housing sector	+500
Healthcare	+3000
Transport	-2300
Education	-4600

Source: Kostrová (2020)

4.5 Position of the elderly in the EU labour market

4.5.1 Employment of the elderly in the EU

Employment rate

The employment rate in the EU-27 is rising. The number of employees aged 15-64 increased by 4.7% between 2011 and 2020 (Eurostat (2021, 5) [lfsa_egan2]). In the next step, we focused on the analysis of the development of the employment rate. We analysed the employment rate in the EU27 on the basis of data available from Eurostat (2021, 5) [lfsa_egan]. We compared the employment rates of people aged 15-59, 60-64 and 65 and over by gender.

The employment rate had a growing trend in all age groups. However, the fastest growing employment rate for both genders was in the group of people aged 60-64. The reason was the postponement of the retirement age in this age group. From 2011 to 2020, the employment rate for men increased from 36.4% to 52.5%, the employment rate for women increased from 23% to 38.7%. The smallest absolute increase in the employment rate was for women aged 65 and over. Their

employment rate rose from 2.9% to 3.9%. The largest share of people in the age group 65 and over worked in agriculture, forestry and fishing. The employment rate of the age group 60-64 in the EU in 2020 was 45.3%. However, when monitoring the employment rate of the elderly in individual EU countries, we can state that there are significant differences between the countries ((Eurostat, 2019, 1) and Eurostat (2021, 5) [lfsa_ergan]). The highest employment rate for people aged 60-64 in 2020 was in Sweden (69.2%) and the lowest in Luxembourg (20.2%). The employment rate in this age group declined in only one country - Luxembourg (a decrease from 20.9% to 20.2%).

In the age group 65 and over, the employment rate in the EU was 5.7% and the highest employment rate (13.7%) was in Estonia. The lowest employment rate was in Spain (2.7%). Interestingly, in some EU27 countries, the employment rate of people aged 65 and over decreased in the period 2011-2020. Such countries include Croatia, Cyprus, Luxembourg, Austria, Romania and Slovenia.

The employment rate of people aged 60-64 (38.3%) in Slovakia was 7 percentage points below the EU average. The employment rate of people aged 65 and over (4.5%) in Slovakia was 1.2 percentage points below the EU average. We can state that the employment rate of people aged 60 and over in the Slovak Republic is below the EU average in all age groups. In connection with rapid population ageing in the Slovak Republic, it will be necessary to increase the employment rate in these age groups in the future.

According to Eurostat (2019, 1) and Eurostat (2021, 5) [lfsi_dwl_a], the average working life in the EU was in 2020 38.0 years for men and 33.2 for women. Men had the longest working life in Sweden (43.2 years) and the Netherlands (43.1 years) and women in Sweden (40.6 years).

Slovakia had a below-average working life for both men (36.4 years) and women (31.6 years).

It is clear from the above that countries that have experienced earlier ageing population have postponed the retirement age and thus extended working life. However, in addition to postponing the retirement age, a suitable supply of jobs for the elderly is needed to reduce the impact of ageing.

Eurostat follows the reason why people in the older age groups are not employed in their last job. The latest published data are for 2019. According to Eurostat (2019, 1), the reason for early retirement had 15.9% people aged 55-64 in the EU27 in 2019 and 15.8% people had own illness or disability as the reason why they are not in employment having left their last job during the previous eight years. The reason for early retirement in 2019 had 14.3% people aged 65-74 years in the EU from people not in employment have left their last job during the previous eight years. It follows that more than 30% of people not in employment having left their last job during the previous eight years do not work because they have retired earlier or are ill.

Part-time employment of the elderly

In the next step, we focused on part-time employment of the elderly in the EU (Eurostat, 2019, 1). The share of part-time employees in the age group 55-64 in the total number of persons employed in the relevant age group was 9.3% for men and 33.9% for women in the EU27 in 2019 (Eurostat (2021, 5) [lfsa_eppgan]). For both genders, the share of part-time employees prevailed in the age group 15-64 (the share of men was 8.4% and the share of women was 29.9%). It is clear from the above that the share of women employed part-time is significantly higher than the share of men employed part-time. This is mainly due to the fact that

children and families are cared for mainly by women and therefore women tend to choose part-time employment.

In the age group 65 and over, the share of men employed on a part-time basis was 47.6% and the share of women was 60.2%. The share of women employed part-time in the oldest age group was also significantly higher than the share of men employed part-time.

The highest share of both men and women employed part-time aged 55-64 and 65 and over was in the Netherlands (women: 80.4%; 89.9%; men: 25.0%; 75.2%). The share of women employed part-time aged 55-64 in the Netherlands (80.4%) differed significantly from the share of women employed part-time in the EU (33.9%). The share of men employed part-time aged 55-64 in the Netherlands was significantly lower (25.0%) than the share of women employed part-time.

The share of men (3.9%) and women (7.9%) employed part-time in the age group 55-64 in Slovakia was significantly below the EU average. The share of men and women employed part-time in the age group 55-64 in the Czech Republic exceeded the values of Slovakia.

The analysis shows that Slovakia has several shortcomings in the employment of older people on a part-time basis. The reason may also be the lack of offers from employers. Increasing the share of part-time employees in Slovakia could be beneficial for the labour market.

It follows from the above that part-time employment has a long tradition in some EU27 countries and employers provide many such jobs. However, there are still many countries where such an approach is not common. It is important to encourage employers to focus on increasing the number of part-time jobs. On the other hand, it is also important to mention the fact that non-standard employment contracts are more often associated with wage disadvantages (European Commission, 2015). We assume that the declining labour force can also

have a positive effect on wages for non-standard employment contracts.

Self-employment of the elderly

“Self-employment can offer the flexibility to help some older people stay in work - for example, professionals such as accountants might become consultants, or teachers may become private tutors or supply teachers.” (Eurostat, 2019, 2, p. 81). Within the EU, according to Eurostat (2019, 1), in 2019 the share of self-employed persons in the total number of employed persons was relatively high in the older age groups. While in the age group 25-54 the share of the self-employed in the EU is 13.3%, in the age group 55-64 it is 18.2%. However, there is a significant difference in the self-employed in the age group 65-74 (41.6%) and in the age group 75 and over (58.4%). About one-seventh of employed people aged 65 and over work from home (Eurostat, 2019, 3), (Eurostat, 2021, 4).

Greece had the maximum values of the indicator in the age groups 55-64 (46.1%) and 65-74 (67.1%). In the age group 75 and over, Portugal had the maximum share of self-employed persons (up to 89.6%).

The share of self-employed people in the age groups 55-64 (16.7%) and 65-74 (24.7%) in Slovakia was below the EU average and the values were lower than in the Czech Republic. Slovakia has shortcomings in the self-employment of the elderly. These large shortcomings were caused by the fact that the current generation of the elderly lived in the period of socialism and therefore did not run a business. The current young generation is in a different situation. Therefore, it can be assumed that the share of self-employed elderly in the Slovak Republic will increase over time.

Employment of the elderly by selected economic activities

In the next step, we focused on the types of employment for people aged 65 and over. According to Eurostat (2019, 1), the largest number of employed people aged 65 and over in the EU in 2019 was employed in agriculture, forestry and fishing. However, the development of their number was declining. The share of people employed in agriculture, forestry and fishing in the age group 65 and over decreased from 30.6% to 14.9% in the period analysed. From 2011 to 2019, the share fell to 48.7%. However, despite the declining trend, the share of people employed in agriculture, forestry and fishing was the highest at the end of the period analysed. The trend in this segment was opposite to the other segments (distributive trades, health and social work, professional, scientific and technical activities, manufacturing and education). The fastest increase in the number of employed persons aged 65 and over in the EU was in the health and social work sector, where the share increased by 51.5%. The second fastest increase in the number of employed persons aged 65 and over was in education, where the share increased by 47.8%.

We anticipate that the share of people aged 65 and over in healthcare and social work and education will continue to rise in the following period. This is due to the lack of physicians and teachers in the younger age groups in most EU27 countries.

The activity where older people (55-74 years) accounted for the highest share of labour force in Slovakia in 2018 were security and investigation activities. Interestingly, in 2019 it was creative and entertainment activities and arts. The activity where older people accounted for the highest share of labour force in the Czech Republic people aged 55 to 74 years were security and investigation activities.

In the next step, we were interested in the average working hours per week for people in the age group 65-74 . The average working hours per

week in the EU27 for people aged 65 to 74 were 25 hours for women and 30.6 hours for men in 2019. On average, men work 5.6 hours longer per week than women.

Eurostat (2019, 1) also monitors people's job satisfaction. Interestingly, both men and women in the age group 60-64 (91%, 90.7%) and in the age group 65-74 years (93.9%, 93.0%) are more satisfied with their work than men and women aged 15-64 (90%, 89.5%). In the age group 65-74, men (90.7%) are more satisfied with their work than women (90.1%). The least satisfied with their work are men aged 55-59 (89.2%). If we understood job satisfaction in terms of how men and women value their work, then the above could lead to the conclusion that people aged 65-74 value their work the most.

4.5.2 Risk of poverty and healthcare for the elderly in the EU

Poverty is a social phenomenon that is always understood as relating to the level in a given society. It relates to extreme inequalities and is the opposite of wealth. It is a complex problem present in every society around the world. The risk of poverty increases due to many factors. One of the basics factors is age. The generation of people in pre-retirement and retirement age is significantly more at risk of poverty than the younger generations.

In the next step, we analysed the development of the risk of poverty of the elderly in the EU. According to Eurostat (2021, 5) [ilc_pns1], the value of the risk of poverty (cut-off point: 60% of median equivalised income after social transfers) for people aged 60 and over increased from 14.8% to 16.1% in the EU27 from 2011 to 2019 (Chart 23). This trend was not stable. Until 2014, the values of the indicator decreased. However, since 2014, the values of the indicator have had a growing

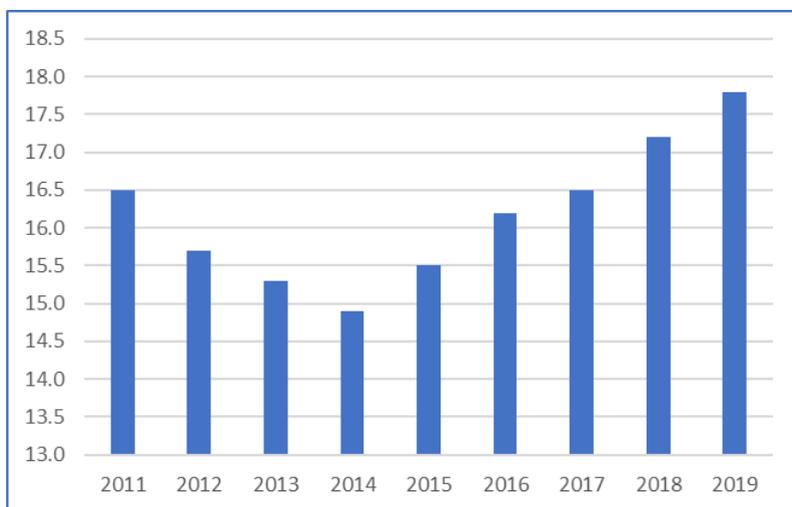
trend. **As the share of elderly people aged 60 and over in the EU increases, so does the number of people who are at risk of poverty.**

The share of people of post-productive age in the EU is expected to increase, and thus, if social policy does not change, it can be assumed that the risk of poverty in the age group 60 and over will increase as well. It is important to take measures now to mitigate this trend.

EU countries differed in the values of the indicator and the development trend. Cyprus had the highest values in 2011 (30.1%) and Latvia in 2019 (42.9%).

The maximum percentage increase was in Latvia, where the value of the indicator rose to 393.6%. A large decrease in the value of the indicator was in Greece, where the value fell to 58.3%.

Chart 23 Development of the risk of poverty rate in the EU27



Source: Eurostat (2021, 5) [ilc_pns1]

In the value of the risk of poverty rate (cut-off point: 60% of median equivalised income after social transfers) for people aged 60 and over, there is gender differentiation. Women are more affected by poverty than men. Thus, women are more endangered also in the age group of 60 or over. In 2011, the risk of poverty was 16.5% for women and 12.7% for men. In 2019, the EU's risk of poverty rate was 18.1% for women and 14.7% for men. Thus, women in the age group of 60 or over are a more vulnerable group. The gender gap is not increasing significantly.

Population ageing and healthcare

Population ageing is manifested in the field of healthcare in several ways. In connection with population ageing, a more significant change is occurring in the age structure of employees working in the field of healthcare and social care. The age structure of physicians and other medical staff is changing significantly.

At the same time, as the population ages, the share of people in need of more healthcare is increasing. This increases the demands on healthcare and social care and leads to an increase in healthcare costs and demands on healthcare staffing.

Thus, the process of population ageing implies that in the future there will be an increasing need for professions providing public health services and providing social and healthcare in households. At the same time, healthcare costs are expected to increase.

4.6 The impact of ageing on selected professions in the EU

The ageing of the population has different levels of impact on different professions. Physicians and teachers are among the professions most affected by population ageing. Therefore, in the next section, we will focus on the ageing of physicians and teachers.

4.6.1 Ageing of physicians in the EU and in Slovakia

The ageing of physicians is manifested by an increase in the share of physicians in the post-productive age and an increase in the average age of physicians. Failure to address the rapid ageing process of physicians can lead to a shortage of physicians, which in turn can affect the economy and human health.

In this analysis, we deal with the ageing of physicians in the EU and we follow the evolution of the relative number of physicians (per 100000 inhabitants) and their structure by age between 2011 and 2019. The reason for the shorter time series is that the data for 2020 have not yet been published. As part of the analysis, we will also focus on the position of the Slovak Republic within the EU. According to Eurostat (2021, 2) and Eurostat (2021, 5) [HLTH_RS_PRS1]) the share of physicians per 100000 population varies considerably across the EU. Austria is one of the countries with a high share of physicians per 100000 inhabitants. In 2019, there were 524.1 practicing medical physicians per 100000 inhabitants in Austria. In contrast, in Belgium there were only 316.3 practising medical physicians per 100000 inhabitants. However, the variability within the EU27 expressed by the margin of variation decreased over the period analysed.. Nevertheless, there are still significant differences between EU countries.

The share of physicians has a growing trend in all EU countries. In our opinion, this trend is also the result of an ageing population. The elderly population has higher demands on health care staffing.

We will monitor the ageing of physicians in the EU on the basis of the share of physicians over the age of 65 in their total number. Data on the share of physicians in the group of 65 and over is published until 2018. Therefore, we will focus on the share of physicians aged 65 and over in 2018. According to Eurostat (2021, 2), the share of physicians in the EU in the age group of 65 and over is relatively high. In 2018, their share

was the highest in Hungary (20.4%). Spain and Cyprus also had a high share (above 19%). Some countries had a significantly low number of physicians in the age group of 65 and over. For example in the UK, their share was only 2.1%. Thus, there are significant differences between countries in the share of physicians in the age group of 65 and over. Slovakia had a share of physicians aged 65 and over of 14.2% and ranks among the EU27 countries with an above-average number of physicians in the age group of 65 and over.

Table 10 The number of physicians in Slovakia

	2011	2012	2013	2014	2015	2016	2017	2018	2019
40-49	3 968	4 188	4 397	4 496	4 491	4 502	4 376	4 425	4 367
50-59	5 056	4 844	4 420	4 103	3 824	3 582	3 349	3 398	3 525
60-64	1 842	2 083	2 247	2 498	2 653	2 702	2 588	2 404	2 114
66+	1 298	1 449	1 632	1 788	1 948	2 177	2 367	2 720	3 014

Source: NCZI (2015), NCZI (2016), NCZI (2017), NCZI (2018), NCZI (2019), NCZI (2020), NCZI (2021)

Table 11 Share of physicians in Slovakia in %

	2011	2012	2013	2014	2015	2016	2017	2018	2019
40-49	22.2	23.0	24.0	24.2	24.0	23.9	23.5	23.1	22.4
50-59	28.3	26.6	24.1	22.1	20.4	19.0	18.0	17.7	18.1
60-64	10.3	11.4	12.2	13.4	14.2	14.3	13.9	12.5	10.9
65-	7.3	8.0	8.9	9.6	10.4	11.5	12.7	14.2	15.5

Source: NCZI (2015), NCZI (2016), NCZI (2017), NCZI (2018), NCZI (2019), NCZI (2020), NCZI (2021)

It is clear that the high share of physicians aged 65 and over in some EU countries could mean a shortage of physicians in the future, provided that the number of new physicians does not increase.

The ageing of physicians is evident also in Slovakia. The number of physicians in Slovakia in a total of 5-year age groups from the age of 40 is shown in Table 10. The share of physicians in the age groups is in Table 11.

The number of physicians in Slovakia had a growing trend between 2012 and 2019. The absolute number of physicians increased by 9% from 2011 to 2019.

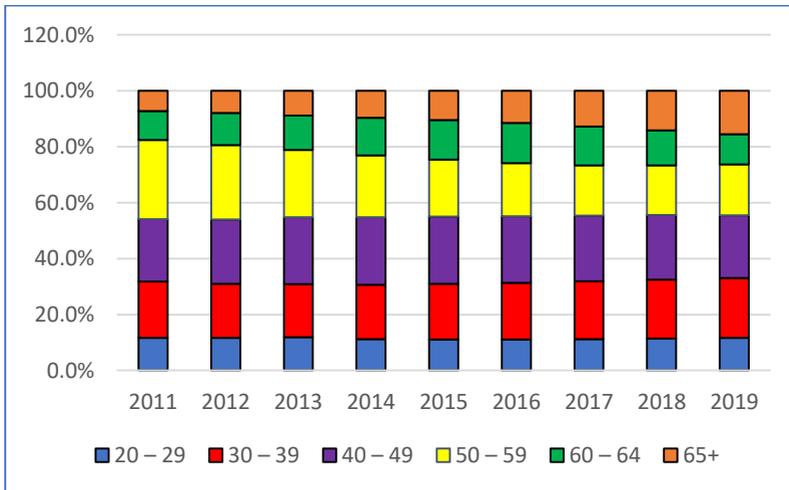
It is clear from the age structure of physicians that since 2011 there has been a significantly growing share of physicians in the age group of 65 and over (Chart 24). Since 2011, their share in the Slovak Republic has increased from 7% to 15.5%. "In particular, over 40% of general practitioners and paediatricians are elderly. With a smaller number of young incoming physicians." (Ministry of Finance of the Slovak Republic, Ministry of Health of the Slovak Republic, 2018, p. 14). In our opinion, the trend of ageing of physicians is alarming and needs attention. Measures need to be taken to reduce the number of physicians leaving Slovakia; increase the number of medical graduates and support the recruitment of physicians from abroad.

From the previous development of the number of physicians, it is possible to expect their further development. Over the next ten years, physicians aged 60 and over will be replaced by physicians aged 50 and 59. However, the number of physicians in the age group 50-59 had a significantly declining trend in the period analysed. At the same time, the share of physicians in the age group under 49 did not change significantly.

It follows that if the share of incoming physicians does not increase in the coming years, there will be a significant shortage of physicians in ten years in Slovakia.

This development will be further accentuated by the fact that by 2020 the post-productive population is expected to increase from 15.5% (in 2018) to 21% (the fastest in the EU). Their rapidly growing share will also increase the demands on healthcare in the Slovak Republic.

Chart 24 Age structure of physicians in the Slovak Republic



Source: NCZI (2015), NCZI (2016), NCZI (2017), NCZI (2018), NCZI (2019), NCZI (2020), NCZI (2021)

4.6.2 Ageing of teachers in the EU

As we consider the ageing of teachers to be a serious problem, in the next part we will focus on the analysis of the state and development of the number of teachers in total and the share of teachers in the age group of 65 and over in the total number. According to the European Commission (2016, 2), “the alarming trend in many countries is the ageing of teachers. With their retirement, the risk of loss of experience and labour shortages increases. Innovative recruitment, attractive

working conditions and policies are needed to create a new generation of teaching professionals to maintain interest in the teaching profession. Equally topical and increasingly urgent priority across the EU is the development of the competencies of teachers, including those who have been in the profession for a long time.”

According to Eurostat (2021, 5) [educ_uoe_perp01], the number of primary education teachers across the EU27 had a growing trend from 2013 to 2019 (data for 2011 and 2012 are not published). The number of teachers in primary education increased by 11.95% in the period analysed.

In most EU countries, the number of teachers in primary education has increased. The largest increase in the number of teachers was in Slovenia (by 183%). Their number decreased in Lithuania, the Netherlands, Portugal and Romania.

We will monitor the ageing of primary education teachers in the EU based on the share of teachers over the age of 65 in their numbers from 2013 to 2019, based on Eurostat data (2021, 5) [educ_uoe_perd01]. EU-wide data are not published. But we can follow the trend in some EU countries. Estonia has had the highest values of the indicator in the long run. In 2019, the share of teachers over the age of 65 in the total number of teachers was 6.7%. By contrast, Luxembourg (0.06%) and France (0.07%) had small values. In Slovakia, their share in 2019 was 1%. The share of teachers over the age of 65 in primary education in their number in the period analysed was not high. Thus, the ageing of teachers in primary education is not alarming.

According to Eurostat (2021, 5) [educ_uoe_perp01], the number of tertiary teachers (levels 5-8) in the EU has been on a rising trend since 2013. However, their numbers have fallen in many EU countries. Such

countries include Bulgaria, Denmark, Estonia, Greece, Italy, Lithuania, Poland, Portugal, Romania, Slovenia, Slovakia and Finland.

We will monitor the ageing of tertiary teachers (levels 5-8) in the EU based on the share of teachers over the age of 65 in their numbers from 2013 to 2019 from Eurostat (2021, 5) [educ_uae_perd02].

EU-wide data are not monitored. However, we can follow the trend in some EU27 countries. Latvia has the highest values of the indicator in the long run. In 2019, their share was 16.1%. Bulgaria (12.2%), Slovakia (12.3%) and Estonia (11.2%) also had high values of the indicator. On the other hand, e.g. Luxembourg had only 0.4% of teachers over the age of 65 in 2019, Belgium (0.9%) and France 1.0%. Thus, it is clear that the EU27 countries differ significantly in terms of the share of teachers in the age group analysed. Slovakia is one of the three countries in the EU with the highest share of teachers in tertiary education over the age of 65.

The high value of the indicator can be a reflection of several influences. Interest in the teaching profession is different. It is related to whether the profession is considered attractive in the country and in many cases depends on the level of teachers' salaries. Due to the high share of teachers aged 65 and over and the low interest of young people in this profession, it can be assumed that in the coming period there will be a gradual shortage of tertiary education teachers in several countries (levels 5-8). EU countries also differ in the trend of the share of teachers in tertiary education over the age of 65 in their number. The Netherlands is one of the countries with a significant increase. The share of teachers over the age of 65 in their number is 200% higher from 2013 to 2019. In Slovakia, their share increased by 46.3% in such a short period. On the other hand, some countries have seen a decline in the

number of teachers over the age of 65. These include e.g. Slovenia (down to 25%).

On the other hand, the share of teachers in most EU countries in tertiary education aged 25-29 had a declining trend between 2013 and 2019. The share of the indicator was significantly low in 2019 in Italy and Greece. Their share was less than 1%. On the other hand, Luxembourg (27.3%) and Germany (18.5%) had a high share of the indicator.

We can therefore conclude that EU countries differ significantly in the share of teachers over the age of 65, even in the age group 25-29 in tertiary education (levels 5-8) in their number. Their variability is higher within the EU compared to the variability of physicians older than 65 years.

Little interest in the teaching profession can be influenced by policies promoting the teaching profession and improving teachers' working conditions.

4.7 Active ageing in the EU

4.7.1 The state and development of active ageing in the EU

At present, active ageing is of interest to national strategy and policy maker. Many world organizations also deal with it. It responds to current demographic developments, which is reflected in an ageing population. The World Health Organization (2002) defines active ageing as a process in which the opportunities for health, social inclusion, participation and safety, and active healthy ageing are optimized with the aim of improving the quality of life of older people. The word "active" refers

not only to the ability to be physically active or to continue working, but also to continuing to participate in economic, social, voluntary, cultural, spiritual and civic affairs. At present, the need to constantly increase the economic activity of the older generation is becoming a necessity. Increasing the number of older generation labour force is only possible by maintaining and improving their health and active approach to life. Thus, increasing the number of older labour force will depend on the success of the active ageing policy.

Active ageing policies have become part of the national policies of EU countries. This created the need to compare their results. A summary indicator known as the Active Ageing Index (AAI) is used to compare and evaluate active ageing policies. The first values of the indicator are published for 2012 and are further published at two-year intervals. The indicator evaluates several areas - the dimensions of life of people aged 55 and over. According to UNECE (2020), AAI is divided into 4 basic domains:

1. Employment
2. Participation in Society
3. Independent and Secure Living
4. Capacity and Enabling Environment for Active Ageing

The first and second domains have a weight of 35%. The third domain has a weight of 10%. The fourth domain has a weight of 20%. The first three domains are associated with actual experience of active ageing. The latter domain binds to capacity to actively age. 22 indicators are evaluated within the four domains. Each indicator has an assigned weight.

Taking a critical look at the indicator, it must be emphasized that it has its advantages and disadvantages. The advantage of the indicator is that it evaluates several areas of life of people aged 55 and over. However, it should also be noted that high values thereof in some countries do not necessarily mean a high standard of living for people aged 55 and over (Vidovičová, Petrová-Kafková, 2016). On the other hand, low overall values of the indicator in some countries do not mean that in some domains this country does not perform better than other countries (Klimczuk, 2016).

One of the biggest disadvantages of the composite AAI indicator is the fact that it is necessary to use alternative indicators in order to use it internally for a country (Marsillas, et al., 2017). Thus, it cannot be used to detect differences within the country.

However, it is indisputable that AAI makes it possible to monitor several areas of life of people in the age group 55 and older and thus to analyse the influence of many factors on active healthy living. In this way, EU countries can use it to address population ageing and to look for ways to improve active ageing.

In order to compare active ageing in EU countries, we analysed the development of AAI values. The data are published for a two-year period on the UNECE website (2020). In our previous analyses, we focused on developments in the period from 2011 to 2020. But because of the two-year intervals, we monitored the values of the indicator in 2012 and 2020 (Chart 25).

Maximum values of AAI in the period analysed were reached by Sweden. The second country in the ranking was Denmark in 2012 and the Netherlands in 2020. By the end of the 20th century, all three countries had a large share of the post-productive population. They have been dealing with the issue of population ageing for a relatively long time and

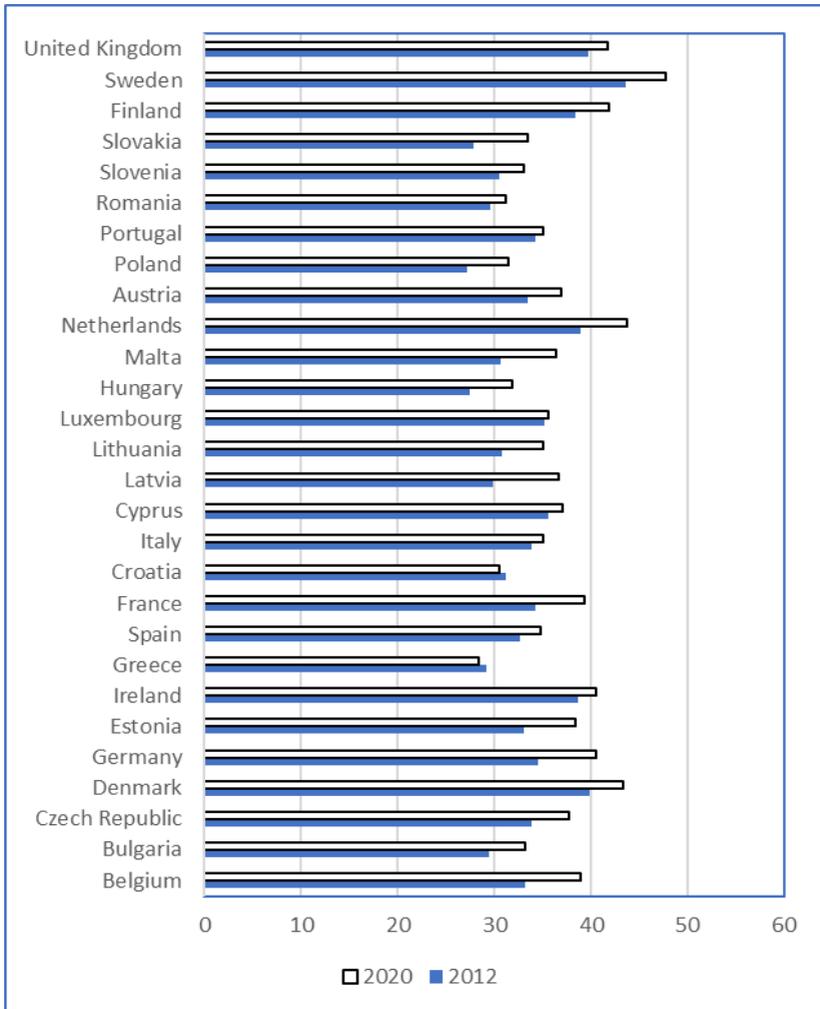
have taken measures aimed at active ageing. They can be considered leaders in the implementation of active ageing policies. The lowest values of the indicator were in Hungary (2012) and Greece (2020).

In most EU countries, the value of AAI rose. The largest increase in the indicator was in Latvia. The indicator decreased in only two countries - Greece and Croatia.

AAI values were below average in the Slovak Republic in 2012 and 2020. Slovakia was in 26th place in 2012 and in 21st place in 2020. Thus, its position within the AAI in the EU is improving. The Czech Republic had significantly higher AAI values than Slovakia. In 2012 it was in 12th place and in 2020 in 11th place. From the above we can summarize that the development trend in the Slovak Republic is positive. Slovakia's AAI values are improving. On the other hand, the Slovak Republic used to be part of Czechoslovakia and therefore the development should not differ significantly from the Czech Republic. However, the values of AAI in the Czech Republic are significantly higher. It follows that the Slovak Republic still has considerable shortcomings in the policy of active ageing.

We may summarize that in the EU countries, the value of AAI increased in most EU countries during the period analysed. The development trend was therefore positive.

Chart 25 AAI values in 2012 and 2020 in EU countries



Source: UNECE (2020)

To find out whether the EU countries approached the AAI values, we expressed unconditional, so-called absolute convergence. We speak of unconditional convergence when we do not take into account the differences in initial conditions and the regions converge to the same steady state. In our analysis, we will use the sigma convergence method. According to Minářik, Borůvková and Vystrčil (2013), sigma convergence is based on the assumption that if convergence occurs, the variability of the variable expressed by the standard deviation decreases. Logarithmic values are used to eliminate positive distribution asymmetry and approximate outliers.

We determined the sigma convergence of the AAI indicator in the period from 2012 to 2020. We used data over five two-year periods. The values of the standard deviation of the logarithmic values are in Table 12.

Table 12 Sigma convergence AAI

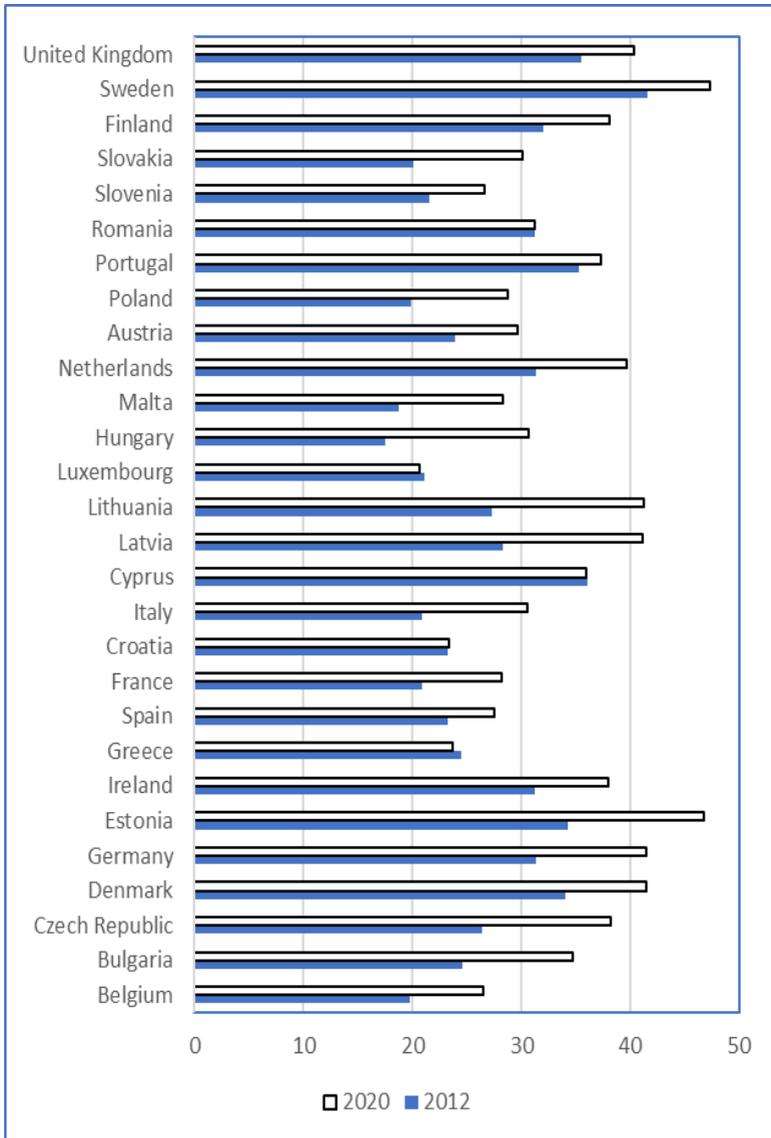
	2012	2014	2016	2018	2020
Standard deviations of logarithmic AAI values	0.0535	0.0531	0.0552	0.0559	0.0530

Source: own calculation

The standard deviation did not have a stable tendency in the whole period analysed. Thus, we cannot speak of a steady tendency towards convergence or divergence throughout the period analysed.

In the next part of our analysis, we focused primarily on the employment domain. This domain has a direct link to the job market. We analysed the values of the employment domain in EU countries in 2012 and 2020 (Chart 26).

Chart 26 Employment domain values in EU countries



Source: UNECE (2020)

Sweden achieved the highest values in the employment domain. It has had a leading position in the field of employment for a long time. In 2012, Hungary had the lowest domain values, in 2020 it was Luxembourg.

The values of the employment domain in the Slovak Republic in 2012 and in 2020 were below average. Slovakia was in 24th place in the values of the domain in 2012 and in 18th place in 2020. Thus, the position of the Slovak Republic in the employment domain is improving. We conclude that although the values of the employment domain are below average, the development trend is positive.

In order to find out whether the EU countries showed absolute convergence within the employment domain in the period from 2012 to 2020, we decided to use the sigma convergence method.

Table 13 Sigma convergence of the employment domain

	2012	2014	2016	2018	2020
Standard deviations of logarithmic values of the employment domain	0.1038	0.1042	0.1006	0.1025	0.0948

Source: own calculation

The standard deviation did not show a steady trend throughout the period analysed (Table 13). Thus, we cannot speak of a steady tendency towards convergence or divergence throughout this period.

We can therefore conclude that EU countries are failing to converge in the long term within the AAI indicator and the employment domain. From this it can be concluded that the countries with the worse results do not take an example by the approaches implemented in the countries

with better results. It is the spread of good practices that could help to reduce disparities between the EU27 countries.

4.7.2 An alternative approach to the evaluation of active ageing by data envelope analysis models

Assessing active ageing based on the AAI indicator is only one of several approaches. As we have already mentioned, it has its advantages and disadvantages.

An alternative approach to assessing active ageing is to use data envelope analysis (DEA) models. These models belong to the multi-criteria methods and were originally designed to evaluate effectiveness. We are interested in whether the countries that have achieved the best results in the field of active ageing on the basis of AAI indicators also achieve the best results by using the DEA models.

DEA models are non-parametric approaches. The subjects analysed in the model are called units. We evaluate and assess them on the basis of their indicators, which are divided into inputs and outputs. According to Jablonský and Dlouhý (2004), the outputs are positive effects, the higher value of which, under unchanged conditions, leads to higher performance of the unit. With inputs, it's the other way around. Lower value of the outputs under unchanged conditions leads to higher performance of the unit.

DEA models are based on mathematical programming. According to Jablonský and Dlouhý (2004), they are based on the assumption that there is a set of admissible options for a specific problem. This set consists of all possible combinations of inputs and outputs. The set of

permissible options is determined by the boundary of efficiency. There are units on it that we call efficient. There is no unit that achieves the same outputs with lower inputs or higher outputs with lower inputs than the efficient unit.

DEA models are divided into several models. In our evaluation we will use the basic models - the so-called radial models. Radial models include CCR models and BCC models. CCR models assume constant returns from the range (Grmanová, Čejková, 2016). BCC models assume variable range returns. In our analysis, we will use an output-oriented CCR model. The boundary of efficiency is formed by the data envelope. In these models, linear programming is used to construct conical CCR data packages.

Model description

When evaluating the unit U_q , the CCR model looks for a virtual unit characterised by inputs $X\lambda$ and $Y\lambda$, which are a linear combination of inputs X and outputs Y of other units and which are "better" than the inputs and outputs of the evaluated unit U_q . If there are no units that are "better", then the unit U_q lies on the boundary of efficiency. A unit lies on the boundary of efficiency if there is no other unit that has better inputs and outputs than the evaluated unit, i. e. the virtual unit is identical to the efficient unit. Thus, the model divides the units into efficient and inefficient. Efficient units lie on a conical data envelope (Jablonský, Dlouhý, 2004) The efficient unit has an efficiency rate of 1, i. e. 100%. Inefficient units have an efficiency ratio of more than 100% for output-oriented models. The greater the efficiency of the unit, the further the unit from the data envelope.

Let us suppose we have n units U_1 to U_n , that are homogeneous. We monitor their m inputs and r outputs. Let us denote the input matrix

$\mathbf{X} = \{x_{ij}, i = 1 \dots m, j = 1 \dots n\}$. Let us denote the output matrix $\mathbf{Y} = \{y_{ij}, i = 1, \dots, r, j = 1, \dots, n\}$. The output-oriented (dual) CCR model in matrix form has a shape of

Maximize $g = \phi_q + \varepsilon(\mathbf{e}^T \mathbf{s}^+ + \mathbf{e}^T \mathbf{s}^-)$

under the conditions

$$\begin{aligned} \mathbf{X}\lambda + \mathbf{s}^- &= \mathbf{x}_q, \\ \mathbf{Y}\lambda - \mathbf{s}^+ &= \phi_q \mathbf{y}_q, \end{aligned}$$

$$\lambda, \mathbf{s}^+, \mathbf{s}^- \geq \mathbf{0}.$$

where ϕ_q expresses the degree of efficiency of the unit U_q , $\mathbf{s}^+, \mathbf{s}^-$ are the deviation variables,

λ is the matrix of weights, $\mathbf{e}^T = (1, 1, \dots, 1)$, ε is the infinitesimal constant (Jablonský, Dlouhý, 2004).

The BCC model, unlike the CCR model, has the condition $\mathbf{e}^T \lambda = 1$.

At the same time, the efficiency rate ϕ_q and deviation variables express how the unit's outputs need to be adjusted (increased) U_q , in order for the unit to become efficient.

In order for the unit U_q to lie on the data envelope, its target values for inputs and outputs can be obtained in one of two ways:

1. $\mathbf{x}'_q = \mathbf{X}\lambda^*$, $\mathbf{y}'_q = \mathbf{Y}\lambda^*$, where λ^* is the vector of optimal values of weights calculated by the model

$$2. \mathbf{x}'_q = \mathbf{x}_q - \mathbf{s}^{-*}, \mathbf{y}'_q = \phi_q^* \mathbf{y}_q + \mathbf{s}^{+*},$$

where the symbols are marked as * are vectors of optimal values in the output-oriented CCR model (Jablonský, Dlouhý, 2004).

In our analysis, we will focus on comparing active ageing in the 28 EU countries. We will use the approach Hužvár, Kaščáková (2017). The approach to alternative assessment of active ageing is based on a method called “benefit of the doubt” (Hužvár, Kaščáková, 2017). Its main idea is based on assessing the unused potential of individual EU countries in the field of active ageing.

We will express the values of the composite active ageing performance indicator using the values of the four AAI domains. According to Hužvár, Kaščáková (2017) „in order to apply benefit of doubt technique, we consider a unit input for all countries while the four sub-indices reflecting the national performance in the specified domains are outputs“. Domain values in EU countries will therefore represent 4 outputs (Y). There will be only one input for each unit. There will be a unit value for each state.

Characteristics of the DEA model used:

Model type: Output-oriented CCR model.

Outputs: number of outputs: 4, their values: AAI domain values (Table 14).

Inputs: number of inputs: 1, their values: equal to 1.

The units are the 28 countries of the EU. Thus, the analysis is based on EU28 data. With such defined inputs, the efficiency rate in the CCR model is identical to the efficiency rate in the BCC model.

Table 14 Output values

	1. domain	2. domain	3. domain	4. domain
Belgium	26.6	27.0	74.2	64.1
Bulgaria	34.7	9.7	65.3	55.6
Czech Republic	38.3	16.2	71.7	57.8
Denmark	41.4	21.7	78.6	66.6
Germany	41.5	15.9	75.4	64.6
Estonia	46.8	14.3	65.9	52.3
Ireland	38.0	18.8	76.2	65.0
Greece	23.7	11.8	57.9	50.8
Spain	27.5	16.2	70.8	62.3
France	28.2	26.2	76.0	63.5
Croatia	23.4	15.8	65.4	51.1
Italy	30.6	17.3	68.8	56.5
Cyprus	36.0	19.4	72.2	52.6
Latvia	41.2	17.8	56.4	51.8
Lithuania	41.2	11.1	63.5	51.9
Luxembourg	20.7	23.8	76.3	62.2
Hungary	30.7	11.6	66.8	51.9
Malta	28.3	20.9	70.4	60.8
Netherlands	39.7	26.6	76.6	64.2
Austria	29.7	18.8	77.1	61.1
Poland	28.7	13.1	62.6	52.7
Portugal	37.3	11.9	69.2	54.6
Romania	31.2	13.6	63.6	45.9
Slovenia	26.7	15.7	71.4	55.1
Slovakia	30.1	16.1	68.7	52.2
Finland	38.1	22.6	77.9	64.4
Sweden	47.3	26.0	78.3	71.6
United Kingdom	40.4	20.7	74.8	64.4

Source: UNECE (2020)

To express the degree of efficiency, we will use the freely available EMS program. We draw data for the year 2020 from the UNECE website (2020). The degree of efficiency was expressed in the CCR model.

The resulting values of the efficiency rate are in Table 15. In the output of the EMS program, efficient units have the so-called super-efficiency rate expressed, which is less than 100%. It enables to compare the efficient units with each other. The smaller the value of the super-efficiency rate, the better rated the unit. From the expressed values of efficiency rates, we can state that four countries are efficient: Belgium, Denmark, the Netherlands and Sweden. We consider them to be the countries with the best results of active ageing. Other EU countries are not efficient. The EU countries with the worst results are Latvia and Romania. Slovakia and the Czech Republic are not efficient. They neither belong to the group of countries with the worst results nor to the group of countries with the best results. The value of the efficiency rate in the Czech Republic is better than in the Slovak Republic. The Czech Republic achieved the best results of all V4 countries.

As we have already mentioned, the degree of super-efficiency makes it possible to determine the order of efficient units. When comparing the values of super-efficiency, we can consider Sweden as the best.

Using both approaches, we can, similarly to Hužvár and Kaščáková (2017), state that there are differences in the results of both approaches. However, by comparing the results of the AAI and the CCR model, we can say that of the first three countries with the best results, all three are efficient in the CCR model. Sweden achieves the best results in both approaches. Its policy and practical experience in the field of active ageing can serve as an example for other countries. Thus, other states should draw on the experience of this country in promoting a policy of active ageing.

Table 15 AAI and efficiency rate

	AAI	Rank according AAI	Efficiency rate in %	Rank
Belgium	39.0	9	98.52	2
Bulgaria	33.2	22	120.34	25
Czech	37.8	11	109.58	14
Denmark	43.3	3	99.62	4
Germany	40.5	6	104.12	11
Estonia	38.4	10	101.07	6
Ireland	40.5	7	103.12	10
Greece	28.4	28	135.52	28
Spain	34.8	20	110.81	16
France	39.3	8	101.15	7
Croatia	30.5	27	120.18	24
Italy	35.0	19	114.24	19
Cyprus	37.1	12	108.86	13
Latvia	36.6	14	114.81	21
Lithuania	35.0	18	114.81	22
Luxembourg	35.6	16	102.76	9
Hungary	31.9	24	117.66	23
Malta	36.4	15	111.49	17
Netherlands	43.7	2	99.81	3
Austria	36.9	13	101.95	8
Poland	31.4	25	125.56	27
Portugal	35.1	17	113.51	18
Romania	31.2	26	123.58	26
Slovenia	33.0	23	110.08	15
Slovakia	33.5	21	114.41	20
Finland	41.9	4	100.80.	5
Sweden	47.8	1	87.77	1
United	41.7	5	105.00	12

Source: UNECE (2020) and own calculation

With both approaches we can conclude:

The first three states in the AAI ranking are efficient also in the CCR models. Sweden has achieved the best values with both methods. Using both methods, we can consider Greece as the worst performing country. Most EU countries should implement active ageing approaches such as those implemented in Sweden, Belgium and Denmark. For the Slovak Republic, this means that the largest increase should be achieved in the values of the first and second domains, i. e. in Employment and Participation in Society. The Slovak Republic achieves the best results in the Independent and Secure Living domain.

Comparison of the principle of both methods

Each of these approaches to assessing active ageing has its advantages and disadvantages. AAI has fixed weights for individual domains and indicators. These were determined directly by experts. CCR models calculate weights and efficiency rates for each unit analysed. Efficiency rates are relative rates. The value of the efficiency rate is therefore expressed relative to other units. Their advantage is that they make it possible to find out how the output values need to be adjusted in order for the units to reach the data envelope (i. e. among the efficient units). On the other hand, the efficiency rates do not allow a direct comparison of how the value of the active ageing indicator of the unit analysed has changed over time.

We can conclude that both approaches are important. The use of DEA models is an alternative to the already established approach. However, it allows a broader view of the issues studied.

As already mentioned, one of the advantages of DEA models is the fact that they enable us to express how the unit should adjust its outputs in order to become efficient. Our intention in the next step was to determine the necessary output adjustments to make the unit CCR

efficient. The values of adjusted outputs (domains) for the Slovak Republic are in Table 16.

For example, the adjusted values for the Slovak Republic show that the Slovak Republic should improve especially in the 1st domain (Employment). The values of this domain should increase up to 137.5%. On the other hand, the Slovak Republic achieves the best results in the 3rd domain (Independent and Secure Living) and an increase in this value to 114.4% would be sufficient.

Table 16 Adjusted output values

		Domain			
	Efficiency rate in %	1th	2nd	3rd	4th
SR original values		30.1	16.1	68.7	52.2
SR modified values	114.41	41.4	21.7	78.6	66.6
Absolute difference		11.3	5.6	9.9	14.4
Relative need to increase (%)		37.5	34.8	14.4	27.6

UNECE (2020) and own calculation

We can conclude from the analysis that for the Slovak Republic the biggest shortcoming in the evaluation of active ageing is the employment of the elderly. It is important that it increases in the next period, which could be supported by government action. Promoting the employment of the elderly would be an important step forward.

5. MIGRATION

The size of a country's population is affected by declining birth rates, rising life expectancy, emigration and immigration. Due to the declining birth rate, the impact of migration on the size of the population is constantly increasing. This is related to the growing importance of migration policy and its objectives.

Emigration and immigration not only affect the size of the population but even affect different areas of economic life. They also have a significant impact on the labour market. They are therefore of particular interest to government policies and the professional public.

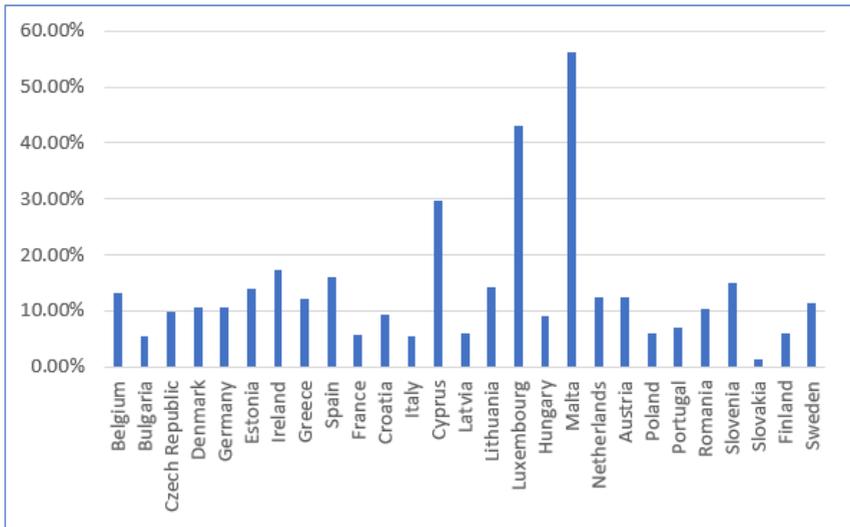
When discussing migration, we will focus on the development of immigration in the EU and in the first subchapter we will compare the differences in the number of immigrants travelling to individual EU countries. In the next subchapter we will analyse the employment of migrants. We will also compare EU countries on the basis of immigrant self-employment and part-time employment of immigrants.

5.1 Development of immigration in the EU

The EU has been an attractive destination for many migrants over the last decade. This period was specific in that there were large differences in immigration and emigration between EU countries. Immigrants were particularly attracted by the economically strong EU countries. However, the migration policies of individual EU countries with high wage levels played a major role too. This fact was reflected in the values of the indicator number of immigrants per 1000 inhabitants in 2019, which can be seen in Chart 27.

Note: Values for 2020 were not published.

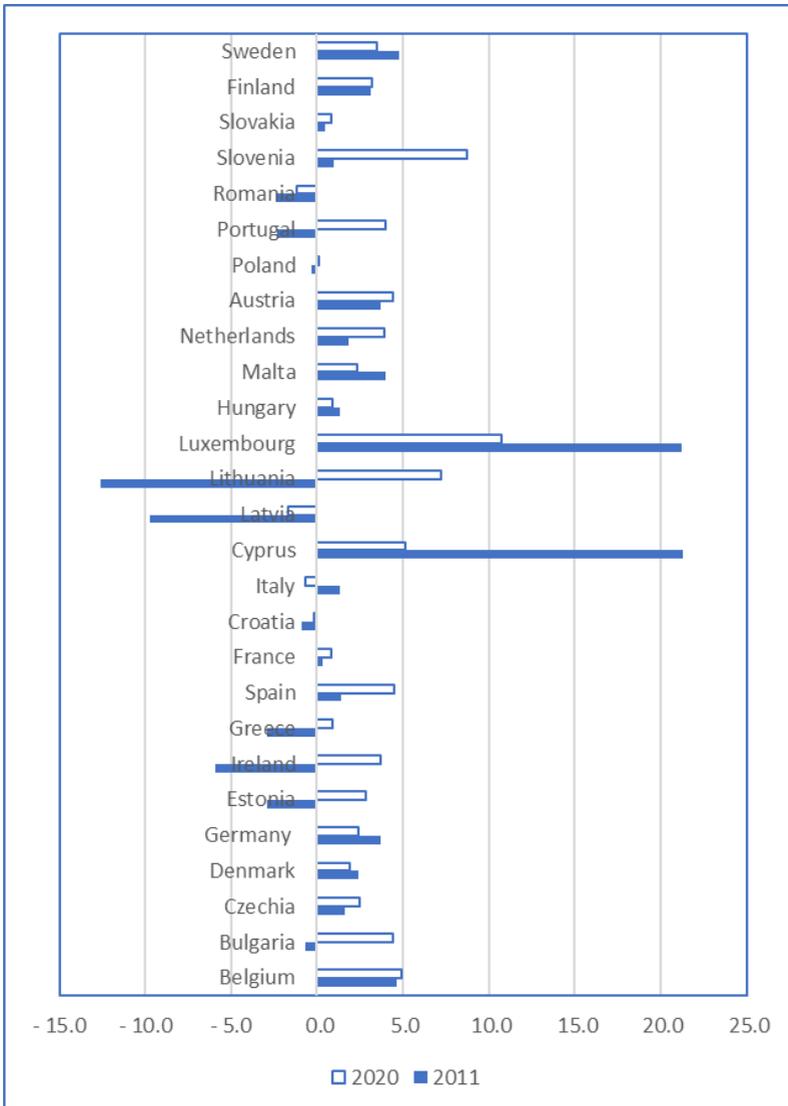
Chart 27 Number of immigrants per 1000 inhabitants in 2019



Source: Eurostat (2021, 5) [migr_imm8]; Eurostat (2021, 5) [demo_pjan]

According to Eurostat (2021, 5) [migr_imm8] and Eurostat (2021, 5) [demo_pjan], the highest annual share of immigrants in terms of population in the EU was in Luxembourg and Malta. The main reason was that both countries were open to accepting immigrants, as in this way they wanted to address their labour shortages. Luxembourg is one of the countries with the highest average wages in the EU. Therefore, it was and still is attractive to economic migrants. On the other hand, Slovakia, which is predominantly a transit country and not attractive to immigrants, had the smallest share of immigrants in terms of population.

Chart 28 - Crude rate of net migration in EU countries in %



Source: Eurostat (2021, 5) TPS00019

When speaking about migration, it is important to monitor not only the share of immigrants in the population, but also the share of net migration in the total population (crude rate of net migration - Chart 28). The positive value of net migration means that more people immigrated to the country than emigrated. The negative value of net migration means that fewer people immigrated to the country than emigrated.

The period analysed is 2011-2020. According to Eurostat (2021, 5) (online data code: TPS00019) and Eurostat (2021, 5) [demo_gind] most EU countries benefited from migration. In 2011, Luxembourg and Cyprus had the highest gross migration rates. The policies of both countries were aimed at accepting new migrants due to labour shortages. The most migratory losses in 2011 were Lithuania and Latvia and in 2020 Latvia and Romania. The main reason was mainly the poor economic performance of these countries and low wages. Most EU countries increased their crude rate of net migration during the period analysed.

A significant decrease in the gross net migration rate from 2011 to 2020 occurred in Denmark, Germany, Italy, Cyprus, Luxembourg, Hungary, Malta and Sweden. Slovakia was migratory profitable at the beginning and at the end of the period analysed. However, the values of the indicator were very small. They increased in the period analysed (from 0.5 ‰ to 0.8 ‰). Thus, the indicator crude rate of net migration had a growing trend.

However, despite the growing development trend, it is necessary to point out the different dynamics of the change process. In the context of increasing crisis capacity, migration policy is becoming increasingly important. If immigrants were not employed in certain sectors, the functioning of the EU economy would be very difficult.

5.2 Employment of migrants in the EU

In the context of immigration, the employment of migrants is an important aspect. Unemployed, inadaptable migrants burden the social system. On the contrary, employed migrants are a benefit. By employing migrants it is possible to address the shortage of workers in areas that are not attractive to domestic workers. At the same time, immigrants may be employed in positions in which there is a shortage of highly qualified specialists. According to SBA (2018), migrants mostly work in positions that require routine activities. “Local employers are increasing the demand for low-skilled labour in areas that are receiving inflows of low-skilled immigrants” (Somerville, Sumption, 2009, p. 5).

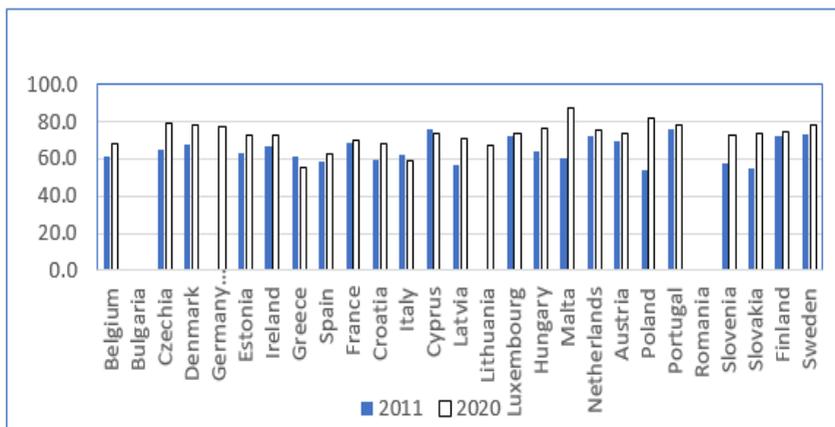
Employed immigrants contribute to the social system and are taxpayers. The importance of migrant employment is constantly increasing due to increasing labour shortages.

When comparing the employment rate of the population born in a given country published by Eurostat (2021, 5) [lfsa_ergacob], we can state that most EU countries have an employment rate of the population born in a given country higher than the employment rate of immigrants. One of the reasons for this is the fact that immigrants have to adapt socially and at the same time it may take some time for them to enter employment. For example, in Sweden in 2013, the employment rate of the population born in Sweden was by 34.2% higher compared to the population born in a non-EU country.

The employment rate citizen of EU27 countries except reporting country from 15 to 64 years in the EU countries in 2011 ranged from 53.8% (Poland) to 76.4% (Cyprus), in 2020 it ranged from 55.6% (Greece) to 87.8 % (Malta). Values of the indicator in 2011 and 2020 are listed in

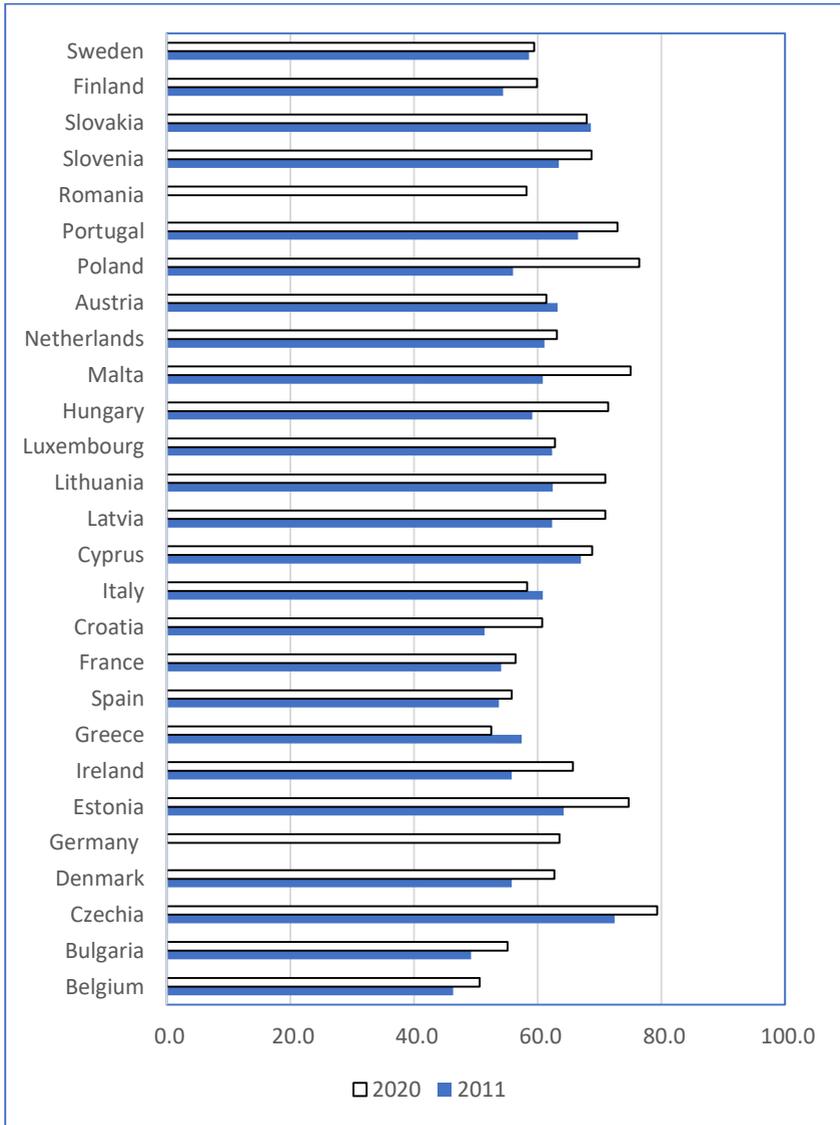
Chart 29. Most countries recorded an increase in the values of the indicator analysed during the period analysed. This is also due to the gradually growing labour shortages that were addressed by employing immigrants in many countries. The largest increase in employment of EU27 countries was in Poland, where the employment rate increased by 52.6%. The largest decline in the employment rate citizen of EU27 countries except reporting country from 15 to 64 years was in Greece, where the employment rate of immigrants fell by 8.85%.

Chart 29 Employment rate EU27 countries except reporting country from 15 to 64 years in %



Source: Eurostat (2021, 5) [lfsa_ergacob]

Chart 30 Employment rate citizen of Non-EU28 countries nor except reporting country from 15 to 64 years in %



Source: Eurostat (2021, 5) [lfsa_ergacob]

The employment rate citizen of Non-EU27 countries nor except reporting country from 15 to 64 years in the EU countries in 2011 ranged from 46.3% (Belgium) to 72.4% (Czech Republic), in 2020 it ranged from 50.6% (Belgium) to 79.3% (Czech Republic).

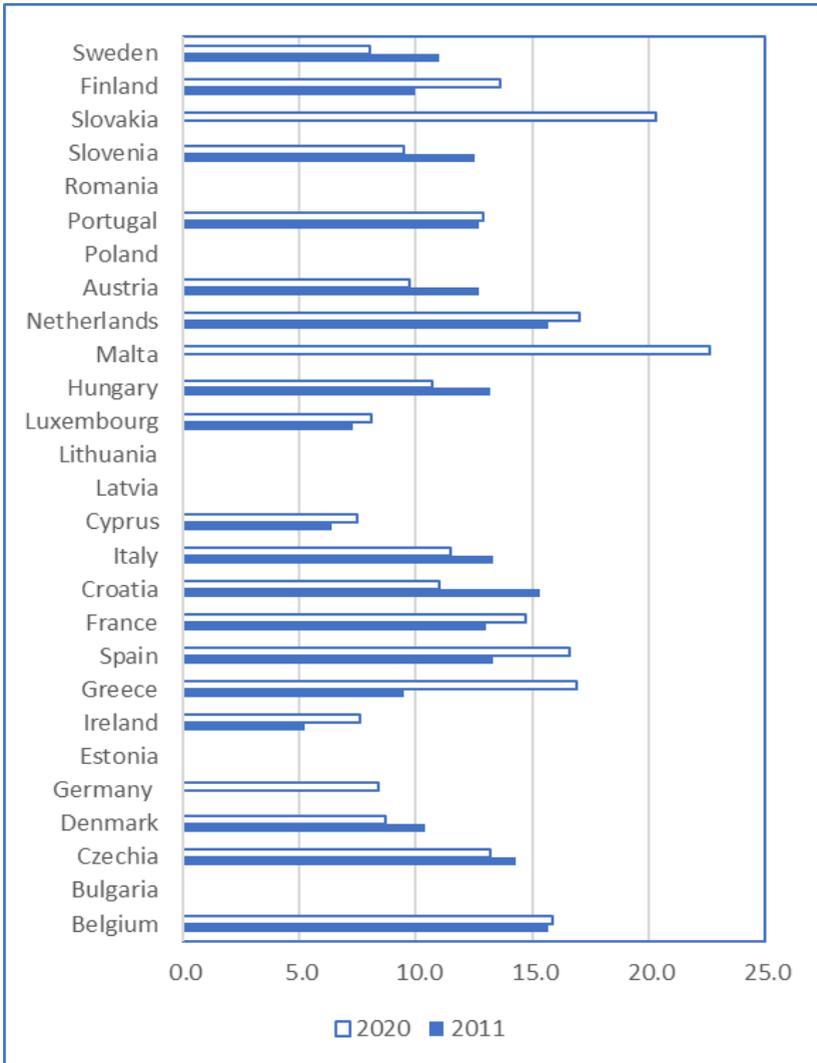
Most countries recorded a lower employment rate citizen of Non-EU28 countries nor except reporting country from 15 to 64 years during the period analysed than the employment rate citizen of EU27 countries except reporting country from 15 to 64 years. From this we can conclude that employers are more willing to employ immigrants from other EU member states than immigrants from outside the EU. The values of the indicator in 2011 and 2020 are listed in Chart 30.

Self-employment of immigrants

The share of self-employed immigrants born in another country of the EU in their total employment

The self-employment of immigrants plays an important role (see Navickas, Grmanová, Gajda, 2020). According to available Eurostat data (2021, 5) [fst_r_e2sgacu], the share of self-employment in the total employment of immigrants born in another EU country in the EU ranged from 5.2% in Ireland to 15.7% in Belgium in 2011 and from 7.5% in Cyprus to 22.6% in Malta in 2020 (Chart 31). The differences in the share of self-employed immigrants born in another EU country are therefore significant. The increase in the self-employment of foreigners depends on the trend of the unemployment rate and on the system of residence permits in the country. In many EU countries, unemployment does not lead to renewal of a residence permit or immigrants lose their residence permit. For this reason, migrants often deal with job loss by becoming self-employed.

Chart 31 The share of self-employment in the total employment of immigrants born in another EU country in %



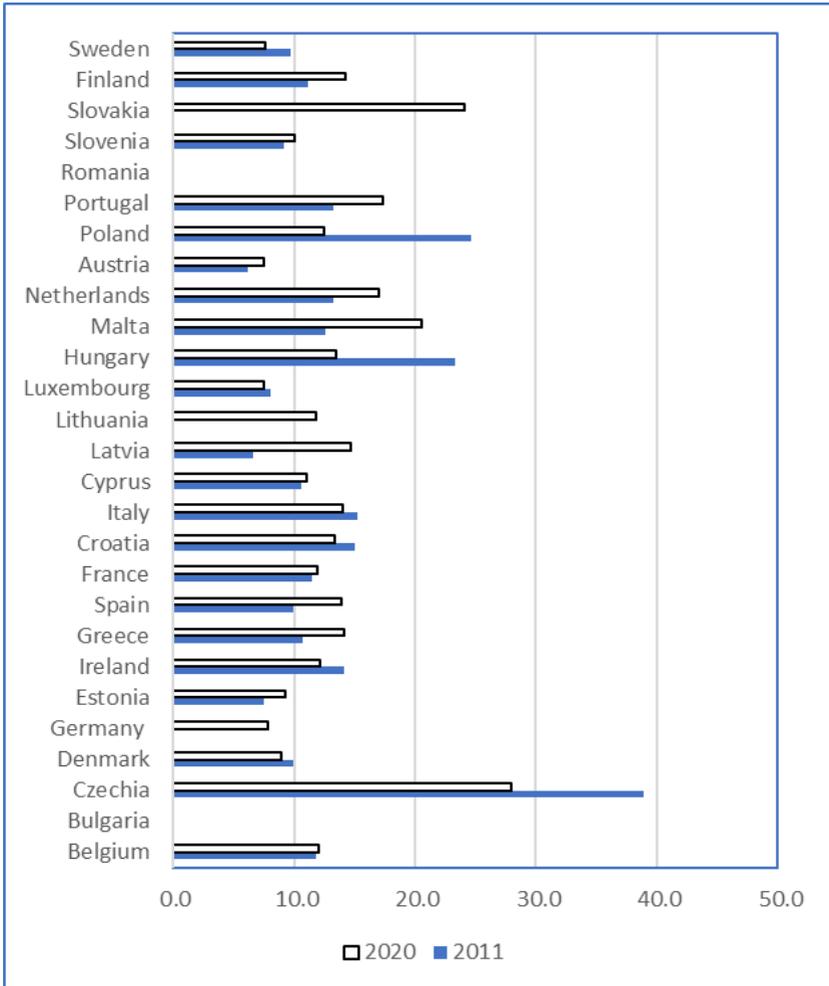
Source: Eurostat (2021, 5) [lfst_r_e2sgacu]

Immigrant self-employment trends varied over the period analysed. The largest decrease in the share of self-employed immigrants was recorded in Croatia, where the value decreased from 2011 to 2020 to 71%. In Greece, on the other hand, the value of the indicator increased by almost 77.9%. Data for Slovakia for 2011 were not published. However, from the values of the indicator in 2020, it can be concluded that although Slovakia is one of the countries with the lowest share of immigrants, it is among the countries with the largest share of self-employment of immigrants born in another EU country.

Share of self-employment of immigrants born in non-EU27 countries (2011-2020) nor reporting country in their total employment

The share of self-employment of immigrants born in non-EU27 countries (2011 and 2020, Chart 32) nor reporting country ranged from 6.2% in Austria to 36.89% in the Czech Republic in 2011 and from 7.5% in Austria to 28% in the Czech Republic in 2020. The share of self-employment of immigrants from non-EU27 countries (2011-2020) nor reporting country in Slovakia was the second largest in 2020. Thus, it can be concluded that the largest share of non-EU27 countries (2011-2020) nor reporting country is in the Czech Republic and Slovakia. The reason for this, in our opinion, is the fact that due to the growing shortage of labour in some professions (e. g. construction, etc.) in the Slovak Republic and the Czech Republic, employers accept immigrants from outside the EU and often employ them as self-employed. These immigrants are mostly from countries where the average wage is lower than in the Slovak Republic (Ukraine, Kazakhstan).

Chart 32 Share of self-employment of immigrants born in non-EU27 countries (2011, 2020) nor reporting country on their total employment rate in %



Source: Eurostat (2021, 5) [lfst_r_e2sgacu]

Developments in the labour market clearly show that migration policy, its objectives and principles will become even more important in the future. The approach of countries to immigration is becoming increasingly important.

The availability of secondary and higher education institutions in EU countries for young people from non-EU countries (e. g. Ukraine and Kazakhstan) and their subsequent retention in EU countries is important in terms of long-term recruitment of suitable labour force. Educated young labour force would be of great benefit to the labour market in each EU country. A systematic policy aimed at admitting young people from abroad to secondary and higher education would be of great benefit in the future.

6. PRACTICES LEADING TO INCREASED ECONOMIC ACTIVITY

Increasing the economic activity of young people

In connection with the economic activity of young people, in some EU27 countries (e. g. the Netherlands, Denmark) there is a large share of young people working alongside their studies. At the same time, these countries have a higher share of young people studying part-time or using distance learning. Thus, higher education in these countries aims to support the employment of young people working alongside their studies. Employers offer a sufficient number of part-time jobs. There is also a lower NEET rate in these countries, which is very important from the point of view of the economic development of the state.

From the point of view of youth employment, national policies supporting the transition of young people from education to work are very important too. The neglect of policies aimed at supporting youth employment is reflected in increased youth unemployment.

Increasing women's economic activity

The parental leave system is very important in connection with women's economic activity. It seems that when women can choose the length of parental leave and the amount of parental allowance, they tend to choose a shorter period of parental leave with a higher amount of parental allowance. Thus, such a system has a positive effect on increasing women's economic activity. EU countries that have introduced such a system (e. g. the Czech Republic) have increased the rate of women's economic activity more significantly.

From the point of view of women's employment, it is important that employers who offer part-time jobs are supported by national policies. Such forms of employment will enable women to better combine

private and professional life. An example of an EU country where the part-time employment of women has significantly increased is the Netherlands.

Practices in some EU countries are aimed at increasing the number of pre-school facilities. Countries have imposed a requirement to set up pre-school facilities in particular on newly emerging companies and institutions (e. g. Austria). The establishment of pre-school facilities in institutions where women work affects the return of women from parental leave.

Increasing the economic activity of the elderly

Increasing the economic activity of the elderly is influenced by state support aimed at employers offering jobs for older people with flexible forms of employment. In particular, the offer of flexible time, one job filled with two employees etc. make it possible to increase the economic activity of older people.

Of course, the economic activity of the elderly is also affected by tax benefits for people of post-productive age who remain at work voluntarily.

Some EU countries try to encourage self-employment of the elderly. E.g. Greece and Portugal have a significant share of self-employed older people. State support for the self-employment of the elderly can have a positive effect on economic activity.

Increasing the economic activity of the elderly is possible only if the older generation is in good mental and physical condition. Therefore, programs aimed at maintaining mental and physical activity also contribute to increasing economic activity.

However, in order that older people remain in the labour market, they must participate in training. As some researches suggests, education in the field of IT technology is important.

Another area that may lead to increased economic activity is the increase in the number of facilities caring for the elderly. In countries where such facilities are lacking, the share of people (mostly family members) caring for the elderly who cannot take care of themselves is increasing. This reduces economic activity.

Increasing economic activity due to migration

Employers in many areas currently cannot do without labour force from abroad. Such areas include construction, engineering but also services such as in the field of spa. It seems that migration policies aimed at supporting labour force from abroad and the integration of foreign workers will become very important in the future due to the declining population.

Making secondary and higher education accessible to young people from outside the EU can help expand labour force with capable young people. Education policies aimed at attracting and integrating young people from abroad can be positively reflected in the size and quality of labour force in the future.

SUMMARY

The current demographic development, in particular declining birth rates, rising life expectancy and changing population structure, have a significant impact on the labour market. It causes both positive and negative changes.

The aim of this scientific monograph is to specify the impact of demographic changes on the labour market, to assess the impact of demographic changes, in particular on labour force and employment, and to define the positive and negative impacts of demographic changes on the labour market.

The changes were analysed in the context of the European Union and the specifics at national levels were defined. Special attention is paid to the position of the Slovak Republic in the EU. In the analysis of the development of time series, the tendencies of the EU states towards convergence or divergence were determined. The dynamics of the changes in individual EU countries is monitored and compared. Based on regression and correlation analysis, development trends were evaluated and used in short-term projections. The monograph not only systematizes existing knowledge but also presents new findings and conclusions.

The first chapter focuses on population development in the EU. It discusses in depth the issue of population development and its impact on the labour market. It is clear from the population projection that a more significant decline in the EU27 population can be expected over the next 30 to 40 years. The declining population trend will then continue. For this reason, it can be assumed that unless appropriate measures are taken, a more significant decrease in the size of the labour force will take place in 30 to 40 years.

The second chapter deals with labour and economic activity, or economic inactivity of the population. In most EU countries, the economically active population is currently growing. Its decline can be seen mainly in countries with an unfavourable employment situation and a long-term decline in population. In the following period, however, the number of economically active people will gradually begin to decline in all EU countries. When looking at gender differentiation of the economically active population, we can state that the increase in the number of economically active women in the EU27 was greater than the increase in the number of economically active men. It follows that the number of economically active women is approaching the number of economically active men. Thus, the gender gap in the number of economically active women and men in the EU is narrowing.

The rate of economic activity varies with age. Currently, the size of labour force in the age group 15-24 is decreasing sharply. This decline is mainly due to the declining population in the age group 15-24 and the increasing number of young people participating in the educational process. Practices in some EU countries lead students in the age group 15-24 to enter employment alongside their studies. The education system at universities is adapting to this phenomenon by changing the methods of education. Distance learning is coming to the foreground. This is then reflected in the economic inactivity rate in this age group. The NEET rate for young people aged 15-24 is decreasing in the EU27. This trend is positive. In the Slovak Republic, the share of young people aged 15-24 not working and not participating in formal and non-formal education and training is declining faster than within the EU27. The values in the Czech Republic are much lower and indicate that there are still certain shortcomings in this area in the Slovak Republic. It follows that in the Slovak Republic it is necessary to look for other opportunities to increase the involvement of young people aged 15-24 participating in formal and non-formal education and training in the work process.

The share of economically inactive people in the total population is declining. The structure of the population is also changing according to the reason for economic inactivity. Inactivity due to education and training is in the first place. However, retirement is no longer in second place due to increasing retirement age, it is the care for adults with disabilities or children and other family or personal reasons.

The third chapter deals with the economic burden on the productive component of the population. The economic burden on the productive component of the population by the non-productive component is growing. The dynamics of the increase in the burden on the productive component of the population in the EU27 is accelerating. Based on the analysis of the dynamics of change, we can state that the increase in the economic burden in Slovakia and the Czech Republic was significantly higher than in the whole EU. The burden on the productive component of the population increases mainly with the increasing post-productive component of the population. This trend is the same in all EU countries. The greatest dynamics of the growth of the burden on the productive component of the population by the component of the population of post-productive age is in Poland, the Slovak Republic and the Czech Republic. Across the EU, the burden on the productive population can be expected to further increase in the short term.

Using regression and correlation analysis, we can assume that the economic burden on the productive component will not increase significantly faster. However, in some EU27 countries, the economic burden on the productive population by the non-productive population will increase faster in the near future. These countries also include the Slovak Republic, and it is necessary to prepare the state economy for such development and to take appropriate measures.

The fourth chapter deals with population ageing and its impact on the labour market. In most EU27 countries, the post-productive population

has already outweighed the pre-productive population. In some EU countries, the share of people of post-productive age is more than 1.5 times higher than the share of people of pre-productive age. At the same time, in most EU countries, the exchange rate is less than 1. Thus, we can talk about reduced labour reproduction. As this trend is continuing, it is clear that there will be labour force shortage in the labour market. This can be solved by hiring employees from abroad and increasing the share of people of post-productive age working.

With regard to the social inclusion of the population, it is important to draw attention to the fact that people of post-productive age are more at risk of poverty than people in other age groups. As the share of elderly people aged 60 and over in the EU increases, so does the number of people who are at risk of poverty.

As the population ages, the average cost of healthcare will increase. Based on the stationary model, we came to the conclusion that by 2050 the healthcare costs in the Slovak Republic will increase by more than 25%. Such an increase in costs will significantly burden the system of public expenditures in the Slovak Republic. Therefore, it is necessary to start looking for approaches to solving such rising healthcare costs now.

The high share of physicians aged 65 and over in some EU countries could mean a shortage of physicians in the future, provided that the number of new physicians does not increase in the future. Similar conclusions follow from monitoring the age structure of teachers. Little interest in the teaching profession can be influenced by policies promoting the teaching profession and improving teachers' working conditions.

In the fifth chapter we examine the impact of migration on the labour market. We focus on the employment of migrants. Most countries recorded a lower employment rate citizen of non-EU28 countries nor

except reporting country from 15 to 64 years during the period analysed than the employment rate citizen of EU27 countries except reporting country from 15 to 64 years. From this we can conclude that employers are more willing to employ immigrants from other EU member states than immigrants from outside the EU. Developments in the labour market clearly show that migration policy, its objectives and principles will become even more important in the future. The approach of countries to immigration is becoming increasingly important. The availability of secondary and higher education institutions in EU countries for young people from non-EU countries (e. g. Ukraine and Kazakhstan) and their subsequent retention in EU countries is important in terms of long-term recruitment of suitable labour force.

An important part of the monograph is the systematization of findings on the possibilities of increasing the economic activity of the population and thus addressing labour shortages in the future. Practices in some countries point to the deficiencies in increasing economic activity. Economic activity can be increased in several ways. We consider the system of maternity and parental leave to be important. It seems that a system in which women can choose the length of maternity leave and the amount of parental allowance increases women's economic activity. The increase in women's economic activity is also supported by the expansion of part-time job offers. In many countries, such jobs are offered on a small scale. The economic activity of young people is also supported by a university study system that is focused on the method of distance learning. The combination of study and employment enables university graduates to get a job faster and to achieve career advancement faster. In connection with increasing economic activity, it is important to support employers to create job opportunities for young and older workers. In this regard, the promotion of jobs with flexible forms of work is of particular importance. We also consider the construction of preschool facilities directly at the company's

headquarters as a positive practice. It seems that combining work and private life will become a necessity in the future.

DATABASE EUROSTAT

Eurostat (2021, 5):

[une_ltu_a] Long-term unemployment by sex

[demo_pjan] Population on 1 January by age and sex

[proj_19np] Population on 1st January by age, sex and type of projection

[TPS00019] Population change - crude rates of total change, natural change and net migration plus adjustment

[lfst_r_lfp2act] Economically active population by sex, age and NUTS 2 regions (1 000)

[tepsr_wc130] Activity rate by sex

[demo_pjanbroad] Population on 1 January by broad age group and sex

[proj_19ndbi] Demographic balances and indicators by type of projection

[lfsa_ipga] Inactive population as a percentage of the total population, by sex and age (%)

[edat_lfse_20] Young people neither in employment nor in education and training by sex, age and labour status (NEET rates)

[edat_lfse_18] Participation rate of young people in education and training by sex, age and labour status (incl. NEET rates)

[lfsa_igar] Inactive population not seeking employment by sex, age and main reason

[demo_pjanind] Population structure indicators at national level

[lfsa_agan] Active population by sex, age and citizenship (1 000)

[migr_pop1ctz] Population on 1 January by age group, sex and citizenship

[hbs_str_t225] Structure of consumption expenditure by age of the reference person and COICOP consumption purpose

[hbs_exp_t135] Mean consumption expenditure by age of the reference person

[hbs_exp_t111] Mean consumption expenditure per household and per adult equivalent

[migr_imm8] Immigration by age and sex

[lfsa_ergacob] Employment rates by sex, age and country of birth (%)

[lfst_r_e2sgacu] Self-employment by sex, age, country of birth and degree of urbanisation

[[lfsa_egan] Employment rates by sex, age and citizenship (%)

[lfsi_dwl_a] Duration of working life

[lfsa_egan2] Employment by sex, age and economic activity (from 2008 onwards, NACE Rev. 2) - 1 000

[ilc_pns1] At-risk-of-poverty rate of older people, by age and sex - EU-SILC and ECHP surveys

[HLTH_RS_PR51] Health personnel (excluding nursing and caring professionals)

https://ec.europa.eu/eurostat/statistics-explained/index.php/Healthcare_personnel_statistics_-_physicians

[educ_uoe_perp01] Classroom teachers and academic staff by education level, programme orientation, sex and age groups

[educ_uae_perd01] Distribution of teachers at education level and programme orientation by age groups

[educ_uae_perd02] Distribution of academic staff at education level by age groups

[demo_gind] Population change - Demographic balance and crude rates at national level

[ifsa_eppgan] Part-time employment as percentage of the total employment, by sex, age and citizenship (%)

REFERENCES

Amado, C., São José., J., M. S., Santos, S., P. 2016. Measuring Active Ageing: A Data Envelopment Analysis Approach. *European Journal of Operational Research*, 255, p. 207-223.

Analytici ÚMS. 2018. Analytical Comment. no. 59, 27. 11. 2018. pp. 1-6. Available on: https://www.nbs.sk/_img/Documents/_komentare/AnalytickeKomentare/2018/AK59_Starnutie_obyvatelstva.pdf

Bleha, B., Šprocha, B., Vaňo, B. 2012. Forecast of Labor Supply Development in the Slovak Republic. National Project Active Aging Strategy. Education Center of the Ministry of Labor Social Affairs and Family of the Slovak Republic. Bratislava, 2012. Available on: https://www.ia.gov.sk/cv/images/projekty/strategiaaktivnehostarnutia/NPSAS_Aktivita1_Prognoza.pdf

Boersch-Supan, A. 2003. Labour Market Effects of Population Aging. *Labour*. vol. 17. No. 1. pp. 5-44. ISSN 1467-9914.

Brožová, D. 2003. Social Context of the Labour Market. Praha: Sociologické nakladatelství. 140 p. ISBN 80-86429-16-4.

Dubois, H. 2017. Mapping the Economically Inactive Population. 5th European User Conference for EU-Microdata. Eurofound. pp. 11-24. Available on: https://www.gesis.org/fileadmin/upload/dienstleistung/daten/amtl_mikrodaten/europ_microdata/Presentations_2017/Dubois_5th_EU_UC.pdf

European Commission. 2018. The 2018 Ageing Report. Economic & Budgetary Projections for the 28 EU Member States (2016-2070). Institutional Paper 079. pp. 1-406. Available on: https://ec.europa.eu/info/sites/info/files/economy-finance/ip079_en.pdf

European Commission. 2016, 1. Draft Joint Employment Report from the Commission and the Council- Accompanying the Communication from the Commission on the Annual Growth Survey 2017. COM(2016). 729 final. pp. 1-90 Available on: <https://view.officeapps.live.com/op/view.aspx?src=http%3A%2F%2Fwww.ipex.eu%2FPIPEXL-WEB%2Fdossier%2Ffiles%2Fdownload%2F082dbcc558a83c4f0158aad169f03ca.do>

European Commission. 2016, 2. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions a new Skills Agenda for Europe. Working together to strengthen human capital, employability and competitiveness. COM(2016) 381 final. Available on: <https://eur-lex.europa.eu/legal-content/SK/TXT/HTML/?uri=CELEX:52016DC0381&from=SK>

European Commission. 2015. Draft Joint Employment Report from the Commission and the Council- Accompanying the Communication from the Commission on the Annual Growth Survey 2016. COM/2015/0700 final. Available on: <https://eur-lex.europa.eu/legal-content/SK/TXT/?uri=CELEX%3A52015DC0700>

Eurostat. 2021, 1. Your Key to European Statistics. Background Information: Population Projections Available on: <https://ec.europa.eu/eurostat/web/population-demography/population-projections>

Eurostat 2021, 2. Healthcare personnel statistics. Available on: https://ec.europa.eu/eurostat/statistics-explained/index.php/Healthcare_personnel_statistics_-_physicians

Eurostat. 2021, 3. People Outside the Labour Market. Available on: https://ec.europa.eu/eurostat/statistics-explained/index.php/People_outside_the_labour_market.

Eurostat. 2021, 4. Statistics Explained. Available on: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Ageing_Europe_-_statistics_on_working_and_moving_into_retirement#Focus_on_common_jobs_among_older_people

Eurostat. 2021, 5. Database. Available on: <https://ec.europa.eu/eurostat/data/database>

Eurostat. 2019, 1. 04_Ageing Europe, Working and Moving into Retirement_AE2020..xlsx Available on: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:04_Ageing_Europe_Working_and_moving_into_retirement_AE2020.xlsx

Eurostat. 2019, 2. Ageing Europe, Working and Moving into Retirement, EU Labour Force Survey. Available on: <https://ec.europa.eu/eurostat/documents/3217494/10166544/KS-02-19-681-EN-N.pdf/c701972f-6b4e-b432-57d2-91898ca94893>

Eurostat. 2019, 3. Ageing Europe – Looking at the Lives of Older People in the EU. ISBN 978-92-76-09814-0. Available on: <https://ec.europa.eu/eurostat/documents/3217494/10166544/KS-02-19%E2%80%91681-EN-N.pdf/c701972f-6b4e-b432-57d2-91898ca94893>

Frkáňová, A. 2015. Determination of Labour Shortages and Labour migration Needs from Third Countries in the Slovak Republic. A Small Thematic Study of the National Contact Point of the European Migration Network in the Slovak Republic. International Organization for Migration (IOM) Office of the Slovak Republic. ISBN 978-80-89506-64-4. pp. 1- 67.

Grmanová, E., Ivanová, E. 2021. Selected Aspects of Working Conditions Differences in EU Countries. *Transformations in Business & Economics*. Vol. 20. No. 3. pp. 151-167.

Grmanová, E. at al. 2018. Demographic Changes and their Impact on the Labour Market. Trenčín: Fakulta sociálno-ekonomických vzťahov TnUAD. 104 p. ISBN 978-80-8075-833-2.

Grmanová, E. 2017, 1. Demographic Ageing in the Regions of Slovakia and the Czech Republic in 2011 - 2015. *Demografie*. ISSN 0011-8265. Vol.59, No.4(2017), pp. 303-314. WOS

Grmanová, E. 2017, 2. Part - time Employment of Seniors in the Countries of the Visegrád Group, 2017. AD Alta Journal of Interdisciplinary Research. ISSN 1804-7890. Vol.7, No.2(2017), pp.68-70. WoS

Grmanová, E., Čejková, V. 2016. The Insurance Market in Slovakia and the Czech Republic and the Efficiency of Insurance Companies. TnUAD. 152 p. ISBN 98-80-8075-758-8.

Hužvár, M. Kaščáková A. 2017. Alternative Methods for Contrustruction of Active Ageing Composite Indicator. RELIK. pp. 165-174. ISBN 978-80-245-2238-8. Available on: <https://relik.vse.cz/2017/download/pdf/126-Kascakova-Alena-paper.pdf>

Infostat. 2006. Forecast of the Labour Force in the Regions of the Slovak Republic until 2025. 16 p. <http://www.infostat.sk/vdc/pdf/pracsily.pdf>

International Labour Organization. 2018. World Employment and Social Outlook – Trends 2018. Population Ageing and Future Labor Market Challenges. pp. 1-4. Available on: <https://www.onlinelibrary.wiley.com/doi/pdf/10.1002/wow3.127>

Jablonský, J, Dlouhý, M. 2004. Models for Efficiency Evaluation of Decision Units. Praha: Professional Publishing. 183 p. ISBN 80-86419-49-5.

Káčerová, M., Ondačková, J, Mládek, J. 2014. Population Ageing of European Populations. STUDIA SCIENTIFICA FACULTATIS

PAEDAGOGICAE UNIVERSITAS CATHOLICA Ružomberok 2014, No. 3
Available on:
http://www.humannageografia.sk/clanky/Kacerova_Ondackova_Mladek_Ruzomberok%20%281%29.pdf

Káčerová, M., Mládek, J., Ondačková, J. 2012. New Methods of Measuring Population Ageing. FORUM STATISTICUM SLOVACUM, No. 3, pp. 62-69. Available on:
file:///C:/Users/Eva/Desktop/Monografia%20demografia/Nove_statisticke_metody_merania_populacn.pdf

Klimczuk, A. 2016. Comparative Analysis of National and Regional Models of the Silver Economy in the European Union. *International Journal of Ageing and Later Life*, Vol. 10. No. 2, pp. 31-59.

Klufová, K., Poláková, Z. 2010. Demographic Methods and Analyses. Praha: Wolters Kluwer, 306 p. ISBN 978-80-7357-546-5.

Koišová, E., Grmanová, E., Škrovánková, K., Kostrová, J. 2019. Competitiveness of Regions in the Visegrad Group Countries. *Engineering Economics*. Vol. 30. No. 2. pp. 203-210.

Kostrová, J. 2020. Changes in the Age Structure and Education Structure of Population and their Impact on the Labour Market. Trenčín: TnUAD. Dissertation Thesis.

Marsillas, S., Donder, L.D., Kardol, T., Regenmortel, S., Dury, S., Brosens, D., Smetcoren, A-S., Braňa, T., Varela, J. 2017. Does Active Ageing Contribute to Life Satisfaction for Older People? Testing a New Model of Active Ageing. *European Journal of Ageing*, Vol. 14. No. 3. p. 295-310.

Minářík, B., Borůvková, J., Vystrčil, M. 2013. Analysis in Regional Development. Praha: Professional Publishing. 234 p. ISBN 978-80-7431-129-1

Ministry of Finance of the Slovak Republic. Ministry of Health of the Slovak Republic. 2018. Revision of Health Care Expenditures II. Interim Report. <https://www.mfsr.sk/files/archiv/uhp/3370/76/Revizia-vydavkov-zdravotnictvo-II.pdf>

Ministry of Health of the Slovak Republic. Institute of Financial Policy. 2016. Dead Souls of Slovak healthcare. Available on: https://view.officeapps.live.com/op/view.aspx?src=http%3A%2F%2Fulozisko.institutfinancnejpolitiky.sk%2F%3Ffile%3DIFP2%25252FMrtve%252Bduse%25252FMrtve%252Bduse_web.xlsx

Mládek, J., Káčerová, M., Stankovičová, I. 2018. Regional Differentiation of Population Aging in Europe. *Geographia Cassoviensis* XII, 1/2018, p. 92-109.

Navickas, V., Grmanová, E., Gajda, W. 2020. Self-employment of Foreigners as an Innovative Solution on the Labour Market in the European Union. *Business: Theory and Practice*. -ISSN 1648-0627. Vol.21, No.1(2020), pp.178-183.

NCZI. 2021. Health Statistics Yearbook of the Slovak Republic 2019. 242 p. ISBN 978-80-89292-77-6.

NCZI. 2020. Health Statistics Yearbook of the Slovak Republic 2018. 234 p. ISBN 978-80-89292-71-4.

NCZI. 2019. Health Statistics Yearbook of the Slovak Republic 2017. 278 p. ISBN 978-80-89292-69-1.

NCZI. 2018. Health Statistics Yearbook of the Slovak Republic 2016. 260 p. ISBN 978-80-89292-61-5.

NCZI. 2017. Health Statistics Yearbook of the Slovak Republic 2015. 242 p. ISBN 978-80-89292-53-0.

NCZI. 2016. Health Statistics Yearbook of the Slovak Republic 2014. 243 p. ISBN 978-80-89292-47-9.

NCZI. 2015. Health Statistics Yearbook of the Slovak Republic 2013. 241 p. ISBN 978-80-89292-41-7.

SBA. 2018. Analysis of the Possibilities of Using Migration to the EU for Business Development in the Slovak Republic. 54 p. Available on: http://www.sbagency.sk/sites/default/files/9_analyza_moznosti_vyu_zitia_migracie_do_eu_pre_rozvoj_podnikania_v_sr.pdf

Somerville, W., Sumption, M. 2009. Immigration and the Labour Market Theory, Evidence and Policy. Migration Policy Institute. 55 p. Available on: <https://www.migrationpolicy.org/pubs/Immigration-and-the-Labour-Market.pdf>

Statistical Office of the Slovak Republic. 2021. Public Database. Statdata. Available on: [http://statdat.statistics.sk/cognosext/cgi-bin/cognos.cgi?b_action=cognosViewer&ui.action=run&ui.object=storeID\(%22iF41FA7A868E74315A56CF26B722E3A07%22\)&ui.name=Indexy%20vekov%20a9ho%20zlo%20c5%20beenia%20-%20SR%20oblasti%20kraje%20okresy%20mesto%20vidiek%205bom7005rr%20d&run.outputFormat=&run.prompt=true&cv.header=false&ui.backURL=%2fcognosext%2fcps4%2fportlets%2fcommon%2fclose.html](http://statdat.statistics.sk/cognosext/cgi-bin/cognos.cgi?b_action=cognosViewer&ui.action=run&ui.object=storeID(%22iF41FA7A868E74315A56CF26B722E3A07%22)&ui.name=Indexy%20vekov%20a9ho%20zlo%20c5%20beenia%20-%20SR%20oblasti%20kraje%20okresy%20mesto%20vidiek%205bom7005rr%20d&run.outputFormat=&run.prompt=true&cv.header=false&ui.backURL=%2fcognosext%2fcps4%2fportlets%2fcommon%2fclose.html)

Statistical Office of the Slovak Republic. 2017. Statistical Yearbook of the Slovak Republic. Bratislava: VEDA. 679 p. ISBN 978-80-224-1629-0.

Stephenson, J. Scobie, G. 2002. The Economics of Population Ageing. Working Paper 02/05. Available on: https://www.researchgate.net/publication/5203980_The_Economics_of_Population_Ageing. pp. 1-30.

Škrovánková, K. 2020. Changes on the Labour Market in the Slovak Republic in Context of Population Ageing. Trenčín: TnUAD. Dissertation Thesis.

Trading Economics. 2021. Main Indicators. Available on: <https://tradingeconomics.com>

UNECE. 2020. Active Ageing Index Home. Available on: <https://statswiki.unece.org/display /AAI/Active+Ageing+Index+Home> [2019-05-08]

Vidovičová, L., Petrová - Kafková, M. 2016. Regional Application of the Active Ageing Index (AAI). *Demografie, Review for Population Research*. 58, pp. 49-66.

World Health Organization. 2002. Active Ageing: A Policy Framework. WHO/NMH/NPH/02.8. 60 p.

ANNEX 1 Health Care Costs in the Slovak Republic

Age	Number of Man	Number of Women	Health Care Costs of Man	Health Care Costs of Woman	Health Care Costs of Men	Health Care Costs of Women
Less than 1	23176	21862	578	521	13395728	11390102
1	23615	22268	875	781	20663125	17391308
2	23849	22513	436	388	10398164	8735044
3	24015	22676	440	363	10566600	8231388
4	24136	22786	450	372	10861200	8476392
5	24204	22856	442	386	10698168	8822416
6	24240	22884	421	360	10205040	8238240
7	24226	22884	379	323	9181654	7391532
8	24193	22848	361	321	8733673	7334208
9	24127	22784	355	309	8565085	7040256
10	24046	22695	365	313	8776790	7103535
11	23945	22596	403	339	9649835	7660044
12	23838	22504	433	361	10321854	8123944
13	23758	22412	431	406	10239698	9099272
14	23703	22357	414	439	9813042	9814723
15	23704	22340	403	456	9552712	10187040
16	23755	22373	414	505	9834570	11298365
17	23871	22479	395	514	9429045	11554206
18	24075	22657	369	494	8883675	11192558
19	24352	22905	326	436	7938752	9986580
20	24672	23227	276	408	6809472	9476616
21	25053	23607	286	408	7165158	9631656
22	25486	24025	278	421	7085108	10114525
23	25974	24503	301	444	7818174	10879332
24	26523	25039	316	470	8381268	11768330
25	27127	25611	316	498	8572132	12754278
26	27792	26226	311	531	8643312	13926006

27	28479	26870	332	573	9455028	15396510
28	29174	27505	335	611	9773290	16805555
29	29863	28142	318	633	9496434	17813886
30	30545	28841	347	680	10599115	19611880
31	30972	29238	371	660	11490612	19297080
32	31216	29627	356	692	11112896	20501884
33	31007	29591	348	669	10790436	19796379
34	30291	28425	369	634	11177379	18021450
35	29593	28363	389	630	11511677	17868690
36	29482	28058	418	621	12323476	17424018
37	30005	28086	429	614	12872145	17244804
38	31963	30468	405	614	12945015	18707352
39	30143	29196	413	615	12449059	17955540
40	31463	29461	431	605	13560553	17823905
41	29998	28288	454	581	13619092	16435328
42	29701	27125	455	591	13513955	16030875
43	28486	26799	477	597	13587822	15999003
44	28759	26992	503	632	14465777	17058944
45	28404	26818	517	675	14684868	18102150
46	27259	25708	537	674	14638083	17327192
47	26719	25410	576	717	15390144	18218970
48	27293	25448	593	732	16184749	18627936
49	28698	27209	620	784	17792760	21331856
50	28864	27753	675	798	19483200	22146894
51	29384	27901	725	791	21303400	22069691
52	30139	28598	752	862	22664528	24651476
53	30656	28959	790	899	24218240	26034141
54	30877	29679	860	941	26554220	27927939
55	32783	31978	903	973	29603049	31114594
56	35860	34595	929	998	33313940	34525810
57	36053	35171	1 036	1 043	37350908	36683353

58	37282	36686	1 104	1 124	41159328	41235064
59	37798	36965	1 166	1 113	44072468	41142045
60	37196	37043	1 220	1 136	45379120	42080848
61	38004	37958	1 269	1 139	48227076	43234162
62	37783	38193	1 285	1 194	48551155	45602442
63	38528	38797	1 386	1 271	53399808	49310987
64	39359	39801	1 473	1 274	57975807	50706474
65	38812	39578	1 544	1 373	59925728	54340594
66	38454	39312	1 614	1 441	62064756	56648592
67	38264	38881	1 699	1 492	65010536	58010452
68	37251	39057	1 729	1 553	64406979	60655521
69	37283	38763	1 865	1 629	69532795	63144927
70	37901	40642	1 938	1 671	73452138	67912782
71	36795	39878	1 999	1 735	73553205	69188330
72	35942	39061	2 070	1 808	74399940	70622288
73	34859	38377	2 117	1 878	73796503	72072006
74	32744	37458	2 168	1 821	70988992	68211018
75	31791	37670	2 255	1 923	71688705	72439410
76	28823	34513	2 253	1 985	64938219	68508305
77	26074	31912	2 208	1 963	57571392	62643256
78	23573	29437	2 175	2 002	51271275	58932874
79	21720	27816	2 208	2 001	47957760	55659816
80	20174	26589	2 171	1 942	43797754	51635838
81	17993	24577	2 103	1 979	37839279	48637883
82	16982	23750	2 074	1 997	35220668	47428750
83	16110	23602	2 070	1 919	33347700	45292238
84	15200	22986	2 040	1 948	31008000	44776728
85	14302	22212	1 932	1 920	27631464	42647040
86	12621	20267	2 009	1 907	25355589	38649169
87	10636	17874	1 854	1 822	19719144	32566428
88	9495	16773	1 794	1 786	17034030	29956578

89	8143	14837	1 622	1 756	13207946	26053772
90	6761	12781	1 553	1 628	10499833	20807468
91	5769	11525	1 290	1 606	7442010	18509150
92	4821	10020	1 153	1 555	5558613	15581100
93	3889	8592	1 086	1 451	4223454	12466992
94	3069	6948	1 011	1 370	3102759	9518760
95	2351	5418	727	1 299	1709177	7037982
96	1788	4200	583	1 120	1042404	4704000
97	1355	3288	359	919	486977	3021849
98	1004	2480	175	596	175307	1478140
99	713	1781	255	620	181957	1104998
100 and more	1588	4114	74	221	117203	909165

Source: Ministry of Health of the Slovak Republic. Institute of Financial Policy. 2016.

About author

doc. RNDr. Eva Grmanová, PhD.

works at the Faculty of Social and Economic Relations at the Alexander Dubček university in Trenčín in Slovakia. Her research areas include statistics, econometrics and demography. She has been involved in several research projects as a research team member.

Translation Mária Štorcelová

Reviewers:

doc. PhDr. Ing. Aleš Gregar, CSc.

doc. PhDr. Jana Marie Šafránková, CSc

First edition, 2021

Publishing House: Centre of Sociological Research

<http://www.csr-pub.eu>

Szczecin, Poland 2021

All rights reserved.

ISBN 978-83-963452-3-3

DOI 10.14254/978-83-963452-3-3/2021

