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Comparison of Sustainability Indicators of Pension Systems in the New EU Member States

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Abstract

The majority of economies in the European Union are experiencing problems with the sustainability of pension systems that are primarily caused by unfavorable demographic trends and inadequate structure of the pension systems. This research concentrates on the New Member States of the European Union, namely eleven post-socialist economies that have a common history of restructuring of pension systems, which included adaptations in the transition to a market economy and the establishment of a multi-pillar pension model. By comparing fundamental indicators, it can be ascertained that these countries also share similar demographics - slower aging of societies compared to the Old Member States, decreasing fertility rates and mostly negative net migration rates, which ultimately makes the situation on the labor market more difficult. The principal objective of this research is to give an external view of the sustainability of pension systems in the analyzed economies from an international perspective, using different sustainability indicators. Not all of the examined pension systems are subject to the same challenges and changes in the same extent. It can be concluded based on the inferences of our comparative analysis that some countries better cope with the challenges ahead of them, owing to the design features of their pension systems, so they are more easily adapted to changing demographic and economic circumstances.

Keywords: *New EU Member States, Pension System, Sustainability*

Track: Governance

Word count: 6858

1. Introduction

Demographic trends are arguably the most important factor deteriorating the financial stability of pension systems. Pension systems in Europe are prevalently based on the Pay-as-you-go (PAYG) social security scheme, introduced in time of high population and real wage growth, when its sustainability was not challenged. The sustainability issues of the pension systems are usually analyzed within the overlapping generations (OLG) framework. As Samuelson (1958) showed, the PAYG pension system is sustainable as long as its internal rate of return does not exceed the growth rate of aggregate income. In Samuelson's words (1967): „The beauty of social insurance is that it is actuarially unsound...Always there are more youths than old folks in a growing population. More important, with real incomes growing at some three percent a year, the taxable base upon which benefits rest in any period are much greater than the taxes paid historically by the generation now retired...A growing nation is the greatest Ponzi game ever contrived“. This result on the sustainability of PAYG pension systems was nicely demonstrated on the model of PAYG pension system in Spain developed by de la Fuente (2015). He delivers two equivalent ways of evaluating long-term sustainability of PAYG pension system: that the initial replacement rate is not greater than the sustainable replacement rate and the above-mentioned sustainability criterion, that the internal

rate of return of the PAYG pension system does not exceed the sum of population and productivity growth (de la Fuente, 2015).

PAYG pension scheme became widespread after World War II, especially after the 1942 Beverage Report in England, “calling for a new and larger public sector role in old-age security” (World Bank, 1994). Afterwards, most industrialized countries experienced a significant decrease in birth rates and mortality rates, especially after the post-war baby boom (von Weizsäcker, 1996). This was the time when the Eastern (and Southern, although much faster) Europe was catching up the demographic transition of Northern and Western Europe (Augusztinovics, 1999). This trend has changed the age structure of the population, in which the share of elderly is increasing and the share of young population is declining. Due to different behavior and requirements of each age group in the population, it is natural that ageing of population has a large economic impact through a variety of channels (Bloom, Canning and Sevilla, 2003). It represents the most important factor deteriorating the financial stability of pension systems.

Pension systems of the New Member States of the European Union, next to demographic challenges, are largely affected by the historically poor design characteristics of their pension plans (World Bank, 1994). This was especially present in the period of privatization in former socialist economies, when early retirement was favored. Former state enterprises were going through a process of restructuring, which caused declining employment, so early retirement was seen as a way out of “mass redundancies” on the labor market (Wagner, 2005). Low retirement age and declining number of workers caused high and rising system dependency ratios. Contributions were paid by employers instead of employees, making weak link between contributions and benefits, and encouraging “underreporting of wages and a growing shadow economy” (Wagner, 2005). Additionally, replacement rates were relatively high. European countries have been reforming the pension systems to improve their sustainability by increasing the retirement age or pension contributions, discouraging early retirement and eliminating privileges for certain groups.

Considering the severity of this problem, an intergovernmental means of governance in the European Union called Open Method of Coordination on Social Protection and Social Inclusion (Social OMC) was established in 2006. The Pensions strand of the Social OMC is governed by three main objectives - adequate pensions, sustainable pensions and modernized pensions - and its indicator portfolio is structured along these objectives (Eurostat, 2019a). This research focuses on the second objective – sustainable pensions. Pallares-Miralles, Romero and Whitehouse (2012) find a pension system sustainable if “it is capable to pay current and future benefits, under reasonable assumptions, without shifting great burdens to future generations and without having to cut benefits, increase pension contributions, or change qualifying conditions”. Therefore, the aim of this paper is to compare the development of main indicators representing pension sustainability in selected European economies, as well as to analyze their subcomponents and trends that affect their movement.

The paper consists of four sections. The first section introduces the analyzed topic. The second section presents conducted theoretical and empirical research. The third section includes comparative analysis of pension sustainability indicators data covering 11 member states of the European Union: Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia. The fourth section presents our conclusions.

2. Literature review

Theoretical and empirical literature on pension sustainability can be divided into two types of studies. The first type of research involves investigation of determinants of the sustainability of pension systems. Second group of studies analyzes ways of measuring sustainability based on different definitions and scope of the term pension sustainability.

Zaidi (2010) examines the financial sustainability of public finances in member states of the European Union, and with the help of projections made available by the European Commission for 2009, takes a forward glimpse at the likely evolution of pension incomes. Furthermore, this study investigates how the pension reform responses at national level to the challenges of financial sustainability have affected the reshaping of pension systems in EU countries, producing a variety of pension systems that are less redistributive in some cases and more socially protective in others. The projections put 13 countries seriously at risk with sustainability gaps in excess of 10% of GDP and suggest the future pensioners of Estonia, Poland, Sweden, Austria, France and Portugal are at high risk of lower relative pensions. Finally, evidence points to changes in pension systems with respect to the element of redistribution and/or linkage of contribution history to pension entitlements

Andersen (2012) addresses the fiscal sustainability of public policies when the demography is changing. The author argues that the widespread view based on the tax-smoothing idea of public finances consolidation, may be appropriate for dealing with the increases in the dependency ratio driven by changes in fertility, but not with the increase caused by changes in the longevity. In the case of longevity, a trade-off between consolidation and increasing retirement ages becomes relevant, and there are solid reasons why the latter should be pursued by linking statutory retirement ages to longevity.

Grech (2013) analyzes the sustainability of pension reforms in Europe, using a broad social sustainability framework. To assess the ability of systems to alleviate poverty and maintain living standards, estimates of pension wealth for a variety of hypothetical cases are used, while also setting out how reforms could change future costs and relative entitlements for different generations. This approach provides additional insights into the impact of reforms by focusing on all prospective transfers rather than those at retirement, and by looking into the interaction between entitlements and labor participation. Results suggest that generosity has fallen, but remains strong in many economies. But, moves to link benefits to contributions have raised adequacy concerns for certain groups and strengthened the need for longer careers. Even though the reforms have helped to address fiscal challenges, in many countries pressures are strong and further reforms likely. An exhaustive review of different pension reforms worldwide is, for example, provided by Holzmann (2013).

Chybalski (2014) offers an alternative approach to analyze public pension expenditure. Using regression analysis of panel data covering 25 European countries in the period 2005-2010, the author attempts to answer the question about the factors determining pension expenditure and the direction of their influence. The study analyses the relationship between five groups of factors that should affect pension expenditure measured with their value in relation to GDP (PE/GDP), and the pension expenditure/GDP ratio divided by the old-age dependency ratio ((PE/GDP)/ODR). Results suggest that the factors that have a significant impact on pension expenditure, and thus the solvency or financial stability of pension systems, include, first of all, demographics, but also the labor market and economic growth.

Verbič and Špruk (2014) investigate the determinants of public pension expenditure using a panel of 33 countries. The authors employ several macroeconomic variables, such as net replacement rate, effective retirement age, and gross savings to GDP ratio. Demographic variables, namely, old-age dependency ratio, total fertility rate, life expectancy at birth and life expectancy at 65 are used as control variables. The method used for the panel data model is IV-2SLS fixed-effect estimator. The authors prove negative impact of aging population on public pensions, a one that is more important than economic and institutional factors.

Maintaining the stability of this system is one of the fundamental problems, both for Croatia and for other EU member states. Matić and Cobović (2017) analyze the efficiency and sustainability of the existing pension system in the Republic of Croatia and the identification of key parameters which determine its further development. The authors' comparative analysis of the Croatian pension system with the pension systems of individual EU Member States investigates the compliance of the Croatian pension insurance with the European social model, and the impact of economic factors on the sustainability of this system. Through the survey, authors explored the impact of non-economic factors on the pension system, and received relevant information about the attitudes of users of the current pension system, their awareness and confidence in the system, the willingness to participate in certain forms of pension insurance (in particular those that are voluntary) and expectations of the insured on the return on investment, and the threshold of satisfaction on investments in pension funds.

Melis and Trudda (2018) introduced a funded component in order to improve the sustainability of Italian public pension system, that is, the capability of the scheme to cover the pension liabilities in the long run, given the actual and future demographic scenario. The authors prove that, for the public budget, if there is set aside a part of the contributions, after a number of years it will get the balance of the system and a state of autonomy, without the intervention of the state to cover the negative balance of social security. The minimum component to be allocated according to the assumptions used in their simulations of new contributors, interest rate and cost of debt is 4% of the contributions, which ensures an overall positive balance after about 27 years.

Most member states of the European Union are forced to reform their pension systems due to the continuous ageing of society. Marcinkiewicz and Chybalski (2014) analyze pension expenditure as one of the main indicators of pension system sustainability. Significant demographic diversity between the EU countries, results in a difficult comparison of public spending on pensions. The most popular indicator of age related expenditures is pension spending as a share of gross domestic product. However, this indicator has some limitations that make it difficult to compare in cross-country analyses. That is why the authors proposed two alternative indicators visualizing the level of pension expenditure: the quotient of pension expenditure in GDP and old-age dependency ratio (PE/GDP/ODR) and the quotient of pension expenditure in GDP and the proportion of population aged 65 and over (PE/GDP/PP65+). The results show that, in most countries, pension expenditure ratio to GDP increased, while in the case of PE/GDP/ODR, pension expenditures went down in 13 countries, and expenditures measured by PE/GDP/PP65+ dropped in 11 countries. The correlation between variables PE/GDP and PE/GDP/ODR, and between PE/GDP and PE/GDP/PP65+ is present in most cases. However, in some cases these coefficients are surprisingly low, which means that growth of pension expenditure as a ratio to GDP was accompanied by a drop in indicators corrected by the demographic effect. Such standardization of the commonly used PE/GDP indicator makes it possible to provide for the demographic effect and facilitates a comparison of pension expenditures between countries

with very different population structures. This research served as one of the main guidelines for this analysis, which is presented in the next section.

3. Assessment of pension sustainability

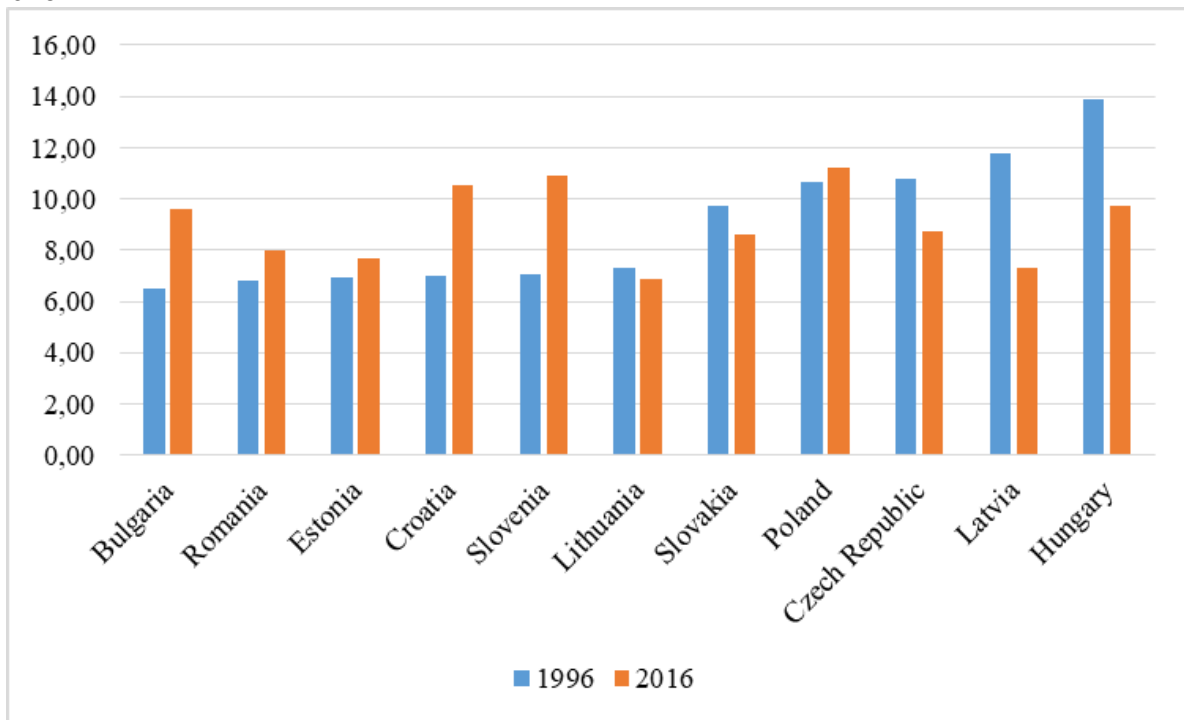
This study uses a total of 17 indicators monitoring the objective of sustainable pensions. European Commission (2009), Moscarola (2009), Pallares-Miralles, Romero and Whitehouse (2012), Marcinkiewicz and Chybalski (2014) and many others, begin the analysis of sustainability with public pension expenditure as a share of gross domestic product. To provide a better insight into the structure of expenses, they are decomposed into types of pensions. Similarly, pension expenditure is decomposed with the old-age dependency ratio, the employment effect, the take-up ratio and the benefit ratio. Furthermore, replacement rates, coverage ratio, the system dependency ratio and the old-age dependency ratio are analyzed, and also their combination called system efficiency. As Zaidi (2012) analyzed, pension sustainability gap or the indicator of a financial gap (as % of GDP) is also investigated in the end. However, sustainability indicators should be interpreted jointly with essential background information. Context information includes evolution of demographic indicators, by gender, and labor market indicators.

The first and most common indicator of sustainability is public pension expenditure as a share of gross domestic product, which includes all cash expenses on old-age and survivors pensions divided by GDP. Pension expenditure as a share of GDP is usually decomposed into factors reflecting the effect of demographics, labor market performance and the generosity of the pension system, which is shown in (1).

$$\frac{\text{pension expenditure}}{\text{GDP}} = \frac{\text{population 65+}}{\text{working population 15-64}} * \frac{1}{\text{employment rate}} * \frac{\text{pensioners}}{\text{population 65+}} * \frac{\text{average pension benefit}}{\text{average productivity}} \quad (1)$$

Figure 1 compares levels of pension expenditure in 1996 and 2016, sorted in the ascending order by values in 1996. Lowest levels in 1996 were recorded in Bulgaria and Romania (6.5-6.8%) and highest in Hungary (14%). On the other hand, Lithuania spent the least in 2016 with expenditure of 6.8% of GDP. Croatia, Slovenia and Poland spent the most on pensions in 2016. Greatest increase can be noticed in Slovenia and Croatia (3.8 and 3.5 percentage points, respectively), whereas Latvia and Hungary decreased spending by over 4 percentage points of GDP. It is interesting to notice that all the countries with lower expenditure in 1996 increased expenditure by 2016, while countries whose expenditure exceeded 7.5% of GDP, cut expenses. The exception is Poland, which increased spending from 10.7 to 11.2% of GDP.

Figure 1: Public Pension Expenditure as a Share of Gross Domestic Product in 1996 and 2016



Source: Eurostat

In the assessment of the sustainability of pension systems in economies that mostly rely on PAYG social security scheme, the most important indicator from the demographic point of view is the old-age dependency ratio, or the number of people aged 65 or over in the working-age population. Its increase implies that the number of workers paying contributions is declining relative to the number of pensioners, given that the statutory retirement age remains the same. The average number of people aged 65 or over expressed as a percentage of the working-age population for the analyzed economies was 28.18 in 2017. It is especially interesting that its value was 19.25 in 1995, which indicates an increase of 46% in 2017 compared to 1995 (World Bank, 2019). According to Eurostat, the predicted old-age dependency ratio for the New Member States in 2050 will almost double, to 53.80 percent (Eurostat, 2019b). A rise in the old-age dependency ratio in a country is, *ceteris paribus*, the result of the rising share of the elderly in an economy, due to rising life expectancy at birth.

There are, however, great differences in the age structure among the analyzed member states. Slovenia has experienced the largest change in the demographic structure of the population among the observed countries, with the share of population aged 65 or above in the working age population rising from 17.69 percent in 1995 to 28.89 percent in 2017. Interestingly, Slovenia in 1995, with Slovakia (16.13) and Poland (16.59), was in the group of countries with the lowest level of old-age dependency ratio recording 17.69. In 2017, Bulgaria (32.02), Latvia (30.47), Estonia (30.31) and Croatia (30.07) recorded the highest old-age dependency ratios, while Slovakia (21.66), Poland (24.50) and Romania (26.69) recorded the lowest demographic dependency ratios in 2017. Table 1 presents the average values of selected demographic indicators in years 1996, 2006 and 2016. By shrinking the contribution base of pensions, and with a growing number of pension beneficiaries, population ageing has a significant impact on the sustainability of the PAYG pension systems.

Table 1: Selected Demographic Indicators Important for Pension Systems

Indicator	1996	2006	2016
Fertility rate	1.38	1.38	1.53
Share of working-age population in total population	67%	69%	67%
Share of 65+ in total population	13%	16%	18%
Old-age dependency ratio	19.25	22.59	27.36
Life expectancy at birth (both sexes)	71.30	73.84	76.63
Life expectancy at 65 for male	12.73	13.90	15.34
Life expectancy at 65 for female	16.40	17.90	19.45
Net migration rate	0.35	-0.04	-3.72

Source: Eurostat, authors' calculation.

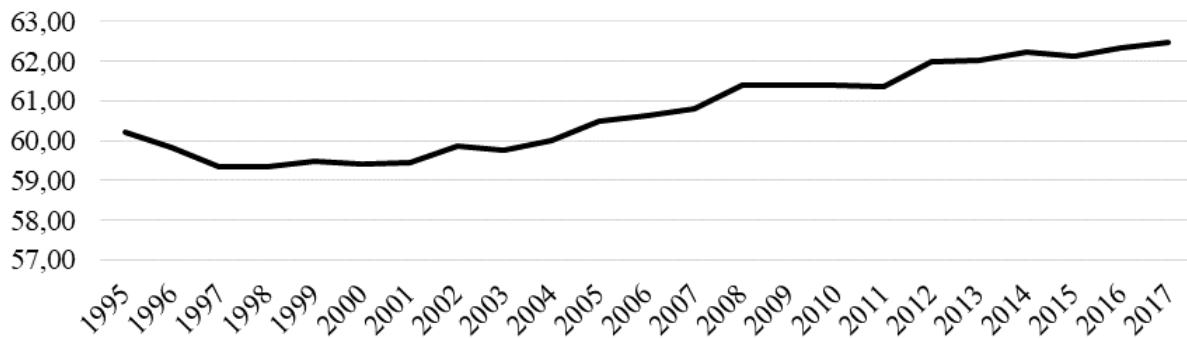
Comparing 2016 to 1996, all the New EU Member States, except for Slovakia (with growth of 1% in 2016 to 1996) and Slovenia (grew by 4% in 2016 to 1996), recorded a decrease in the total number of inhabitants in the observed period. The largest decrease in total population was recorded in Latvia and Lithuania (20% each), with Bulgaria (15%) and Romania (13%) following. Bulgaria (-18,259), Romania (-92,762) and Lithuania (-26,683) recorded the highest average negative net migration values in the period from 1995 and 2017, that persisted throughout the entire observed period. Bulgaria has been recording negative net migration values since 2001. Hungary, the Czech Republic, Slovakia and Slovenia were the only predominantly immigration countries.

According to Augustinovitzs (1999), transition countries are very similar to the Western economies with respect to fluctuation in the crude birth rate, however, crude death rate is still much higher in transition countries. The average life expectancy at the age of 65 of men increased from 12.72 in 1995 to 15.34 in 2017. In 2016, it was the lowest in Latvia (14.00), Lithuania (14.30), Bulgaria (14.50) and Hungary (14.72), and the highest values were recorded in Slovenia (17.70), Czech Republic (16.30), Poland (16.00) and Croatia (15.64). On the other hand, all New Member States belong to the Top 50 lowest fertility world economies, according to the World Population Review in 2019, with four of them (Poland (1.29), Hungary (1.40), Croatia (1.45), Slovakia (1.46)) belonging to the group of twenty countries with the lowest fertility in the world (World Population Review, 2019).

Next to demographic developments, the second set of variables affecting pension system sustainability are related to the pension systems design features. One of them is certainly statutory retirement age. Figure 2 shows the development of the average weighted effective retirement age in the period between 1995 and 2017 for the analyzed economies. The indicator has been weighted by the proportion of male and female citizens in each country in each year to accurately represent the entire population. It shows an upward trend since 1998, from 59.34 in 1998 to 62.47 in 2017, with some slight fluctuations, which was expected as all reforms are aimed at increasing the working life to achieve sustainability of the system. By observing the percentage change of this variable in 2017 with respect to 1998, Bulgaria (by 12%) and Hungary (by 9%) experienced the largest increase in the weighted effective retirement age. Slovakia (by 8%) and Slovenia (by 8%) followed. It is interesting to observe how the variability among countries with respect to average effective retirement age was reducing, measured by the coefficient of variation, from 3.7% in 1998 to 1.9% in 2007. Slovakia in 2017 registered the lowest average weighted retirement age (58.23). Hungary (58.82) and Bulgaria (59.02) followed. Slovenia is joining with the average weighted effective

retirement age below 60, recording 59.46. On the other hand, Romania (64.99) and the Baltic countries (Estonia (62.96), Latvia (62.16) and Lithuania 61.40)) recorded the highest average weighted effective retirement age in 2017.

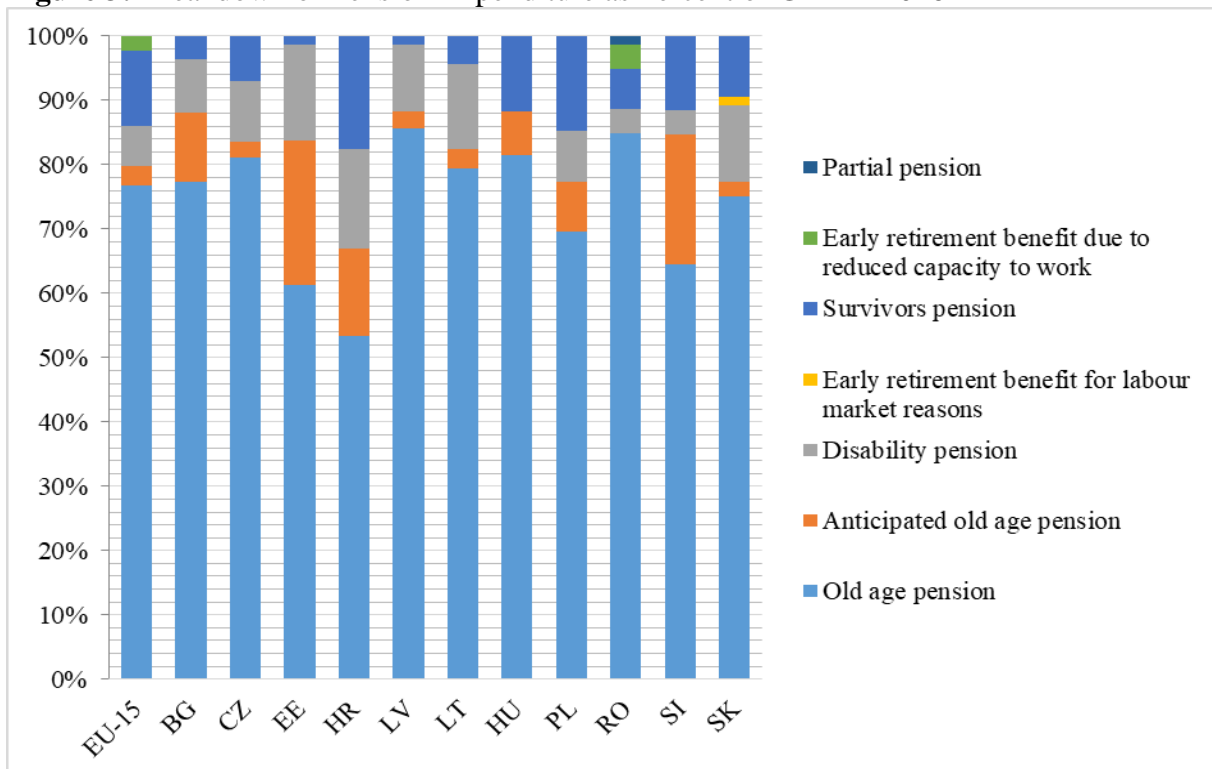
Figure 2: The average value of the weighted effective retirement age for the New EU Member States, 1995-2017



Source: Eurostat, authors' calculation.

To give a sense of feeling about the prevalence of early retirement in analyzed economies, total level of public pension expenditure as a share of GDP is decomposed below, in Figure 3. According to Eurostat, expenditure on public pensions comprises the following social benefits: old-age pension (beneficiaries who retire at the legal or standard age), anticipated old-age pension (beneficiaries who retire before the legal or standard age), disability pension, early retirement due to reduced capacity to work, partial pension, survivor pension and early retirement due for labor market reasons. The share of anticipated old-age pensions is especially interesting, since it is related to beneficiaries who retire before the legal or standard age (Eurostat, 2019b).

Figure 3: Breakdown of Pension Expenditure as Percent of GDP in 2016



Source: Eurostat, authors' calculation.

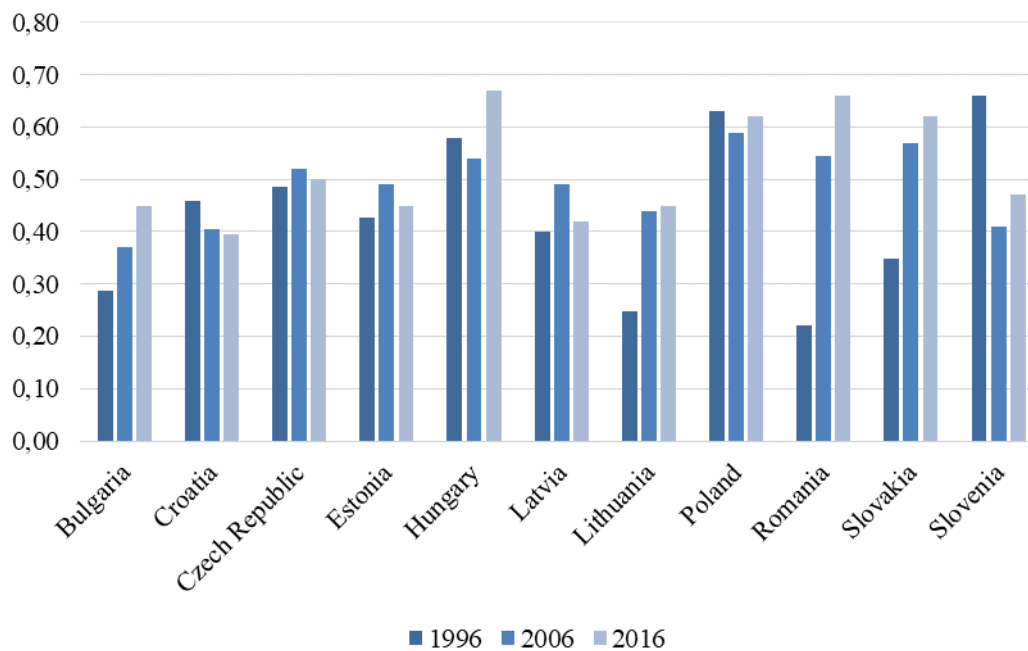
In 2016, the following countries, in descending order of magnitude, recorded the highest share of early retirement: Estonia (23%), Slovenia (20%), Croatia (13%) and Bulgaria (11%), as opposed to Romania (0%), Slovakia (2%), the Czech Republic (2%), Latvia (3%) and Lithuania (3%) that recorded the lowest share of early retirement in total public pension expenditure in 2017. Croatia stood out with the highest share of survivors' pensions (17%) in 2016. Poland follows with 15%. Hungary shares the average with EU-15 recording 12%. Estonia and Latvia (both with 1%), Lithuania and the Czech Republic (both with 4%) are on the other end with the lowest share of survivors' pensions in total public pension expenditure in 2016. The highest share of disability pensions in 2016 recorded Croatia and Estonia (15%), Lithuania (13%) and Slovakia (12%).

Looking at the share of old-age pensions in the total pension expenditure in 2016, Croatia recorded the lowest share, of only 53%. These countries followed: Estonia (62%) and Slovenia (63%). On the other hand, Latvia (86%), Romania (85%), the Czech Republic (82%), Hungary (81%) and Lithuania (79%) recorded the highest share of old-age pensions, and all are above the EU-15 average, which was 77% in 2016.

Another indicator, reflecting the number of pensioners in the population over 65, called the coverage ratio, for two years 2006 and 2014 is given in Table 2. It can be concluded that all countries except Croatia, Estonia and Lithuania recorded a decrease in the share of the number of pensioners in the population above 65. The average coverage ratio decreased from 1.8 in 2006 to 1.63 in 2014, with Hungary registering the biggest reduction. All countries are ranked with respect to the value of an indicator, where Rank 1 in the coverage ratio indicates that the country recorded the lowest value of the indicator.

Although it is usually presented as an adequacy indicator, replacement rate plays a great role in pension sustainability, determining the level of pension expenditure. It is the percentage of an employee's pre-retirement monthly income that an employee receives after retiring. Figure 4 compares levels of replacement rates in three years: 1996, 2006, 2016. The average replacement rate in 1996 was 0.47, but with great variability among countries, with Lithuania (0.25) and Bulgaria (0.29) recording the lowest levels and Slovenia (0.66) and Poland (0.63) recording the highest levels. The variability among countries with respect to replacement rate steadily decreased, with the coefficient of variation of 30% in 1996 declining to 15% in 2006 and increasing to 19.8% in 2016. The lowest replacement rate in 2016 was 0.40 and was recorded in Croatia. Latvia followed with the replacement rate of 0.42. Hungary (0.67), Romania (0.66) and Poland (0.62) recorded the highest level of replacement rate in 2016. The lowest average replacement rate in the whole observed period between 1995 and 2017 was recorded in Bulgaria (0.39) and Croatia (0.41) and the highest in Hungary (0.61) and Poland (0.6). Comparing 1996 and 2016, the greatest increase in replacement rate in 2016 compared to 1996 was recorded in Lithuania (80%), Slovakia (77%) and Bulgaria (55%). Romania (32%) and Hungary (16%) followed. The lowest was recorded in Estonia and Latvia (5% both). On the other hand, Slovenia (29%), Czech Republic (15%), Croatia (13%) and Poland (2%) had a decline in replacement rates.

Figure 4: Trends in Replacement Rates



Source: Eurostat, authors' calculation.

The labor market performance is another equally important part of the analysis for the sustainability of the pay-as-you go-pension scheme, since current benefits are paid from the contributions paid by the current workers. Table 2 delivers two important labor market indicators for the pension system, participation and employment rates, in two years, 2006 and 2014, for every economy, as well. Countries are ranked, and Rank 1 in the participation rate indicates that the country recorded the highest value of an indicator, whereas Rank 1 in the unemployment rate indicates that the country recorded the lowest value of an indicator.

Table 2: Changes in Coverage Ratio, Participation Rate and Unemployment Rate

	Coverage ratio					Participation rate					Unemployment rate				
	2006	Rank	2014	Rank	Change	2006	Rank	2014	Rank	Change	2006	Rank	2014	Rank	Change
Bulgaria	1.70	4	1.54	2	-9%	51.29	9	54.14	9	6%	8.9	8	11.6	9	30%
Croatia	1.46	1	1.56	3	7%	49.19	11	52.36	11	6%	11.1	9	16.7	11	50%
Czech Republic	1.88	8	1.60	5	-15%	59.27	3	59.42	2	0%	7.1	5	6.2	1	-13%
Estonia	1.67	3	1.71	8	2%	60.64	1	61.12	1	1%	5.9	2	7.7	3	31%
Hungary	1.92	9	1.26	1	-34%	50.65	10	53.68	10	6%	7.5	6	7.8	4	4%
Latvia	1.58	2	1.57	4	-1%	59.10	5	59.27	4	0%	6.8	4	10	7	47%
Lithuania	1.72	5	1.74	9	1%	55.25	6	58.93	5	7%	5.6	1	11.3	8	102%
Poland	1.99	10	1.69	7	-15%	54.00	8	56.25	7	4%	13.8	11	9.2	5	-33%
Romania	1.85	7	1.62	6	-12%	54.97	7	54.87	8	0%	7.3	7	7	2	-4%
Slovakia	2.00	11	1.91	11	-5%	59.14	4	59.35	3	0%	13.3	10	13.3	10	0%
Slovenia	1.84	6	1.77	10	-4%	59.30	2	57.67	6	-3%	6	3	9.5	6	58%

Source: Eurostat, authors' calculation.

Additionally, Eurostat's Labor Force Survey Database contains data on the participation rates of the age cohort 55-64 in the period between Q1998-Q2018, which is another interesting indicator. Listing countries in descending order of magnitude with respect to the average participation rate of this age cohort: Estonia (62.55%), Latvia (57.45%), Lithuania (57.09%), Czech Republic (49.42%), Bulgaria (46.19%), Romania (43.69%), Croatia (40.16%), Slovakia (39.76%), Poland (37.37%), Hungary (36.24%) and Slovenia (33.66%). The biggest deviation from the activity rates of the whole working age population can be found in Slovenia (by 52%), Slovakia, Hungary and Poland (by 43%), and the smallest in Estonia (15%) and Latvia (21%). Employment rates of the age cohort 55-64 across observed economies for the same period show that Slovenia (31.97%), Hungary (34.40%), Poland (34.72%), Slovakia (35.80%) and Croatia (36.98%) registered the lowest levels, whereas Estonia (57.89%), Lithuania (51.82%) and Latvia (51.73%) are on the other end. The Czech Republic (47.10%), Romania (42.57%) and Bulgaria (41.96%) are in the middle.

System dependency ratio makes one of the most important indicators of pension sustainability. It is the number of pensioners divided by the number of workers. To incorporate development of demographics (represented by the old-age dependency ratio), the pension system design (represented by the coverage ratio) and the labor market developments (represented by the activity or participation and employment rates), we represent it as follows:

$$\begin{aligned} \text{System Dependency Ratio} &= \frac{\text{Number of pensioners}}{\text{Number of workers}} \\ &= \frac{\text{Number of 65+}}{\text{Number of 15-64}} * \frac{\text{Number of pensioners}}{\text{Number of 65+}} * \frac{1}{\frac{\text{Number of workers}}{\text{Labor force}} * \frac{\text{Labor force}}{\text{Number of 15-64}}} \end{aligned} \quad (2)$$

$$\text{System Dependency Ratio} = \text{Old age dependency ratio} * \text{Coverage Ratio} * \frac{1}{\text{Employment Rate} * \text{Participation Rate}} \quad (3)$$

Table 3 presents the values for the number of pensioners expressed as a share of the number of workers. The ratio is expressed as pensioners to workers ratio (although the opposite ratio is also common) and it illustrates how close the countries are to the unsustainable equilibrium: one pensioner per one worker. In 2006, Czech Republic and Slovakia were in the best situation, with a ratio of almost two workers per one pensioner. On the other hand, Hungary recorded a value of 0.78, which means 1.28 workers per one pensioner. Comparing 2014 to 2006, majority of the countries recorded an increase in the number of pensioners relative to workers. The exceptions include Hungary and Poland that have reduced the proportions and Romania, where value has not changed. The highest values in 2014 were recorded in Bulgaria (0.75) and Croatia, with as much as 0.88.

Furthermore, it is interesting to compare the system dependency ratio and the old-age dependency ratio. Their ratio is called system efficiency of the pension system. It is a function of the coverage, participation and employment ratios. Table 3 delivers system efficiency of the pension systems of New EU Member States in two years: 2006 and 2014 and ranks the countries according to this system efficiency. Rank 1 indicates that the country recorded the lowest value of this indicator. It is apparent that in 2014, compared to 2006, the majority of countries improved their system efficiency (lowered it). The decline is recorded in Hungary, Poland, Czech Republic, Bulgaria, Romania, Slovakia, Lithuania and Slovenia. Conversely, Croatia, Latvia and Estonia recorded increase in 2014, compared to 2006.

Table 3: System Dependency Ratios and Efficiency of the Pension Systems

	System dependency ratio (2006)	System efficiency (2006)	Rank	System dependency ratio (2014)	System efficiency (2014)	Rank	Change in the system efficiency
Bulgaria	0.74	2.89	7	0.75	2.5	5	-13%
Croatia	0.72	2.757738	5	0.88	3.136	11	14%
Czech Republic	0.57	2.870531	6	0.60	2.311	2	-19%
Estonia	0.61	2.435662	2	0.69	2.44	4	0%
Hungary	0.78	3.42	10	0.54	2.148	1	-37%
Latvia	0.60	2.39437	1	0.70	2.412	3	1%
Lithuania	0.66	2.709152	3	0.73	2.67	7	-1%
Poland	0.70	3.77	11	0.61	2.84	9	-25%
Romania	0.65	2.924975	8	0.65	2.64	6	-10%
Slovakia	0.55	3.366	9	0.60	3.11	10	-8%
Slovenia	0.62	2.750753	4	0.71	2.74	8	0%

Source: Eurostat, authors' calculation.

Finally, by studying the fiscal balance of the pension systems, significant differences in their structure and in the fulfillment of the obligations to pay current and future benefits can be observed. The main indicators analyzed are pension revenues and expenditure in 1996 and projected gross and net pension spending and contributions as a share of GDP in 2016, which indicate how the PAYG scheme is funded. In 1996, the most favorable situation was in Lithuania, which was in a plus of 1.7% of GDP. Followed by Slovakia, which had roughly the same revenue of 8.1% of GDP, but the difference was 0.8% of GDP. Estonia and Latvia recorded a positive value of 0.6%, while the last country with a positive difference in pension revenue and pension expenditure was the Czech Republic with 0.3% of GDP. Although it had the largest pension contribution of 11.9% of GDP, Poland recorded a negative difference of 1.1% of GDP, due to expenditure of 13%. Slovenia was in the most unfavorable situation, where expenditure exceeded revenue by 3.5% of GDP, while the second last was Croatia with the negative difference of 2.7% of gross domestic product.

The greatest issue of unsustainability in 2016 had Bulgaria whose gross public pension expenditure amounted to 9.6%, and public pension contributions 4.2% of GDP, so as much as 5.4% had to be covered by tax revenues or borrowing. The second place belongs to Croatia whose gross public pension expenditure was 10.6% and public pension contributions 5.8% of GDP, creating a gap of 4.8% of GDP. It is followed by Poland with a gap of 3.3%, Estonia and Romania with 2.4%, Slovenia with 1.8%, Slovakia with 1.7%, Latvia with 0.6%, and Czech Republic and Hungary with 0.3%. The most interesting is the case of Lithuania that earned more revenue than it needed to cover pension expenses and was in surplus of 0.3% of GDP in 2016 (Schmähl and Horstmann, 2002; Holzmann and Guven, 2009; European Commission, 2019). So, in the 20-year period, Lithuania kept the most favorable position, while Bulgaria fell to the last position. Probably the biggest problem of unsustainability is noted in the Croatian pension system, which has remained in the second to last place throughout the period.

4. Conclusion

This study analyzes a large number of indicators of the sustainability of pension systems proposed by the European Commission's Open Method of Coordination on Social Protection and Social Inclusion, World Bank and other relevant institutions, that are included in empirical studies such as Moscarola (2009), Pallares-Miralles, Romero and Whitehouse (2012) and Marcinkiewicz and Chybalski (2014). No analysis of pension sustainability is complete without the examination of public pension expenditure divided by gross domestic product, which is usually decomposed into factors reflecting the effect of demographics, labor market performance and the generosity of the pension system. In the eleven New Member States of the European Union, for the last three decades, about 9% of GDP was spent annually on pensions, on average, while today the "leaders" in spending are Croatia, Slovenia and Poland. It is interesting to notice that all the countries with lower expenditure in 1996 increased expenditure by 2016, while almost all countries whose expenditure exceeded 7.5% of GDP, cut expenses, indicating a decrease in dispersion of pension expenditure to GDP. In the economies that mostly rely on PAYG social security scheme old-age dependency ratio makes an important indicator. Its value in New Member States increased by 46% in 2017 compared to 1995 and according to Eurostat, the predicted old-age dependency ratio in 2050 will almost double, to 53.80%. Negative trends in fertility rates and migration trends further aggravate the sustainability of pension systems.

Aside from demographics, design features affect pension systems' sustainability greatly. The average weighted effective retirement age is analyzed in the period 1995-2017 and it shows an upward trend since 1998, amounting to 62.47 in 2017. Early retirement is prevalent in Estonia, Croatia and Slovenia, and rare in Slovakia, Latvia and Lithuania. Analysis of the structure of public pension expenditure to GDP shows that Croatia has the smallest share of old-age pension, indicating a problem with loose retirement criteria and great privileges for certain groups, whereas Latvia recorded the highest share of old-age pensions. Replacement rates point to the generosity of pension systems and pensioners' standard of living, however, greater benefits mean greater unsustainability. The lowest average replacement rate in the whole observed period between 1995 and 2017 was recorded in Bulgaria (0.39) and Croatia (0.41) and the highest in Poland (0.60) and Hungary (0.61).

Indicators of labor market performance also have to be included in the sustainability analysis, since current benefits are paid from the contributions of current workers. Observing the average participation rate of the 55-64 age cohort can be concluded that the most favorable situation is in Baltic countries with over 57% and the most unfavorable in Slovenia (33.66%). Employment rates of the age cohort 55-64 across observed economies for the same period give the same ranking order. System dependency ratio makes one of the most important indicators of pension sustainability related to labor market, being the number of pensioners divided by the number of workers. In this paper it is combined with the old-age dependency ratio to calculate the system efficiency. Majority of countries improved their system efficiency, while Croatia, Latvia and Estonia diminished it.

Lastly, fiscal balance of pension systems is analyzed. Pension revenues are compared to gross and net pension spending and contributions as a share of GDP in 1996 and 2016. Baltic countries and Slovakia had positive results in 1996, but also managed to balance well in 2016, together with Czech Republic and Hungary. Conversely, problems are evident in Bulgaria, Croatia, Poland, Romania and Slovenia. In conclusion, taking into account all 17 indicators, one can conclude that some of the analyzed pension systems have shown better quality design, while others suffer from structural problems and long-term unsustainability. Probably,

Croatia, Slovenia and Poland face the greatest challenges with high pension spending, low fertility rates and somewhat lower participation rates, high negative net migration and significant share of privileged benefits and early retirement. On the contrary, Baltic States, especially Lithuania, have managed to keep positive fiscal balance, allocate pension expenditure more rationally and maintain the same levels of replacement rate and pensioners' income adequacy throughout the period.

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