Similarity Assessment of the Pension Systems of the New European Union Member States

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Abstract

Recent macroeconomic and demographic trends have resulted in new challenges for pension systems. One of these challenges is to create a sustainable pension system while simultaneously providing adequate pension benefits for current and future pensioners. This research explores how similar are pension systems of eleven European Union countries by using hierarchical cluster analysis for year 2016. Variables representing pension systems, as well as demographic, macroeconomic and labour market data were used to cluster these economies. Three clustering solutions were generated using hierarchical clustering approach, one for each variable group. Given the number of observed countries, only two cluster solutions were considered. According to the characteristics of the pension systems, countries that have greater problems of unsustainability are recognized. A similar group of countries also forms the cluster characterized by unfavourable demographic trends that make it more difficult to maintain sustainability. Romania stands out from other economies, based on macroeconomic indicators, as it recorded faster economic growth, greater labour productivity growth and lower unemployment rate in 2016. The findings of this study provide a guideline for future pension reforms, since they indicate which countries' experience could be valuable in defining certain policy measures.

Introduction

All the countries of Central and Eastern Europe in the 1990s passed through the transition from the socialist economies to capitalism, so they share similar history and nowadays converge in many ways. Common characteristics that can be identified in pension systems of these countries include an unfavourable ratio of retirees to workers, a large share of retirees that have low pension benefits, early retirement, increased life expectancy, aging societies, decline in fertility rate, negative net migration and low employment rates.

This study focuses on the pension systems of eleven economies referred to as New Member States of the European Union in year 2016. Although all the eleven countries have many similarities, they can be further classified into smaller groups.

In order to examine the similarity of the pension systems of the mentioned countries, the trends in macroeconomic indicators and resemblance of the design of pension systems are investigated. The study employs a multivariate statistical method, cluster

analysis, to classify countries, i.e. their pension systems into homogeneous groups. Cluster analysis may be used instead of regression analysis, or some advanced methods where the link between endogenous and exogenous variables is decided in advance.

The obtained clusters provide a different insight into the relationship between the chosen variables, as well as between the pension systems than studies that have used other econometric methods. The analysis groups economies that share the same demographic and macroeconomic situations, which represents a crucial step in setting up the basic assumptions of more advanced models of pension systems.

The rest of the paper is organised as follows. In the second section a brief overview of literature is given. Data and empirical model are described in the third section, while the last section contains concluding remarks.

Literature Review

Classification and similarity of pension systems that is examined in this paper has been the subject of debate in the broader literature. First, there is a considerable literature on typology of pension regimes, both empirical and theoretical work. Esping-Andersen (1990) examines the relationship between public and private pensions, distinguishing three pension regime types: a corporatist state-dominant insurance system, a residualist and a universalistic state-dominated system. This classification largely corresponds to his general typology of welfare regimes. Lately, Esping-Andersen's typology has been debated widely, with many studies replicating the analyses and making new classifications.

Soede and Vrooman (2008) conducted an empirical study of categorization of pension systems of the European Union economies, the United States, Australia, Canada and Norway. They compare the systems using 34 quantitative and qualitative characteristics of the mandatory parts of the pension systems. The authors conclude that Esping-Andersen's (1990) categorization of welfare regimes is not entirely valid for pension systems. They identified four clusters of pension regime types, where the first two are the corporatist and liberal. The other two clusters are not in line with the standard classification of welfare regimes. In the "moderate pensions" cluster, the level of pension provision is lower than in the corporatist cluster, but above the standard attained by economies in the liberal cluster. In the "mandatory private" cluster, employees have to participate in private pension schemes that are generally funded and based on defined contributions.

Kim and Lee (2008) attempted to typify the strategies of the developed countries for coping with ageing societies and analyse the implications of the related causal variables. Using two dimensions, employment- and income security, they classify countries into welfare-to-work type, welfare-emphasis type, labour-emphasis type and market-emphasis type. The authors concluded the advanced strategy in dealing effectively with ageing is placing equal emphasis on income and employment guarantees. Mikulec (2011) investigates the level of pension systems' efficiency and classifies EU and EFTA countries in the years 2005-2007. Solutions with three to seven clusters are provided. The results indicate that countries of Central and Eastern Europe show similar pension systems' efficiency. Aysan (2013) analyses 19 OECD economies to create a pension regime classification and to reveal the place of Turkey among these countries. The findings of the cluster analysis prove that pension regimes can be classified in three broad clusters: Southern European, Continental European, and social-liberal.

Marcinkiewicz and Chybalski (2016) propose a new pension regimes typology based on two main criteria: (1) the relation between state and market in the pension

system, and (2) the share of voluntary and mandatory schemes using cluster analysis. The results confirm the theoretical typology they proposed: the first regime is similar to the voluntary private regime, the second to the mandatory private regime, whereas the third to the mandatory public one. Marcinkiewicz (2017) groups 30 OECD countries into three pension regimes using Kendall's W concordance coefficient to measure intra-group similarity. The author argues that the extent of state's involvement in the pension system and level of voluntariness are the basic dimensions for distinguishing social policy models with respect to old-age pensions.

Chybalski (2016) observes 4 dimensions of the pension system efficiency, which refer to the GDP distribution, the pension adequacy, the labour market influence and the administrative costs. Based on Spearman's rank correlation coefficient and cluster analysis he analyses 28 EU countries during the 2007-2011 period. His results showed that Norwegian and the Icelandic pension systems prove to be the most efficient in the observed group. Roman, Toma and Tuchiluş (2018) use Chybalski's approach to compare the efficiency of the pension systems in 26 Member States of the European Union. They conduct a cluster analysis to classify the countries by their pension systems' efficiency that is by the GDP-distribution efficiency, the adequacy efficiency and the labour market efficiency. The results reveal that Hungary, Luxembourg and Romania have the most efficient pension systems.

Methodology

In the paper focus is given to the European Union member states that have joined the European Union since 2000. In period from 2000 to 2019, 13 countries have joined the European Union. Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia joined the European Union in 2004 whereas Bulgaria and Romania joined in 2007. The last country that joined the European Union was Croatia in 2013. It has been decided that due to their small size in the paper Cyprus and Malta will not be observed. So, in the paper 11 European Union member states are observed.

In order to inspect characteristics of the pension system, demographics, macroeconomic development and labour market in the observed countries, overall 11 variables were carefully selected. Each of the variables is assigned to a corresponding group of variables. Full list, their codes and sources is given in Table 1.

Table 1
Selected Variables

Variable group	Variable code	Variable description	Source
Characteristics of the pension system	AERA	Average effective retirement age - weighted	OECD, Eurostat
	PPEXP	Public pension expenditure as % of GDP	Eurostat
	RRATE	Replacement rate	Eurostat
Demographics	FRATE	Fertility rate	World Bank
	LEA65	Life expectancy at the age of 65 – weighted	World Health Organization
	NETMR	Net migration rate	Eurostat
	OADR	Old age dependency ratio	World Bank
Macroeconomics and labour market	GDPGR	GDP growth rate, in %	World Bank
	LABPR	Real labour productivity per person employed - annual data (2010=100)	Eurostat
	LFPR	Labour force participation rate	World Bank
	UNEMP	Unemployment rate, in %	World Bank

Source: Authors' work

For starters, basic descriptive statistics are examined. Afterwards, the hierarchical cluster analysis is conducted by using Ward's method as the clustering criteria and squared Euclidean distances as cluster distance measure. In line with the stated research hypothesis, only two cluster solutions are considered. Furthermore, clustering is conducted for each variable group separately. Since measure units differ, standardized values are used. Nevertheless, the characteristics of clusters will be commented in original values.

Results

In the first part of this section descriptive statistics are examined. The results also point to significantly different values of the observed variables, i.e. outliers, if they exist. Then the main results of conducted hierarchical cluster analyses are presented.

Table 2
Basic Descriptive Statistics Results, n=11 European Union Member States, Data for 2016

Variable group	Variable code	Statistics					
		Aver.	Stan. dev.	Coeff. of var.	Min.	Med.	Max.
Characteristics of the pension system	AERA	62.35	1.99	3.20	60.11	61.82	67.16
	PPEXP	9.01	1.49	16.49	6.84	8.74	11.20
	RRATE	0.52	0.10	19.79	0.40	0.47	0.67
Demographics	FRATE	1.53	0.12	8.02	1.32	1.57	1.70
	LEA65	17.53	0.93	5.28	16.29	17.30	19.55
	NETMR	-2.03	3.86	-189.95	-10.52	-0.12	1.90
	OADR	27.36	3.07	11.21	20.74	27.98	31.29
Macroeconomics and labour market	GDPGR	2.97	0.84	28.32	2.06	2.86	4.82
	LABPR	111.99	8.11	7.24	100.60	109.50	131.80
	LFPR	57.32	3.65	6.36	51.32	56.60	62.87
	UNEMP	8.00	2.65	33.09	4.05	8.00	13.48

Source: Authors' work

The results from Table 2 show that the average pension expenditure to GDP in 2016 was 9.01%, with Lithuania recording the lowest expenditure, and Poland the highest. Workers of the analysed economies on average retire at the age of 62, with Slovaks retiring the earliest and Romanians at the latest. Pension systems pay the benefits to a retiree for 17.53 years on average, considering the average life expectancy at 65. When retired, Bulgarians live the shortest and Slovenes the longest. Among the variables representing the pension system, the greatest variability among countries is visible in the generosity of their pension systems, with the average replacement rate of 0.52 and the coefficient of variation of 20%. Hungarians have the most generous pension system, and Croats the least generous.

The average number of people aged 65 or over expressed as a percentage of the working-age population, was 27.36 percent in 2016, Slovakia being the youngest among the analysed economies and Bulgaria the oldest. The greatest variability among the countries overall is detected in the net migration rate. Six economies registered more emigrants than immigrants, and five economies had positive net migration rate. Lithuania, Latvia and Croatia recorded the highest levels of net emigration, whereas the Czech Republic, Estonia and Slovakia registered the highest levels of net immigration.

There were major differences in unemployment levels of the observed economies, varying between 4.05 percent in the Czech Republic, and 13.4 percent in Croatia, in

2016. The average labour participation rate was 57.32%. All the economies recorded positive GDP growth rates in 2016 compared to 2015 and positive growth of labour productivity with respect to 2010. Additionally, the conducted outlier analysis implies that there are no values that would be significantly different from the other values at the observed variables.

Table 3
Hierarchical Cluster Results for Two Cluster Solutions, Ward's Clustering Method, Squared Euclidean Distances, n=11 European Union Member States, Data for 2016

Variable group	Cluster	Country	Variable code	Variable average
Characteristics of the pension system	1	Bulgaria, Croatia, Czech Republic, Hungary, Poland, Slovakia, Slovenia	AERA	61.47
			PPEXP	9.89
			RRATE	0.53
	2	Estonia, Latvia, Lithuania, Romania	AERA	63.90
			PPEXP	7.46
			RRATE	0.50
Demographics	1	Bulgaria, Croatia, Hungary, Latvia, Lithuania, Romania	FRATE	1.56
			LEA65	16.92
			NETMR	-4.43
			OADR	28.56
	2	Czech Republic, Estonia, Poland, Slovakia, Slovenia	FRATE	1.49
			LEA65	18.28
			NETMR	0.84
			OADR	25.91
Macroeconomics and labour market	1	Romania	GDPGR	4.82
			LABPR	131.80
			LFPR	53.72
			UNEMP	6.42
	2	Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, Slovenia	GDPGR	2.79
			LABPR	110.01
			LFPR	57.67
			UNEMP	8.15

Source: Authors' work

The economies belonging to the first cluster according to the characteristics of the pension system - Bulgaria, Croatia, Czech Republic, Hungary, Poland, Slovakia and Slovenia - recorded higher levels of pension expenditure to GDP in 2016. Their workers retired earlier, at the average age of 61.47 and their beneficiaries enjoyed higher replacement rates. In this group, Poland, Croatia and Slovenia had the highest pension expenditure to GDP in 2016, whereas Polish retirees enjoyed the third highest replacement rate. Slovenes and Croats on the other hand had replacement rates that are below the average. They retired approximately at the age of 64 and received lower retirement benefits compared to the beneficiaries of other countries in Cluster 1. The second cluster consists of Estonia, Latvia, Lithuania and Romania. Although Romanians and Estonians retire at the latest, Romania has one of the highest replacement rates, while Estonian pension is below average as compared to the average wage. Latvia and Lithuania also register one of the lowest replacement rates. The derived results are confirmed by Figure 3, which represents the graph of the normalized means of selected variables in each group and confirms the above mentioned conclusions.

Figure 3
Profile Diagrams of Clusters, Average Standardized Values, Data for 2016
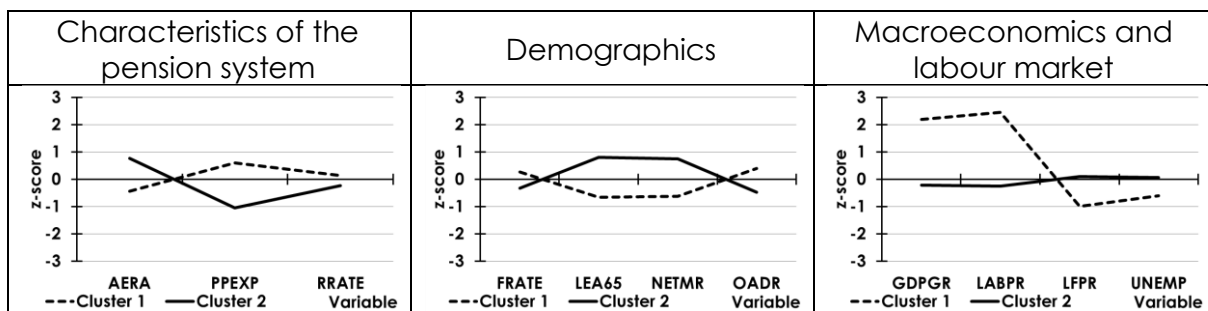
Source: Authors' illustration

From the demographic perspective, Bulgaria, Croatia, Hungary, Latvia, Lithuania and Romania make the Cluster 1, having relatively more elderly persons, which is deduced from the higher old age dependency ratio. At the same time, relatively high average fertility rates give hope that this will change in the future. Retirees in these economies live shorter on average, which is 17 years on average. First cluster economies were all emigration countries in 2016. Czech Republic, Estonia, Poland, Slovakia and Slovenia form the second cluster. Their population is relatively younger, they live longer in retirement, for 18.28 years on average. Their average fertility rate is lower.

Due to the exceptional increase in labour productivity in Romania in 2016, by 31.8% compared to 2010, the highest GDP growth rate in 2016 compared to the previous year, of 4.82%, and below average unemployment rate in 2016, Romania is the sole member of the Cluster 1. It recorded, on the other hand, below average labour force participation rate. Other economies belong to the Cluster 2, having lower GDP growth rates, lower labour productivity, and higher participation and unemployment rates.

Conclusion

This paper examines how similar are pension systems of eleven economies called New Member States of the European Union by employing a multivariate statistical method. Eleven variables were selected in total, to represent the pension systems' characteristics, demographics, macroeconomic environment and labour market situation. For each of the three variable groups, a clustering solution was generated by using hierarchical clustering approach. Since the number of observed economies was little, only solutions with two cluster were an option.

Conducted analysis points to the countries that have greater problems of unsustainability, whereas a similar group also forms the cluster of countries with adverse demographic trends that exacerbate sustainability. In the cluster solution based on macroeconomic indicators, one economy stands out – Romania – because of a faster economic growth and lower unemployment rate. The demonstrated results match state of the art methods. A similar pattern of results was obtained in older studies and the results are not in contradiction with empirical typologies.

The analysis identified economies that share same demographic problems. Bulgaria, Croatia, Hungary, Latvia, Lithuania and Romania have relatively more elderly persons, relatively high average fertility rates, their retirees live shorter on average, and they all represent emigration countries. The remaining economies have a more favourable situation and their pension systems a better perspective.

Results provide a basis for further research and indicate which economies' experience with pension reforms may be valuable. However, future investigations are necessary to validate the kinds of conclusions that can be drawn from this study.

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