II. EFFICIENCY OF PENSION SYSTEMS IN THE EU COUNTRIES

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Abstract

Demographic projections imply that the pension costs will increase in the future, which puts pressure on the government budgets. European countries are also worried about this phenomenon and have worked to define and adopt reforms to help improve the way that pensions are run. Our aim is to analyze and to compare the efficiency of the pension systems in 26 European Union countries using Chybalsky's approach for 2011-2015 period. Using three economic and social dimensions (in static and dynamic approach), respectively the GDP-distribution efficiency, the adequacy efficiency and the labor market efficiency we conduct a cluster analysis in order to classify the European Union countries from the perspective of pension system efficiency. Thus, the Hungarian, the Luxembourgian and the Romanian pension systems are revealed to be the most efficient ones. At the opposite side, the worst pension systems are reported in Greece, Portugal and Italy.

Keywords: cluster analysis, efficiency, pension reform, pension system
JEL Classification: H55, H75, J26, C38

1. Introduction

The demographic crisis around the world has made many countries reform their pension systems. The fundamental issue in this context is the direction towards which the pension reforms should go. A criterion (after the adequacy of pension systems) according to which the pension systems can be evaluated is their efficiency. According to ECOFIN (2007) *"the efficiency can be defined by the amount of foregone resources by moving towards the desired allocation. Social spending is more efficient if less resources are used for a given change, or if, for a given level of foregone resources, the economy moves closer to the desired allocation."* The efficiency analysis of the pension systems tries to answer the following questions: Will the pension system be financed or remain under-financed? Should

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it be based on a defined contribution or on defined benefit? Should it be more a Beveridgian or a Bismarckian pension system?

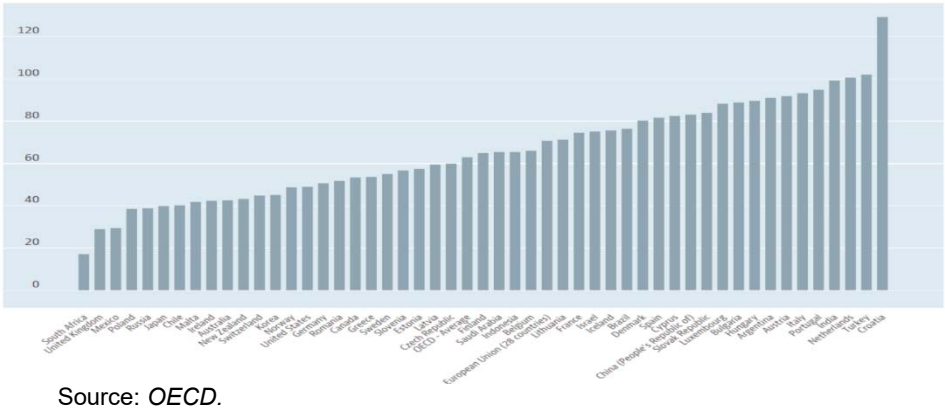
Pre-retirement contribution and retirement benefits are essential for the defined benefit pension fund (DC) and the retirement benefit fund (DB). The DC pension fund establishes the contribution in advance and the benefit of the fund is based on the economic behavior of the contributor. In DB, the benefit is initially established, and the taxpayers' contributions should be adjusted continuously before retirement.

Worldwide, the quality of pension systems available to workers varies greatly (see Figure 1). According to the OECD's Pensions at a Glance (2017) report, retirees in the Netherlands, Turkey and Croatia receive more than 100% of a working wage when they retire (Dutch – 101% and Turkish - 102%, but Croatians receive a generous 129%). This report also reveals that India (99%), Portugal (95%), and Italy (93%) have very competitive pension rates.

The worst situations are registered in South Africa and the United Kingdom with only 18% respectively 29% of working wage received in 2017 when workers retire. For comparison, the OECD average is 63% and the average for the EU member states is 71%.

Figure 1

Percentage of a Working Wage Retirees Receive around the World, 2017



Source: *OECD*.

In order to measure and assess the efficiency of the pension system, we applied Chybalsky's both static and dynamic approach. In accordance with the four dimensions proposed by Chybalsky (2016), in this paper the following representative indicators for the 2011-2015 period were chosen: pension expenditures as percentage of GDP, at-risk-of-poverty ratio, median relative income ratio of elderly people aged 65+, aggregate replacement ratio, employment rate for older workers aged 55-64 and 65-69, average retirement age for men and women. Based on the results, the static and dynamic approaches should be treated as complementary ones, not as alternatives in measuring the pension efficiency. The study uses cross-sectional data for 26 EU countries retrieved from Eurostat and OECD Databases and is mainly based on Spearman's rank correlation coefficient and cluster analysis. With this approach, cross-country quantitative comparisons are possible and can be used in order to search for better pension system designs. Hence, the pension systems of Hungary, Luxembourg and Romania seem to be the most efficient in the analyzed group, while the worst pension systems can be found in Greece and Portugal, followed by Italy.

Our study is organized into five sections. The introductory section contains a brief overview of the efficiency of pension systems in the OECD countries. The literature review section contains a summary of the main relevant studies on the efficiency of the pension systems. Third section includes the data and methodology used. Section four presents the results of our analysis, and the final section concludes the study and presents our suggestions.

2. Literature Review

The efficiency of pension systems is a very sensitive issue for all the countries. Due to the complexity and the ambiguity of the pension systems efficiency, we may find many studies in literature that aim to review and assess such systems.

Considering the pension system efficiency as being multidimensional, Chybalsky (2016) established 4 dimensions that refer to the GDP distribution, the pension adequacy, the labor market influence and the administrative costs, grouped the analyzed pension systems and evaluated this problem from both static and dynamic perspectives. His work is based on Spearman's rank correlation coefficient and cluster analysis and covers the 28 EU countries during the 2007-2011 period. The results obtained showed that Norway's and Iceland's pension systems were the most effective of the analyzed group.

In order to identify an optimal design of the pension systems, Fehr and Uhde (2013) quantified the efficiency of the social security systems of the various institutional projects. The results showed an optimal replacement rate of about 50% of the average earnings. The authors highlighted in the optimal design model the trade-off between progressivity and generosity (*i.e.,* the rate of optimal replacement of a retirement pension system is higher than that of a benefit system).

Using the same hypothesis, Fehr and Uhde (2014) determined the optimal transition path between stable states while eliminating the effects of reforms, with and without social security benefits.

The efficiency of the pension system was also analyzed by Mikulec (2011). His research is based on statistical data for 25 EU and 2 EFTA countries (Iceland and Norway) collected for the 2005-2007 period. With a total of 21 indicators and using the cluster analysis, a classification of the pension systems of the analyzed countries was made. He found a common feature in the efficiency of the pension systems for some Central and East European countries (namely Estonia, Lithuania, Latvia, Poland, Slovakia, Czech Republic) given especially from their common history in the last decades. He argued that an optimal pension system gives incentives to productive workers to fully realize their potential, while providing benefits to people experiencing low productivity. However productive workers are stimulated over time to obtain an early retirement.

Brzęczek and Szczepański (2017) compared the roles of employers in additional voluntary pension schemes in the Central European countries, such as the Czech Republic, Poland, Romania, Slovakia and Hungary. They noticed a wide variety of institutional and tax solutions applied during the 2009-2011 period. Thus, Poland and Hungary provided typical occupational pension schemes, quasi-occupational schemes were provided in Slovakia, and the Czech Republic and Romania provided individual plans with employer-financed option instead of the purely professional one. Also related to the role of employer, Bossler (2015) verified whether the employer has provided occupational pensions by assessing the employees' commitment to their work. The author has found a significant and positive effect of occupational pensions on the employment commitments.

Kryger (2011) suggested a set of criteria to measure the fairness and efficiency of the retirement benefit schemes. The author also outlined the characteristics of an optimal design in two situations: firstly, when only the current generation is taken into account and secondly, when the bequest for future generations is taken into account. His model indicated that when efficiency is the object of maximization or of fairness then in both cases there exist various non-dominant strategies as equilibria.

Guan and Liang (2015) analyzed the optimization of the DC pension plan by using the mean-variance criterion. They also they studied the impact of economic conditions on the efficient frontier, using DEA method and determined the efficient strategies. The main result indicates that the efficient strategy, in order to minimize the risk of wealth loss at retirement, is to invest less in stocks and more in bonds.

The DEA method was used by Hsu and Lee (2014) to evaluate the efficiency of public spending for 18 OECD countries over the 1995-2002 period. The results showed that 14 countries could reduce the technical inefficiency.

Lobonţ et al. (2018) compared the public sector performance (including pension system performance) in the European countries between 1995 and 2014. In this paper authors construct a public sector performance index (using seven relevant indicators for the public sector) and proved that administration policies had a major contribution to the performance of the public sector.

Government spending in the advanced economies is shared by social security benefits, private pension subsidies and elderly income. Using an OLG model, O' Dea (2018) determine the perfect combination of these approaches. The analysis suggests that private pension subsidies and pensions that are closely linked to the average career gains should be replaced by a combination of higher revenues from retirement incomes and lower income taxes.

3. Data and Methodology

Following Cybalsky's idea of measurement of pension efficiency, we consider the following variables:

- Conditional variable: OADR (old-age dependency ratio), which is the ratio of the number of people aged 65 to the number of people aged 15-64 (expressed per 100 persons of working age);
- Input: EXP_PEN (Pension expenditures as % of the GDP);
- Outputs:
  - POVRE describes at-risk-of-poverty and is measured as ratio of pensioners' living under the poverty threshold in total population;
  - MRIOP is median relative income ratio for elderly people aged 65+;
  - ARR (Aggregate replacement ratio) is the gross median individual pension income of the population aged 65-69 relative to the gross median individual earnings from work of the population aged 50-59, excluding other social benefits (according to EUROSTAT definition);

- Side-effects:
  - EROW (Employment rate for older workers) is calculated as ratio of employed persons aged 55 to 64 or 65 to 69 to the total number of people aged 55 to 64 respectively 65 to 69.
  - ARA-M, ARA-F (The average effective age of retirement) calculated as a weighted average of (net) withdrawals from the labor market at different ages over a 5-year period for workers initially aged 40 and over, by gender, for men and for women.

This approach is based on statistical data describing the above-given categories and proposes two complementary ways to measure and assess the pension system efficiency in cross-country studies, namely one static and one dynamic.

3.A. Efficiency Indicators – The Static Approach

In order to analyze the overall efficiency of pension systems in the static approach for the three dimensions described above we define the following indicators:

The indicator for the first dimension (GDP distribution efficiency) is:

$$GDP - D\_E = (EXP\_PEN)/OADR \quad (1)$$

For the second dimension - *adequacy efficiency* - the three indicators are:

$$POVRE\_E = (1/POVRE)/(EXP\_PEN) \quad (2)$$

$$MRIOP\_E = MRIOP/(EXP\_PEN) \quad (3)$$

$$ARR\_E = ARR/(EXP\_PEN) \quad (4)$$

where: POVRE_E, MRIOP_E, and ARR_E denotes the efficiency of poverty alleviation, the efficiency of consumption smoothing measured by relative median ratio, and by aggregated replacement ratio, respectively.

This set of indicators represents the main output of pension system, describing the efficiency of pensioners' incomes. The indicators are stimulants, i.e. a greater value correspond with greater efficiency of pension system.

The set of indicators for the third dimension - labour market efficiency - includes three efficiency indicators, as follows:

$$EROW(55-64)\_E = EROW(55-64)/(EXP\_PEN\ \ ) \quad (5)$$

$$EROW(65-69)\_E = (EROW(65-69))/(EXP\_PEN\ \ ) \quad (6)$$

$$ARA-M\_E = (ARA-M)/(EXP\_PEN) \quad (7)$$

$$ARA-F\_E = (ARA-F)/(EXP\_PEN) \quad (8)$$

where: EROW (55-64)_E, EROW(65-69)_E and ARA_E denotes efficiency in term of labour market for each age group and male or female, respectively.

3.B. Efficiency Indicators – The Dynamic Approach

According to Cybalsky, the pension system efficiency is the result of a combination which involves poverty alleviation (POVRE) and consumption smoothing (MRIOP and ARR). Based on them, we define the following three dynamic indicators:

$$POVRE\_DE = (POVRE_t - POVRE_0)/((EXP\_PEN_t)/(EXP\_PEN_0)) \quad (9)$$

$$MRIOP\_DE = (MRIOP_t - MRIOP_0)/((EXP\_PEN_t)/(EXP\_PEN_0)) \quad (10)$$

$$ARR\_DE = (ARR_t - ARR_0)/((EXP\_PEN_t)/(EXP\_PEN_0)) \quad (11)$$

The dynamic efficiency indicators proposed above can be interpreted as follows: POVRE_DE measures the efficiency of poverty reduction, MRIOP_DE and ARR_DE measure the efficiency of increase in the level of consumption smoothing. We determine this indicators using the same base period (0) and current period (t).

Hence, the measurement of pension system efficiency proposed by us is comparable to Cybalsky's: ours is based on three different dimensions. Our research includes the Spearman's rank correlation coefficient and cluster analysis. To answer the main question about the number of efficiency dimensions, the proposed indicators need to be classified. The analysis covers 26 European Union countries (without France and Croatia, with no data). We use cross-sectional data from 2011–2015. The sources of the data are Eurostat and the OECD databases. The Spearman's rank correlation coefficients are calculated for the entire analyzed period, and the cluster analysis is conducted for each year separately

4. Empirical Results

Table 1 shows the Spearman's rank correlation coefficients between the efficiency indicators. As expected, the GDP-D_E indicator is correlated (negatively) with all indicators.). The Spearman correlation coefficient for the pair GDP-D_E, POVRE_E is insignificant (-0.048), which means that there is a weak relationship between these two indicators. This value may indicate the efficiency of ensuring poverty alleviation in the pension system is resistant to the changes of the relation between pension expenditures and demographics. The negative sign of the Spearman correlation coefficient between GDP-D_E and other indicators show that a higher GDP distribution efficiency (a lower value of that indicator) increase the labor market efficiency. Since the GDP-D_E indicator measures the resistance of the pension system to demographic changes, this resistance influences the labor market efficiency positively.

The GDP-D_E positively influences MRIOP_E and ARR_E, which measure the efficiency of ensuring consumption smoothing. This means a higher GDP distribution efficiency increase the consumption smoothing.

The adequacy efficiency indicators and labor market efficiency indicators are positively correlated in analyzed period. However, the correlation between POVRE_E and EROW_E(65-69) is statistically insignificant (0.025). The same situation is observed for ARA_M (0.142) and ARA_F (0.148). This leads to the conclusion that there is independence between the poverty risk and the employment rate of persons aged 65 to 69, and the age of retirement for both men and women, respectively.

Table 1

Spearman Correlation between the Static Efficiency Indicators (2011-2015)

			GDP-D_E	POVRE_E	MRIOP_E	ARR_E	EROW_E(55-64)	EROW_E(65-69)	ARA-M_E	ARA-F_E
Spearman's rho	GDP-D_E	Correlation Coefficient	1.000	-.048	-.582**	-.566**	-.775**	-.516**	-.786**	-.805**
		Sig. (2-tailed)	.000	.589	.000	.000	.000	.000	.000	.000
		N	130	130	130	130	130	130	130	130
	POVRE_E	Correlation Coefficient	-.048	1.000	.245**	.254**	.243**	-.025	.142	.148
		Sig. (2-tailed)	.589	.000	.005	.004	.005	.775	.108	.094
		N	130	130	130	130	130	130	130	130
	MRIOP_E	Correlation Coefficient	-.582**	.245**	1.000	.830**	.527**	.289**	.802**	.806**
		Sig. (2-tailed)	.000	.005	.000	.000	.000	.001	.000	.000
		N	130	130	130	130	130	130	130	130
	ARR_E	Correlation Coefficient	-.566**	.254**	.830**	1.000	.480**	.249**	.764**	.771**
		Sig. (2-tailed)	.000	.004	.000	.000	.000	.004	.000	.000
		N	130	130	130	130	130	130	130	130
	EROW_E(55-64)	Correlation Coefficient	-.775**	.243**	.527**	.480**	1.000	.723**	.805**	.802**
		Sig. (2-tailed)	.000	.005	.000	.000	.000	.000	.000	.000
		N	130	130	130	130	130	130	130	130
	EROW_E(65-69)	Correlation Coefficient	-.516**	-.025	.289**	.249**	.723**	1.000	.562**	.552**
		Sig. (2-tailed)	.000	.775	.001	.004	.000	.000	.000	.000
		N	130	130	130	130	130	130	130	130
	ARA-M_E	Correlation Coefficient	-.768**	.142	.802**	.764**	.805**	.562**	1.000	.996**
		Sig. (2-tailed)	.000	.108	.000	.000	.000	.000	.000	.000
		N	130	130	130	130	130	130	130	130
	ARA-F_E	Correlation Coefficient	-.805	.148	.806	.771	.802	.552	.996	1.000
		Sig. (2-tailed)	.000	.094	.000	.000	.000	.000	.000	.000
		N	130	130	130	130	130	130	130	130

***. Correlation is significant at the .01 level (2-tailed)*

Source: Authors' calculations based on t data provided by Eurostat.

Further, we use the cluster analysis for our indicators, because it provides other results concerning the two proposed sets of efficiency indicators and it confirms that the pension system efficiency is multidimensional. The results obtained after applying the cluster analysis are presented in Table 2. Therefore, 4 or 5 clusters for each year can be observed as follows: 4 clusters for 2011 and 2013 and 5 clusters for the rest of the analyzed years.

For the 2011-2015 period, our cluster analysis shows that the first cluster includes only the GDP-D_E, which refers to the resistance of a pension system to demographic factors. The last cluster includes EROW_E(65-69) (in 2012, 2014 and 2015 years), which refers to employment rate of people aged 65–69 and that indicates an important loss of revenues after the retiring. In 2011 and 2013 years the EROW_E(65-69) indicator is included in the fourth cluster and that indicates a variation of behavior for employed persons in 65-69 age period. Going further, we may see that for the analyzed time frame the second cluster consists of POVRE_E, which refers to the poverty alleviation. An exception occurred in 2011, when the POVRE_E was grouped with ARR_E. This grouping mode suggests that the level of consumption becomes closer to the reduction of poverty level.

In 2011 and 2012, the third cluster contains indicators related to the pension adequacy and labor market dimensions: MRIOP_E, EROW_E(55-64), ARA-M_E, ARA-F_E. This fact suggest that all these indicators are highly connected with the decision to retire (average effective age of retirement) and the employment rate for workers aged 55-64. For 2013, we observe that ARR_E (aggregate replacement ratio) groups with the above indicators in a cluster. This fact indicates that consumption smoothing is closer to the pension adequacy and the labour market indicators in this year.

Table 2

Cluster Analysis for the Static Efficiency Indicators (2011-2015)

	Year				
Clusters	2011	2012	2013	2014	2015
C1	GDP-D_E	GDP-D_E	GDP-D_E	GDP-D_E	GDP-D_E
C2	POVRE_E ARR_E	POVRE_E	POVRE_E	POVRE_E	POVRE_E
C3	MRIOP_E EROW_E (55-64) ARA-M_E ARA-F_E	MRIOP_E EROW_E(55-64) ARA-M_E ARA-F_E	MRIOP_E ARR_E EROW_E (55-64) ARA-M_E ARA-F_E	MRIOP_E	MRIOP_E
C4	EROW_E (65-69)	ARR_E	EROW_E(65-69)	ARR_E EROW_E(55-64) ARA-M_E ARA-F_E	ARR_E EROW_E (55-64) ARA-M_E ARA-F_E
C5		EROW_E(65-69)		EROW_E(65-69)	EROW_E (65-69)

Source: *Authors' calculations based on data provided by Eurostat.*

Table 3 shows the Spearman's rank correlation coefficients between the selected static and dynamic efficiency indicators for the 2012-2015 period. The presented results confirm the argument in favor of applying the two approaches to the efficiency evaluation proposed by Chybalsky.

Therefore, we may notice that Spearman correlation is statistically insignificant between the static efficiency and the dynamic efficiency. In other words, POVRE_E and POVRE_DE are not correlated, the same results being obtained for the other pairs: (MRIOP_E, MRIOP_DE) and (ARR_E, ARR_DE). This means that there is no relationship between the static and the dynamic approaches of assessing the pension efficiency.

Upon checking the dynamic indicators' Spearman correlations, we may see that the following pairs show correlation at the 0.01 level: (POVRE_DE, MRIOP_DE), (ARR_DE, POVRE_DE) and (ARR_DE, MRIOP_DE). The first pair's correlation suggests that an increase in the efficiency of at-risk-of-poverty measured by POVRE_DE highly corresponds to the decrease in the efficiency of consumption smoothing measured by MRIOP_DE. ARR_DE and POVRE_DE are also correlated with POVRE_DE, meaning that an increase in the efficiency of the aggregate replacement ratio is associated to the decrease in the efficiency of at-risk-of-poverty. Last but not least, there is a correlation between ARR_DE and MRIOP_DE, suggesting that an increase in the efficiency of the aggregate replacement ratio corresponds to an increase in the efficiency of consumption smoothing measured by MRIOP_DE.

Table 3

Spearman Correlation between Selected Static and Dynamic Efficiency Indicators (2012-2015)

			POVRE_E	MRIOP_E	ARR_E	POVRE_DE	MRIOP_DE	ARR_DE
Spearman's rho	POVRE_E	Correlation Coefficient	1.000	.227*	.245**	.053*	.052	-.047
		Sig. (2-tailed)	.	.021	.012	.591	.598	.635
		N	104	104	104	104	104	104
	MRIOP_E	Correlation Coefficient	-.227*	1.000	.836**	.150	.175	-.207**
		Sig. (2-tailed)	.021	.	.000	.128	.076	.035
		N	104	104	104	104	104	104
	ARR_E	Correlation Coefficient	-.245*	.836**	1.000	.227*	-.236*	-.180
		Sig. (2-tailed)	.012	.000	.	.020	.016	.000
		N	104	104	104	104	104	104
	POVRE_DE	Correlation Coefficient	-.053	.150	.227*	1.000	-.550**	-.424**
		Sig. (2-tailed)	.591	.128	.020	.	.000	.000
		N	104	104	104	104	104	104
	MIRIOP_DE	Correlation Coefficient	-.052**	-.175	-.236*	-.550**	1.000	.535**
		Sig. (2-tailed)	.598	.076	.016	.000	.	.000
		N	104	104	104	104	104	104
	ARR_DE	Correlation Coefficient	.047**	-.207*	-.180	-.424**	.535**	1.000
		Sig. (2-tailed)	.635	.035	.068	.000	.000	.
		N	104	104	104	104	104	104

**. Correlation is significant at the 0.05 level (2-tailed)*

***. Correlation is significant at the 0.01 level (2-tailed)*

Source: Authors' calculations based on data provided by Eurostat.

Our analysis continues with a cluster analysis for the countries pension systems as individuals. Using the Centroid Method, we obtained the dendrograms for the static efficiency indicators (see Figure 2) in the 2011-2015 period. The main clusters (determined as countries that remains in the same group for all analyzed years) are:

- First main cluster: Denmark, Finland, Germany and the Netherlands;
- Second main cluster: Belgium, Poland, Slovenia and Spain;
- Third main cluster: Bulgaria, Ireland, Latvia and Lithuania;
- Fourth main cluster: Hungary, Malta and Slovakia.

When examining the clusters, we observe some countries that are very close to each other in terms of efficiency over the entire analyzed period depending on geographical proximity, (see cluster 1). Other countries are grouped depending on efficiency of the pension system (cluster 2) or on the consumption efficiency (cluster 4).

When aggregating the static efficiency indicators and analyzing the distribution efficiency, Lithuania stands among the top countries, with the best GDP distribution for the pension system over the entire analyzed period. Also, Bulgaria, Estonia, Latvia and Romania should be classified into this group, together with Lithuania. These countries are classified as efficient ones (grouped in the 2nd cluster). On the other side, the worst GDP distribution for the pension systems among the analyzed countries in terms of the static efficiency can be found in Austria, Greece, Italy, the Netherlands, Poland and Portugal, mostly grouped in the first cluster in 2012.

As far as poverty alleviation is concerned, the fastest increase in efficiency is reported by the Czech Republic, Ireland, Hungary, Luxembourg, the Netherlands and Slovakia. There are mainly countries from the 1 and 2 groups in the cluster analysis (2011-2014), while in 2015 they are included in the first and third cluster. At the same time, the fastest decrease in this type of efficiency is observed in Bulgaria, Cyprus, Greece, Italy, Latvia, Portugal and Romania. They are mainly countries classified into 1 and 2 groups.

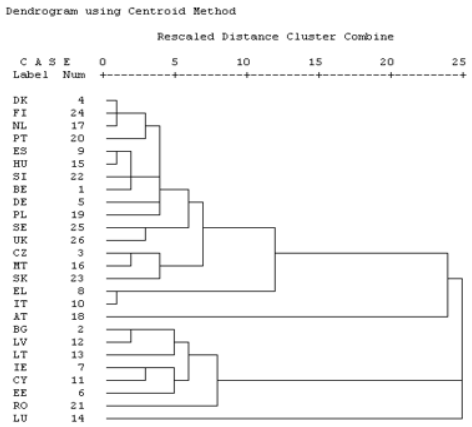
In terms of consumption smoothing, the fastest increase in efficiency is reported by Hungary, Latvia, Luxembourg, Romania and Slovakia (mainly grouped in the second cluster). At the opposite end, the fastest decrease is observed in Belgium, Germany, Greece, the Netherlands and Portugal.

When analyzing the labor market efficiency, Ireland and the Baltic countries reported the fastest increase, while Austria, Belgium, Greece and Italy reported the fastest decrease.

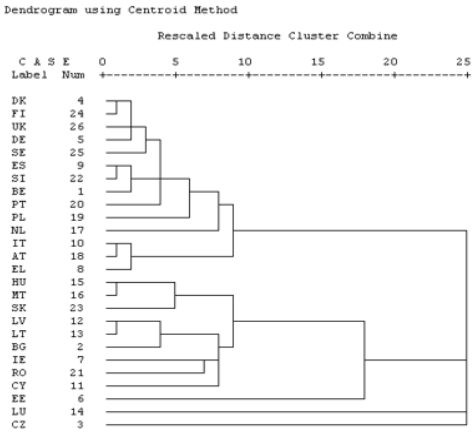
Figure 2

Cluster Analysis for Countries and Static Efficiency (2011-2015)

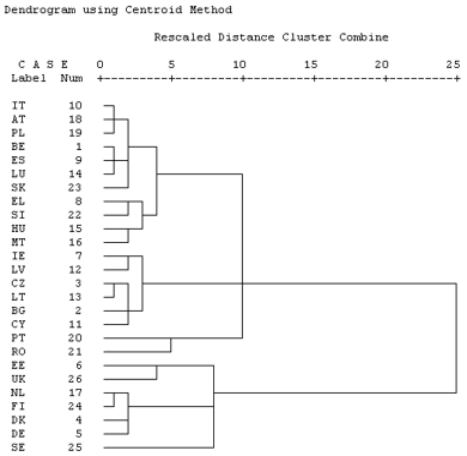
2011



2012



2013



2014

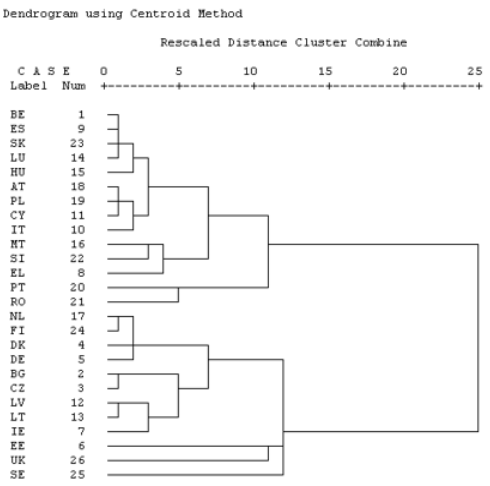
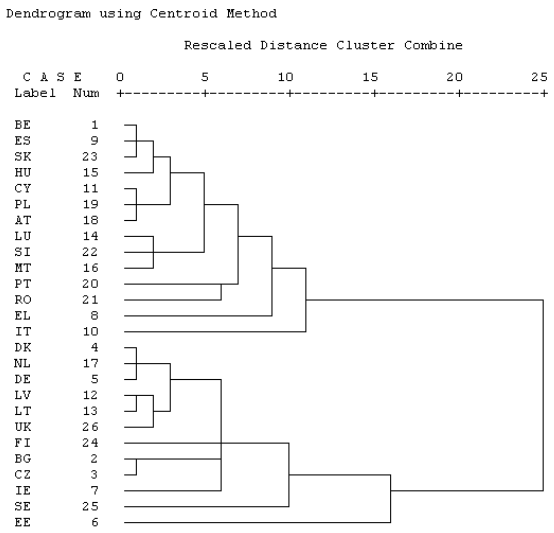


Figure 2 (cont.)

2015



Source: *Authors' calculations based on data provided by Eurostat.*

The results also indicate that the pension systems of Hungary, Luxembourg and Romania seem to be the most efficient in the analyzed group, while the worst pension systems can be found in Greece and Portugal, followed by Italy.

When analyzing the dynamic efficiency indicators, we observe that in terms of poverty alleviation, Estonia and Latvia reported the fastest increase in efficiency, while Poland reported the fastest decrease. In terms of consumption, the results are different from one year to another.

When we compare the dynamic groups with the groups of the best and worst pension systems in the static view, we see that they differ significantly. Our results confirm that the static and dynamic approaches may be treated as complementary ones, and not as alternative ones.

5. Conclusions

The rapidly aging population in the European countries exerted additional pressure on the sustainability and adequacy of public pensions. In this context, efficiency gains a key place, since an inefficient pension system cannot be adequate and sustainable. Starting from this hypothesis, we tested Cybaslky's methods to evaluate the pension system efficiency for a set of 26 EU countries. One of the strengths of this approach is that it enables comparisons between different pension systems from both static and dynamic perspectives. This approach does not require prior standardization of data; therefore, it ensures that the evolution of indicators is in the same direction with the phenomenon it measures. However, this approach has some limitations, as it works effectively only when at least several pension systems are compared, or a given pension system is analyzed over time (year after year), and it does not provide a borderline between an efficient and an inefficient pension system.

It only offers the possibility to compare many pension systems and group them in clusters according to a set of pre-established criteria.

Another limitation of this approach is that some of the variables it uses refer only to the public pension system, while the other ones refer to the pension systems which contain other types of benefits as well (such as individual pension schemes or other incomes paid to pensioners). The labor market indicators target only the public pension system and it should also consider the private one, because the decision of leaving the labor force might be affected by private pension schemes, too. Despite of all the above limitations, Cybalsky's method seems to be working in providing an evaluation of pensions' efficiency.

Using the Cybalsky's basic method (but different one due on number of indicators and dimensions involved in analysis), for a different period (2007-2011 in Cybalsky's paper and 2011-2015 in this work), we obtained a different countries cluster separation. Also we introduced a supplementary grouping of main indicators that describe pension system efficiency.

The empirical verification of the indicators involved in our analysis sustains the hypothesis that a pension system is multidimensional. The results show that an increase in the efficiency of at-risk-of-poverty corresponds to the decrease in the efficiency of consumption smoothing. Going further, we observe that an increase in the efficiency of the aggregate replacement ratio is associated with the decrease in the efficiency of at-risk-of-poverty. Last but not least, an increase in the efficiency of the aggregate replacement ratio corresponds to an increase in the efficiency of consumption smoothing measured by the ratio of median relative income of elderly people to the median relative income of persons aged 0-59 years.

Cluster analysis for Union European countries indicates some interesting result. First of all we obtain a geographical grouping of countries (countries from North of Europe especially) that had systems of retirement very closed. Secondly, analyzing the labor market efficiency, we observe the fastest increase in Ireland and the Baltic countries, while Austria, Belgium, Greece and Italy reported the fastest decrease.

When poverty alleviation is concerned, the fastest increase in efficiency is registered in the Czech Republic, Ireland, Hungary, Luxembourg, the Netherlands and Slovakia. At the same time, the fastest decrease in this type of efficiency is observed in Bulgaria, Cyprus, Greece, Italy, Latvia, Portugal and Romania.

Finally, our analysis suggests that the Hungarian, the Luxembourgian and the Romanian pension systems are overall the most efficient ones. At the opposite, the worst pension systems in terms of efficiency are registered in Greece, Portugal and Italy.

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