

Analysis of pension systems in the European Union based on cluster analysis

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ABSTRACT: Sovereign pension systems in the European Union are diverse. The similar challenges facing these systems and the deepening of economic integration have made and continue to make Community objectives and recommendations necessary. In my study, I have analysed the pension systems of the EU Member States, their parametric and paradigmatic characteristics, using cluster analysis. I was looking for answers to the question of which clusters can be created if we examine the structures independently of economic and demographic indicators, and what conclusions can be drawn from this regarding the necessary restructuring of the Hungarian pension system. The results of the data reduction procedure suggest that an efficient and modern pension system is based on a multi-pillar, individual accounting system with built-in automaticity to promote its long-term sustainability, increasing the resilience of pension systems to exogenous processes and making short-term and frequent interventions unnecessary.

KEYWORDS: sustainable pension system, pension reform

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Introduction

Given the importance of the subject, the study of the sustainability of pension systems has been the focus of professional debate and analysis at international level. The European Union, the OECD and the World Bank are constantly examining the solutions adopted in different countries, changes in the rules and their impact, and making recommendations. In 2008, the World Bank, following its 1997

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recommendation adapted in Hungary, outlined a five-pillar (pillars 0-4)² pension system, three of which are based on self-sufficiency (World Bank, 2008). In the context of such recommendations, it is now clear that there is no single model that works for everyone (Barr-Diamond, 2008; Simonovits, 2015). Each country must apply 'best practice' based on international experience, tailored to its own social, economic and financial circumstances.

At the beginning of my study, I need to clarify what I mean by sustainability and sustainable pension systems. I argue that sustainability means the organic, harmonious balance of a system. I have examined how the pension fund can balance its income and expenditure and what additional conditions are needed to ensure that this balance is sustainable in the long term. The requirements for an optimal pension system can be formulated as one that responds continuously and automatically to demographic and economic changes, has a positive (feedback) effect on demographic and labour market trends, does not significantly increase the burden on public finances, provides a fair pension contribution and is backed by a broad social and political consensus on its long-term viability. The balance is therefore achieved without any generation having to pay higher contributions or receive lower benefits than the previous generation.

Old-age social security is a highly complex system. Therefore, when designing it, the parameters and internal functioning of the system must be addressed in a detailed and interdependent way, with the system itself both depending on and reacting to its external environment (social and economic processes). It must be consciously defined in terms of its target system, and its structure, subsystems, parameters and paradigm must be defined accordingly. The elements that make up the system, both individually and collectively, must serve the objective pursued. If the balancing mechanisms can be made a structural element in the design, then interventions driven by short-term and/or other interests can be avoided or reduced.

The current problems of the Hungarian pension system are partly rooted in the past, and its future prospects depend to a large extent on the success of its resolution and the effectiveness of the responses to the challenges. In 2023, the window of opportunity opened for a comprehensive, forward-looking pension reform, as the Hungarian government committed to, among other things, a rigorous timetable for reforming the pension system to access EU-RRF³ funds (Government of Hungary 2022). Today, we see that this window of opportunity has closed, and the promised reform has not materialised. Although the OECD published its international expert report on the sustainability of the Hungarian pension system (OECD 2024), the

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- 2 Pillar 0: basic pensions funded by tax revenues Pillar 1: mandatory pay-as-you-go public pensions where entitlements are held in individual accounts Pillar 2: mandatory private pension schemes Pillar 3: voluntary pension schemes Pillar 4: other forms of old-age provision (formal/informal, financial/non-financial).
 - 3 Recovery and Resilience Facility (RRF): the European Union's Recovery and Resilience Instrument for the 2021-2027 budget cycle

Government did not consider its proposals to be timely and did not submit them for public debate. However, it is clear to experts on the subject that the current system needs to be changed to ensure long-term sustainability, equity and modernity. Although the need for paradigmatic (affecting the internal logic and principles of the system) and parametric (affecting the level of contributions and pensions and the way they are calculated) reforms was already apparent in the 2010s (cf. Holtzer, 2010; Augusztinovics, 2014; Bajkó et al. 2015; Borlói, 2016), their implementation is still awaited. Recent domestic and international studies suggest that pension system reform is mainly geared towards reforms to meet demographic challenges and long-term sustainability. In the context of demographic challenges, it is important to note that the underlying deterioration in dependency ratios is the result of several processes moving independently of each other: on the one hand, life expectancy and life expectancy after retirement (improving mortality) are increasing, and on the other, low fertility rates (declining fertility) and longer periods of further education are leading to later entry into the labour market. The importance of the dependency ratio lies in the fact that, in the case of full employment and a rigid age limit, it sets the equilibrium contribution rate together with the replacement rate (Simonovits, 2017). In the context of foreseeable demographic changes, Demény's 1987 paper (Demény, 1987/2016) launched the debate on the link between child-rearing and pension contributions in Hungary, while the most important European literature is that of Cigno (1992), Sinn (2005) and Cigno-Werding (2007). Banyár – Mészáros (2003), Augusztinovics (2014), Botos – Botos (2011), Banyár (2019) argue in favour of linking the age-based redistribution to the number of children, while Mihályi (2012), Simonovits (2014a, 2014b, 2020) and Borlói (2016) argue against the idea.) In their macroeconomic model, Major and Varga (2013) show that while declining fertility reduces the working age population, it also creates opportunities to increase labour supply (especially for women) and increase savings through increased employment, which in turn generates economic growth. Ultimately, therefore, age-sensitive processes are set in motion that can automatically neutralise some of the negative consequences of ageing (Gál – Radó, 2019). Looking at the debate, I agree with the opponents. In my opinion, support for childcare is indeed a highly important issue, but it should fall under the remit of family policy and should be flexible (typically annually). And pensions should remain dependent on work (number of years worked and level of earnings) and their system should be characterised by long-term stability.

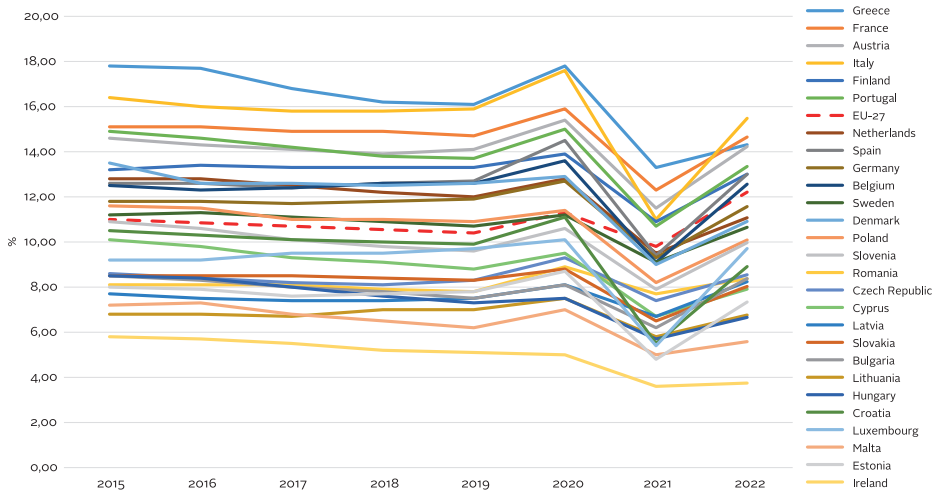
This paper, which is part of a broader work, compares the parametric and paradigmatic characteristics of the Hungarian pension system with those of other EU Member States using cluster analysis. Pension expenditure is the largest single item of public expenditure in all EU Member States. Therefore, the sustainability of pension systems has a crucial impact on the medium and long-term position of public finances. Although the expenditure of the Hungarian pension system as a share of GDP is lower than the EU average (Figure 1), the rapidly changing macro-environment calls for an increase in resilience and the political exposure of the system and its internal inequities and injustices require a transformation. Most recently, in its assessment of the 2022 Convergence Programme, the European Commission

drew attention to the risks to sustainable public finances posed by ageing populations and the negative impact on the budgetary position of the reintroduction of the 13th month pension (European Commission, 2022). It also pointed out that recent policy measures (unchanged level of the minimum pension, abolition of the pension and contribution ceiling, single rate personal income tax) have had a negative impact on solidarity and equality. This is why the country-specific recommendation (2022 CSR₁₄) calls for improving the long-term sustainability of pension systems, in particular by addressing income inequalities (European Commission, 2023).

Figure 1 illustrates both the exposure of pension systems to exogenous developments and the impact of reforms. The fall in economic performance in 2019-2020 as a result of the covid crisis led to an increase in pension expenditure as a share of GDP everywhere. Between 2020 and 2021, the ratio declined more sharply than before, reflecting three factors: the economic recovery, the disproportionately higher impact of the covid shock on the pension age group and the pension reforms enacted between 2010 and 2020. On average, the pension expenditure ratio has declined by 3.2 percentage points across the EU. The countries that have been able to reduce the ratio more than the average are those that have recently introduced reforms to make their pension systems more sustainable (e.g. Italy, Spain, Greece, Portugal, Belgium).

4 CSR (country specific recommendations): in the wake of the 2008 crisis, the European Commission has been monitoring key public policy developments in annual cycles (European Semester) since 2010 to ensure closer economic and budgetary policy coordination and make country-specific recommendations calling for important structural reforms. Their implementation is not yet at the right scale and pace in all areas (Bíró-Nagy – Laki, 2020).

Figure 1: Evolution of pension expenditure as a share of GDP in the European Union (2015-2022)

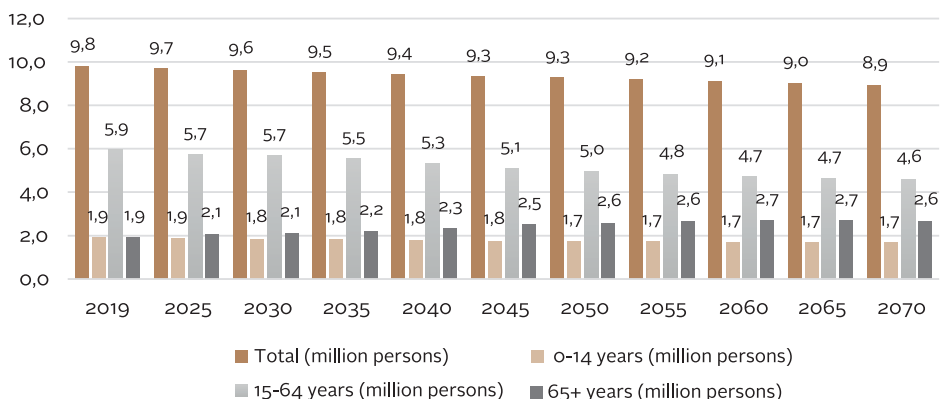


Source: own editing based on Eurostat

Demographic challenges

The future population trends in Hungary clearly show the dual components of the ageing process: a decline in the proportion of young people and an increase in the proportion of people aged 65 and over. According to Eurostat’s projections (European Commission, 2021), Hungary’s population will fall from 9.8 million in 2019 to 8.9 million in 2070. Within this, the proportion of the population aged under 14 will change from 19.6% to 18.7% (from 1.9 million to 1.7 million), and the proportion of the population aged 65 and over will change from 19.6% to 29.6% (from 1.9 million to 2.6 million). The age structure is also expected to change significantly: while in 2019 the proportion of the retired population (65+) aged 80+ was 22.7%, by 2070 it is expected to reach 41%, i.e. ageing will become significant (Figure 2).

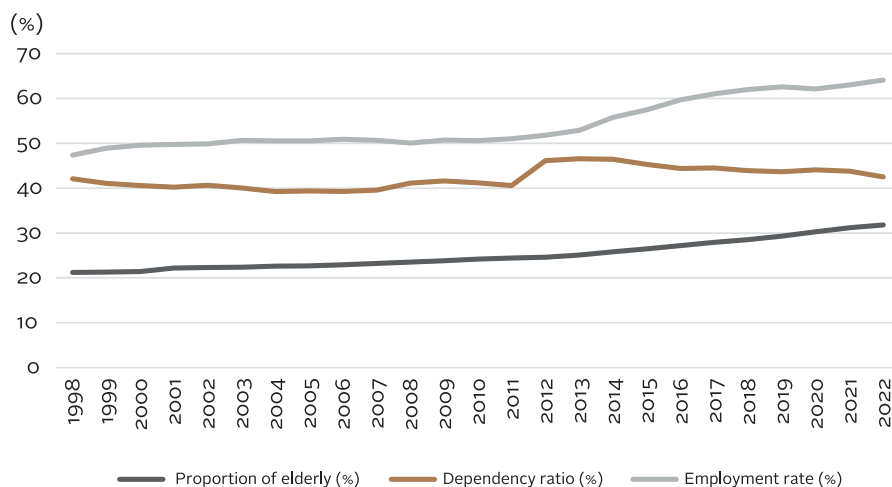
Figure 2: Population projections for Hungary, based on 2019 actuals and projections, 2019-2070 (in millions)



Source: own editing based on Eurostat

While in 1998, pensioners accounted for 21.2% of the total population and the dependency ratio (the ratio of pensioners to employed persons) was 42.1%, this ratio had risen to 31.8% and 42.5% respectively by 2022 (Figure 3). The figure also shows that, while the dependency ratio of the retired population to the total population has increased, the dependency ratio has barely changed over the period considered as a whole, with the slight improvement or deterioration from year to year being driven by changes in the employment rate. However, demographic trends can be measured and statistically predicted. This is why a passive approach must be replaced by a proactive one, which, by coordinating complementary policies, shapes future trends rather than suffering them. While falling fertility reduces the working age population, it also creates opportunities to increase labour supply (especially for women) and to increase savings through increased employment, which in turn generates economic growth. In the end, age-sensitive processes can be set in motion that can automatically neutralise some of the negative consequences of the demographic transition (Major – Varga, 2013; Gál – Radó, 2019).

Figure 3: Trends in the proportion of older people, dependency and employment rates in Hungary (1998–2022)



Source: own editing based on KSH

Pensions in the European Union

The need for a coordinated and comprehensive approach to pensions at EU level, with guidelines and a common methodology at Community level, is driven by the deepening of economic and social integration between Member States. The effectiveness (or failure) of pension systems in individual Member States is increasingly a cross-border externality. A high level of employment, protection against poverty in old age and a stable budgetary position are expectations of all Member States, and are even more important in a monetary union.

Protecting social security beneficiaries is a key element of the European Union's social commitment⁵, which is why the EU will continue to focus intensively on pensions to help Member States take the necessary action. Community coordination can help to bridge the gaps between Member States' social safety nets, but its effectiveness depends to a large extent on the commitment and cooperation of the Member State concerned (Malustyik, 2021). The Open Method of Coordination

5 See Regulation (EC) No 883/2004 of the European Parliament and of the Council on the coordination of social security systems. Online: <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2004R0883:20100501:hu:PDF>, and Regulation (EC) No 987/2009 of the European Parliament and of the Council implementing Regulation (EC) No 883/2004 on the coordination of social security systems, Online: <https://jogkodex.hu/doc/9417644>

(OMC) can be seen as the EU's soft law instrument⁶, providing a framework for cooperation between countries in areas of national competence (such as pensions), and a form of intergovernmental decision-making. The OMC identifies the objective to be achieved and sets out the measurement tools to assess the performance of a Member State and compare it with other Member States (European Parliament, 2014). The OMC criteria for pensions cover three areas (adequate, sustainable and modern pensions), within which primary and secondary indicators are identified.⁷

Method

In my empirical research I examined pension systems in the European Union Member States using hierarchical cluster analysis. The purpose of cluster analysis is to group elements according to their similarity or dissimilarity (Mur et al., 2016), i.e. countries in one cluster have similar pension parameters, while countries in other clusters have different structures. One of the characteristics of cluster analysis is that the number of clusters formed is not known in advance, but is inferred by the analyst from the structure of the data and the methods used. It is the researcher's task to define what is meant by similarity and distance, i.e. what decision function is used when separating or merging groups (Obádovics, 2009). In my study, I used simple Euclidean distance to measure the distances between clusters.

The aim of the analysis is to use clustering to identify structural similarities and differences between the pension systems in the Member States. The result is not a ranking; the aim was to identify the systemic principles, measures and operational logics that could be considered and possibly adapted in the sustainability reform of the Hungarian pension system.

The data source for the paradigmatic characteristics of pension systems is The 2021 Ageing Report (European Commission, 2021), while the parametric data are partly from Eurostat's publicly available database and partly from the report. For the data collection, I have relied exclusively on EU data sources and, where data reporting was incomplete in some cases, I have not substituted from other sources (e.g. OECD) based on the data consistency criterion.

The clustering was based on the structural characteristics of pension systems: funding principle, number of pillars, whether it operates as a stand-alone fund, how contributions/taxes are distributed between employers and employees, indexation method, retirement age, retirement age centre, whether there is built-in

6 The concept of soft law is used for norms that are not coercive, do not impose obligations on the addressee, yet in many cases – typically indirectly – have a regulatory, behavioural and practical effect (Kun, 2012).

7 Employment and social inclusion indicators. Online: <https://ec.europa.eu/eurostat/web/employment-and-social-inclusion-indicators/social-protection-and-inclusion/pension>

automaticity, etc. The clusters thus provide a comprehensive typology of parametric and paradigmatic features of pension systems, which only indirectly reflect the economic development and performance of the country concerned.

During the abstraction process, I performed clustering with 2-7 cluster numbers and chose the commonly used elbow or silhouette method to determine the optimal cluster number (Szüle, 2019). The silhouette method favoured the two-cluster solution, while the elbow method showed the sharpest breakpoint with the 4-cluster clustering. When choosing the number of clusters, other considerations may also be taken into account (Simon, 2006); thus, based on my research decision to include the dendrogram (see Figure 5), I finally chose the result with 5 clusters, as it gave the most meaningful, professionally differentiated, yet communicable cluster structure. As EU Member States' pension systems show significant differences in funding model, degree of public involvement, burden size and distribution, indexation rules and replacement rates, a cluster result of 2-4 clusters would not have provided the possibility for a more refined segmentation. The 6 and 7 cluster models, on the other hand, resulted in more clusters, but with a small number of elements, which, when treated as separate groups, would not provide meaningful additional information. The 5 cluster approach chosen allows for a more detailed interpretation and comparison of the structural models – in particular, whether there are structural parallels between more and less developed countries and whether a pattern of West-East, North-South and old-New Member States dichotomies can be observed. I begin my analysis by briefly describing the factors included in the analysis and then present the resulting groups.

Results

Pension insurance funds can be divided into three groups in terms of financing and actuarial principle: 1: autonomous financial fund with compulsory budgetary supplement, 2: autonomous financial fund without compulsory budgetary supplement, 3: non-autonomous financial fund. Only two countries belong to the latter category: Hungary and Lithuania. In Hungary, the introduction of the social contribution tax in 2012 and the introduction of the consolidated social security contribution in July 2020 have partially abolished the autonomous financial fund. In Lithuania, a similar process has been taking place since 2019, with the reform of the social contribution tax and personal income tax, which made the Pension Insurance Fund part of the central budget. The other Member States have an autonomous financial Pension Insurance Fund, with a possible deficit that has to be supplemented by the central budget, except in three countries (Sweden, Latvia and Luxembourg).

The funding system of a mandatory public pension scheme based on a notional defined contribution (NDC) and a financial defined contribution (FDC) was first introduced by Sweden, followed by Latvia, and later by Italy and Poland. The Swedish system consists in keeping a part of the active-age pension contributions (16%) in a nominal individual account and increasing it with the virtual interest rate of the wage

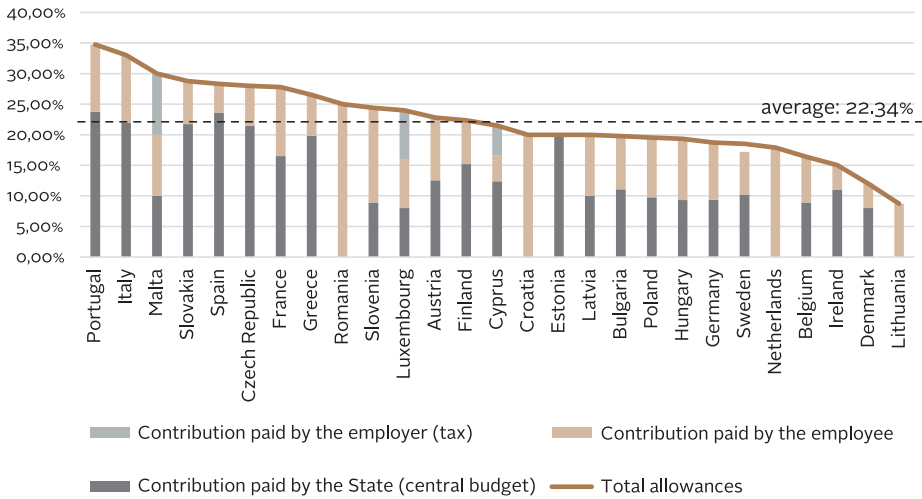
index (managed equally by the four public pension funds). From this virtual funding system, current pension expenditure is financed on the basis of the pay-as-you-go (PAYG) principle. The smaller part of the contributions (2.5%) is accumulated in a real funded scheme (managed by five investment funds chosen by the policyholder from a number of investment funds). The future pension of current contributors is determined solely by the amount accumulated in the nominal and actual individual account and the remaining life expectancy for the year of birth (the so-called annuity divisor). This has made it possible to decouple the amount of the pension from both the length of service and the moment of retirement. The dual fairness of the system can therefore be expressed in terms of higher annuities for those who have paid more contributions and for those who have paid more (and vice versa) (Farkas, 2023). This is achieved by taking into account the life expectancy of the person (as opposed to, for example, Hungarian practice). The sustainable functioning of the system is ensured by the accumulated reserve, the inheritance gains and the smoothing mechanism. Under this mechanism, if payments exceed payments in a given year, the wage index is reduced in proportion to the ratio of expenditure to income (as was the case between 2010 and 2018). By means of automaticity, the lost benefits of the more difficult economic years are compensated by indexing the better economic years above the wage index.

The level of pension contributions (taxes) and the distribution of the burden between the employer and the employee varies considerably between Member States (Figure 4). The total contribution (employer and employee together) is highest in Portugal (34.75%) and lowest in Lithuania (8.72%). The EU average is 22.34% of gross pay, with Hungary's 19.31% three percentage points lower. In most countries (sixteen), employers pay the higher contributions, in five countries they pay the same, while in six countries employee contributions are higher (Hungary, Romania, Croatia, Slovenia, the Netherlands, Lithuania). In these countries, with the exception of the Netherlands, the lower burden on employees may be due to the use of tax policies to increase competitiveness, which unilaterally interpret the burden on labour as a competitive disadvantage. In the Netherlands, there is no contribution from employees to the state pension fund because it is the revenue of the separate so-called occupational pension fund.

In terms of the overall burden, the southern Member States and France can operate their pension systems with above average contribution rates, while the developed welfare states of the north and west can operate their pension systems with average or below average contribution rates.

This highlights the role of productivity and average wages. Where productivity is high and wages are consequently high, a lower contribution rate is sufficient. Conversely, countries with lower productivity and wages need higher contributions to finance the pension system.

Figure 4: Distribution of pension contribution burden between employer and employee, EU-27, 2021



Source: own editing

The contribution rate is of course also determined by the promise of the pension scheme, which is best expressed by the replacement rate. The country with a higher ratio of median pension to median salary will have a higher contribution rate. The replacement rate and the indexation method used also have a decisive influence on the evolution of payments as a share of GDP. The reform of the Swedish pension system is also a pioneer in this respect: it has shifted from a defined benefit (DB) to a defined contribution (DC) paradigm, reversing the direction of dependency: it does not link the contribution to the promise to pay, but matches the payout to the contribution. In doing so, it has made long-term, stable, predictable operation a systemic paradigm, in addition to better sustainability.

Transparency and clarity in the financing of the mandatory public pension pillar is also ensured by the introduction of a points system, as in Germany, in a growing number of countries (e.g. France, Slovakia, Estonia and Lithuania). The system is transparent for all (based on individual accounting), comprehensible (contribution paid on average salary = 1 point) and thus proportionate and fair (higher pensions are paid to those who pay more contributions and to those who have worked longer), it does not lead to disparities (wage indexation) and fragmentation (on the one hand because of the contribution ceiling of twice the average wage, which results in a maximum of 2 pension points per year, and on the other hand because of the method used to determine the value of the pension points: each year the value of all pension benefits must be adjusted according to the defined pension value). Sustainable (automatic rebalancing mechanisms ensure that the balance is restored in the event of an imbalance between income and expenditure), yet equitable (the value of the

pension point cannot be lower than in the previous period. If the equilibrium would require a lower value, it will be charged against the increase in the following period). Flexibly rewards or penalises retirement beyond the age limit, recognises child-rearing, higher education and other non-contributory periods (e.g. incapacity for work due to illness, rehabilitation, unemployment). It provides a pension promise (DB), but it is defined contribution (DC) and relatively independent of policy (thanks to built-in automaticity). Together, these serve the EU's expectations (that the pension system should be sustainable, adequate and modern).

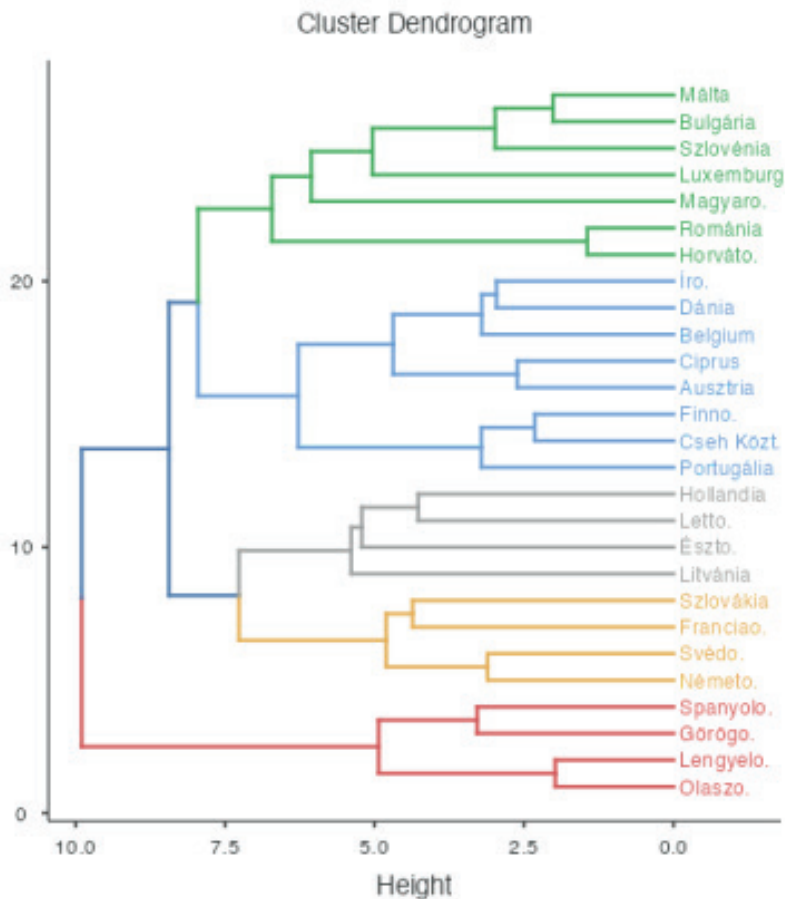
Looking at the number of pillars, we can see that all EU countries have pension systems with several pillars, but in practice there are huge differences in the role and weight of the pillars. While the state pension pillar plays the most important (almost exclusive) role in old-age provision in Hungary, in the Nordic and Western Member States it is a combination of state, employer and individual roles. In several Member States there is a basic pension guaranteeing the minimum subsistence level depending on the length of citizenship or residence (e.g. Sweden, the Netherlands, Finland). Equity is also supported by wage or mixed indexation, which can be interpreted as a refusal to forego a fair increase in the benefits of older people in order to ensure the long-term sustainability of the system.

More and more Member States are looking to use automatic mechanisms to make their pension systems more sustainable and flexible. More than half of the Member States (16) have already introduced automatic adjustment mechanisms (AAMs), which can help to restore the imbalance by automatically adjusting a system parameter in a flexible way, without political interference, thus increasing the resilience of the pension system to exogenous developments. Automaticity can be applied to the retirement age, to the registration of vested rights and to the determination of benefits. There is also a model of how several mechanisms can co-exist (see Sweden, which has introduced a smoothing mechanism for inequalities in contributions and payments, in addition to nominal and actual individual accounts).

Finally, I also looked at which countries use contribution ceilings to reduce the extremes between the benefits of the pensioner population. Nine mainly developed old Member States have minimum and/or maximum limits. Hungary has a minimum pension, but this has not changed for a long time and is a fraction of the subsistence level, but there is no upper limit, so the average pension does not give a true picture of the income situation of the pensioner population. 16 Member States (including Hungary) take some account of child-rearing. 18 Member States (Hungary is not one of them) pay gross pensions, on which taxes and contributions are payable, but in many countries only the highest benefits are taxed, with low or average pensions falling into the tax-free band.

The results of my cluster analysis based on the parametric and paradigmatic elements of the pension systems in each Member State are illustrated in Figure 5.

Figure 5: Clusters of pension schemes in the European Union



Source: own editing

The cluster in yellow includes Sweden, Germany, France and Slovakia, all of which keep individual accounts (nominal or point system), have an upper contribution limit (Sweden also has a lower limit), take into account childcare and most of which also tax pensions. Their system is based on several pillars. For the first three countries, in addition to state pensions, the occupational pension pillar and self-sufficiency are of paramount importance. Only Slovakia applies price indexation, the others use wage or mixed indexation to update the value of pensions. Slovakia has been able to join the three old Member States with advanced economies and welfare institutions because it has recently introduced a number of reforms (nominal individual accounts, point system) modelled on Western Europe. Slovakia is also a good example of a country that restructured its pension system in the early 2000s along the lines of

Hungary, and then fine-tuned it after the 2008 crisis, rather than abolishing it. It adopted changes that were progressive but has not changed contribution rates since 2005. This leads to stability, predictability and sustainability.

The cluster in grey includes the also very efficient and developed Dutch pension system and the three Baltic states (Estonia, Latvia and Lithuania). All members of the cluster have introduced individual accounting (nominal or point-based) and other automatism for transparency and sustainability. Three members are mixed and Lithuania applies wage indexation. What distinguishes them from the members of the yellow group is that they have lower than average replacement rates (with the exception of Germany, the yellow group has higher than average replacement) and correspondingly lower than average pension expenditure (except for the Netherlands, where it is slightly above average).

The blue cluster includes Denmark, Austria, Finland, Ireland, Belgium, Portugal, Cyprus and the Czech Republic. All countries have in common that they pay a gross pension and most of them apply some form of automatism and take into account child-rearing. All of these Member States have a multi-pillar pension system, with a first, public pillar, an autonomous financial fund with a compulsory budgetary supplement. Most of the state pension pillar is defined benefit (DB), but Denmark has actual individual accounts and Ireland has a basic pension. There are significant differences between Member States in terms of indexation, replacement rates and contribution rates.

The cluster analysis clustered the southern Member States (Spain, Italy, Greece) and Poland (red cluster) together, with a much higher than average replacement rate, which led to high pension expenditure as a share of GDP and required higher than average pension contributions. As all four Member States are obliged to supplement their pension fund deficits from the central budget, several measures have recently been taken to improve medium and long-term sustainability: all have switched to price indexation and introduced automaticity (individual accounts and life expectancy-linked retirement ages). In Spain and Greece, a contribution cap protects against excessively high benefits (Spain also applies a minimum limit). Another feature they have in common is that the pension paid is a taxable and contributory benefit, taking into account the time spent bringing up children (except Spain).

The fifth cluster, marked in green, includes Hungary, Slovenia, Romania, Bulgaria, Croatia, Malta and Luxembourg. The latter was placed in the same cluster as the other Member States that joined after 2004 because its pension paradigm is defined benefit and uses mixed indexation, as do the other cluster members (except Hungary). However, a difference can be seen in the replacement rate: while the lower than average replacement rate in most Member States leads to lower than average pension expenditure as a share of GDP, Luxembourg has the highest replacement rate in the EU, which provides for exceptionally high pensions (after Denmark, Luxembourg has the highest average pension), which does not lead to a high expenditure rate because of its also exceptionally high GDP. In Hungary, the average replacement rate (53%) is associated with a lower than average expenditure-to-GDP ratio due to statistical anomalies (disability and early retirement benefits

are not included in pension statistics) and price indexation. Other similarities between the CEE group members are that the pension reforms of the 2000s were all based on the World Bank recommendations, following and largely modelled on the Hungarian 1998 reform (as in Poland and Slovakia). Multi-pillar systems were established, but the mandatory private pension pillar was shaken everywhere after the 2008 crisis, and was abolished in Hungary. People's capacity/propensity for self-care is low, partly due to low wage levels and partly due to shaken confidence. All group members except Malta and Hungary apply contribution limits and four countries (Hungary, Slovenia, Romania and Croatia) take into account child-rearing. Luxembourg's pension system is characterised by stability, with no frequent interventions in its conditions. Any shortfall in its pension fund is not made up by the central budget, but is automatically compensated by a rebalancing mechanism. It can be said that, with the exception of Luxembourg, these Member States are the least compliant with the EU's criteria for pension systems (in particular equity and modernity) and will have to take significant steps in the future to adapt to a rapidly changing economic and demographic environment (Romania has also decided to reform in November 2023).

Conclusions

Based on a cluster analysis of the structure of pension systems in the European Union, we can conclude that an efficient and sustainable pension system is based on several pillars, in which, in addition to the state's role, the employer and the employee have an equal stake. One of the prerequisites for creating individual ownership is the introduction of individual accounting, which makes the benefits and entitlements earned transparent and understandable, both at micro and macro level. Long-term sustainability is ensured by automatic mechanisms that use built-in algorithms to adapt flexibly to economic and demographic changes, without the need for short-term policy intervention to rebalance the balance. Keeping the parameters of pension systems constant increases confidence in the system, which also improves efficiency. The Hungarian pension system needs to be reformed and modernised in all these areas. The most important step in the reform could be the restoration of the autonomous financial fund system, which would create clarity and transparency in the system's revenues and expenditures, while also helping to ensure that contributions are set at a level that is soundly based. Following the example of developed pension systems, the methodology of indexation should be adapted to increase the fairness of the system, automatic mechanisms should be introduced to create resilience, and individual accounts should be introduced to create transparency. The complex demands on pension systems can only be met by genuine multi-pillar systems, in which old-age provision is not only a public responsibility but also an occupational and individual responsibility.

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