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## PENSION SYSTEMS IN EUROPEAN COUNTRIES: PECULIARITIES AND CHALLENGES

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**Abstract.** This study explores the role of pension systems in maintaining the basic living needs of retirees after retirement. As the proportion of elderly populations grows, the burden of the elderly dependency ratio also increases. The article's objective is to ensure the basic living standards of retirees in different European countries in the face of growing population ageing, maintain sustainable development of pension funds, and reduce the government's financial burden. Additionally, the analysis evaluates the impact of government regulation on the lives of people aged 65 and above. Using panel data from Eurostat between 2019 and 2023, we adopt a longitudinal approach to study how long-term commitments to pension fund regulation will influence pension financial sustainability and quality of life after retirement. The analysis provides theoretical insights and tailored managerial policy recommendations.

**Keywords:** pension systems; retirement; living standards; poverty; population; wages; pension benefits

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### 1. Introduction

One of the most critical components of social security for older people is the pension system. They are intended to give future income to older adults past working age. However, an increasing number of people are at risk of old-age poverty due to the current design of pension systems. The EU's attempts to combat poverty are at odds with this tendency. In the EU, Member States are in charge of pension plans. The EU legal framework covers some aspects of pensions, including the protection of rights in cases of cross-border mobility, consumer protection of pension savings, gender equality to secure equal pension benefits, and the single market for supplemental pensions, even though the EU is unable to regulate the design of pension systems.

Even though EU pension systems vary greatly, they all face the same primary obstacle: figuring out how to maintain pensions' long-term financial viability in the face of an ageing population and a rising proportion of pensioners compared to working-age individuals. While it is unknown how wages and prices will change, Member States are working to guarantee pension adequacy, or an adequate level of pension benefits and protection of older people from poverty. To varying degrees, these concerns are addressed by recent national pension reforms.

As the population's age distribution shifts and people live longer and have fewer children, the European population is quickly ageing and is predicted to begin declining by 2026. In 2022, 21.1% of EU citizens were 65 or older. By 2070, this percentage will increase to around 30%, along with age-related public spending on long-term care, healthcare, and pensions. Conversely, the proportion of the working-age population, meaning those aged 20 to 64, would decrease from 59% to 51% of the overall population. With pensions eating up more and more of government money each year, it is imperative to promote long-term savings to lessen the strain on Europe's social security systems.

The number and percentage of senior people in practically every country are on the rise, indicating that the world's population is entering an ageing period (Halliday, 2024). The United Nations World Population Outlook 2024 predicts that the proportion of people 65 and older will increase quickly, almost tripling from 17% to 33% between 2024 and 2054. In the group of nations that have already reached their peak in size, older people may make up 40% of the population by 2100 (with a 95% chance that the proportion of those 65 and over will fall between 33% and 49% in that year) (UN, 2024). As the population ages, several nations may experience pressure to adjust their social security (Petruhhin & Kazjulja, 2025) and pension systems (Sinha & Irala, 2025). The global economic growth rate is also at its lowest point in decades, and as inflation drives up prices and economic growth slows, the cost of living continues to rise. Thus, the issues related to the pension systems occupy an essential place in the EU. To summarise, demographic changes in EU countries, specifically declining birth rates and a rising proportion of older adults, pose a fundamental challenge to pension systems. As the elderly population grows, the ratio between young working individuals who pay into the pension system and retirees who receive pension benefits shifts. In other words, because the proportion of young workers contributing to the pension system is lower than that of the retired elderly population, governments struggle to sustain pension systems. To address the issue, pension system reforms aim to raise the retirement age, reduce the replacement rate of pensions, and increase the roles of private and individual pension systems. However, even private pension systems, in which previous contributions finance current benefits, have been under pressure for decades from the ageing population problem (Ebbinghaus, 2021; Dumiter et al., 2024).

## **2. System reforms for sustainable pensions in the EU and comparison of Global Pension Index 2024 indicators**

In the last decades, EU countries have sought solutions to ensure the sustainability of their pension systems. One such solution is pension system reform, which aims to reduce the benefits provided to retirees to sustain the system. The UK's Thatcher government adopted the Social Security Act in 1986, which expanded individual and private pension accounts while reducing the role of public earnings-related pensions. As a result, between 1986 and 1997, the size of personal pension funds increased by 50% (Professional Pensions, 2019).

Dossinger & Beaver (2025) emphasised that current pension systems face a series of common challenges, which are likely to persist in the future, potentially with more severe consequences. The crisis highlighted the importance of the EU's approach to pension systems and the need for greater efforts to increase the effectiveness and security of pension plans. In Romania, it was suggested that creating quality jobs, promoting legal employment, improving contribution collection, and developing the individual pension system would support the population and the economy through the generated and invested financial resources. While the changes are presented as the employer taking responsibility for workers' future security, an alternative view is that the employer is shifting pension obligations—and the related risks—to employees in pursuit of greater profitability (Vansweevelt et al., 2022; Stiemke, Hess & Pink, 2025).

Hagemann and Scherger (2016), examining pension age increases in Germany and the UK, analysed expert opinions from major political parties, government agencies, employer confederations, trade unions, and interest groups. Despite Germany and the UK having very different pension systems, discussions around similar reforms showed striking similarities. In both countries, reform advocates emphasised fiscal necessity and the ability of older adults to work longer. At the same time, opponents questioned older individuals' capacity to continue working and expressed doubts about the reforms' feasibility. Supporters focused on intergenerational justice and merit-based fairness, while opponents emphasised needs-based justice and social inequalities. The two countries' views differed significantly regarding flexible retirement transitions (Fontana et al., 2024; Vigezzi et

al., 2025). Olivera (2018), using cross-sectional data from the EU Statistics on Income and Living Conditions (EU-SILC), estimated pension wealth inequality among elderly households in 26 EU countries. To evaluate the role of life expectancy inequality on pension wealth, the study used life tables by educational level to estimate socioeconomic status (SES), also disaggregating mortality estimates by gender, birth cohort, and year. In most countries, this effect declined between 2006 and 2018, indicating that SES-related mortality inequalities have become less significant in explaining current pension wealth disparities. Recentered Influence Function (RIF) regressions confirmed the declining effect of higher education on pension wealth inequality. Chłoń-Domińczak et al. (2017) used age-period-cohort (APC) decomposition to measure cohort effects on pension income profiles of individuals born between 1927 and 1962 in Austria, Germany, Hungary, Poland, and Sweden—countries representing different labour markets and pension systems. The analysis of pension age profiles estimated with the National Transfer Accounts (NTA) approach for 2005–2013 showed that cohort effects have declined for younger cohorts. Increasing age coefficients have offset these adverse effects, reflecting longer working lives and rising retirement ages. Adjustments to pension levels to reflect actual values were more prominent in countries with defined contribution or points-based systems, even before the crisis. Period effects also reflected some reaction to the economic crisis.

Leroux (2019), in his study, showed a close link between payroll taxation and pension benefits as a means to reduce tax evasion. Using a political economy model where institutions may hide part of their income to avoid taxation and where the public sector is more efficient in delivering annual pension entitlements than the private sector, he demonstrated that in the absence of avoidance costs, agents are indifferent to tax rates, as they can perfectly adjust their compliance to match preferred effective tax rates. He found unanimous support for higher tax rates and that public pension systems partially enhance tax compliance and the resources collected, resulting in greater redistribution toward those worst off. The perfect substitution between compliance and taxation breaks down when introducing avoidance costs. In a majority voting equilibrium, a coalition emerges between low-income individuals and those favouring more redistribution to the elderly, opposing middle-income representatives through support for higher tax rates. Beyond the traditional tax base argument, Leroux proposed that the optimal level of the “Bismarckian” pillar is now chosen based on political support. There are also studies criticising pension system reforms for gender discrimination, especially against women. Tabata (2015), analysing the unintended gendered outcomes of seemingly gender-neutral EU policies, examined pension policy reforms that have entered the political agenda due to demographic trends and concerns about the financial sustainability of public pensions. She argued that although EU member states have enacted a series of reforms to reduce state responsibility and increase individual responsibility, these reforms—while appearing gender-neutral—reflect male work models and disadvantage women, who are often removed from the workforce due to caregiving and domestic responsibilities, and who are more likely to work part-time or in temporary jobs.

Given the October 2024 announcement of declining birth rates and rising longevity, the Mercer CFA Institute Global Pension Index 2024 emphasises the necessity of retirement system enhancements. Defined contribution (DC) plans are gradually replacing defined benefit (DB) plans in retirement systems across the globe (CFA Institute, 2024). The study examines the advantages and disadvantages of DC plans for people and pensioners in the continuous transition to defined-contribution pension systems. Retirement is changing, with many people either gradually moving into retirement or returning to work in a different role following their first retirement. Gig and contract workers, frequently excluded from standard DB schemes, can also profit greatly from DC plans.

Restoring stability to retirement systems cannot be accomplished with a single approach. Governments, legislators, the pension industry, and employers must now cooperate to guarantee that older people are treated with respect and can continue living the same way they did during their working years. Forty-eight retirement income systems worldwide are benchmarked by the Mercer CFA Institute Global Pension Index, highlighting potential and concerns in each system. The index compares each retirement income scheme to over 50 indicators and comprises three sub-indices: adequacy, sustainability, and integrity. Overall, ratings were marginally lower this year due to mounting pressure on government resources to sustain pension schemes brought on by rising healthcare expenses, high interest rates, and longer lifespans. In recent years, many systems have implemented pension reforms, including those in China, Mexico, India, and France. Table 1 shows that the Netherlands had the highest results for adequacy (86.3), Iceland for sustainability (84.3), and Finland for integrity (90.8) for each

sub-index. As the Netherlands transitions from a DB framework to a more individualised DC approach, its pension system remains the best.

**Table 1. Measurements of retirement systems by Mercer CFA Institute Global Pension Index**

| Country     | Overall grade | Total | Adequacy | Sustainability | Integrity |
|-------------|---------------|-------|----------|----------------|-----------|
| Netherlands | A             | 84,8  | 86,3     | 81,7           | 86,8      |
| Iceland     | A             | 83,4  | 82,0     | 84,3           | 84,4      |
| Denmark     | A             | 81,6  | 84,0     | 82,6           | 76,3      |
| Finland     | B+            | 75,9  | 77,0     | 64,2           | 90,8      |
| Norway      | B+            | 75,2  | 77,2     | 63,6           | 88,3      |
| Sweden      | B             | 74,3  | 75,2     | 73,7           | 73,6      |
| Switzerland | B             | 71,5  | 66,0     | 71,4           | 80,4      |
| Belgium     | B             | 68,6  | 81,8     | 40,1           | 87,4      |
| Ireland     | B             | 68,1  | 73,6     | 52,8           | 80,5      |
| France      | B             | 68,0  | 84,8     | 43,4           | 75,7      |
| Germany     | B             | 67,3  | 81,1     | 45,8           | 75,3      |
| Portugal    | B             | 66,9  | 83,4     | 34,6           | 85,7      |
| Spain       | C+            | 63,3  | 82,9     | 30,7           | 77,6      |
| Poland      | C             | 56,8  | 59,2     | 45,2           | 69,4      |
| Italy       | C             | 55,4  | 68,2     | 25,1           | 77,2      |

Source: SFA Institute, 2024

The data in Table 1 also provides participants with guidance regarding their pensions and has strict requirements.

### 3. Review of pension systems developments in the European Union

The EU, which has the world's largest senior population, is under tremendous strain on social security and the population. Ensuring the sustainable growth of pension funds, guaranteeing the basic living standards of retirees, and lessening the financial burden on the government have progressively grown in importance in social security as the population ages. The duration of statutory social insurance, the amount of contributions, the financing sources, the range of users, the amount of payments they get, and the system's overall viability vary throughout EU nations' pension systems. They are structured around three pillars and comprise both a public and a private section: The first pillar is made up of mandatory public statutory pensions, the second pillar is covered by occupational pensions (quasi-mandatory, earnings-related) and the third, supplementary personal pensions (voluntary, earnings-related).

For those not covered by an earnings-related plan or with limited accrued pension entitlements, most systems offer a minimum guaranteed pension. The state is in charge of pension provision in every EU nation and has the authority to determine the minimum and maximum pension levels.

Different criteria can be used to categorise public pension schemes. Funding sources may be derived from taxes, other non-contributory sources, or contributions (contributory or earnings-related). While some nations have flat-rate pensions that occupational plans can augment, others have public pensions tied to earnings. Concrete pension benefits are calculated using a formula unique to each country. Merit (years worked, payments put into the system) and revenue level are typically combined, along with a baseline pension component that is the same for everyone.

There are three main categories of publicly offered earnings-related pension plans. The primary categories of publicly funded pension plans in the EU countries provide pension benefits that are either benefit-defined or contribution-defined, either as a notional defined contribution or based on a point system (Table 2).

**Table 2.** Main types of publicly provided pension schemes in the EU

|         | <b>Defined (DB)</b>  | <b>Benefit</b> | <b>Notional defined contribution (NDC)</b> | <b>Point systems (PS)</b>                                       | <b>Flat rate + DB</b>                | <b>Other combination</b>   |
|---------|--|----------------|--|---|--------------------------------------|--|
| Country | Austria, Belgium, Bulgaria, Czechia, Finland, Hungary, Luxembourg, Portugal, Slovenia, Spain |                | Italy, Latvia, Poland, Sweden              | Croatia, Cyprus, Estonia, Germany, Lithuania, Romania, Slovakia | Denmark, Ireland, Malta, Netherlands | Greece: Flat rate + DB + NDC (auxiliary mandatory pension scheme); France: DB + PS (complementary schemes AGIRC and ARRCO) |

Source: The 2021 Ageing Report, European Commission, 2021.

For every year of service, a fixed accrual rate is paid under a defined-benefit plan (DB). Benefits are calculated using the average revalued earnings over a lifetime. Wages times the contribution rate is the annual inflow to notional accounts, which is known as the notional defined contribution (NDC). The hypothetical interest rate raises the notional capital annually. The total notional capital is divided by the notional annuity factor at retirement. Contributions made during a person's career are turned into points and accumulated in an account under a points system (PS). The value of a point at the time of retirement then determines the pension payment. There are several methods for funding state pension plans as well. Most public pension plans are supported using the pay-as-you-go (PAYG) model, in which current pension benefits are paid out of current contributions. An alternative is to invest contributions in a special fund, which is subsequently used to pay future pension benefits. Every EU member state has a PAYG-based system complemented by sponsored or required PAYG programs. Old-age and early pensions, disability benefits (not considered pensions in many countries, but health-related payments), survivor and minimum systems, and certain special pensions are among the risks covered (European Parliament, 2023).

Social protection payments, general government revenue (mostly from taxes), and "other receipts" such as transfers from other programs or investment returns are the main funding sources for old-age benefits. The primary source of funding for minimum pensions is general taxation. Employment-related systems typically rely on mandatory contributions from employers and employees, expressed as a proportion of income. Governments frequently support social security programs and earnings-related schemes (either entirely or partially through tax incentives). The primary funding source for old-age benefit programs in the EU is social contributions, primarily from employers. Over the past 20 years, there has been a noticeable movement toward funding from general government revenue as the employer contribution has decreased (European Commission 2021). All pension plans are subject to various hazards, depending on their design, but third-pillar plans are more vulnerable (Brandt, Zanker, & Frommert, 2024; Cumming et al., 2024; Wiman, 2024).

The system's generosity, eligibility conditions, and demography influence the amount and evolution of public pension spending.

In 2020, EU-27 pension spending accounted for 13.6% of GDP. Ireland, Malta, and Lithuania had the lowest levels, while Greece, Italy, and France had the highest (Chen et. al, 2021). Although pensions are taxed in most nations, pensioners sometimes do not make social security contributions.

The tax rate on labour income is typically higher than the average tax rate on pension income. Certain nations provide pensioners with extra tax breaks, and taxes are progressive. People in most nations quit their jobs (and, consequently, their pension contributions) before they reach the legal retirement age, at which point they begin receiving pension benefits (European Parliament, 2023). Although there is still income inequality in old age, it is less severe than in working age in most Member States because of redistribution through pension and tax systems. The gap between people with low incomes and the general population is widening. It's still difficult to maintain acceptable living standards in retirement. For those with modest salaries or brief careers, minimum old-age benefits are considered a crucial sufficiency buffer (European Commission 2024). Growing in popularity are pension credits for taking care of dependent family members, which are an effective way to

safeguard pension entitlements. At the late-career stage, pension incomes comprise one-third to more than two-thirds of employment incomes.

At the EU level, this replacement ratio has not changed. Older people's income decreases as working-age salaries rise compared to younger generations. This tendency is anticipated to continue as young people's educational attainment increases. It is expected that PAYG public pensions will become less generous in the future due to the ageing population. This has sparked requests for additional opportunities for people to augment their public pensions with safe, well-funded ones, such as occupational programs. Adequate pension indexation and providing services for older adults, particularly long-term care and healthcare, are additional measures to promote living standards throughout retirement. Pensions are a national responsibility of the Member State. Despite this, the EU backs them and aims for higher socioeconomic convergence. On the other hand, EU pension expertise is limited (Eurostat, 2024). Although the EU lacks the authority to enact laws governing pension systems per se, it can enact laws addressing issues that impact the internal market's operation (such as free movement of people, the provision of services, and consumer protection), combat discrimination (including age and gender discrimination), and safeguard workers' rights. The "proportionality measure" was employed by the authors of a 2021 future-focused review of pension systems published by the Centre for Economic Policy Research (CEPR) (European Voices, 2024). to evaluate pension fairness by contrasting contributions made during working life with retirement benefits.

They found that European pension systems, as constructed, are neither egalitarian nor sustainable, and that many require significant state transfers. This was because Europe's average pension system deficit was expected to rise from 2.5% of GDP in 2021 to 4% in 30 years. They believe pension reforms should benefit younger generations and strive for improved sustainability. They also warn against protracted phase-in periods (for changes), which, although they provide people and households time to adjust, exacerbate generational gaps and endanger future implementation of the reforms.

Other experts used two new indicators to analyse the sustainability of the public pension system in a 2023 CEPR discussion paper (European Voices, 2024): the "pension space," which gauges the ability to pay for pension expenditures from labour taxes, and the "pension space exhaustion" probability, which takes demographic uncertainties into account. They discovered that during the next 30 years, most nations will not have much room to increase pension funding through labour income taxes. They estimated that by 2030, France and Italy will run out of pension space, followed by Austria and Finland by 2040, and eventually by most EU nations, excluding Ireland.

The authors recommend lowering pension payouts or raising consumption taxes as preventive measures since they involve less distortionary labour income taxation than raising the retirement age. Key conclusions were drawn from an analysis of eleven European pension systems conducted by the Austrian economic research firm EcoAustria. The ageing of the population forces nations like Austria, which mainly use a pay-as-you-go system to fund their state pensions, to spend a significant portion of their budgets. By 2035, it will account for over 15% of Austria's GDP, up from over 13.7%. Similar circumstances exist in Germany, where a research project projects 12% of GDP by 2035; in Italy, the figure is 18%. However, pension finance expenses are currently lower in the Netherlands, Sweden, and Denmark, at 6.5%, 7.4%, and 8.3% of GDP, respectively (European Voices, 2024). According to the Mercer CFA Institute, the Netherlands has maintained its position as the nation with the best pension system in the world because of its robust asset base and extremely sensible regulation. Forty-eight nations, home to 65% of the world's population, were compared in the analysis.

#### **4. The main challenges of occupational pensions in Europe**

Defined Benefit (DB) and Defined Contribution (DC) are the two main types of occupational pension plans, while it is entirely feasible to include aspects of both into "hybrid arrangements." The methods used to calculate pension benefits and who is responsible for the risks involved vary throughout these plans. Most of the risks are borne by employers in traditional DB schemes, where benefits are frequently tied to an employee's ultimate salary. Still, in traditional (or sometimes called pure) DC schemes, the risks are transferred to the individual employees.

In actuality, several hybrid arrangements fall somewhere between these two extremes. These agreements include varying levels of risk-sharing between employers and employees, often coupled with collective risk-sharing or specific assurances. DC or hybrid plans have replaced traditional DB pension plans in several Member States over the last few decades; EU policymakers have also called attention to this trend (Peyravi, 2015). Several causes have contributed to this transition, such as shifting regulatory environments, economic constraints, and demographic shifts. Stress due to these demographic shifts.

Along with their pension benefits from the first pillar, many European people already rely on workplace and/or occupational DC pension plans, and this number is predicted to increase in the future. Given that the working-age populations of several Member States—including Greece, Lithuania, and Poland—are expected to decline by at least one-third by 2060, structural changes in their populations present difficulties. The current and upcoming pension systems, especially “PayAsYouGo” arrangements, are under challenge.

In certain nations, it is also anticipated that age dependency ratios—the proportion of dependents to working-age individuals—will increase. According to some estimates, by 2060, there would be fewer than two working-age people for every person over 65 in more than half of the EU's member states. Some governments have created regulations that either mandate or encourage employers to switch to DC schemes in response to these developments. The trend toward DC pension plans is also influenced by the evolving labour market, which includes increased workforce mobility, self-employment, and flexible work schedules. Pension plans that accommodate changing work schedules and offer simple portability when workers quit their jobs or take time off are becoming increasingly popular. Because DC plans provide more control over pension expenses and reduce exposure to the risks and volatility of DB plans, businesses are also selecting them.

Economic pressures: Greece and Italy devote more than 15% of their GDP to pensions, and pension spending as a proportion of GDP has increased in certain European nations. According to Eurostat data, the EU's average pension spending in 2021 was 12.9%. Variations in the labour share of GDP, employment trends, and demographic shifts can all be used to explain this sizeable portion of GDP that goes into pensions. In the second pillar, DB schemes have also found it challenging to produce enough returns to cover their commitments due to falling interest rates, which have been present since the late 1980s. These causes accelerated the trend toward DC (Pensions Europe, 2024). According to the EIOPA Consumer Trends Report from 2020, DC schemes accounted for 55% of active members in 23 Member States. This trend has only gotten stronger since then. According to the 2023 edition of the EIOPA Consumer Trends Report, the number of new members in DC pension plans rose by 115% in 2022 over 2021, with France and Sweden seeing the most significant increases at 61% and 90%, respectively. As a percentage of all active members overall, it translates to an 11% rise in active members in DC schemes in a year (Eurostat, 2024). The number of members and the assets under management of DB and hybrid schemes continue to grow. Regarding absolute numbers, DB pension plans added more members in 2022 (2.1 m for DC and 2.5 m for DB).

As some Member States, like Germany, will continue to offer primarily DB contracts, it is crucial to remember that the trend is not unique to Europe and that DB schemes will continue to be significant. The retirement age in Denmark, which has one of the greatest pension systems, will increase to 67 in 2022. The Netherlands, which is ranked as the best country for retirees, will follow suit in 2024. Germany and Spain will also have a 67-year-old retirement age. Currently, Iceland has the highest retirement age in Europe, at 67. Sailors in this nation are an exception, as they are eligible to retire at age sixty. Iceland has no immediate plans to increase the current cap. There are several exceptions, even though practically every European nation is hiking the retirement age. Norway's retirement age was 67 until recently, but following a reform that increased the pension system's flexibility, citizens can now retire at any age between 62 and 75. Later, people who entered the workforce gained the most from this arrangement, which garnered much praise. As a result, the government rewards Norwegians for working longer hours. By doing this, the detrimental effects of rising life expectancy and falling birth rates are countered, and the strain on the social security system is lessened.

Outside of Europe, the retirement age is typically lower. The retirement age criteria outside of Europe are likewise noticeably lower. For instance, the United Arab Emirates has the lowest retirement age in the world, at just 49. However, this age only applies to citizens physically present in the nation; foreigners who wish to

earn a pension must be at least 60 years old. Many Asian and African countries also have somewhat lower retirement ages. The retirement age for women is 60 in Egypt, Cameroon, India, and Sri Lanka, while it is even lower in Iran and Vietnam, where it is 55. The issue of an ageing population has been made worse by rising life expectancy and falling fertility rates. Many nations have addressed these problems, including extending pension payment periods and reforming the pension benefit adjustment mechanism to address the adverse effects of growing fiscal costs, ensuring that retired workers benefit from socioeconomic development (European Central Bank, 2022). Pension payments might be made easier by making adjustments to benefits. Scientists and policymakers are now concentrating on assessing the efficacy of pension insurance benefits adjustment plans due to the acceleration of population ageing and socioeconomic development. To modify pension benefits, EU nations typically opt for a mixed indexation model that incorporates both the wage and consumer price indexes (European Central Bank, 2022). This adjustment method often comes in two forms: one is based on the pay index multiplied by a specific percentage, and the other is based on the consumer price index multiplied by the total of the two.

For instance, the adjustment index for pension payments in Switzerland combines 50% of the price index and 50% of the wage index (European Central Bank, 2022). Another kind of adjustment is determined by which is higher, the wage growth rate or the consumer price index. For instance, the automatic yearly adjustment in the Czech Republic is predicated on either a one-third increase in average salaries or a 100% increase in the consumer price index (European Central Bank, 2022).

## **5. Development of demographic indicators of EU countries**

### **5.1. The share of older people continues to increase in EU countries**

As of January 1, 2023, an estimated 448.8 million people lived in the EU. The EU's working-age population, which includes those aged 15 to 64, made up 63.8% of the total population, while children aged 0 to 14 made up 14.9%. At 21.3%, the proportion of older adults (65 and older) increased by 0.2 percentage points (pp) from the year before and 3.0 pp from ten years ago. For contrast, the three demographic categories of working age (15–64 years), older persons (65 years and more), and children (0–14 years) made up 15.0%, 63.9%, and 21.1% of the EU population in 2022, respectively (Eurostat, 2024). In 2023, Ireland (19.3%), Sweden (17.4%), and France (17.3%) had the largest proportions of children aged 0 to 14 in their total populations among EU member states, while Italy (12.4%), Malta (12.7%), and Portugal (12.9%) had the lowest proportions.

Compared to 2022, the proportion of children aged 0-14 in the population of only three Member States (the Czech Republic, Portugal, and Germany) increased in 2023. This proportion decreased or remained constant in the other 15 Member States.

In terms of the proportion of the population that is 65 years of age or older, the most significant shares were found in Italy (24.0%), Portugal (24.0%), Bulgaria (23.5%), Finland (23.3%), Greece (22.0%), and Croatia (22.7%). In contrast, the lowest numbers were found in Luxembourg (14.9%) and Ireland (15.2%).

The percentage of adults 65 and older rose in 2023 compared to 2022 and 2021. Still, it fell in Estonia, Czechia, and Malta. It stayed the same in Spain, Lithuania, Hungary, and Germany (Population age structure by major age groups, 2013 – 2023, in % of the total population, Eurostat).

### **5.2. Life expectancy trend comparing differences between men and women**

Life expectancy increased by 3.8 years between 2003 and 2023. One factor contributing to the ageing of the EU population is the rising life expectancy—people are living longer and longer. Due to several causes, including decreased infant mortality, increased living standards, better lifestyles and education, and advancements in healthcare and medicine, life expectancy at birth increased significantly during the past century. The EU's life expectancy at birth was 77.7 years in 2003, rising by 3.6 years to 81.3 years in 2019. Life expectancy dropped to 80.4 years in 2020 and 80.1 years in 2021 after the COVID-19 pandemic. In 2022 and 2023, it recovered to 80.6 and 81.5 years, respectively, 0.2 years longer than the 2019 value before the COVID-19 pandemic. Between 2003 and 2023, life expectancy increased by 3.8 years at the EU level. From 2003 to 2023, all EU nations had increases; Estonia saw the most significant increase (6.9 years, from 71.9 years in 2003 to 78.8 in

2023), while Greece saw the smallest (2.3 years, from 79.3 to 81.6). In 2023, Bulgaria (75.8) and Latvia (75.9) had the lowest life expectancies at birth, while Spain (84.0) and Italy (83.8) had the highest 75.9.

Significant disparities still exist when comparing men's and women's life expectancy across nations. In 2022, women's life expectancy remained greater than men's, as it had in prior years. In 2022, the gender difference in the EU was 5.4 years, meaning that newborn girls might expect to outlive males. Additionally, there were significant differences in life expectancy between EU Member States based on gender. Latvia had the most critical gender gap in 2022 (10.0 years), while the Netherlands had the smallest (2.9 years). The gender disparity in life expectancy was greater than the EU average in 13 Member States (Life expectancy at birth, gender age, 2022 (years, female expectancy - male life expectancy), Source: Eurostat)

In 2022, the gender gap decreased in 19 Member States and the EU (from 5.7 years in 2021 to 5.4 years in 2022). According to data from 2023, women in the EU had an 84.2-year life expectancy at birth, while men had a 78.9-year life expectancy, a 5.3-year discrepancy. This was the case in every EU nation, with the Netherlands (2.9; 83.4 and 80.5) and Sweden (3.3; 85.0 and 81.7) having the smallest variations and Latvia (10.0 years; women 80.8 and males 70.8) and Lithuania (9.2; 81.7 and 72.5) having the highest. In 2003, the gender gap in life expectancy at birth in the EU was 6.4 years (women 80.8 and males 74.4), which is 1.1 years more than in 2023. Cyprus (4.4; 81.2 and 76.8) and Malta (4.4; 80.8 and 76.4) had the lowest differences among EU nations in 2003, while Lithuania (11.3; 77.7 and 66.4) and Estonia (10.8; 77.2 and 66.4) had the largest. The gender disparity in life expectancy at birth has shrunk in 25 EU nations between 2003 and 2023, with the most significant declines occurring in Luxembourg (-2.6 years; from 6.0 to 3.4) and Lithuania (-2.1; from 11.3 to 9.2). Only Romania (0.2; from 7.4 to 7.6) and Bulgaria (0.6; from 7.0 to 7.6) had increased.

In 2023, Bulgaria (79.6) and Hungary (80.1) had the lowest life expectancies at birth for women, while Spain (86.7) and France (85.7) had the highest. According to estimates, Latvia (70.8) and Bulgaria (72.0) had the lowest life expectancies at birth for men, while Malta (81.8), Italy, Luxembourg, and Sweden (81.7) had the highest. According to Eurostat (Increase in the share of the population aged 65 years and over, 2013-2023), the effects of the EU's ageing population will significantly impact the ensuing decades. Higher life expectancy and consistently low birth rates are changing the shape of the EU's age pyramid. The significant shift toward an older demographic structure—evident in some EU member states - will likely be the most critical adjustment. The proportion of working-age individuals in the EU is declining due to demographic shifts, while the proportion of retired individuals is increasing. The proportion of older persons is anticipated to rise dramatically in the upcoming decades. As a result, working-age people may find it more challenging to cover the social expenditures that the ageing population needs for various associated services. Meanwhile, fewer people in the EU are of working age (Eurostat, 2022).

The EU's working-age population fell from 269 million in 2012 to 264 million in 2021 over the past ten years. Although the situation is common, it is more noticeable in some Member States (such as Latvia, Bulgaria, and Romania) that experience low birth rates and migratory outflows (Eurostat, 2022).

## 6. Economic indicators' influence on pension adequacy

In addition to expressing the numbers in a common currency, it is preferable to account for variations in price levels when comparing national accounts statistics internationally, such as GDP per capita. If this were not done, the GDP levels of high-price countries would be overestimated in comparison to low-price countries. Table 4 displays the volume indices of GDP per capita for each country from 2013 to 2023. There is a notable disparity in GDP per capita among EU member states. Of all the nations in this comparison, Luxembourg had the greatest GDP per capita, over 2.4 times more in 2023 than the EU average. This is partially explained by the fact that, although they do not reside in Luxembourg, many foreign residents work there and contribute to the GDP. Their consumption expenditures are documented in their home country's national accounts. The national accounts of their home country reflect their consumption expenditures. The existence of major multinational corporations that own intellectual property helps to explain Ireland's high GDP per capita.

While a significant portion of the revenue generated by this output is given back to the companies' foreign ultimate owners, the contract manufacturing that goes along with these assets also contributes to GDP. Ireland ranked second among EU nations in 2023, with a GDP per capita of 113% higher than the EU average. The Netherlands, Denmark, and Austria were next, all with more than 20% higher GDPs than the norm. The GDP per capita of the EFTA nations of Iceland, Norway, and Switzerland was 35%, 54%, and 71% higher than the EU average. The other EU nations with GDPs per capita higher than the EU average were Belgium, Germany, Sweden, Malta, and Finland. The GDP per capita of France, Italy, Cyprus, Slovenia, Spain, and Czechia was less than 10% lower than the EU average. (Eurostat- Gross Domestic Product (GDP) per capita, 2013-2023, EU=100).

Romania, Poland, Hungary, Croatia, Slovakia, the candidate country of Turkey, and Latvia all had GDPs per capita less than 30% below the national average. The GDP per capita of Greece and Bulgaria was less than 40% lower than the national average. The candidate country, Montenegro, was placed at 49% below the EU average, followed by the candidate countries Serbia, North Macedonia, Albania, and Bosnia and Herzegovina. Between 2013 and 2023, Table 4's ranking of nations by GDP per capita volume index demonstrates a fair amount of stability. Over the entire period, Bulgaria had the lowest volume index and Luxembourg the highest among EU nations.

Nonetheless, the disparity diminishes within this time frame; in 2013, the highest GDP per capita was six times greater than the lowest, but by 2023, it had dropped to nearly four times. The Gini coefficient shows how much a nation's income distribution departs from a perfectly equal distribution. A Gini number of 0 indicates that income is divided evenly among the population, whereas a value of 100 means that a single individual receives all of the nation's income. The EU's Gini coefficient in 2023 was 29.6.

In 2023, Latvia (34.0), Lithuania (35.7), and Bulgaria (37.2) had the highest levels of inequality in the EU regarding disposable income. The European Union's statistical agency, Eurostat, compared the average pension in Figure 5 by dividing the number of old-age pension claimants by the amount spent on old-age pensions. The figures were taken from Eurostat's database. According to a comparison conducted by Eurostat, the statistics office of the European Union, the average old-age pension in Finland is approximately 1,700 euros, as shown in Figure 5 below, where purchasing power is equal to Purchasing Power Standard (PPS)/month. In 2021, purchasing power was around 1,300 euros per month. The average pension in Finland is higher than the average in the EU. The country-by-country difference in pensions, expressed in euros, is substantial. When the difference in price levels is considered, and pensions are valued according to their purchasing power, the disparity becomes equal. However, Finland's average pension, expressed in purchasing power, is higher than the European average (Finnish Centre for Pensions, 2025). The figures are suggestive. Due to the significant variations in pension systems, comparing pension levels between countries is challenging.

Occupational pensions that augment statutory pensions and are provided to wage earners in many countries are not included in the comparison data for all nations. Furthermore, the comparison ignores the impact of taxes on the ultimate pension amount. The occupational pensions that many nations' wage earners are covered by and which augment statutory pensions are not included in the comparative data for all nations. Furthermore, how taxes impact the ultimate pension amount is not taken into consideration in the comparison (Eurostat - Old age pension in EU countries, in euros/month)

## 7. Research Methods

TOPSIS, as one of the MCDM methods, considers both the distance of each alternative from the positive ideal and the distance of each alternative from the negative ideal point. In other words, the best alternative should have the shortest distance from the positive ideal solution (PIS) and the longest distance from the negative ideal. This study ranks five criteria and 30 countries based on the TOPSIS method. Table 3 describes the criteria.

**Table 3.** Characteristics of criteria

|   | name                                     | type | weight |
|---|--|------|--------|
| 1 | GDP/capita                               | +    | 0.2    |
| 2 | Gini index                               | -    | 0.2    |
| 3 | Labour productivity: unit of measure     | +    | 0.2    |
| 4 | Unemployment                             | -    | 0.2    |
| 5 | 65 years and over population, percentage | -    | 0.2    |

Table 4 shows the decision matrix.

**Table 4.** Decision matrix

|             | GDP/capita | Gini index | Labour productivity: unit of measure | Unemployment | 65 years and over population percentage |
|-------------|------------|------------|--------------------------------------|--------------|---|
| Belgium     | 118        | 29.6       | 123.319                              | 5.5          | 19.7                                    |
| Bulgaria    | 64         | 24.2       | 168.965                              | 4            | 23.5                                    |
| Czechia     | 90         | 37.2       | 148.328                              | 2.8          | 20.4                                    |
| Denmark     | 125        | 24.4       | 111.103                              | 6.4          | 20.5                                    |
| Germany     | 116        | 28.2       | 124.737                              | 3.5          | 22.1                                    |
| Estonia     | 80         | 29.4       | 167.886                              | 7.6          | 20.2                                    |
| Ireland     | 213        | 31.8       | 103.789                              | 4.1          | 15.2                                    |
| Greece      | 69         | 27.4       | 101.465                              | 9.3          | 23                                      |
| Spain       | 91         | 31.8       | 123.636                              | 11.2         | 20.1                                    |
| France      | 99         | 31.5       | 116.053                              | 7.6          | 21.2                                    |
| Croatia     | 76         | 29.7       | 127.439                              | 4.8          | 22.7                                    |
| Italy       | 98         | 29.7       | 110.206                              | 6.1          | 24                                      |
| Cyprus      | 97         | 31.5       | 111.182                              | 5            | 16.6                                    |
| Latvia      | 70         | 29.6       | 159.557                              | 6.9          | 21                                      |
| Lithuania   | 87         | 34         | 173.547                              | 7.9          | 20                                      |
| Luxemburg   | 237        | 35.7       | 140.000                              | 5.9          | 14.9                                    |
| Hungary     | 77         | 30.6       | 167.022                              | 4.5          | 20.5                                    |
| Malta       | 107        | 29         | 124.044                              | 3            | 18.6                                    |
| Netherlands | 133        | 33         | 125.791                              | 3.7          | 20.2                                    |
| Austria     | 120        | 26.5       | 126.717                              | 5.5          | 19.6                                    |
| Poland      | 77         | 28.1       | 145.377                              | 2.9          | 19.9                                    |
| Portugal    | 81         | 27         | 131.937                              | 6.4          | 24                                      |
| Romania     | 78         | 33.7       | 187.306                              | 5.5          | 19.7                                    |
| Slovenia    | 92         | 31         | 135.096                              | 3.4          | 21.4                                    |
| Slovakia    | 74         | 23.4       | 144.45                               | 5.2          | 17.9                                    |
| Finland     | 105        | 21.6       | 115.656                              | 8.6          | 23.3                                    |
| Sweden      | 114        | 26.6       | 125.674                              | 8.6          | 20.4                                    |
| Iceland     | 135        | 29.5       | 146.185                              | 3.4          | 15                                      |
| Norway      | 171        | 24         | 127.921                              | 3.58         | 18.4                                    |
| Switzerland | 154        | 24.7       | 104.621                              | 4.05         | 19.2                                    |

**The steps of the TOPSIS method**

**STEP 1. Normalising the decision matrix**

The following formula can be used to normalise.

$$r_{ij}(x) = \frac{x_{ij}}{\sqrt{\sum_{i=1}^m x_{ij}^2}} \quad i = 1, \dots, m ; j = 1, \dots, n \tag{1}$$

Table 5 shows the normalised matrix.

**Table 5.** The normalised matrix

|          | GDP/capita | Gini index | Labour productivity: unit of measure | Unemployment | 65 years and over population percentage |
|----------|------------|------------|--------------------------------------|--------------|---|
| Belgium  | 0.186      | 0.184      | 0.166                                | 0.169        | 0.178                                   |
| Bulgaria | 0.101      | 0.15       | 0.227                                | 0.123        | 0.212                                   |
| Czechia  | 0.142      | 0.231      | 0.199                                | 0.086        | 0.184                                   |
| Denmark  | 0.198      | 0.152      | 0.149                                | 0.196        | 0.185                                   |
| Germany  | 0.183      | 0.175      | 0.168                                | 0.107        | 0.199                                   |
| Estonia  | 0.126      | 0.183      | 0.226                                | 0.233        | 0.182                                   |
| Ireland  | 0.337      | 0.198      | 0.14                                 | 0.126        | 0.137                                   |
| Greece   | 0.109      | 0.17       | 0.136                                | 0.285        | 0.207                                   |

|             |       |       |       |       |       |
|-------------|-------|-------|-------|-------|-------|
| Spain       | 0.144 | 0.198 | 0.166 | 0.344 | 0.181 |
| France      | 0.156 | 0.196 | 0.156 | 0.233 | 0.191 |
| Croatia     | 0.12  | 0.185 | 0.171 | 0.147 | 0.205 |
| Italy       | 0.155 | 0.185 | 0.148 | 0.187 | 0.216 |
| Cyprus      | 0.153 | 0.196 | 0.149 | 0.153 | 0.15  |
| Latvia      | 0.111 | 0.184 | 0.214 | 0.212 | 0.189 |
| Lithuania   | 0.137 | 0.211 | 0.233 | 0.242 | 0.18  |
| Luxemburg   | 0.375 | 0.222 | 0.188 | 0.181 | 0.134 |
| Hungary     | 0.122 | 0.19  | 0.225 | 0.138 | 0.185 |
| Malta       | 0.169 | 0.18  | 0.167 | 0.092 | 0.168 |
| Netherlands | 0.21  | 0.205 | 0.169 | 0.114 | 0.182 |
| Austria     | 0.19  | 0.165 | 0.17  | 0.169 | 0.177 |
| Poland      | 0.122 | 0.175 | 0.195 | 0.089 | 0.179 |
| Portugal    | 0.128 | 0.168 | 0.177 | 0.196 | 0.216 |
| Romania     | 0.123 | 0.209 | 0.252 | 0.169 | 0.178 |
| Slovenia    | 0.145 | 0.193 | 0.182 | 0.104 | 0.193 |
| Slovakia    | 0.117 | 0.145 | 0.194 | 0.16  | 0.161 |
| Finland     | 0.166 | 0.134 | 0.155 | 0.264 | 0.21  |
| Sweden      | 0.18  | 0.165 | 0.169 | 0.264 | 0.184 |
| Iceland     | 0.213 | 0.183 | 0.197 | 0.104 | 0.135 |
| Norway      | 0.27  | 0.149 | 0.172 | 0.11  | 0.166 |
| Switzerland | 0.243 | 0.154 | 0.141 | 0.124 | 0.173 |

**STEP 2. Calculating the weighted normalised decision matrix**

According to the following formula, the normalised matrix is multiplied by the weight of the criteria.

$$v_{ij}(x) = w_j r_{ij}(x) \quad i = 1, \dots, m ; j = 1, \dots, n \quad (2)$$

Table 6 shows the weighted normalised decision matrix.

**Table 6.** The weighted normalised matrix

|             | GDP/capita | Gini index | Labour productivity: unit of measure | Unemployment | 65 years and over population percentage |
|-------------|------------|------------|--------------------------------------|--------------|---|
| Belgium     | 0.037      | 0.037      | 0.033                                | 0.034        | 0.036                                   |
| Bulgaria    | 0.02       | 0.03       | 0.045                                | 0.025        | 0.042                                   |
| Czechia     | 0.028      | 0.046      | 0.04                                 | 0.017        | 0.037                                   |
| Denmark     | 0.04       | 0.03       | 0.03                                 | 0.039        | 0.037                                   |
| Germany     | 0.037      | 0.035      | 0.034                                | 0.021        | 0.04                                    |
| Estonia     | 0.025      | 0.037      | 0.045                                | 0.047        | 0.036                                   |
| Ireland     | 0.067      | 0.04       | 0.028                                | 0.025        | 0.027                                   |
| Greece      | 0.022      | 0.034      | 0.027                                | 0.057        | 0.041                                   |
| Spain       | 0.029      | 0.04       | 0.033                                | 0.069        | 0.036                                   |
| France      | 0.031      | 0.039      | 0.031                                | 0.047        | 0.038                                   |
| Croatia     | 0.024      | 0.037      | 0.034                                | 0.029        | 0.041                                   |
| Italy       | 0.031      | 0.037      | 0.03                                 | 0.037        | 0.043                                   |
| Cyprus      | 0.031      | 0.039      | 0.03                                 | 0.031        | 0.03                                    |
| Latvia      | 0.022      | 0.037      | 0.043                                | 0.042        | 0.038                                   |
| Lithuania   | 0.027      | 0.042      | 0.047                                | 0.048        | 0.036                                   |
| Luxemburg   | 0.075      | 0.044      | 0.038                                | 0.036        | 0.027                                   |
| Hungary     | 0.024      | 0.038      | 0.045                                | 0.028        | 0.037                                   |
| Malta       | 0.034      | 0.036      | 0.033                                | 0.018        | 0.034                                   |
| Netherlands | 0.042      | 0.041      | 0.034                                | 0.023        | 0.036                                   |
| Austria     | 0.038      | 0.033      | 0.034                                | 0.034        | 0.035                                   |
| Poland      | 0.024      | 0.035      | 0.039                                | 0.018        | 0.036                                   |
| Portugal    | 0.026      | 0.034      | 0.035                                | 0.039        | 0.043                                   |
| Romania     | 0.025      | 0.042      | 0.05                                 | 0.034        | 0.036                                   |
| Slovenia    | 0.029      | 0.039      | 0.036                                | 0.021        | 0.039                                   |
| Slovakia    | 0.023      | 0.029      | 0.039                                | 0.032        | 0.032                                   |
| Finland     | 0.033      | 0.027      | 0.031                                | 0.053        | 0.042                                   |
| Sweden      | 0.036      | 0.033      | 0.034                                | 0.053        | 0.037                                   |
| Iceland     | 0.043      | 0.037      | 0.039                                | 0.021        | 0.027                                   |
| Norway      | 0.054      | 0.03       | 0.034                                | 0.022        | 0.033                                   |
| Switzerland | 0.049      | 0.031      | 0.028                                | 0.025        | 0.035                                   |

**STEP 3. Determining the positive ideal and negative ideal solutions**

The TOPSIS method aims to calculate the degree of distance of each alternative from positive and negative ideals. Therefore, the positive and negative ideal solutions are determined in this step according to the following formulas.

$$A^+ = (v_1^+, v_2^+, \dots, v_n^+) \tag{3}$$

$$A^- = (v_1^-, v_2^-, \dots, v_n^-) \tag{4}$$

So that

$$v_j^+ = \{(\max v_{ij}(x) | j \in j_1), (\min v_{ij}(x) | j \in j_2)\} \quad i = 1, \dots, m$$

$$v_j^- = \{(\min v_{ij}(x) | j \in j_1), (\max v_{ij}(x) | j \in j_2)\} \quad i = 1, \dots, m$$

where  $j_1$  and  $j_2$  denote the negative and positive criteria, respectively.

Table 7 shows both positive and negative ideal values.

**Table 7.** The positive and negative ideal values

|   | Positive ideal | Negative ideal |
|---|----------------|----------------|
| GDP/capita                              | 0.075          | 0.02           |
| Gini index                              | 0.027          | 0.046          |
| Labour productivity: unit of measure    | 0.05           | 0.027          |
| Unemployment                            | 0.017          | 0.069          |
| 65 years and over population percentage | 0.027          | 0.043          |

**STEP 4. Calculating distance from the positive and negative ideal solutions**

The TOPSIS method ranks each alternative based on the relative closeness degree to the positive ideal and distance from the negative ideal. Therefore, the distances between each alternative and the positive and negative ideal solutions are calculated using the following formulas in this step.

$$d_i^+ = \sqrt{\sum_{j=1}^n [v_{ij}(x) - v_j^+(x)]^2} \quad , \quad i = 1, \dots, m \tag{5}$$

$$d_i^- = \sqrt{\sum_{j=1}^n [v_{ij}(x) - v_j^-(x)]^2} \quad , \quad i = 1, \dots, m \tag{6}$$

Table 8 shows the distance between positive and negative ideal solutions.

**Table 8.** Distance to positive and negative ideal points

|             | Distance to positive ideal | Distance to negative ideal |
|-------------|----------------------------|----------------------------|
| Belgium     | 0.046                      | 0.041                      |
| Bulgaria    | 0.058                      | 0.05                       |
| Czechia     | 0.052                      | 0.054                      |
| Denmark     | 0.048                      | 0.039                      |
| Germany     | 0.045                      | 0.052                      |
| Estonia     | 0.06                       | 0.031                      |
| Ireland     | 0.028                      | 0.066                      |
| Greece      | 0.072                      | 0.017                      |
| Spain       | 0.073                      | 0.014                      |
| France      | 0.058                      | 0.026                      |
| Croatia     | 0.057                      | 0.041                      |
| Italy       | 0.056                      | 0.034                      |
| Cyprus      | 0.052                      | 0.042                      |
| Latvia      | 0.061                      | 0.033                      |
| Lithuania   | 0.06                       | 0.03                       |
| Luxemburg   | 0.029                      | 0.067                      |
| Hungary     | 0.054                      | 0.046                      |
| Malta       | 0.046                      | 0.054                      |
| Netherlands | 0.041                      | 0.052                      |
| Austria     | 0.045                      | 0.043                      |
| Poland      | 0.053                      | 0.054                      |
| Portugal    | 0.059                      | 0.034                      |
| Romania     | 0.056                      | 0.043                      |
| Slovenia    | 0.051                      | 0.05                       |
| Slovakia    | 0.055                      | 0.044                      |

|             |       |       |
|-------------|-------|-------|
| Finland     | 0.06  | 0.029 |
| Sweden      | 0.056 | 0.028 |
| Iceland     | 0.036 | 0.057 |
| Norway      | 0.028 | 0.061 |
| Switzerland | 0.036 | 0.055 |

**STEP 5. Calculating the relative closeness degree of alternatives to the ideal solution**

In this step, the relative closeness degree of each alternative to the ideal solution is obtained by the following formula. Suppose the relative closeness degree has a value close to 1. In that case, the alternative has a shorter distance from the positive ideal solution and a longer distance from the negative ideal solution.

$$C_i = \frac{d_i^-}{(d_i^+ + d_i^-)}, \quad i = 1, \dots, m \tag{7}$$

Table 9 shows the relative closeness degree of each alternative to the ideal solution and its ranking.

**Table 9.** The Ci value and ranking

|             | Ci    | rank |
|-------------|-------|------|
| Belgium     | 0.47  | 13   |
| Bulgaria    | 0.467 | 14   |
| Czechia     | 0.508 | 9    |
| Denmark     | 0.451 | 16   |
| Germany     | 0.537 | 8    |
| Estonia     | 0.344 | 24   |
| Ireland     | 0.703 | 1    |
| Greece      | 0.191 | 29   |
| Spain       | 0.163 | 30   |
| France      | 0.312 | 28   |
| Croatia     | 0.418 | 20   |
| Italy       | 0.381 | 21   |
| Cyprus      | 0.448 | 17   |
| Latvia      | 0.349 | 23   |
| Lithuania   | 0.335 | 25   |
| Luxemburg   | 0.698 | 2    |
| Hungary     | 0.46  | 15   |
| Malta       | 0.542 | 7    |
| Netherlands | 0.56  | 6    |
| Austria     | 0.487 | 12   |
| Poland      | 0.504 | 10   |
| Portugal    | 0.363 | 22   |
| Romania     | 0.436 | 19   |
| Slovenia    | 0.497 | 11   |
| Slovakia    | 0.443 | 18   |
| Finland     | 0.322 | 27   |
| Sweden      | 0.328 | 26   |
| Iceland     | 0.617 | 4    |
| Norway      | 0.689 | 3    |
| Switzerland | 0.604 | 5    |

Figure 1 shows the Ci values.

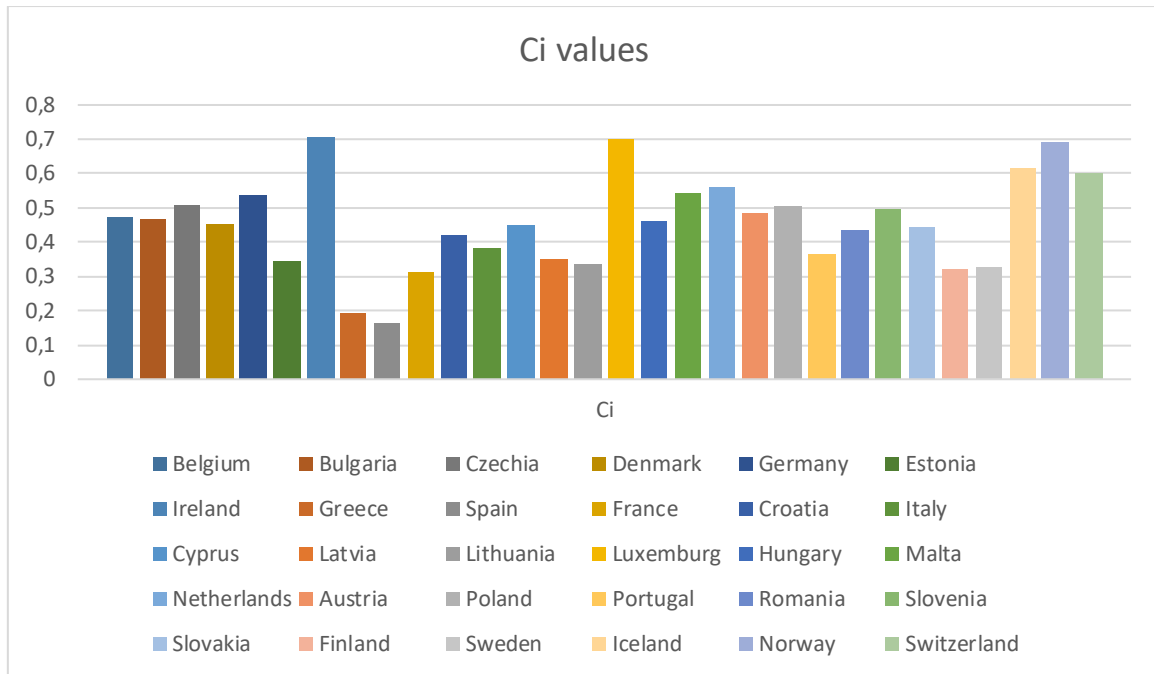


Figure 1. The changes in the CI value of EU countries

Based on the TOPSIS examination, the criteria selected in different EU countries were positioned according to their relative closeness to the ideal arrangement. So, as we can see in Table 11, with the highest relative closeness,  $Ci^*=0.703$  was Ireland, with a 2nd ranking with  $Ci^*=0.698$  was Luxembourg, and a third ranking with  $Ci^*=0.689$  was in Norway, next was Iceland ( $Ci^*=0.617$ ), and fifth was Switzerland ( $Ci^*=0.604$ ). The TOPSIS analysis has identified the most effective alternatives in managing pension systems. The second group of EU countries can be defined as Sweden (26) -  $Ci = 0.328$ ; Finland (27) -  $Ci = 0.322$ ; France (28) -  $Ci = 0.312$ ; Greece (27) -  $Ci = 0.191$ . Another group of EU countries is in the middle: Cyprus (17) -  $Ci=0.448$ ; Denmark (16) -  $Ci=0.451$ ; Hungary (15) -  $Ci=0.460$ ; Bulgaria (14)  $Ci=0.467$ ; Belgium (13) -  $Ci=0.470$ .

### Conclusions

1. The global population is entering an ageing stage, and the number and proportion of older adults in almost all countries are showing an upward trend. In the process of increasing population ageing, ensuring the basic living standards of retirees, maintaining sustainable development of pension funds, and reducing the government's financial burden have gradually become essential issues in social security.
2. All EU Member States have a system based on a PAYG system, supplemented by mandatory or optional PAYG or funded schemes. The risks covered include old-age and early pensions, disability (some countries do not consider disability benefits as pensions but health-related payments), survivor and minimum schemes, and some special pensions.
3. Analysis of demographic indicators of EU countries shows that the share of older people continues to increase in EU countries, so the governments must analyse how to develop a pension system.
4. Pension systems in Europe, as designed, are neither sustainable nor equitable, and many require substantial state transfers. In their view, pension reforms should aim for greater sustainability and do so not only at the expense of younger generations.
5. Occupational pension schemes take two primary forms: Defined Benefits and defined contributions, and they combine elements of both within "hybrid arrangements".
6. Based on the TOPSIS examination, the selected criteria in different EU countries have been positioned according to their relative closeness to the ideal arrangement. So, as we could notice in Table 11, with the highest relative closeness,  $Ci^*=0.703$ , was Ireland, with a 2nd ranking,  $Ci^*=0.698$ , was Luxembourg, and a third ranking,  $Ci^*=0.689$ , was Norway. Next was Iceland ( $Ci^*=0.617$ ), and fifth was Switzerland ( $Ci^*=0.604$ ). Other countries, such as Sweden, Finland, France, Greece, and Spain, are less close to the ideal arrangement, with a CI interval from 0,328 to 0,163. These results of TOPSIS research provide policymakers and

governments with theoretical insights and tailored managerial policy recommendations to help them maintain financial sustainability and quality of life after retirement.

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