HOW DO LIFECYCLE, EMPLOYMENT AND CHILDCARE SUPPORT CONTRIBUTE TO THE GENDER PENSION GAP IN EUROPE? THE CLUSTERING METHODS ANALYSIS

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Abstract. Despite ongoing efforts in Europe to tackle discrimination against women in the labor market and societal roles, gender inequality remains entrenched. This study shifts focus from the design of pension systems to explore other key factors impacting women's careers. By examining life cycle demographics, career paths, and childcare support systems, we utilize clustering to categorize European countries based on factors influencing women's pension capital accumulation, excluding pension design. Our innovative approach highlights the significance of these factors in the gender pension gap. Findings suggest demographic and social similarities across countries do not necessarily equate to equitable retirement scenarios for women compared to men, underscoring the potential of pension system design to mitigate disparities. Using Ward's method and the silhouette index for country classification on 10 variables, our analysis reveals distinct differences in gender pension gaps across Southern, Northern, Western, and Eastern Europe. This divergence, alongside observed differences in retirement outcomes for women affected by prior pension regulations, points to increasing challenges for younger European women in achieving pension parity with past generations.

1. Introduction

The 2015 Agenda for Sustainable Development, through each of its 17 Goals (SDGs), highlights the critical importance of addressing women's issues. It advocates for measures and actions to eliminate gender inequalities in economic participation, the labor market, quality of life, and the distribution or compensation of caregiving roles and domestic responsibilities of women. Despite the initiation of systemic measures aimed at combating discrimination against women much earlier in European countries, gender inequality persists in Europe. The European Institute for Gender Equality [EIGE] (2022) reported a gender equality index score for the EU in 2022 at 68.6%, which is only 5.5 points higher than in 2010. This indicator, measuring the gender gaps over time, has deteriorated in terms of employment and access to economic and financial resources during the last decade. The progress in unpaid care and

household production during the COVID-19 pandemic period has especially slowed down or even reversed in particular member countries. These aspects translate and contribute to the pension gap, as modern pension systems are based on the accumulated capital. Moreover, the minimum benefits or the state pension depend on the number of years worked as well. The shape of the pension system is crucial but not the sole factor of the retirement situation of women. It is the derivative of the structure of the system and women's life course decisions regarding their labor market attachment. These decisions may result from one's own choices, may be culturally conditioned, but also influenced by systemic solutions of childcare.

The aim of our research is to explore the identification of factors (other than the pension system) that influence the gender gap in pensions. In general, the factors that determine the gender pension gap can be classified in two main categories (Dessimirova & Bustamante, 2019): the employment history characteristics of someone, and the pension systems and policies of a country. The first group is consisted of factors such as the years in employment, the work intensity and the remuneration while the second group is consisted of policies such as career break compensations or penalties on early retirement. The main factors of the gender pension gap identified in the literature include the status in the labor market (Dessimirova & Bustamante, 2019), potential breaks related to motherhood (Betti et al., 2015; Jędrzychowska et al., 2020) and social roles (as care givers) (Samek Lodovici et al., 2016). We focus on broadly understood motherhood and professional activity related factors as they affect the labor force participation which directly translates into these women pension accumulated capital. We are aware that the pension system itself is not directly tackled in our research, but we primarily contribute by focusing on other crucial determinants, usually less pronounced in the research. In particular, we focus on the selected (more on that later) factors:

- the life cycle and demography,
- the pathways of professional activity,
- systemic support for childcare.

At the same time, in the selection of parameters in the above groups, we focus on what was more focused on the situation of mothers, not women in general. However, because our area isas we examine the pathways of professional activity, where there is no maternal-centric data, we took advantage of the gender difference.

We argue that, if countries with similar demographic and social conditions exhibit significant differences in the retirement situation of women compared to men, it may indicate that the design of the pension system can change the rules of the game. Conversely, ongoing demographic and cultural-social changes in the area of selected factors are insufficient to equalize retirement opportunities for women and men. Therefore, it is necessary to explore possibilities for changing pension systems to achieve this equality. To achieve the aim of the article we analyze European countries using the method of Ward clustering, followed by a homogeneity analysis of the groups regarding the pension situation of women and men.

It's supposed to allow to identify dependencies between the professional activity and variables related to having (lifestyle and demography) and caring for children (systemic support), and further – to classify European countries on the basis of those factors. In the analysis, we omit elements of the construction of the pension system in different countries due to the significant differentiation of detailed components, which requires further research.

2. Women pension gap – literature review

The gender pension gap is defined a situation where women's and men's retirement outcomes differ in terms of the amounts paid. Sometimes an additional gap distinction is even made. Differences in the average pension savings between women and men of working age and differences in the average pension income of women and men who have already exceeded the retirement age are pointed out (Cribb et al., 2023). It should be emphasized that the problem of lower pensions affects mostly women and it is present in European countries (Vara, 2013). Although the gender pension gap is narrowing, its level is still alarmingly high (in 2021 in the EU 27 it was 27.1%), but significantly diversified in European countries (from 3.5% in Estonia to 41.5% in Malta – data for 2021)[1].

Recognition of the gender pension gap as a socio-economic problem revealed the need to close it. Therefore, attempts have been made to identify the reasons for the emergence and persistence of the pension gap, which allowed for the conclusion that there is a whole bunch of such factors (OECD, 2021; Niessen-Ruenzi & Schneider, 2022).

Construction of the pension system may affect the women pension gap both as a stimulant and a destimulant (Storelli & Williamson, 2015; Kuivalainen et al., 2020). The key importance is whether the elements of the system are based on the principle of defined benefit or defined contribution (Ponthieux & Meurs, 2015). Another very important factor explaining the differences in the formation of the gender pension gap is the adopted model of the pension system: Beveridgean or Bismarckian (Lannoo et al., 2014). Crepaldi et al. (2011) indicated that defined contribution schemes are less favorable to women, as are Bismarckian systems. Undoubtedly, however, the construction of pension systems in most EU countries contributes to the existence of a significant relationship between the length of working activity and the level of pension (Dewilde, 2012; Veremchuck, 2020). The analysis of the gender pension gap should also take into account the way of indexing pensions (Chłoń-Domińczak, 2017). In turn, differences in retirement age contribute to the deepening of the gender pension gap (lower age for women – in 2021, the gender "inequality" persists in Albania, Belarus, Moldova, Romania and Poland (after the initial compensation in 2013, the lower retirement age for women in Poland was restored in 2018)). It should be pointed out that there are compensating elements for interruptions in professional work caused by the performance of caring responsibilities (e.g. including periods of maternity, parental and childcare leave as seniority, payment of contributions for these periods, marriage pension, inheritance of contributions, etc.). Möhring (2015) studied 13 European countries and provided evidence that for men there is little variation between countries, but for women the strength of the relationship between employment history and retirement income varies from country to country and may be largely mitigated by factors related to the adopted model of the pension system. Another very important factor influencing the level of the gender pension gap is the guaranteed basic pension regardless of employment history (Jefferson, 2009; Lis & Bonthuis, 2019).

When analyzing the differences in the courses of professional life of women and men, it is necessary to recall studies indicating that the gender pension gap is a derivative of the gender pay gap (Veremchuck, 2020; Cordova et al., 2022). On the other hand, Betti et al.

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[1] Source: Gender pension gap by age group – EU-SILC survey, last update: 17.03.2023 (Eurostat, n.d.).

(2015) showed that there is no relationship between these two phenomena that would be easy to interpret. In turn, the strong relationship between the gender pension gap and differences in labor market histories (which means in a broader sense than just the gender pay gap) occurs even in Finland, where relatively strong gender-equal policies on the labor market are observed (Kuivalainen et al., 2020). The conclusions of the research conducted by Bonnet et al. (2022) on French pensioners show that the gender pension gap is fundamentally due not only to wages, but also to differences in contribution periods. Samek Lodovici et al. (2016) emphasize the more general relationship that differences from the labor market translate into the later picture of the gender gap in pensions. Analyzing the gender pension gap, Crystal et al. (2017) refer to the concept of cumulative advantage and disadvantage introduced in the early 1990s, according to which the economic effects of women's weaker attachment to the labor market, motherhood and lower wages accumulate over the life cycle, reducing women's pensions and increasing the pension gap. Also Dekkers et al. (2022) point out that the consequences of these inequalities are perpetuated and may even be reinforced during a person's lifetime, which results in a higher level of the pension gap than the wage gap. In this context, it is worth mentioning that the women's pension gap is more than twice as large as the women's pay gap in the EU 27 (27.1% vs 12.7% in 2021)[2]. In addition, the over-representation of female employment in sectors with lower wage levels, such as education or health, should be taken into account (Blau & Kahn, 2017; Boniol et al., 2019). At the same time, there is the phenomenon of the glass ceiling, which is an invisible barrier preventing women from advancing to higher positions, and the phenomenon of the sticky floor, when female-dominated occupations are permanently assigned to the lowest income level, which is associated with the lack of a career development path (Ciminelli et al., 2021). On the other hand, it is also noted that part-time work or atypical forms of employment, which are often performed by women in order to combine caring responsibilities and employment, but also a greater commitment to household chores than men, are associated with lower earnings and, consequently, lower pension entitlements (Fouarge & Muffels, 2009; Gerber, 2022). Looking from a slightly broader perspective, a shorter duration of working life due to caring responsibilities and differences in the retirement age of men and women is noticeable, which is related to the social perception of women as the main carers of a children.

It is worth emphasizing that the differences in the course of professional life of women and men are also largely related to socio-cultural factors affecting the gender pension gap. Burkevica et al. (2015) indicated that childcare and other care activities can widen the pension gap, especially where childcare is not only too expensive, but also of insufficient quality, inadequate or even unavailable. In such a situation, mothers are somehow forced to stay at home with their children. Similar conclusions were reached by Kreyenfeld and Hank (2000), who analyzed the problem of institutionalized childcare in western Germany. Frericks et al. (2006) found an association between the lack of childcare in the Netherlands and women's career breaks and part-time employment, which made it more difficult for women to meet occupational pension entitlements. It should also be borne in mind that the need to incur the costs of institutional childcare may limit or completely stop making payments to voluntary pension contributions (Prabhakar, 2017), and additionally in many cases these costs are not shared

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[2] European Commission (n.d.).

between both parents, but covered only by women. The situation may be aggravated by the lower level of women's financial education, which affects their financial decisions (Hasler & Lusardi, 2017; Cupák et al., 2018). In addition, an important group of problems classified as socio-cultural factors are various types of stereotypes, leading to educational differences (e.g. in science), which result in pay differences (Picatoste et al., 2023). The gender pension gap is influenced by stereotypes and expectations regarding the scope of unpaid household work (higher for women) and the scope and intensity of professional work. Lack or insufficient legal solutions regarding the fair distribution of the pension capital accumulated during the relationship in the event of divorce are also noteworthy (Böhmer & Schinnenburg, 2018).

The majority of the above-mentioned factors influencing the gender pension gap are strongly related to the fact that a woman has at least one child. The literature even uses the term "motherhood penalty" (Kahn et al., 2014; Möhring, 2018). In this context, the differences between the typical configuration of the life cycle of mothers and non-mothers or men are pointed out. In general, mothers tend to have shorter lifetime employment and are more likely to work part-time and in lower paid jobs. In addition, despite increasing maternal employment rates, these rates are still insufficient to achieve fair retirement incomes paid by pension schemes. Of course, there are a number of systemic solutions aimed at compensating the motherhood penalty by equalizing the differences, but as can be seen in the EU countries, the gender pension gap still exists.

3. Methodology and data

We perform the quantitative analysis by applying Ward's method to the cluster analysis. Data refer to four points in time: 2005, 2010, 2015 and 2020; and were retrieved from Eurostat, OECD, The World Bank. We standardize data for better comparability and weights to balance the number of variables in groups.

The Ward's method (minimum variance, sum of squares, incremental sum of square clustering) is an example of hierarchical cluster analysis (Ward, 1963). This type of method works within an agglomerative procedure, one can also control the classification process. The outcome of the analysis is most often presented in dendrograms, which explicitly show how the groupings are formed.

The starting point is classifying each object into a separate class. Next step involves the algorithm looking for objects most resembling each other (those with the smallest distance), which are combined into one new class. The distances between newly formed classes are computed. The procedure is repeated until only one class remains in the sample. Particular methods differ due to different methods for computing distance between the objects. The Ward algorithm is based on analysis of variance between the objects (Gatnar & Walesiak, 2004).

When we refer to the Ward method, if the classes P_p, P_q are the most similar ones, then if $p < q$, then in the next step the combined classes are reformed into class p and the subsequent ones are enumerated consecutively. The distance between $P_p \cup P_q$ which was formed due to combing P_p, P_q and other classes is computed in the following manner (Gatnar & Walesiak, 2004):

$$d\left(P_p \cup P_q, P_r\right) = \frac{w_p + w_r}{w_+} \cdot d\left(P_p, P_r\right) + \frac{w_q + w_r}{w_+} \cdot d\left(P_q, P_r\right) - \frac{w_r}{w_+} d\left(P_p, P_q\right),$$

where: r – the class number; $d(P_p, P_r)$ – previous distance between the classes p and r (and analogously $d(P_q, P_r)$ and $d(P_p, P_q)$); w_p, w_q, w_r – frequency of the previous classes: p, q and r respectively, and $w_+ = w_p + w_q + w_r$.

Once grouping is finished, the dendrogram is drawn, which shows the distances between the classes, the order of combining the classes and the composition of particular classes. By manipulating the distance, we can determine the number of classes. There are a few ways to identify the optimal distance value:

- silhouette index (Kaufman & Rousseeuw, 1990),
- Davies-Bouldin index (Davies & Boudin, 1979),
- Dunn index (Dunn, 1973),
- elbow method (Thorndike, 1953).

In research was have chosen the last method which involves plotting the explained variation as a function of the number of clusters and selecting the bend (elbow) of the curve as the number of clusters to use. In the article, we also generated and used a step dendrogram, which suggests that individual objects are quite distant and the given moment of class division is correct. To assess the quality of the classification result obtained, a synthetic measure proposed by Rousseeuw (1987) – silhouette index has been calculated. This measure allows for the measurement of the correctness of the classification of individual objects into classes, the correctness of class distinction, as well as the relative compactness and separability of classes, meaning the overall quality of classification. It is expressed by the formula:

$$S\left(i\right) = \frac{b\left(i\right) - a\left(i\right)}{\max\left[a\left(i\right); b\left(i\right)\right]}, \tag{1}$$

where: consider t groups, A and B are any two groups from this set of groups; n_A – number of elements in cluster A; $a(i)$ – average dissimilarity of object i to all other object of cluster A (cluster A contains other objects apart from i);

$$a\left(i\right) = \sum_{k \in A} \frac{d_{ik}}{n_A - 1}, \tag{2}$$

$b(i)$ – dissimilarity of object i to all other clusters

$$b\left(i\right) = \min_{B \neq A}\left\{d_{iB}\right\}, \tag{3}$$

d_{iB} – average dissimilarity of object i to all other object of cluster B

$$d_{iB} = \sum_{k \in A} \frac{d_{ik}}{n_B}. \tag{4}$$

Which is a measure of how well object i matches the actual clustering comparing to cluster B.

Then, the average of $S(i)$ is calculated for a given cluster, i.e. the value:

$$S\left(P_A\right) = \sum_{i \in A} \frac{S\left(i\right)}{n_A}. \tag{5}$$

Then the average value for all clusters, which can constitute an assessment of the entire clustering result:

$$S(P) = \sum_t \frac{S(P_t)}{t}. \tag{6}$$

The method's author indicates that for similarities, it is advisable to apply a modification of measure (1), in which the max function is used for the distance $b(i)$. Then, the measure $S(i)$ is denoted as $S'(i)$.

$$b'(i) = \max_{B \neq A} \{ d_{iB} \}. \tag{7}$$

This indicator takes values from the range $<-1; 1>$, with higher values indicating a higher quality of classification.

Given that the difference in the situation of women in Europe in the analyzed area is not drastically different between countries, with objects being quite similar, we also used the aforementioned modification. Since in each of the analyzed years the classification results included single-element classes, for which the silhouette index algorithm arbitrarily assumes a value of 0, potentially underestimating the results, both indicators were calculated in two ways: for all obtained classes and excluding single-element classes.

3.1. Variables

Initially, we identified 14 factors that could have potentially determined the retirement situation of the mothers (Table 1). We chose a subsample of them to exemplify the scope of the differentiation in socio-economic aspects of gender pension gap. We computed the Pearson correlation coefficient to avoid duplication of information. We assumed the maximum acceptable correlation coefficient at the level of 0.7. The occurrence of quasi-constants was also checked. Two variables showed a coefficient of variation (CV) of less than 10%.

A major problem in the study conducted was the availability and comparability of data for the countries taken for analysis. The authors decided to use 3 reliable databases (Eurostat, OECD, World Bank). The authors realize that more relevant variables could be used (e.g., age of labor market entry), but such data are not published for the appropriate group of countries for the study.

We considered it appropriate to leave one of the two variables, D2 and D3, one of L3 and L4, and one of S1 and S2. D3 was rejected because the most significant decline in maternal labor force participation occurs when the first child arrives. Variable L3 was left in as this variable is consistent with the others in this category. It shows the share of women in the relevant population (here, part-time workers). The variable S1 was left as it was considered that a faster return to work would be regarded as by a mother who can already give her child to the nursery.

We examined how these covariates evolved in different European countries in the next step. The charts are included in the appendix and the analysis is presented below. Variables have been standardized and grouped (squared Euclidean distance).

Table 1. Variables (source: own study)

Category		Variables [source]
the life cycle and demography	**D1**	**Total fertility rate [Eurostat]**
	D2	Mean age of women at childbirth [Eurostat]
	D3	**Mean age of women at first childbirth [Eurostat]**
	D4	**Estimated average age of women access to labor market, own definition: Effective retirement age [OECD] – duration of working life [Eurostat]**
the pathways of professional activity	**L1**	**Percentage of women among people with tertiary education [Eurostat]**
	L2	**Percentage of women in managers (15 to 64 years) [Eurostat]**
	L3	**Percentage of women among part-time employees (15 to 64 years) [Eurostat]**
	L4	Percentage of women working part-time (15 to 64 years) [Eurostat]
	L5	**Gender pay gap [Eurostat]**
	L6	Duration of working life for women [Eurostat]
systemic support for childcare	**S1**	**Children in formal childcare or education by age group 0–3 (% of population) [Eurostat]**
	S2	Children in formal childcare or education by age group 4–15 (% of population) [Eurostat]
	S3	**Paid maternity + parental leave in weeks [World Bank]**
	S4	**Public benefits for children, own definition: total public benefits / number of children (0–19) / average wage**

Note: the covariates bolded remained in the study.

3.1.1. The life cycle and demography

Variable 1: Total fertility rate

It is assumed that a fertility rate between 2.10 and 2.15 is a value that ensures simple replacement.

The number of children affects the career progression of women in various countries, primarily in terms of career breaks and the total tenure and pension capital.

Ireland, France, and Iceland have had historically a rate at this level, but lately (in 2020), none of the countries under study have such a rate. The values of this rate are low, over the years, counting 2005 to 2020, 16 countries had an increase. Only four countries (Czechia, Germany, Romania, and Slovakia) having an increase in each analyzed year of the survey relative to the previous analyzed moment. In contrast, there was a decrease in 13 countries, with year-on-year declines in Denmark and Luxembourg. In 2020, the highest fertility rates were in France (1.83), and Romania (1.8), and the lowest in Malta (1.13), and Spain (1.19).

Variable 2: Mean age of women at birth of first child

The moment when a woman decides to have her first child also significantly affects her career progression, impacting its slowdown.

This is the only variable that increased in all countries during the study period. The most significant increase was observed in Lithuania and Estonia, and the smallest gain of 0.3 years was observed in Germany. On average, the soonest women become mothers in Bulgaria

(26.4 years), Romania (27.1 years), and Slovenia (27.2 years), the latest in Switzerland, Spain, and Italy – over 31.

Variable 3: Estimated average age of young women access to labor market

This variable was included in the study because the length of employment before the birth of the first child and the woman's professional position mitigate the impact of career breaks associated with maternity leave. The greater the work experience a woman accumulates before having a child, the more stable her professional position and the easier her return to work.

This is one of important lifetime milestones. The soonest transition to work age is observed in Iceland (in 2020 – 20.8) and the latest in Italy (in 2020 – 34.9). Six countries show a significant decrease in transition to work age Cyprus, Luxembourg, Spain, Greece, Malta (here, a reduction of 8.5 years), or Ireland. In contrast, there was a delay in women starting work in, e.g. Bulgaria (the most significant increase – by 3 years), Latvia, Slovakia, Finland, Iceland or Ireland. In 2010, in Malta, women only started work at an average age of 39.2, while at the earliest (2005) in Iceland, at 19.8.

3.1.2. The pathways of professional activity

Variable 1: Percentage of women among people with tertiary education

In international comparisons regarding the level of education, the main indicators focus on measures describing two extremes: individuals with the lowest educational attainment and those with the highest, primarily at the tertiary education level. Among the variables characterizing the level of education in different countries, we have chosen higher education as the most differentiating and influential on career progression.

In only two countries surveyed (Germany and Switzerland), fewer women than men have tertiary education, 46% in 2020. In the remaining countries it was the opposite case – the highest proportion in Lithuania and Estonia (63%) and Portugal (61%) in 2020.

Variable 2: Percentage of women in managers

According to Eurostat data, occupations such as managers and professionals allow for above-average earnings, which translates into the accumulation of pension capital (both in the social security system and in the private pillar).

In none of the countries surveyed do women form a majority of managers. The smallest gap is in Hungary, where women accounted for 47% in 2020. Although an increase in this variable can be observed in most countries, it is not the rule, e.g. Malta (down from 43% in 2005 to 37% in 2020). The lowest share is in Luxembourg (25% in 2020), but it's increasing.

Variable 3: Percentage of women among part-time employees

Part-time work directly affects the size of pension capital. In the case of women, due to their more frequent caregiving responsibilities, part-time work occurs more often than in men.

This variable shows that women in all countries (except for Romania, 44% in 2020) account for more than half of part-time workers. There is also no homogeneity in the change in the

value of this covariate, as countries such as Cyprus, Sweden, Denmark, or Luxembourg show a decrease in percentage share of women among part-time employees. Still, countries such as Bulgaria, Slovenia, Hungary, and Ireland experience increase in this indicator.

Variable 4: Gender pay gap

This variable was included in the study due to its direct impact on the pension gap.

One can watch a trend towards reducing the gender wage gap in the countries analyzed. The gap is the lowest in Luxembourg at 0.7% in 2020; in 2005 – 10.7%. Only ten countries achieved level the wage gap of maximum 10% in 2020. The largest decreases in the variable were observed in Cyprus (from 21.8% in 2005 to 9% in 2020) and Iceland, from 24% to 13%. The highest gender pay gap was in Latvia (22.3% in 2020), which is further increasing.

3.1.3. Systemic support for childcare

Variable 1: Children in formal childcare or education by age group 0–3

This variable describes the possibility of a mother's quick return to work after childbirth, continuation of her professional career, and achieving higher wages.

This indicator shows what percentage of children up to the age of three is in nursery care. The value of this indicator has been increasing in most countries. The most significant increase was observed in Luxembourg, from 22% in 2005 to 63% in 2020. But this is not a general rule either because, e.g in Germany, the variable took on values of respectively: 16%, 20%, 26%, and 16%. The Netherlands had the highest value in 2020 (68%), while Czechia and Slovakia the lowest (just 5%).

Variable 2: Paid maternity + parental leave in weeks

This variable is not unambiguous; it can affect the timing of returning to work, which may complicate this return. A longer break results in a larger gap in pension capital. On the other hand, in many countries, pension contributions are made for these periods (no gap in pension capital), but a gap in professional career arises.

The longest paid break in employment is found in Portugal (162 weeks), followed by Czechia (between 2005 and 2010, reduction from 184 to 131 weeks, but it is still the second highest value). On the other hand, there is a large group of countries whose paid leave is at most 20 weeks: 11 in Portugal, 14 in Switzerland, 15 in Slovenia and Belgium, and 16 in Spain, Luxembourg, and the Netherlands. Just as in Czechia, the length of leave in Germany was reduced from 108 weeks to 57 weeks between 2005 and 2010. In Poland, between 2010 and 2015, leave was extended almost three times from 18 to 52 weeks.

Variable 3: public benefits for children

This variable describes the level of financial support for childcare, which can lead to a faster return of mothers to work after childbirth and continuation of their professional careers, achieving higher wages. Additionally, it may affect the fertility rate

This is an indicator of the percentage of public expenditure on childcare per child on average. This value has been related to the average salary in the economy to ensure comparability between countries. An outlier is Luxembourg, with a value almost eight times higher than in

Cyprus or Malta. In countries such as the UK, the Netherlands, and Sweden, outlays on children are relatively constant over the years surveyed. The changes are in different directions. For example, in Bulgaria, from a low value in 2005, it increased in the following years to fall in 2020 to a similar level as at the beginning. In Poland, on the other hand, there is a significant increase in social benefits per child from 5% of the national average to around 21%[3].

4. Results

After calculations in the Statistica, classification trees were obtained as shown in Appendix, based on the chart of the binding distance against the stages of binding, it was determined that the division into classes will be carried out at the level of 40. This gave the division results, which are included in Table A4 in Appendix. The classification validation results for individual years are presented in the Table 2.

Table 2. Values of silhoutte index (source: own calculations)

	Silhouette index for all classes				Silhouette index excluding single-element classes			
year	2005	2010	2015	2020	2005	2010	2015	2020
S(P)	0.308527	0.345477	0.294086	0.308552	0.385658	0.414572	0.352903	0.370263
$S(P)_{modified}$	0.617012	0.66173	0.62301	0.654332	0.771264	0.794076	0.747612	0.785199

The result obtained, ranging from 0.29 in 2015 to 0.35 in 2010, indicates that in none of the analyzed years was a strong class structure achieved. The silhouette index, when excluding single-element classes, varies between 0.35 in 2015 and 0.41 in 2010. This suggests that there are many objects that are between classes – these are countries that are similar to one group in some respects and to another in different respects – which is described in more detail in the later part of the article, in the interpretation of the results.

As a result of calculating the modified silhouette index, significantly higher values were obtained, for all classes ranging from 0.61 in 2005 to 0.66 in 2010, and after excluding single-element classes, ranging from 0.74 in 2015 to 0.79 in 2010. Such values indicate the presence of a substantial class structure, thus providing a much better assessment of classification quality.

Due to the values of the silhouette index in its basic version, it was decided to take a closer look at the classification results and expertly analyze what characterizes countries that, in the analyzed years, always (in all 4 years of analysis) or often (in 3 out of 4 years of analysis) appeared in the same groups, as described in more detail in the later part of the article.

The Figure 1 shows the countries that in all 4 classifications (in each year of the analysis: 2005, 2010, 2015, 2020) were in one group ("always together") – on the left, and those that were at least three times in one group ("often together") – on the right – discussed in details below.

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[3] This may be due to the introduction of a social program in 2016 (expanded in 2019), under which caregivers receive a monthly amount of about €113 (increased to about €181 from 2024) for child-related expenses.

In addition, Figure 2 shows the gender pension gap values for 2010 and 2020 in individual European countries. We present this information with the aim of laying the groundwork for further analysis of the issue in article.

Always together

Often together

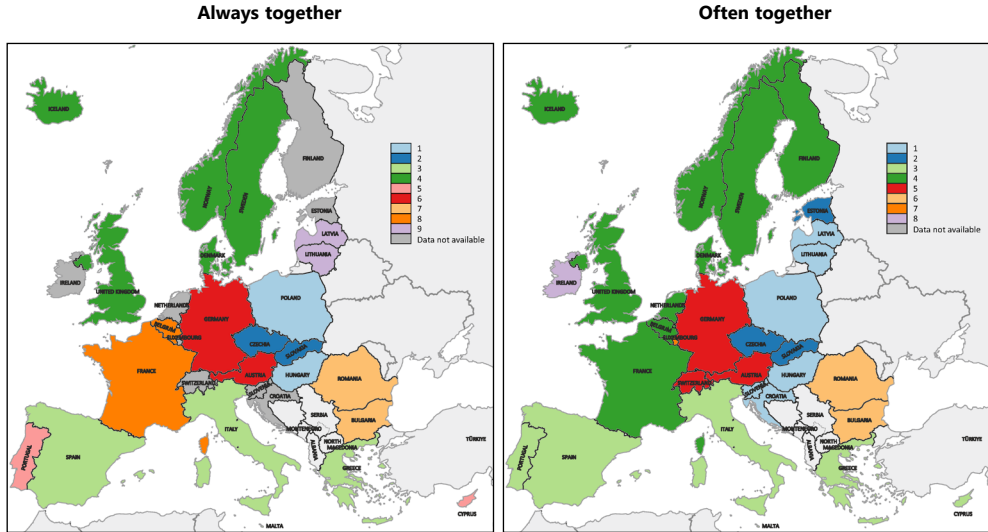**Figure 1.** Countries classification results (source: own calculations, maps drawn using EuroStat IMAGE)

Gender pension gap in 2010
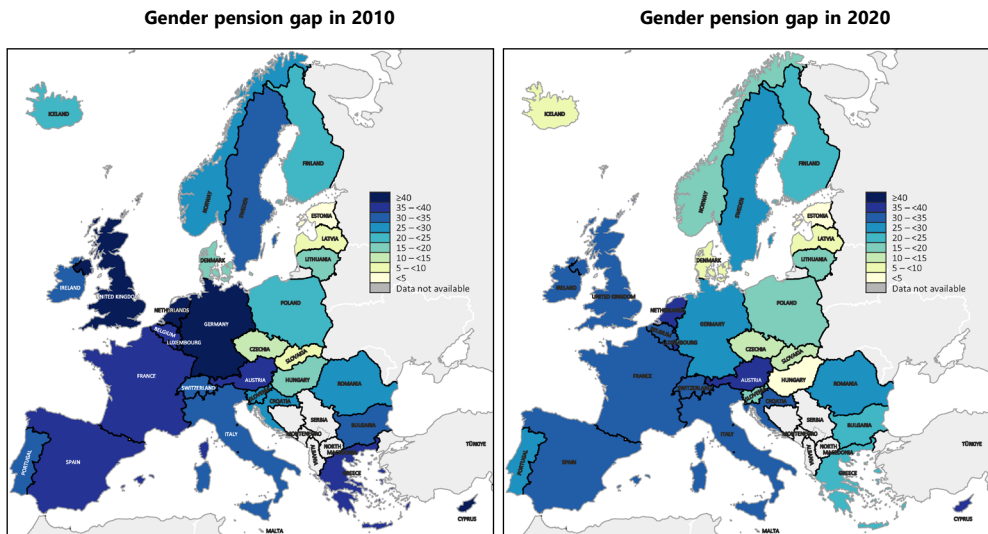
Gender pension gap in 2020

Figure 2. Gender pension gap in 2010 and 2020 (source: Eurostat database)

4.1. Southern European countries (Greece, Spain, Italy, Cyprus, Malta, Portugal) – light green

What distinguishes these countries:
- The lowest fertility rates – in 2020, the average only 1.3 children per woman.
- Relatively late age of women's entering the labor market – 29.1 (33.7 in 2005).
- The percentage of women in managers, in 2020 has an average value compared to other groups, but in 2005 and 2010 was the highest.
- 70% of women working part-time.
- Very short paid maternity and parental leaves – 16.9 weeks (less only in Luxembourg).
- The lowest benefits for children. Cyprus had a much higher rate than countries in the group, 15–16%, then a drop to 6%, Malta and Greece much lower, 4–5% only, then an increase.
- Only 20% of children in formal childcare in 2005, but 33% in 2020. This is a substantial variation e.g. in Greece there has been a threefold increase to 22% in 2020, in Malta a six fold increase, from 5 to 30%, in Portugal a rise from 30 to 53%, in Spain from 37% to 46%, but in Cyprus and Italy a stable level.

The age at which the first child is born is similar to Western Europe – aged over 30.

The percentage of women among people with tertiary education is 56% at the level of Western Europe. The pay gap is about 9% (12% in 2005) – an average level compared to other groups, but Italy stands out firmly – only 4–5%, meanwhile, Malta and Portugal increased, with the other countries halving.

The pension gap is now 32–33%. It varies from 23.5% in Greece (36.5% in 2010) to 39.3% in Malta (double the 2005 figure). The pension gap is still high in Cyprus (44.8% in 2015, currently 36%, previously ca. 40%), for Spain and Italy – between 31 and 35%.

4.2. Western and Northern European countries (Belgium, Denmark, France, Netherlands, Finland, Sweden, Iceland, Norway, United Kingdom) – green

What distinguishes these countries:
- Relatively high fertility rate (1.6 in 2020, down from 1.8 in 2005).
- High average age at birth of first child 29.3.
- Low age of entering the labor market – at 25.
- High formal childcare ratio – 56% in 2020.
- High gender pay gap (from 18.7% in 2005 to 13.7% in 2020) – higher only in the German-speaking countries and central Europe groups.

The average proportion of women among: people with tertiary education is 55%, managers – slightly above the average, part-time workers – at the average level.

Average level of the length of paid leaves (over 30 weeks), however varies enormously within the group (CV 45–49%), from 15–16 weeks in Belgium, France, the Netherlands and Norway (at the same time, these countries have a very high number of children in formal care) to over a year in Denmark and Finland. The average level of public benefits for children is 15% – the Netherlands has the lowest (6–7%), the highest in Denmark, Norway and Finland (around 20%).

The pension gap was about 24% in 2020 (down from over 31.5% in 2010), but this figure also varies enormously within the group. Denmark and Iceland have low levels (7% and just under 5.5%), this is a halving of the 2005 figure. There is around 20% now in Norway, drop from 32.5% in 2005. Similarly, in Finland 20.3% in 2020, 25% in 2005. By contrast, the pension gap is 30% or more in the rest of the group. There is only little reduction of the gap over time, except in the UK – a drop from 45% in 2005 to 34% today, which is still high.

4.3. German-speaking countries (Germany, Austria, Switzerland – mostly German-speaking) – red

What distinguishes these countries:
- The age at which the first child is born is over 30.
- The inhabitants of these countries have a long working life – entering the labor market early or working for a long time.
- The lowest percentage of women among tertiary educated (47% in 2020, up from 40% in 2005), but the highest value of the share of women among managers (41%).
- Very large percentage of women as working part time (currently 80%, down from 84% in 2005).

The fertility rates are similar to Central European countries. In terms of gender pay gap, it is an almost homogeneous group (18.5% in 2020, down from 22% in 2005), the highest value among all groups.

22.7% of children are in formal care, which is slightly higher than in central Europe, with significant increase in Austria from 4% in 2005 to 21% in 2020. Paid leaves lasts an average of 46.3 weeks (reduced from almost 72 weeks in 2005) – again close to the Central Europe, but varies enormously within the group, in Switzerland only 14 weeks, in Germany 57 weeks and in Austria 68 weeks (reduced from 108 in Germany and from 93 in Austria). The benefits for children are 18%, again similarly to Central Europe, only Luxembourg has higher (37%). It has a value of only 8% in Switzerland, 19% in Austria and 26% in Germany – which means high CV.

The pension gap has been reduced from 38% in 2010 to 33% in 2020. In the analyzed period the value of this variable was unfavourable for female residents in Germany, in 2005, 2010 and 2015 it was above 40%, fall to less than 30% in 2020. At the same time, in Austria and Switzerland, this variable is still about 30%.

4.4. Central European countries – 1 (Croatia, Latvia, Lithuania, Hungary, Poland, Slovenia) – light blue

What distinguishes these countries:
- Around 60% of those with tertiary education are women – the highest average value.
- On average, 65% of part-time workers here are women – quite low.
- Only 21.3% of children are in formal childcare. The CV was 73% in 2010 and 53% in 2020. The situation is quite good in Slovenia (44%), but in other countries, the value is at least half of that, the worst in Poland (2 to 5%) and Hungary (currently 11%, previously lower). The situation regarding the length of paid leaves also differs (CV 38–49%),

the average at 46 weeks. From in Slovenia (15 weeks – stable), through 30 in Croatia (fell from 59 in 2005), to 52 in Poland (increased from 16). In the other countries it's stable – about a year.

This is a group of countries with levels of three variables similar to those in German-speaking countries: fertility rates, paid holidays, and benefits for children. The fertility rates are now 1.5 (in 2005 the lowest value in groups – 1.3). Also the average age of birth of the first child is lower in 2010, 2015 and 2020 compere to first year of analysis, at 28.2 years old (up from 26 in 2005). The average age of starting work is almost constant at 27.4 years old.

The proportion of female in managers is not high, only 35%. Hungary and Slovenia stand positively out, except for Lithuania, all countries show an upward trend. The value of the gender pay gap is moderate (12%), but the CV is 53%, varies from Poland and Slovenia (around 3.1%), to 22.3% in Latvia in 2020.

The average benefits for children are around 16% in 2020 (observed increase and homogenising over time – decrease in CV).

The pension gap is about 15.3% in 2020 (a reduction from 19.5% in 2010), and shows significant disparities among countries. In 2020, the lowest value is 2.6% in Hungary (decrease from around 15%), while the highest, over 30%, is in Croatia (up from 26%), in Latvia fluctuates between 8.5% and 16.8%, in Lithuania, downs from 19.7% in 2005 to 15% in 2020, in Poland, a slight reduction, from 24% to over 19%. On the other hand, Slovenia is halving from over 31% to 16.3% in the last year of analysis.

4.5. Central European countries 2 (Czechia, Estonia, Slovakia) – dark blue

What distinguishes these countries:
- The longest paid leaves – av. 126 weeks, reduced in Czechia from 184 to 131 weeks, in Slovakia extended to 162 weeks, in Estonia extended to 86 weeks. Public benefits for children are slightly lower than in central Europe 1, in Estonia and Slovakia increasing.
- Low number of children in formal childcare, only 12% in 2020, earlier even less than 6%, except for Estonia, where it's 27% in 2020.
- High gender pay gap (from 26% in 2005 – the highest, to almost 18% in 2020 – the second highest, after the German-speaking countries).

Czechia and Slovakia were classified four times in this group of countries, and Estonia three times. The demographic factors are similar to those Central European countries. Differences can be observed in the other two groups of variables, e.g. a lower proportion of women with tertiary education.

Interestingly, these are countries with the lowest pension gap – 8%. In Estonia it has fallen from 6% in 2005 to just 1.1% in 2020, Czechia and Slovakia remains stable (11–12%).

4.6. Eastern European countries (Bulgaria, Romania) – bright orange

What distinguishes these countries:
- Fertility rates are the highest, currently 1.7 (1.4 in 2005).
- Women have first child the earliest in Europe – this occurs at the age of 26.6, while they are the latest to enter the labor market – at the age of 32.2, presumably after "rearing" children.

- What draws attention is late entry into the labor market and small percentage of children in formal care, in 2020 only 11% (in Romania 7–8%, in Bulgaria, twice as much, 15–16%).
- The lowest share of women among part-time workers, only 48%.
- Both countries have long (almost 108 weeks) paid leaves (longer are only in Czechia and Slovakia).
- Public benefits for children are low – 12%.

The percentage of women among university graduates is similar to Western and Southern Europe, among managers – similar to Central Europe (34%).

The pay gap is not high, from 12.7% in Bulgaria, to 2.4% in Romania in 2020, and decreasing (from average 10% in 2005 to 7.6% in 2020).

The pension gap is high: 31% in 2010, 42% in 2015, and 23.6% in 2020. In Romania, a record high of 55% was recorded in 2015. In Bulgaria, it has been reduced from 35% in 2005 to 22% in 2020, but this is still relatively high.

4.7. Luxembourg – dark orange

What distinguishes this country:
- Among the demographic variables, one has to look at the fertility rate falling from 1.6 in 2005 to 1.4 in 2020 – this is one of the lowest levels in Europe.
- Luxembourg's female residents are the latest to give birth to their first child – at an average age of 31.1, this rate for Luxembourg was the highest in Europe in all analyzed periods.
- The current age of entry into the labor market is 27.6, down from 34.4 in 2005.
- The percentage of women among highly educated is 50% – it is now the lowest, just after the German-speaking countries.
- The percentage of women among managers is currently the lowest (only 25%, but more than 16% in 2005).
- The rate of women among part-time employees is very high – 80% (and even 92% in 2005).
- Notably Luxembourg has the lowest gender pay gap – only 0.7%, decreased from 10.7% in 2005.
- There have been significant changes in the formal childcare, in 2005 it was only 22% children in formal childcare or education, in 2020, it is 63%. This may be related to the shortest paid childcare leave in Europe, only 16 weeks, similar to Belgium, France, the Netherlands and Norway (lower only in Switzerland, with 14 weeks). Attention is also drawn to the high public benefits for children, as high as 37% in 2020.

In Luxembourg, the gender pension gap is very high, at 37.7 % in 2020 (47.3% in 2010).

4.8. Ireland – heather colour

What distinguishes this country:
- The fertility rate is currently at 1.6 but have fallen sharply from 1.9–2 in previous periods.
- The average age of becoming mother is now 30.7, the second highest age among European countries after Luxembourg.

- Additionally women are late accessing the labor market – assessing at 30.3 years old, before even at 35 years old in 2005 (similar trend to Luxembourg).
- Attention is drawn to the low rate of women among managers – 28% – the second lowest result after Luxembourg.
- Public benefits are low, at just 10% (in 2005 and 2010 over 12%).

The percentage of women among highly educated and women among part-time employees and also gender pay gap (11.3% in 2020, 17% in 2005) is at the level of Western European average.

The percentage of children in formal care is currently at the level of 23% – similar to German-speaking countries and Central Europe (decrease from 31% in 2015 to 29% in 2020). The length of paid leaves is 26 weeks, slightly less than the Western European average. The pension gap is relatively high, currently 31%.

5. Conclusions and discussion

In the article, we have made an attempt to identify how factors, other than the pension system, describe the scope of the gender pension gap. The research usually focuses on the pension system design. We, in turn, have tried to analyze to what extent other factors explain the difference in the gender pension gap if we keep the pension system itself aside. Our aim was to signalize the differences and similarities in certain aspects with respect to currently observed gender pension gap, although being aware that it is the result of past career of current retirees. This approach has undoubtful merits, since it can emphasize usually intangible and unobservable cultural aspects. Moreover, although the data refer to gender dimension, out emphasis was put on motherhood aspects and we have tried to draw conclusion from this perspective. We are aware of the limitations in the study resulting from the analysis of factors concerning the situation of mothers in the period of professional activity and comparison with the pension gap indicator reflecting the situation of current retirees. In addition, there is a non-standard pandemic period in our study period (2020), which may affect data, e.g. on childcare. Accounting for these issues, we have formulated the following conclusions.

The first thing that draws attention when we analyze countries that have often been classified into the same group is their similar geographical location and similar cultural heritage, e.g. language (like in German-speaking countries) or a long period of common history (e.g. Czech Republic and Slovakia). This may indicate that socio-demographic factors, the approach to the division of social roles, including caring responsibilities or women's participation in social life, are variables that are deeply rooted in tradition. Similar correlations can be observed with regard to variables describing systemic support, which also seems to be strongly culturally conditioned. It seems that the inclusion of variables describing, e.g. religion or the level of religiousness of the society in subsequent studies may be interesting.

Factors from the first group (demographic), indicate very clearly the division of the European countries into two subgroups: first including Western, Northern and Southern Europe and second – Central and Eastern Europe. First of all, it can be seen in fertility rates and mean age of women at first childbirth. In Western, Northern and Southern European countries women give birth later – over or around 30 and moreover fertility rates decrease; and in Cen-

tral and Eastern European countries – between 26.5 and 28 years of age, while fertility rates increase slowly there. In this respect, German-speaking countries are closer to the countries of Central Europe than Western Europe.

Similar differences can be seen in the difference in age at which women enter the labor market, although here, the south of Europe differs significantly from the West and North. German-speaking countries, however, are closer to the Western European approach.

Such clear divisions between the countries are no longer visible in the factors from the second group - labor market. Clearly better educated than men are mainly women from Central Europe, at the opposite extreme are women from German-speaking countries, which in turn stand out from other groups of countries with a high percentage of women among managers and part-time workers. This variable, in turn, may be the result of the level of employment flexibility, including regulations. The gender pay gap is high in German-speaking countries as well as in the Czech Republic, Slovakia and Estonia, while in the countries of southern and central Europe is low. It is worth emphasizing that this does not translate into a gender pension gap at all, which indicates that factors other than just pay differences are important.

Further clear geographical divisions can be seen in the analysis of factors from the last group, which refers to the systemic support for childcare. In the countries of Central and Eastern Europe and German speaking countries, the dominant model seems to be in which mothers stay at home with their children for a long time. Support in the form of formal childcare is very weak, breaks in professional career are long, and are partly compensated by long paid leaves. The exact opposite approach prevails in the west and north of Europe, but the high percentage of women working part-time may suggest that although returning to work after childbirth is faster, it is not common to work full-time. It is therefore difficult to predict how one or the other approach will affect the gender pension gap, which requires further analysis. Of course, it is worth remembering that the pension gap is calculated for people who are currently retired, so its values are a consequence of the situation from years ago, they do not fully reflect the current situation.

A very low pension gap can be observed in such countries as the Czech Republic, Slovakia, Estonia, and not very high in other Central European countries. High values are the domain of German-speaking countries, Western and Southern Europe as well as Bulgaria and Romania. In the last two of these countries, this seems to be a consequence of late entry into the labor market and long maternity breaks. In German-speaking countries and Luxembourg, it may result from low intensity of professional work (a lot of part time), differences in earnings and education of women and men.

In the countries of Western Europe, it is a bit more difficult to find unambiguous reasons, the more so that this group is internally quite diverse, but here positive trends can be observed, i.e. a decrease in the pension gap. Central European countries stand out the most here, however, especially the Czech Republic, Slovakia and Estonia. It is worth noting here that the pension systems of these countries, until the 1990s and even longer, were quite similar, typical of post-communist countries, based on the defined benefit structure, and were (partially) reformed at the end of the 1990s. For example, the Czech system is a two-pillar system where the first pillar is a DB system, while many European countries' systems have

moved towards defined contribution systems. In several countries of Central Europe, e.g. in Poland, Hungary or Slovakia, several years after the reforms, the second pillar, i.e. mandatory pension funds, was (partially or completely) withdrawn, while the principles of the first pillar are very diverse (e.g. in In Poland, there are almost no elements based on DC, apart from the minimum pension). Denmark and Iceland also belong to the countries differing positively from the rest of the group in terms of the pension gap. It is worth emphasizing that these are countries whose pension systems are at the forefront of rankings (e.g. Mercer Global Pension Index or Allianz Pension Index). This inspires further analysis.

The authors are aware of the limitations in the study resulting from the analysis of factors concerning the situation of mothers in the period of professional activity and comparison with the pension gap indicator reflecting the situation of current retirees. In addition, there is a non-standard pandemic period in our study period (2020), which may affect data, e.g. on childcare. In the scope of further research, it is also necessary, in our opinion, to consider that policy interventions create incentives, cultural factors change slowly, and the system plays a significant role. Hence, we assume that only a combination of all factors can more effectively reduce the gap.

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Authors contribution

AJ – conceptualisation, data curation, investigation, methodology, visualization, writing original draft, writing review and editing. IK – conceptualisation, funding aquisition, investigation, project administration, writing original draft, writing review and editing. EP – conceptualisation, data curation, investigation, methodology, visualization, writing original draft, writing review and editing. EC – funding aquisition, investigation, writing original draft, writing review and editing. EG-B – conceptualisation, methodology, writing original draft, writing review and editing.

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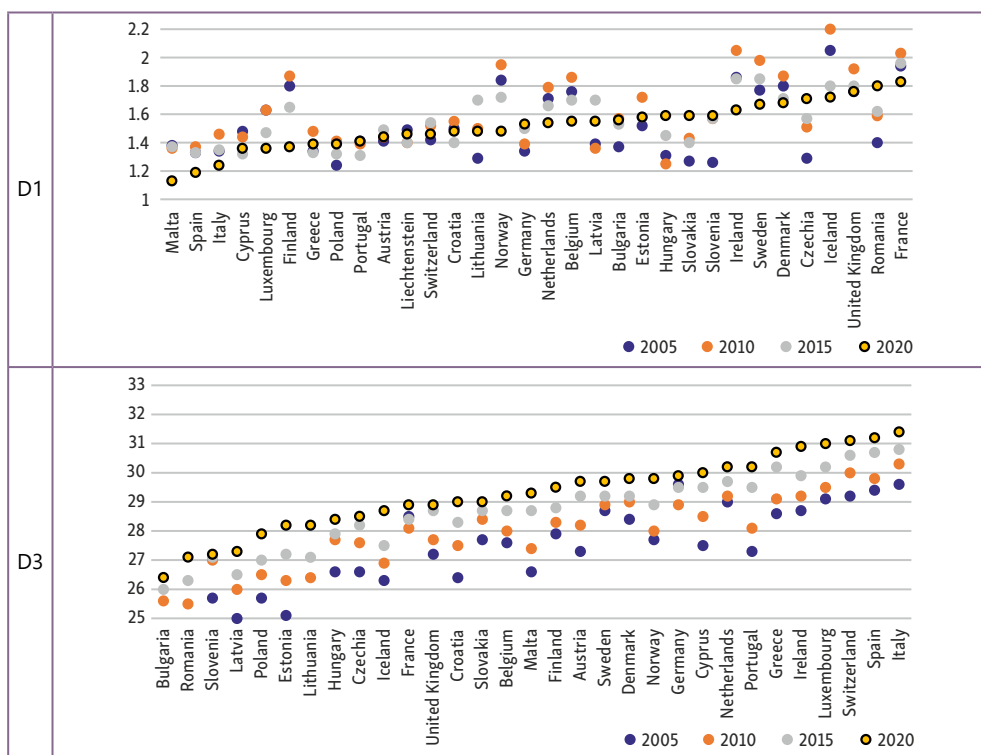
APPENDIX

Table A1. Result table – green is the lowest value and red is the highest value

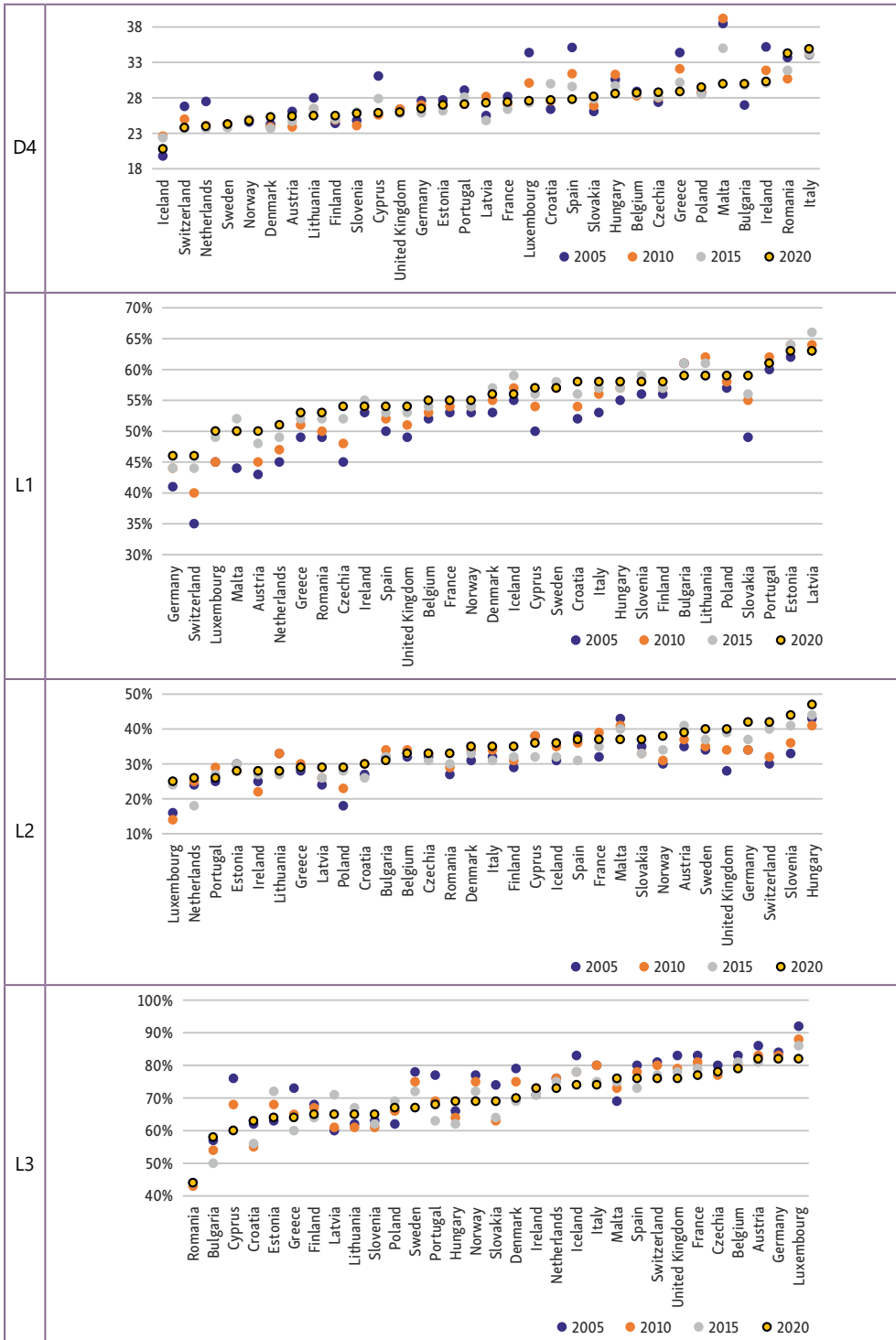|	Variable	Year	Croatia Latvia Lithuania Hungary Poland Slovenia	Czechia Estonia Slovakia	Greece Spain Italy Cyprus Malta Portugal	Belgium Denmark France Netherlands Finland Sweden Iceland Norway United Kingdom	Germany Austria Switzerland	Bulgaria Romania	Luxem-bourg	Ireland
D1	Total fertility rate	2005	1.3	1.4	1.4	1.8	1.4	1.4	1.6	1.9
		2010	1.4	1.6	1.4	1.9	1.5	1.6	1.6	2
		2015	1.5	1.5	1.3	1.8	1.5	1.6	1.5	1.9
		2020	1.5	1.6	1.3	1.6	1.5	1.7	1.4	1.6
D3	Mean age of women at first childbirth	2005	26	25.8	28.2	27.9	28.7	24.7	29.1	28.7
		2010	27.1	27	28.9	28.2	29	25.6	29.5	29.2
		2015	27.6	27.5	29.9	28.8	29.8	26.2	30.2	29.9
		2020	28.2	28	30.3	29.3	30.2	26.6	31.1	30.7
D4	Estimated average age of young women access to labor market	2005	27.3	27.1	33.7	25.4	26.8	30.4	34.4	35.2
		2010	27.8	27.3	31.6	25.2	25.3	30.3	30.1	31.9
		2015	27.6	27.4	30.8	24.9	24.8	30.9	27.3	30.1
		2020	27.4	28	29.1	25.2	25.2	32.2	27.6	30.3
L1	Percentage of women among people with tertiary education	2005	57%	52%	51%	53%	40%	55%	45%	53%
		2010	59%	56%	54%	54%	43%	56%	45%	54%
		2015	60%	57%	55%	55%	45%	57%	49%	55%
		2020	59%	59%	56%	55%	47%	56%	50%	54%
L2	Percentage of women in managers	2005	30%	32%	34%	30%	33%	30%	16%	25%
		2010	32%	31%	35%	33%	34%	32%	14%	22%
		2015	32%	31%	32%	33%	39%	31%	24%	27%
		2020	35%	33%	33%	36%	41%	34%	25%	28%
L3	Percentage of women among part-time employees	2005	62%	73%	75%	76%	84%	51%	92%	80%
		2010	62%	69%	72%	75%	82%	48%	89%	72%
		2015	64%	69%	67%	73%	80%	49%	83%	69%
		2020	65%	70%	70%	71%	79%	48%	80%	72%
L5	Gender pay gap	2005	12.2%	26.3%	13.1%	18.7%	22.3%	10.1%	10.7%	17.2%
		2010	9.4%	23%	12.2%	17.1%	21.4%	10.9%	8.7%	13.9%
		2015	11.8%	23%	12.0%	15.5%	20.5%	10.6%	4.7%	13.9%
		2020	11.9%	17.8%	9.1%	13.7%	18.5%	7.6%	0.7%	11.3%
S1	Percentage of children in formal childcare or education by age group 0–3	2005	11.5%	5.7%	20.5%	41.1%	15%	12%	22%	20%
		2010	15%	8.7%	23.2%	45.3%	18.3%	7%	36%	29%
		2015	17%	8.3%	27.3%	48.7%	26%	9%	52%	31%
		2020	21.3%	12.3%	33%	56%	22.7%	11%	63%	23%
S3	Paid maternity + parental leave in weeks	2005	44.7	137.3	16.9	30.7	71.8	112	16	26
		2010	40.2	125.1	16.3	31.9	54.7	112	16	26
		2015	45.9	125.1	16.9	32.4	54.7	107.7	16	26
		2020	45.9	126.6	16.9	30.3	46.3	107.7	16	26

	Variable	Year	Croatia Latvia Lithuania Hungary Poland Slovenia	Czechia Estonia Slovakia	Greece Spain Italy Cyprus Malta Portugal	Belgium Denmark France Netherlands Finland Sweden Iceland Norway United Kingdom	Germany Austria Switzerland	Bulgaria Romania	Luxem-bourg	Ireland
S4	Public benefits for children	2005	25%	11%	8%	15%	15%	10%	31%	12%
		2010	14%	15%	9%	15%	16%	15%	37%	12%
		2015	13%	14%	7%	15%	17%	12%	36%	10%
		2020	16%	15%	8%	15%	18%	12%	37%	10%
	Gender pension gap	2010	19.50%	8.70%	33.30%	31.60%	38.00%	31.20%	47.30%	34.60%
		2015	18.10%	7.70%	33.40%	28.00%	37.60%	42.20%	34.20%	30.20%
		2020	15.30%	8.20%	32.00%	24.10%	33.10%	23.60%	37.70%	31.30%

Table A2. Variables used in the analysis – countries and years
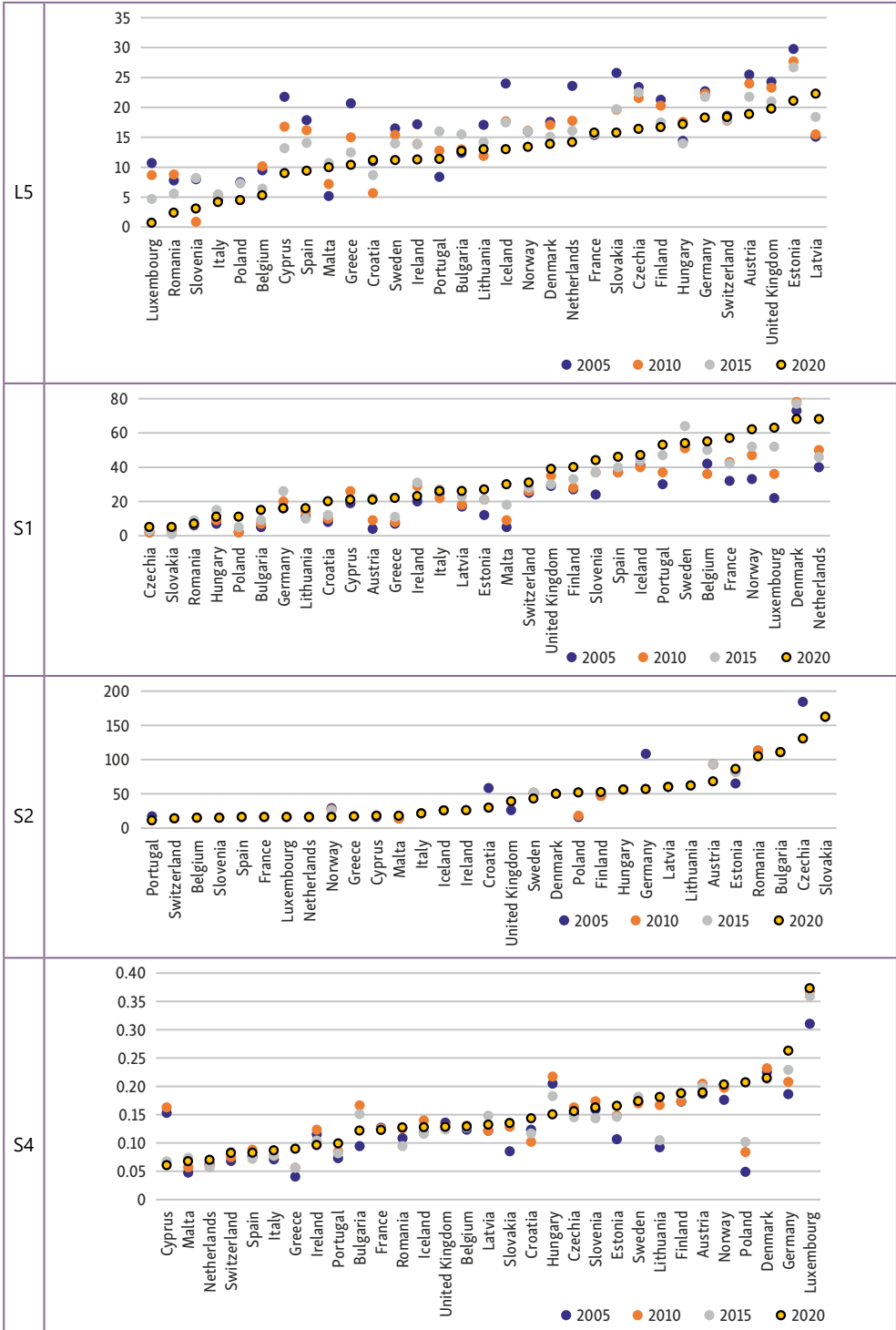
Continue of Table A2

End of Table A2

L5 — Scatter plot showing values (0–35) by country with years 2005, 2010, 2015, 2020.

S1 — Scatter plot showing values (0–80) by country with years 2005, 2010, 2015, 2020.

S2 — Scatter plot showing values (0–200) by country with years 2005, 2010, 2015, 2020.

S4 — Scatter plot showing values (0–0.40) by country with years 2005, 2010, 2015, 2020.

Table A3. Classification results – Statistica
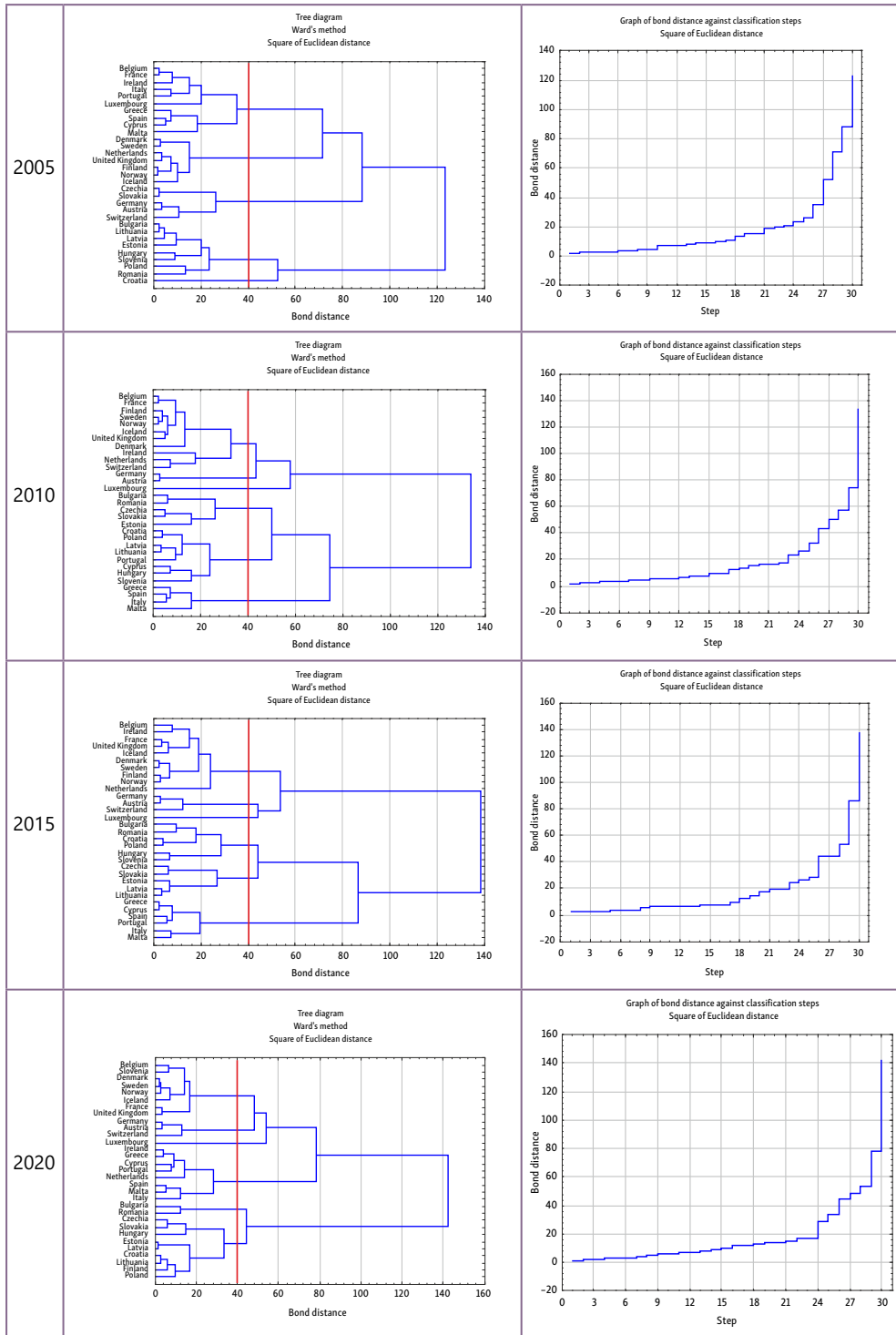
Table A4. Classification results

	1	2	3	4	5	6
2020	Croatia Czechia Estonia Finland Hungary Latvia Lithuania Poland Slovakia	Bulgaria Romania	Belgium Denmark France Iceland Norway Slovenia Sweden United Kingdom	Austria Germany Switzerland	Cyprus Greece Ireland Italy Malta Netherlands Portugal Spain	Luxembourg
2015	Croatia Hungary Poland Bulgaria Romania Slovenia	Czechia Estonia Latvia Lithuania Slovakia	Belgium Denmark France Iceland Norway Sweden United Kingdom Ireland Netherlands Finland	Austria Germany Switzerland	Cyprus Greece Italy Malta Portugal Spain	Luxembourg
2010	Croatia Hungary Latvia Lithuania Poland Cyprus Portugal Slovenia	Czechia Estonia Slovakia Romania Bulgaria	Belgium Denmark France Iceland Norway Sweden United Kingdom Switzerland Finland Ireland Netherlands	Austria Germany	Greece Italy Malta Spain	Luxembourg
2005	Bulgaria Romania Estonia Hungary Latvia Lithuania Poland Slovenia	Croatia	Denmark Iceland Norway Sweden United Kingdom Finland Netherlands	Austria Germany Switzerland Czechia Slovakia	Belgium France Cyprus Greece Ireland Italy Malta Portugal Spain Luxembourg	