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ANALYSIS OF INEQUALITIES THROUGH THE LENS OF THE MEMBER STATES OF THE EUROPEAN UNION

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Abstract

Addressing gender inequalities at work is an area of interest for the European Commission. Among the important pillars of the National Recovery and Resilience Plans are aspects related to the reduction of these inequities. The purpose of this paper is to analyse the level to which these gender differences are present within each member country of the European Union in order to determine the proportion in which states can fulfil their promises to reduce inequalities. Eliminating or at least the reduction, of gender disparities is a problem discussed not only through the lens of the European NextGenerationEu project, this being debated worldwide through Agenda 2030, as a Sustainable Development Goal. As a result of the research carried out, it was observed that for all member states the percentage of male persons who are employed is higher than that of female persons. In addition to this, in most of these states, there are much higher percentages of young females who are neither working nor in a training/education program compared to males.

Keywords: Inequalities, Sustainable Development Goals, Unsupervised Shape Recognition, Cluster Analysis

Introduction

Gender equality and the reduction of inequalities (in all its forms) represent important aspects that we want to achieve worldwide, this fact being supported by the 2030 Agenda, where two of the 17 objectives have these two concepts as their theme (United Nations, 2015). At the EU level,

through the NextGenerationEU plan, through the "Make it Equal" pillar, policies that promote equality in all its forms are supported, including gender equality by promoting women's empowerment (EU, 2022).

The purpose of this paper is to determine the level at which the EU countries are regarding gender inequality, to observe the discrepancies between the member states regarding indicators such as long-term unemployment rate, young female neither in employment nor in education and training, etc.

This article begins by describing in the section dedicated to the literature review the difficulties faced by women at work, but also the fact that people in countries where there are significant differences in the income obtained by men and women tend to underestimate these discrepancies. In the section dedicated to the methodology, elements related to the cluster analysis were discussed because the EU member states will be grouped into different classes, depending on the similarities identified between them. Among the results of the research, it is noted that the grouping of countries in five different classes provides the largest variance between the clusters, and the member states can thus be ranked based on the analysed indicators.

Literature review

The income differences can be noted also from the perspective of age. According to Vlachantoni (2012), 21% of women, compared to 16% of men aged over 65, were at risk of poverty. Based on the employment records, this situation occurred to women due to periods with shorter working hours, with interruptions, but also with lower paid jobs (Vlachantoni, 2012).

Also, energy poverty plays an important role in gender inequality at work. According to a global study, a reduction in energy poverty would have a positive impact on women’s employment opportunities. The reduction of this indicator also seems to lead to the improvement of the percentage of school enrolment for women at the level of primary, secondary and tertiary education (Nguyen & Su, 2021) .

Even in times of crisis, gender inequities at work remain significant, and following a study carried out in Greece (Anastasiou, et al., 2015), after the 2008 crisis, it has been showed that the

drop in GDP led to an increase in the number of unemployed for both genders, but regardless of the economic context, women face with higher unemployment rates.

The job satisfaction paradox shows that even though they work for worse pay and in poorer conditions than men, women seem to be more satisfied with their jobs than men. However, when early exposure to gender equality is taken into account, gender differences in job satisfaction levels diminish. (Perugini & Vladisavljević, 2019).

According to a survey carried out for 28 European states (Faggian, et al., 2023), it can be stated that most states underestimate the real level of income inequalities, the biggest differences being observed for Bulgaria, Italy, Poland and Romania and overestimate this level in countries such as the Czech Republic, Finland, Holland, Slovenia, Sweden. This fact can lead to the application of wrong policies through the prism of people's perception of the inequalities encountered, in the sense in which they can deepen these disparities even more.

The articles described above detail ways in which gender inequalities are visible in the workplace. Precisely for this reason, policies were needed to help equalize the proportion of women and men on the labour market, as well as the incomes obtained by them. Thus, according to a study carried out by Franczak and Margolis (2022), the authors admit that the number of women in leadership positions has started to increase in the last decade, which is a good start to the attempt to equalize gender opportunities.

Methodology

This chapter will describe the main methods used to help visualize inequities at EU level as clearly as possible.

Correlation coefficients are used to determine the relationship that may exist between the data. The most used method is Pearson's because the values are in the range -1, 1. If the value is positive, the relationship between the variables is direct, and if negative, the relationship is inverse. The closer the coefficient values are to the ends of the interval, the stronger the link becomes (Schober, et al., 2018).

Clustering involves the grouping of similar objects into clusters. For the best grouping, it is necessary that the data in the cluster be as similar as possible, and the variance between the clusters

be large (Sinaga & Yang, 2020). One of the most used clustering methods is the K-means algorithm, this fact can be attributed to its simplicity. To determine the distance between objects, the Euclidean distance is calculated, the number of clusters is given by the researcher, and the initial centroids are chosen randomly, which is why the method also has certain disadvantages. Despite the limitations of this algorithm, it is used for its efficiency, flexibility, and ease of implementation. (Ikotun, et al., 2023).

Results

The indicators presented in this section were collected from Eurostat for the year 2022, with the exception of part-time employment as percentage of the total employment for young people by sex, where the last available year is 2021. The data was used to describe the gender inequalities found in the EU Member States.

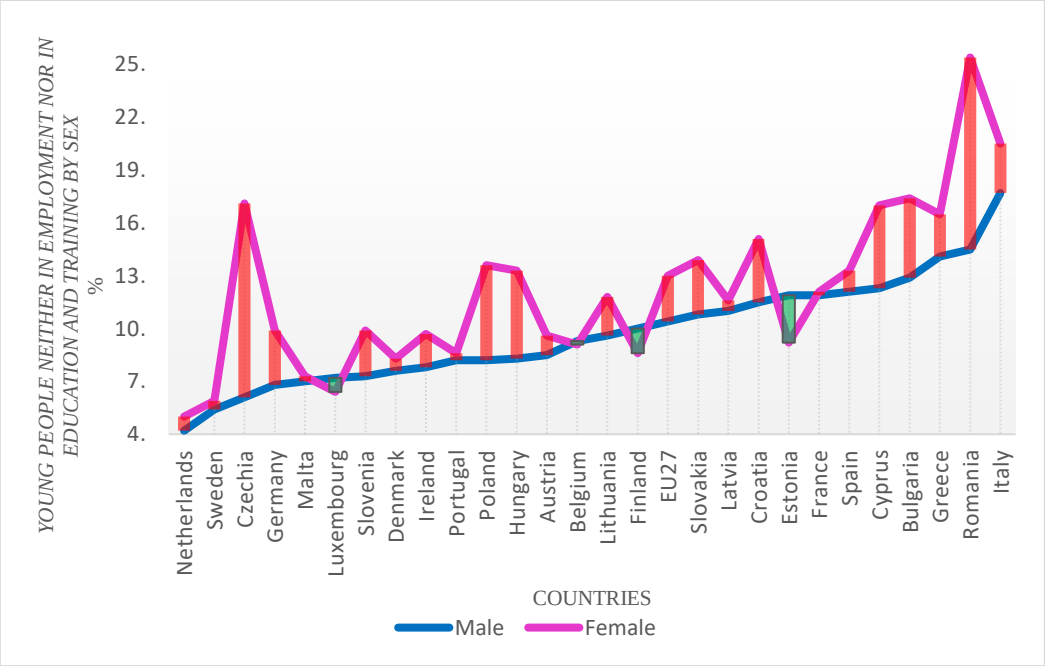

Figure 1: Young people neither in employment nor in education and training by sex

Figure 1 shows that in most European Union states the percentage of young women who are neither in employment nor in education and training is higher compared to that of men, with the exception of Luxembourg, Belgium, Finland and Estonia, where the percentage of women is lower.

The largest recorded differences can be identified in the Czech Republic and Romania, and among the smallest are Malta, Portugal and France.

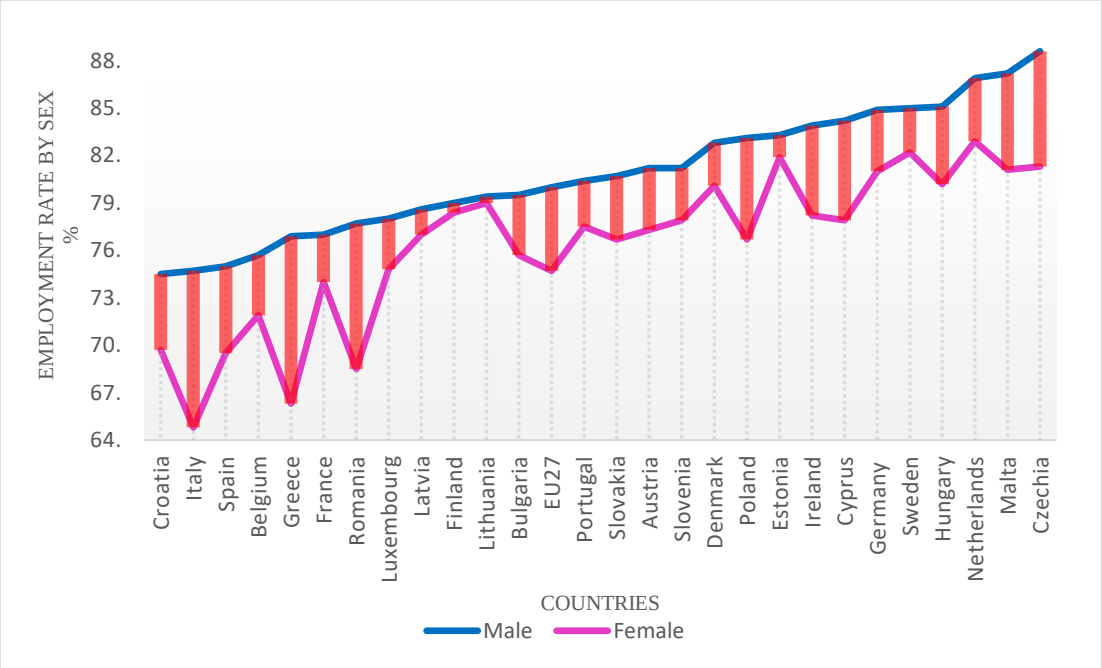

Figure 2: Employment rate by sex

The discrepancies between women and men are all the more evident in Figure 2 where, for all EU member states, the percentage of employed men is higher than that of the opposite sex. The biggest difference identified is attributed to Greece, with 11.6%, followed by Italy with 9.9% and Romania with 9.2%. The countries where the percentages do not show significant differences are Lithuania, Finland, Latvia, Estonia.

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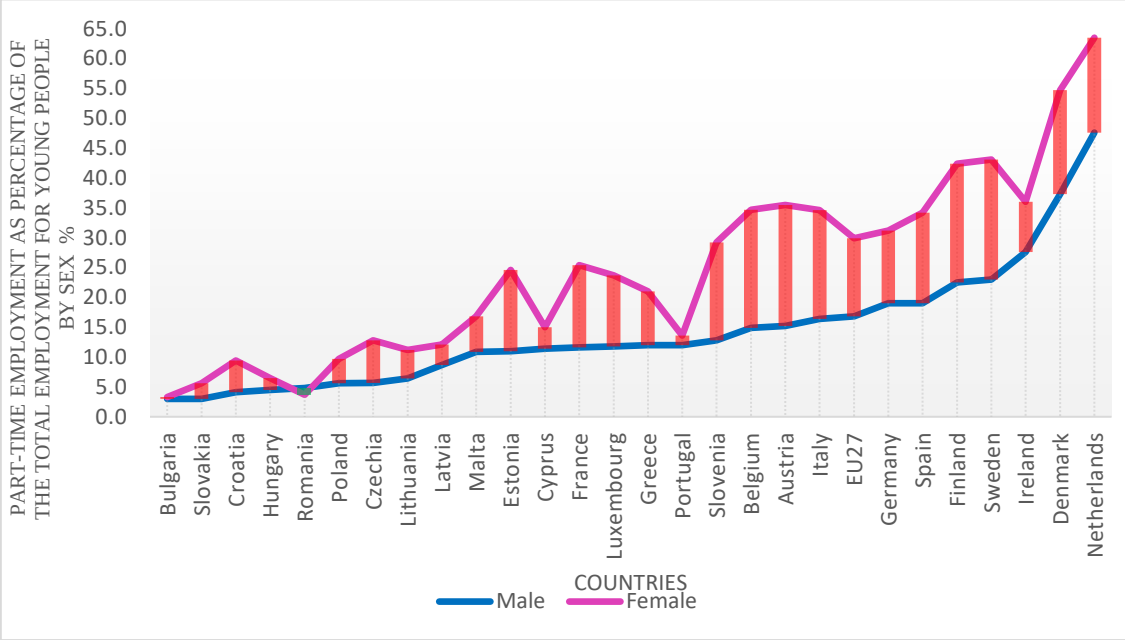

Figure 3:Part-time employment as percentage of the total employment for young people by sex (2021)

If in terms of the number of employed persons men have higher percentages in all EU member states, the situation is the other way around in terms of part-time employment as percentage of the total employment for young people, where apart from Romania, the percentage of women is higher compared to of men; showing that women want to work fewer hours.

Figure 4: Correlation EU27(2015-2022)

Figure 4 shows the correlations between employment rate, young people neither in employment nor in education and training and long-term unemployment rate for the female gender and real GDP per capita for the period 215-2022 at the EU level. One can very clearly note the strong and negative relationship between GDP and young female neither in employment nor in education and training, a sign that if an attempt were made to identify policies to support young women to obtain a professional qualification or for their employment, the increase of the real GDP

per capita would be a guaranteed one. Also, the fact that they are neither studying nor employed leads to long-term unemployment among women (direct and strong link between the two variables of 0.86).

Figure 5: Correlation Romania (2015-2022)

For Romania, the situation is very similar compared to the EU average, however, the link between long-term unemployment rate and young female neither in employment nor in education and training is stronger, a sign that it is much harder for Romanian women to get a job of work without having a prior qualification or experience in the field of work.

To determine the position of the European Union regarding the role of women in work and education, indicators such as young female neither in employment nor in education and training, tertiary educational attainment, seats held by women in parliament, positions held by women in senior management positions (executives), long-term unemployment rate and employment rate were used. In the following, cluster analysis of European countries will be presented to determine their similarities and perceptions.

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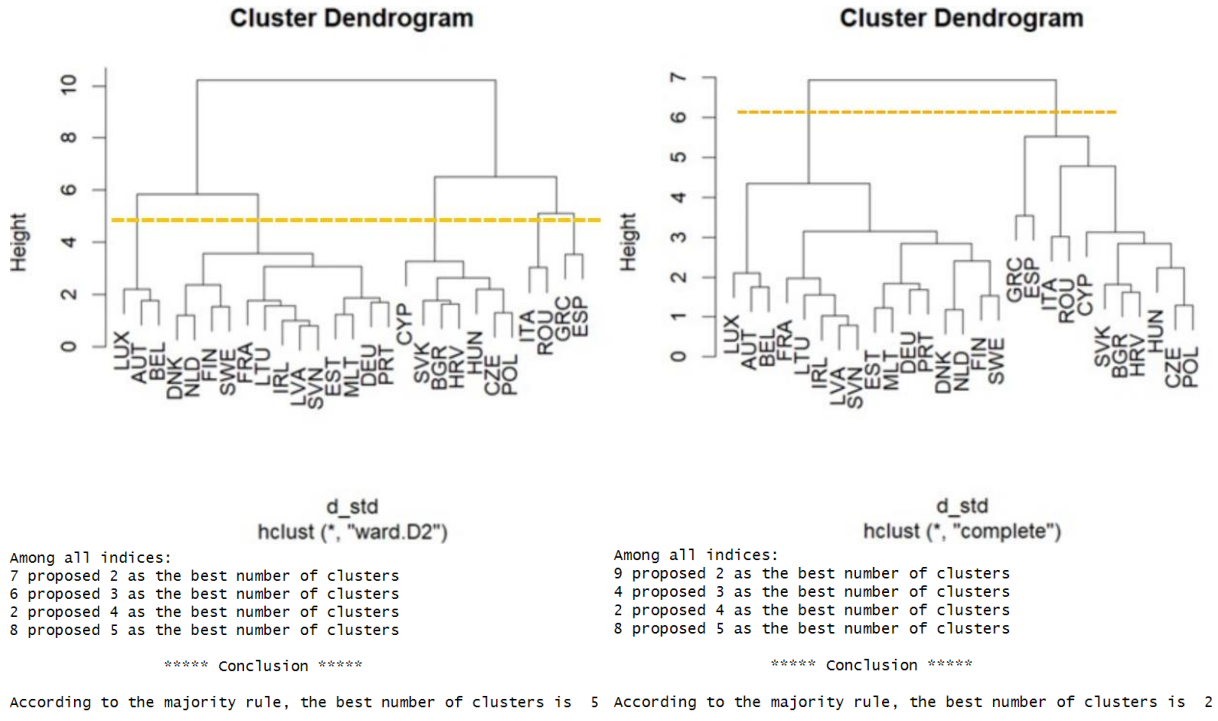

Figure 6: Cluster and indices (methods ward and complete)

After the previously described data were standardized, the Euclidean distance between the states was calculated and the ward and complete methods were applied to degenerate the dendrograms. Using the Nbclust package in RStudio (Charrad, et al., 2014) applied to both methods it is noted that in both cases two or five classes are preferred. However, according to the number of indices chosen to determine the number of classes, five classes are recommended for ward method and only two for complete. The two classes identified using the complete method are divided into two and three classes respectively by the ward method.

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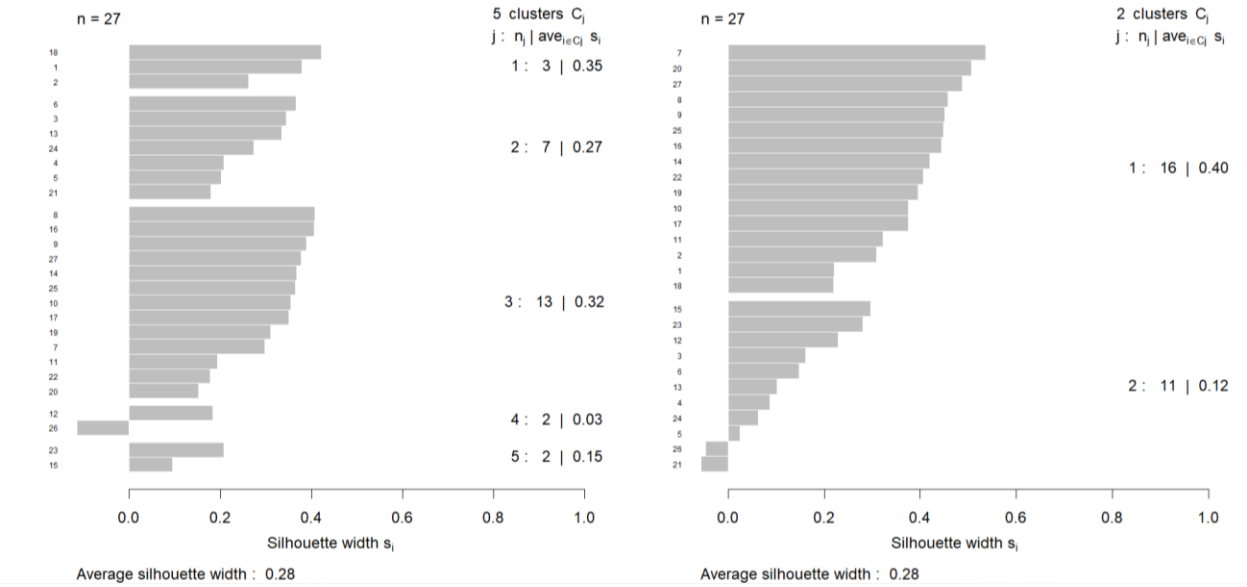

Figure 7: Silhouette

Figure 7 shows the silhouette graphs made for the two previously discussed methods to determine how correctly the countries were grouped into classes. The best way to group the classes is determined by identifying the largest average silhouette width, only in this case, it can be noted that they are equal.

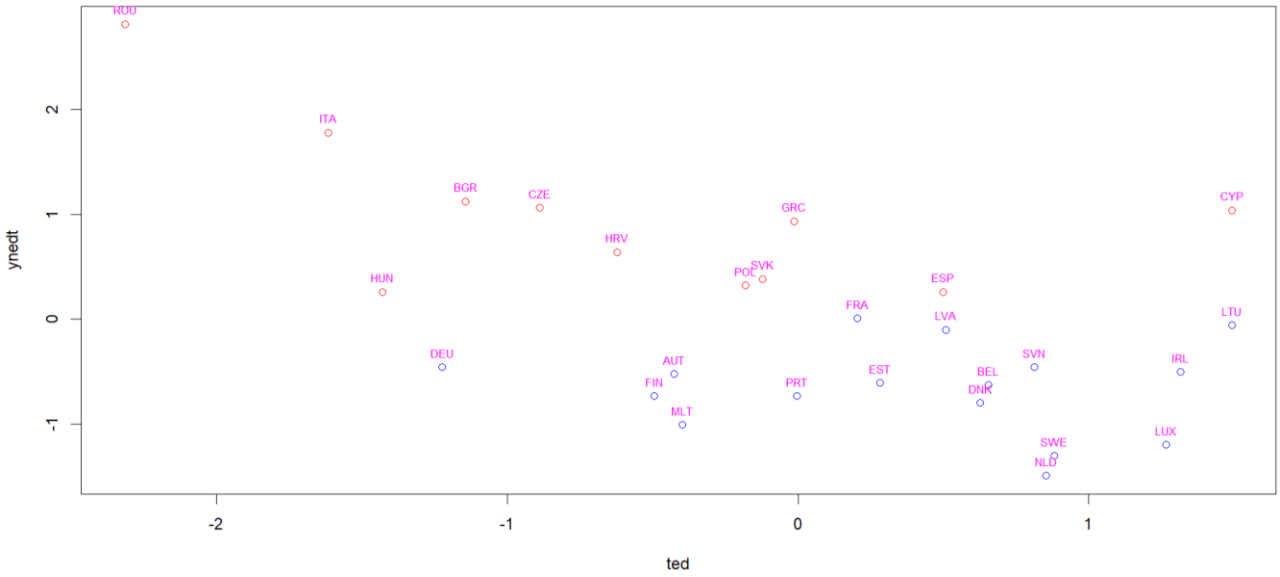

Figure 8: Young female neither in employment nor in education and training and tertiary educational attainment (complete)

Figure 8 shows the delimitation of the countries in the two classes presented in the dendrogram in Figure 6 for the variables young female neither in employment nor in education and training

and tertiary educational attainment. Thus, it is noted that in this case the most noticeable difference between the two classes is related to the first variable, the countries represented in red (Romania, Italy, Bulgaria, Czech Republic, Hungary, Poland, Slovakia, Greece, Spain, Cyprus, Croatia) have a higher percentage of young females neither in employment nor in education and training compared to the other EU member states.

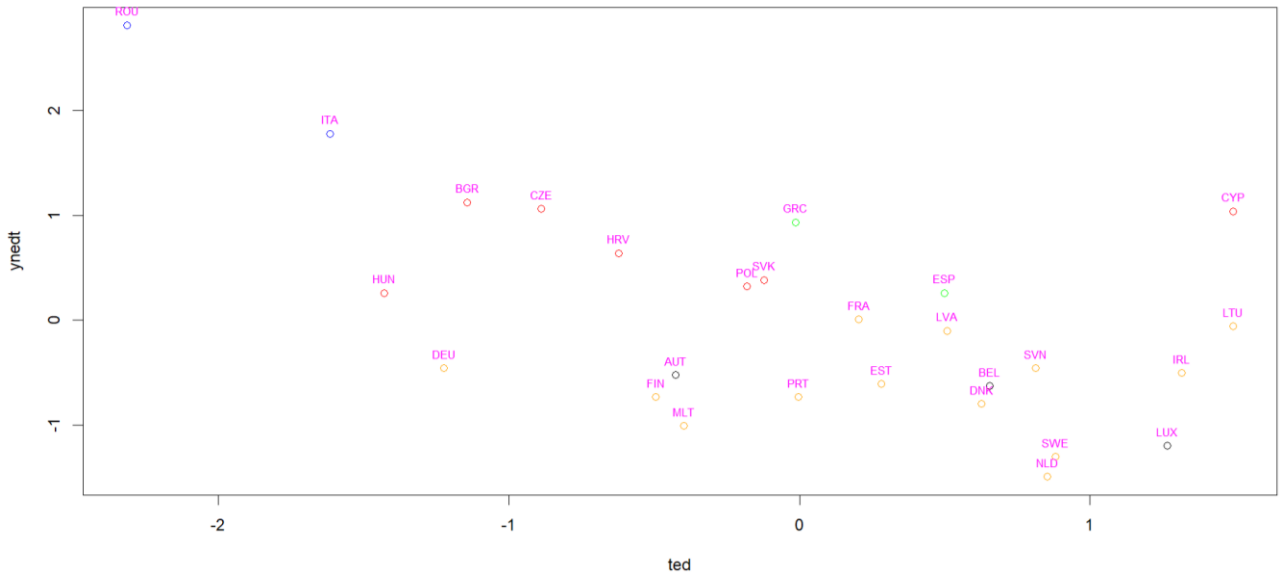

Figure 9: Young female neither in employment nor in education and training and tertiary educational attainment (ward)

For the ward method the two previously discussed classes were divided into five. Thus, according to the data provided in Figure 9, it is noted that Romania and Italy form a class, having the highest number of young female neither in employment nor in education and the lowest values for tertiary educational attainment. Another class consists of Hungary, Bulgaria, the Czech Republic, Croatia, Cyprus, Slovakia and Poland which are characterized by medium to high values for the percentage of young female neither in employment nor in education and training, and with the exception of Cyprus where tertiary educational attainment is high, the other countries show low to medium values for this indicator. Greece and Spain form another class, having average values for both analysed indicators. Austria, Belgium and Luxembourg show a small number of young female neither in employment nor in education and training and medium to high values for tertiary educational attainment. The class with the most numerous countries (Denmark, Holland, Finland, Sweden, France, Lithuania, Ireland, Latvia, Slovenia, Estonia, Malta, Germany and Portugal) is characterized by very low values of the percentage of young female neither in

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employment nor in education and training, having medium to high values for tertiary educational attainment.

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K-means clustering with 2 clusters of sizes 11, 16

Cluster means:
        exec       parl        ted      ynedt         er       ltur
1 -0.4005714 -0.7161561 -0.5765413  0.9637529 -0.7441403  0.5613397
2  0.2753928  0.4923573  0.3963721 -0.6625801  0.5115965 -0.3859211

Clustering vector:
AUT BEL BGR HRV CYP CZE DNK EST FIN FRA DEU GRC HUN IRL ITA LVA LTU LUX MLT NLD
  2   2   1   1   1   1   2   2   2   2   2   1   1   2   1   2   2   2   2   2
POL PRT ROU SVK SVN ESP SWE
  1   2   1   1   2   1   2

Within cluster sum of squares by cluster:
[1] 59.95266 44.00916
 (between_SS / total_SS =  33.4 %)
```

```
K-means clustering with 5 clusters of sizes 7, 2, 13, 3, 2

Cluster means:
        exec       parl        ted      ynedt         er       ltur
1 -0.4299545 -0.9515060 -0.4137493  0.6889125 -0.04659658 -0.1138200
2 -0.2205999 -0.4951085 -1.9649972  2.2939749 -2.18242914  0.6342472
3  0.7319962  0.3788646  0.3729754 -0.6347857  0.65840405 -0.3999830
4 -1.7032219  0.9841594  0.4977580 -0.7830226 -0.12456974 -0.3249862
5 -0.4777020 -0.1134792  0.2421427  0.5954723 -1.74725457  2.8514914

Clustering vector:
AUT BEL BGR HRV CYP CZE DNK EST FIN FRA DEU GRC HUN IRL ITA LVA LTU LUX MLT NLD
  4   4   1   1   1   1   3   3   3   3   3   5   1   3   2   3   3   4   3   3
POL PRT ROU SVK SVN ESP SWE
  1   3   2   1   3   5   3

Within cluster sum of squares by cluster:
[1] 14.900562  4.544749 23.143040  3.918461  6.245215
 (between_SS / total_SS =  66.2 %)
```

Figure 10: Description of classes

Figure 10 shows information about the two ways of grouping countries. The number of countries in each class can be noted, but also how they were allocated, the most important aspect can be found on the last line, being the ratio between the variance between the classes and the total variance. For the best grouping, the variance between the classes must be as high as possible, clearly observing that the best result (almost double) is recorded for grouping into five classes.

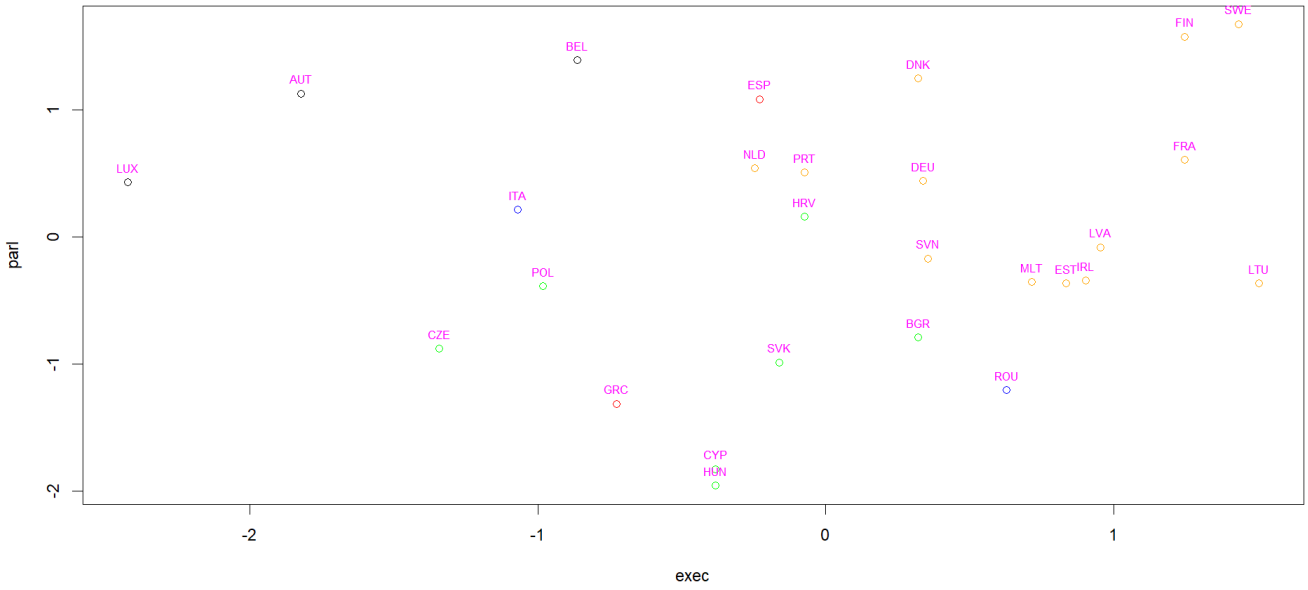

Figure 11:Seats held by women in parliament, positions held by women in senior management positions (executives)

Figure 11 shows that Luxembourg, Austria and Belgium have medium to high percentages of seats held by women in parliament, but small percentages of positions held by women in senior management positions (executives). Greece and Spain present average values, but only for positions held by women in senior management positions (executives). Regarding seats held by women in parliament, the percentage allocated to Greece is small, and that for Spain is very high.

Romania presents high values of the number of positions held by women in senior management positions (executives), but among the lowest for the percentage of seats held by women in parliament, while Italy has a medium to high percentage of seats held by women in parliament and small to medium for the other indicator. The class with the largest number of included countries is characterized by medium to high values for both analysed indicators. Hungary, Bulgaria, the Czech Republic, Croatia, Cyprus, Slovakia and Poland are described as countries with medium values of positions held by women in senior management positions (executives) and low to medium values for the number of seats held by women in parliament.

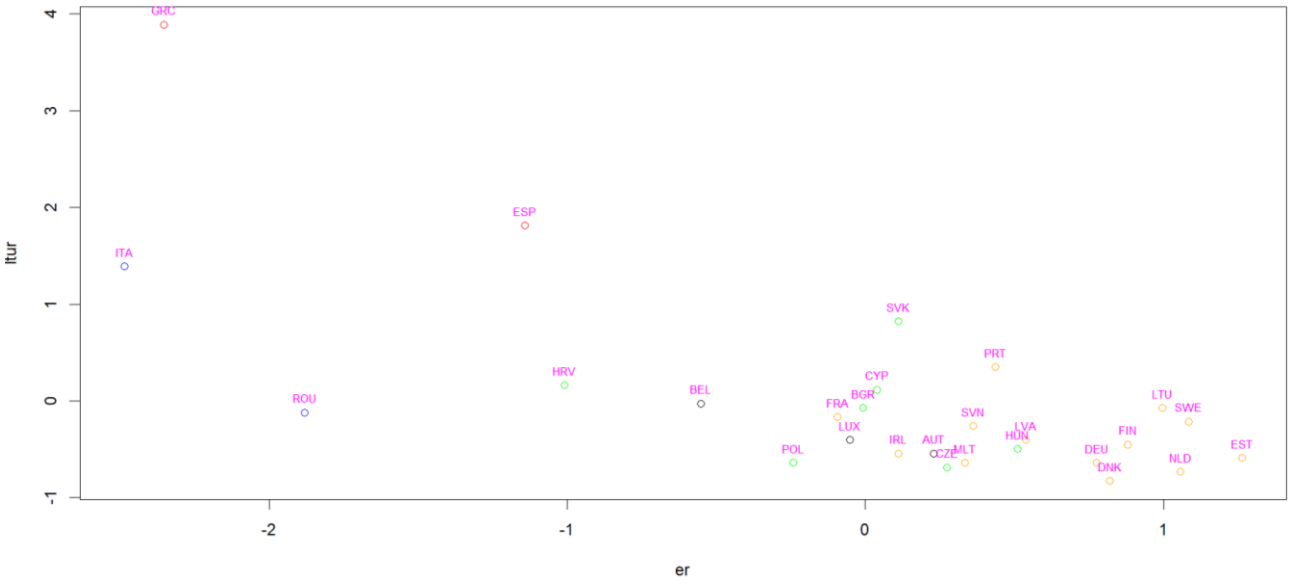

Figure 12:Long-term unemployment rate and employment rate

In Figure 12, the EU member states are represented through the prism of Long-term unemployment rate and employment rate for women. It can be seen that Romania and Italy have very low values for the percentage of employed women, the same is noted for Greece and Spain, the latter also having very high percentages for the long-term unemployment rate. As expected, the northern and western EU countries (the largest class) show high values of the percentage of employed women and low long-term unemployment rates. Austria, Belgium and Luxembourg also have low values of long-term unemployment and average values for the employment rate; Hungary, Bulgaria, the Czech Republic, Croatia, Cyprus, Slovakia and Poland are in a similar situation.

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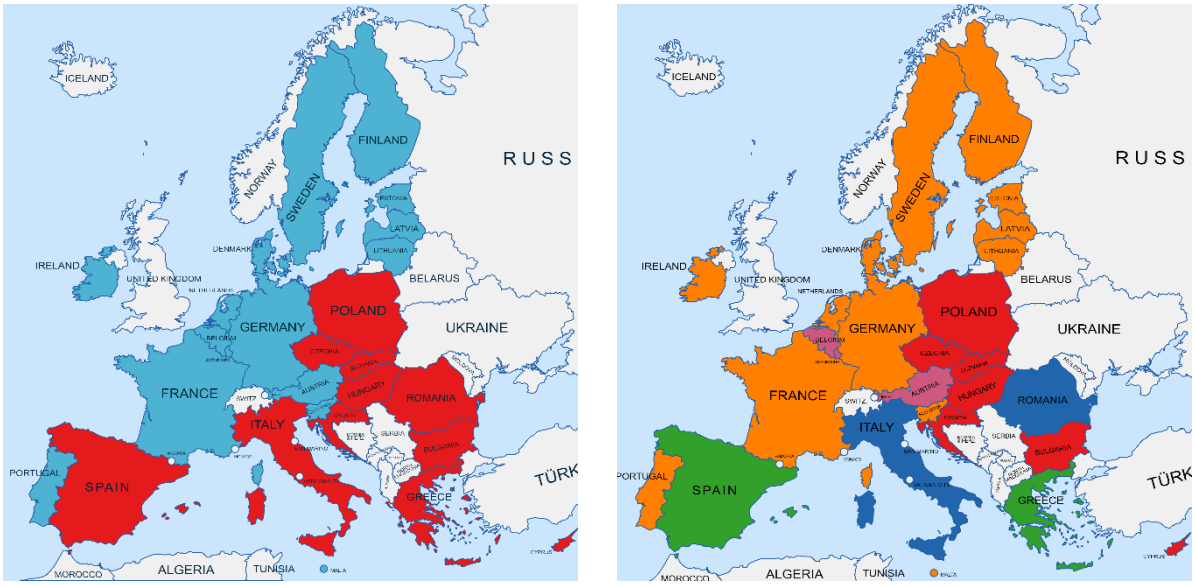

Figure 13: Graphical distribution of countries on the map
Source: https://www.mapchart.net/europe.html

With the help of the map on the left of Figure 13, it can be noted that the grouping of countries respects a certain geographical arrangement, the countries being divided into the south-east and north-west areas. As noted throughout the analysis carried out, the countries of the north and west of the EU show good and very good values for all the indicators described, a sign that for these countries the gender disparities are less significant compared to the other regions. The map on the right shows the division of the two previously presented classes into five new classes. Where Romania and Italy form a class with the highest percentages of young female neither in employment nor in education and training and among the lowest regarding employment rate, this last characteristic can also be attributed to the class formed by Greece and Spain. The Nordic countries and a large part of the Western ones formed the most numerous class (marked in orange), also having very good values for all the analysed indicators. Eastern countries (marked in red) showed low to medium indicator values, a sign that there should be improvements made to the policies applied to reduce gender disparities.

Conclusions

According to the study carried out, it is noted that in most EU states the percentage of young female neither in employment nor in education and training is higher compared to men (with the

exception of Luxembourg, Belgium, Finland and Estonia). Also, in all the countries of the Union, the percentage of employed men is higher compared to that of women, while, for part-time employment as percentage of the total employment for young people, the situation is the opposite, with the exception of Romania.

Regarding the grouping of EU member states according to the characteristics described by the analysed indicators, it was noted that the Nordic countries and those in the west of the EU (Denmark, Holland, Finland, Sweden, France, Lithuania, Ireland, Latvia, Slovenia, Estonia, Malta, Germany and Portugal) show good and very good values for all the indicators presented. Romania and Italy, together with Greece and Spain, form two classes that present low percentages of the employment rate for women, the last two also having very high values of the long-term unemployment rate; however, Romania and Italy present the highest percentages of young females neither in employment nor in education and training. Hungary, Bulgaria, the Czech Republic, Croatia, Cyprus, Slovakia and Poland formed another class in which, as a rule, the recorded values of the indicators showed average to good values.

References

Anastasiou, S., Filippidis, K. & Stergiou, K., 2015. Economic Recession, Austerity and Gender Inequality at Work. Evidence from Greece and Other Balkan Countries. *Procedia Economics and Finance*, Volume 24, pp. 41-49.

Charrad, M., Ghazzali, N., Boiteau, V. & Niknafs, A., 2014. NbClust: An R Package for Determining the Relevant Number of Clusters in a Data Set. *Journal of Statistical Software*, 61(6), pp. 1-36.

EU, 2022. *NextGenerationEU.* [Online]
Available at: https://next-generation-eu.europa.eu/index_en
[Accessed 25 05 2023].

Faggian, A., Michelangeli, A. & Tkach, K., 2023. Income inequality in Europe: Reality, perceptions, and hopes. *Research in Globalization*, Volume 6, p. 100118.

Franczak, J. & Margolis, J., 2022. Women and great places to work: Gender diversity in leadership and how to get there. *Organizational Dynamics*, 55(4), p. 100913.

Ikotun, A. M. et al., 2023. K-means clustering algorithms: A comprehensive review, variants analysis, and advances in the era of big data. *Information Sciences,* Volume 662, pp. 178-210.

Nguyen, C. P. & Su, T. D., 2021. Does energy poverty matter for gender inequality? Global evidence. *Energy for Sustainable Development,* Volume 64, pp. 35-45.

Perugini, C. & Vladisavljević, M., 2019. Gender inequality and the gender-job satisfaction paradox in Europe. *Labour Economics,* Volume 60, pp. 129-147.

Schober, P., Boer, C. & Schwarte, L., 2018. Correlation Coefficients: Appropriate Use and Interpretation. *Anesthesia & Analgesia,* 126(5), pp. 1763-1768.

Sinaga, K. P. & Yang, M.-S., 2020. Unsupervised K-Means Clustering Algorithm. *IEEE Access,* Volume 8, pp. 80716-80727,.

United Nations, 2015. *Department of Economic and Social Affairs, Sustainable Development.* [Online]
Available at: https://sdgs.un.org/goals
[Accessed 25 05 2023].

Vlachantoni, A., 2012. Financial inequality and gender in older people. *Maturitas,* 72(2), pp. 104-107.