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## Abstract

This article examines the status of women in labor market conditions within the European Union member countries. Since the women's status in the labor market and their participation in the labor process belong to one of the most discussed topics, we decided to analyze selected indicators and to compare them using cluster analysis method. The main objective of this article is to present an analysis of the situation and position of women in the labor markets of 28 member states of the EU using selected Quality of Life Indicators. The method of cluster analysis is applied in order to group countries with similar gender and labor market characteristics together.

*Key Words:* Cluster Analysis, Labor Market, European Union, Women's status

## Introduction

Women represent more than one half of the world's population but according to many researchers, "their contribution to the economic activity measured by the growth and well-being is below their potential" (IMF, 2013). Generally, in many European countries it can be observed that there is an increase in women's participation in the labor market. This is seen as a key factor in

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achieving the goals of the European Employment Strategy and the Europe 2020 Strategy. Therefore, it seems that the situation for women has improved over time, and that is the reason we have decided to have a closer look at this issue as well as to reveal the situation for women in the labor markets within the European Union (EU).

First, we had to think about research methodology because the existing economic literature identifies a lot of factors that determine the quality of life, defined as the well-being of an individual and society, as well as the labor market. Cipollone, Patacchini and Vallanti (2012) identify the following factors that contribute to women's labor market behavior: changes in cultural attitudes towards work, demographic factors, changes in the characteristics of the female population and educational choices. Other factors that are often included in empirical researches are reforms of the welfare state and changes in policies of labor market institutions. There are various studies focusing on the impact of labor market institutions on women's employment and labor market participation in European countries (Jaumotte, 2003 and Genre et al., 2010). The general conclusion of these studies is that labor market institutions are important for women's participation in the labor market and labor force. For our research we were interested in such indicators that are expressed by statistical data. The Eurostat database gathers many statistics including the labor market and labor force data. Based on that, the Quality of Life Indicators were found to be useful and accurate.

The main objective of this article is to present an analysis of the situation and position of women in the labor markets of 28 Member states of the EU using selected Quality of Life Indicators. For these purposes we have formulated a hypothesis: The Status of women within different EU member countries in selected Quality of Life Indicators with an emphasis on the participation in labor markets does not differ from one country to another. We formulated this hypothesis based on the assumption that all women in EU countries (28 members) belong to developed economies that are generally known by their access to education and employment, appropriate working conditions and high engagement of women in the labor markets. A cluster analysis is applied in order to group countries with similar gender and labor market characteristics together.

## Methodology

*Selection of Quality of Life Indicators with an Emphasis on Labor Market*

"The analysis of quality of life is considered one of the main challenges of economic science in view of its important role in political, social and economic areas." (Somarriba, Pena, 2009) For the measurement and evaluation of the status of women of the EU in selected Quality of Life Indicators we have used the database of Eurostat, which provides appropriate statistical information. In 2011, The European Statistical System Committee decided to work towards developing a set of Quality of Life Indicators for the EU. They are divided into 9 dimensions: material living condition, health, governance and basic rights, overall experience of life, productivity or main activity, education, leisure and social interactions, economic and physical safety as well as natural and living environment. The dimensions are broken down into topics and subtopics. We have selected from them six indicators related to the labor market: education, weekly hours of work, income, risk of poverty, unemployment rates and life expectancy. We have investigated these six indicators among women in 28 countries of the EU in the year 2012.

The first selected indicator, *Education*, refers to acquired competence and skills. It reflects the percentage of the population (females in EU from 15 to 64 years) with Bachelors and Master's

degrees. *Weekly hours of work* expresses the average number of weekly hours of work spent at a woman's full-time job. Another indicator, *Income*, represents average net yearly income of women in the EU in euro currency. *Risk of Poverty* reflects the percentages of females exposed to poverty or are at the poverty threshold. The next indicator, *Unemployment Rate*, expresses the percentage of females, from 15 to 64 years, who are unemployed. The last selected quality of life indicator is *Life Expectancy*; this is a subtopic of the topic outcomes of health dimension. The mean number indicates the number of years that a newborn child (girl) can expect to live if subjected throughout her life to the current mortality conditions (age specific probabilities of dying). In Table 1 a summary of the descriptive statistics of selected indicators for European Union is shown.

**Table 1. Descriptive Statistics (European Union, Year 2012)**

| | Education (%) | Weekly hours of work | Income (EUR) | Risk of poverty (%) | Unemployment rate (%) | Life expectancy (years) |
|---|---|---|---|---|---|---|
| Minimum | 14.2 | 37.1 | 2070 | 10.5 | 4.4 | 77.4 |
| Maximum | 39.2 | 42.2 | 32180 | 23.6 | 28.3 | 84.7 |
| Mean | 27.075 | 40.046 | 13401.3 | 16.904 | 10.811 | 81.529 |
| Standard Deviation | 8.1029 | 1.1821 | 8197.7 | 3.5801 | 5.5079 | 2.0441 |

Source: Own elaboration using data in Eurostat, 2014.

As can be seen, more than 27% of women in the EU in the year 2012 had first and second stage of tertiary education. Romania had the least number of females with first and second stage of tertiary education, with only 14.2%. On the other hand, Estonia had almost 40% of women with tertiary education. Mean weekly hours worked by women in 2012 in the EU were 40.046 hours. In Ireland, females worked an average of only 37.1 hours per week. The longest time spent at work per week was in Austria. The average net yearly income in EU was 13 401.36 EUR. The women in Luxembourg earned the highest income; coming out to 2.4 times more than the mean. Women in Romania earned only 2 070 EUR per year. On average, more than 16.9% of women were exposed to the risk of poverty. The highest risk of poverty was in Greece, 23.6%. The lowest risk of poverty was in the Czech Republic. The average unemployment rate was 10.81%. In Austria, more than 95% of women were employed. The highest unemployment rate was measured in Greece at 28.3%. The average life expectancy was found to be around 81.5 years. The lowest life

expectancy was in Bulgaria, at only 77.4 years, and the highest life expectancy was in Spain, France and Lichtenstein.

*Cluster Analysis*

Cluster analysis belongs to a group of multivariate methods whose primary purpose is to group objects based on the characteristics they possess. Cluster analysis gathers objects that are very similar to others in the groups based on a set of selected characteristics. This method is used for classifying a large quantity of information into meaningful subgroups, called clusters, that are more manageable than individual datum. Obtained clusters show high internal homogeneity and high external heterogeneity (Hair, Black, et al., 2009).

Using cluster analysis, we can identify homogenous groups of objects and allows us to determine what in our sample belongs to which group. Cluster analysis also allows us to minimize variability within clusters and maximize variability between clusters. The aim of cluster analysis is to reduce the data by grouping them into smaller groups (Burns, R. B., Burns, R. A., 2008).

We can distinguish between hierarchical and nonhierarchical methods according to mutual arrangement of the data. Hierarchical cluster analysis combines the clusters gradually and reduces the number of clusters step by step until only one cluster is left. For this procedure we use the dendrogram (the hierarchical tree diagram), which shows us when and which objects join together using the dissimilarities, such as distance, between them (Mooi, Sarstedt, 2011).

First, we have to calculate distances among objects of cluster analysis. We can use different methods for distance measuring. For example, Euclidean distances or Squared Euclidean Distances are used more often in order to assign progressively greater weight on objects that are further apart (Mooi, Sarstedt, 2011). Squared Euclidean Distances can be calculated by following formula (Řezánková, 2009): $D_{ES}(x_i, x_j) = \sum_{i=1}^{m}(x_{il} - x_{jl})^2$, where $x_{il}$ is value of l-th attribute on the i-th object, $x_{jl}$ is value of l- th attribute on j-th object.

Second, we have to decide about the clustering algorithm. Clustering algorithm is the set of rules that specify between which points distances are measured to examine cluster membership. There are many methods used for clustering algorithm. For example, single linkage, complete linkage, average linkage with (between) groups, Ward´s method, centroid method and median method (Burns, Burns, 2008). According to Poledníková (2014), to determine the optimum solution, the most common approach is to use hierarchical cluster analysis and Ward's method, applying Squared Euclidean Distance as the distance of similarity measure.

The Ward method is mostly used for its analysis of the variance approach to evaluate the distances between clusters. Cluster membership is estimated by calculating the total sum of squared deviations from the mean of a cluster. The smallest possible increase in the error sum of squares occurs if the objects are more similar and clustered together. The last step of cluster analysis is the results interpretation.

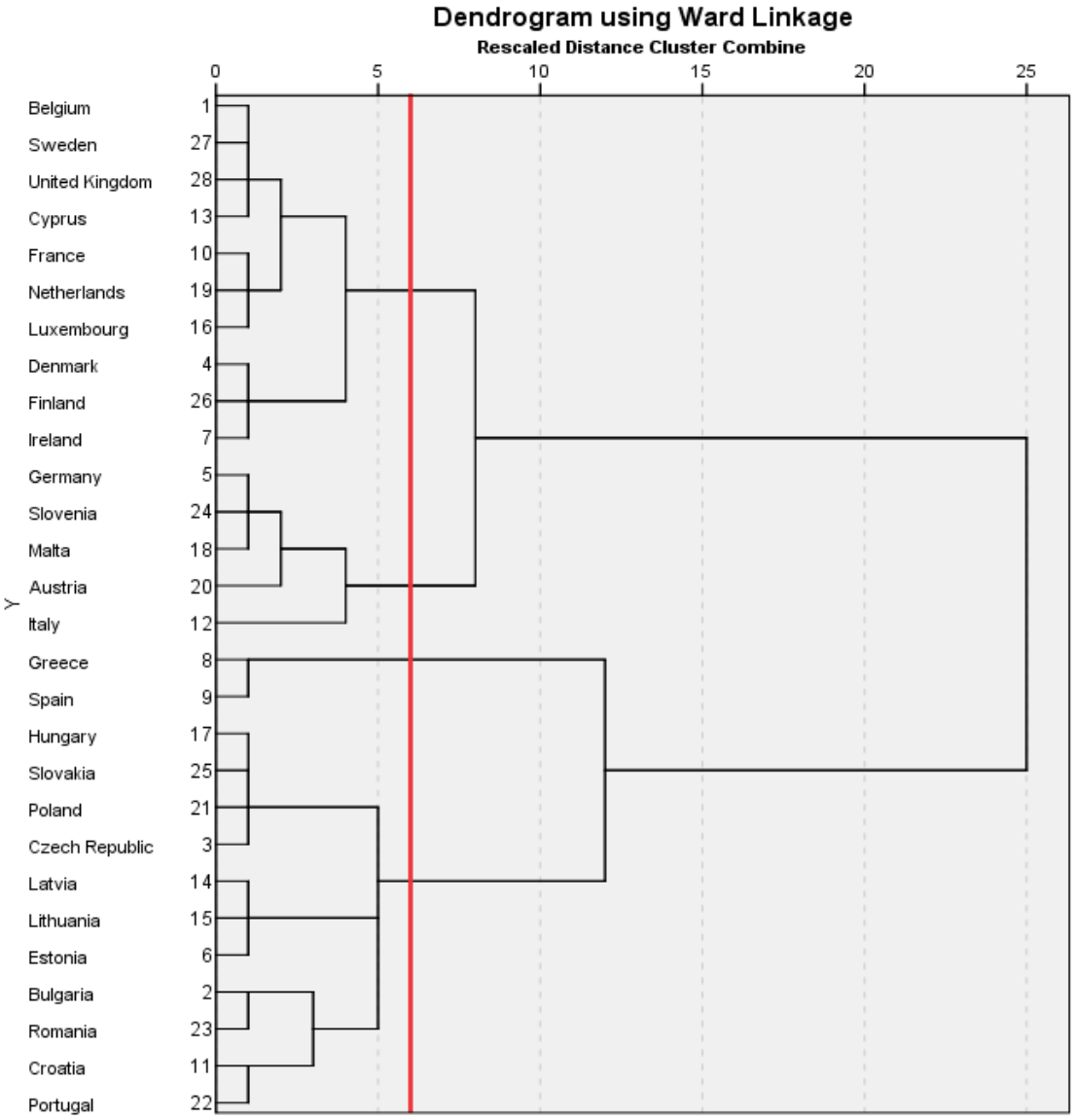
## The Result of Cluster Analysis

The technique of the agglomerative hierarchical clustering was used to apply cluster analysis of 28 Member countries of the EU and 6 selected Quality of Life Indicators in the year 2012 from the Eurostat database. For the criterion of the distance, we selected the Squared Euclidean Distance as a base of Ward's method. Due to different scales of indicators (percentage, currency, hours, etc.), the statistical software chosen standardized by Z-score method selected

indicators. The optimal solution in the form of four clusters was determined on the basis of the cluster analysis using statistical program SPSS.

Figure 1 presents the graphical illustration (dendrogram) of the arrangement of the clusters produced by cluster analysis. The dendrogram contains the gradual clustering of all EU member countries in the year 2012. The left side represents data of all 6 indicators of the 28 countries. The lines on the right side represent the clusters to which the countries belong and their length represents the distance (dissimilarity). The distance between merged clusters (0-25) is increasing with the level of merger. The red line in the dendrogram represents the optimal selected solution of the four clusters' distribution. The result of cluster analysis and distribution of all EU member countries is presented in Table 2.

**Figure 1. Dendrogram of Cluster Analysis Using Ward Linkage**




Source: Own elaboration using data in Eurostat, 2014.

**Table 2. Cluster Membership of EU 28 in 2012**

| Cluster 1 | Cluster 2 | Cluster 3 | Cluster 4 |
|---|---|---|---|
| Belgium | Bulgaria | Germany | Greece |
| Denmark | Czech Republic | Italy | Spain |
| Ireland | Estonia | Malta | |
| France | Croatia | Austria | |
| Cyprus | Latvia | Slovenia | |
| Luxembourg | Lithuania | | |
| Netherlands | Hungary | | |
| Finland | Poland | | |
| Sweden | Portugal | | |
| United Kingdom | Romania | | |
| | Slovakia | | |

Source: Own elaboration using data in Eurostat, 2014.

**The Clusters' Description and Evaluation of Women's Status in Clusters**

The optimal solution, according to the cluster analysis, presents distribution to four clusters. Cluster 1 is composed of ten countries: Belgium, France, Luxembourg, Netherlands (founding members of EU), Denmark, Ireland, United Kingdom (first enlargement in 1973), Finland and Sweden (fourth enlargement in 1995) and Cyprus (fifth enlargement in 2004). Cluster 2 represents the largest cluster and consists of 11 member countries: Bulgaria and Romania (sixth enlargement in 2007), Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland, Slovakia (fifth enlargement in 2004), Portugal (third enlargement in 1986) and Croatia (seventh enlargement in 2013). Cluster 3 contains five EU member states: Germany and Italy (founding members of EU), Malta, Slovenia (fifth enlargement in 2004) and Austria (fourth enlargement in 1995). Cluster 4 represents the smallest cluster and consists of only two countries: Greece (second enlargement in 1981) and Spain (third enlargement in 1986).

The summary of the indicators in clusters using mean values of selected indicators, shown in Table 3, is helpful for comparison of the four clusters in the context of the status of women in the EU in selected Quality of Life Indicators with emphasis on the labor market.

**Table 3: Summary of Indicators in Clusters (Mean Values)**

| | Cluster 1 | Cluster 2 | Cluster 3 | Cluster 4 |
|---|---|---|---|---|
| **Education (%)** | 34.030 | 24.109 | 19.540 | 27.450 |
| **Weekly hours of work** | 39.320 | 40.455 | 40.240 | 40.950 |
| **Income (EUR)** | 21 852.10 | 5 143.00 | 15 795.20 | 10 584.00 |
| **Risk of poverty (%)** | 14.720 | 17.891 | 16.720 | 22.850 |
| **Unemployment rate (%)** | 8.090 | 11.791 | 7.720 | 26.750 |
| **Life expectancy (years)** | 82.660 | 79.500 | 82.880 | 83.650 |

Source: Own elaboration using data in Eurostat, 2014.

According to Table 3, the highest average value for the Education indicator is represented in Cluster 1, with more than 34% of women having achieved first and second stage of tertiary education. The lowest average value of this indicator is Cluster 3, with the value below 20%. Cluster 1 also achieved the highest average yearly net income for women with more than 21,852 EUR. On the other hand, the lowest average value of yearly net income for women is found in Cluster 2 with 5,143 EUR. In 2012, Cluster 1, which achieves the highest average yearly net income for women, surprisingly achieved the lowest average value for weekly hours of work for women (34.03 hours per week). The possible interpretation of this situation can be a different distribution of women's jobs in particular sectors. We assume that in countries from Cluster 1, most of the employed women work in services sector and the minority of them in sectors of agriculture or industry. On the contrary, Cluster 4 represents countries in which women spend an average of more than 40.9 hours a week at work. We can describe Cluster 1 with the lowest risk of poverty, characterized by 14.72% of women who are at this risk. On the contrary, this indicator in Cluster 4 suggests more than 22.8 % of women are at risk. The lowest average unemployment rate was achieved in Cluster 3 (7.72%) and the highest average unemployment rate was measured in Cluster 4 (26.75 %). The lowest average life expectancy of women was measured in Cluster 2 countries (79.5 years) and the highest level of average life expectancy for women is in Cluster 4 countries (83.65 years). The biggest differences in average values in selected indicators that we can see are between Cluster 1 and Cluster 4.

## Conclusions

The result of our analysis reveals that there are differences among EU countries. We can identify four clusters with similar characteristics of Quality of Life Indicators. According to the results, our hypothesis that "The Status of women within different EU member countries in selected Quality of Life Indicators with an emphasis on labor market does not differ from one country to another" is rejected.

We can define Cluster 1 as a cluster of countries (Belgium, France, Luxembourg, Netherlands, Denmark, Ireland, United Kingdom, Finland, Sweden, and Cyprus) with the best

results in selected indicators. It is possible to call this cluster the most "woman-friendly" in the context of selected labor market characteristics. Cluster 4 (Spain and Greece) and Cluster 2 (Bulgaria, Romania, Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland, Slovakia, Portugal, Croatia) can be, on the other hand, defined as clusters with worse results in selected indicators. Cluster 4 has the worst results in the "risk of poverty" and "unemployment rate" categories as well as slightly higher working hours than the rest. But the other three indicators are better here than in the other clusters. Cluster 2 has the worst results in "income" and "life expectancy" and in the rest of the indicators, its results reach only the lower average.

According to our results, we suggest that there should be further research and deeper analysis of the dissimilarities of the status of women in the labor markets of the EU countries among these four determined clusters. Dissimilarities can be caused by different distribution of sector employment of women in clusters. Also the weights of the indicators could be defined therefore making other factors more important to stress.

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