

# Disparities between the Economies of the EU Countries and the Application of Convergence

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## Abstract

*The EU is one of the richest regions in the world but despite this, it is very different in terms of key economic and social indicators between countries and regions.*

*The study of social and economic disparities have always aroused questions and many economists over time have tried to study this phenomenon and to establish a theory of reducing the distances that exist between economies of the EU countries.*

*In this paper the propose is to highlight economic and social disparities between EU countries by applying different statistical methods, graphs and numerical that explain the phenomenon. In the structure of the paper, we planned that the economic and social phenomenon, to be studied independently, and later they will be also compared.*

*Also, we want to highlight how is applied the phenomenon of convergence at European level and what are the methods that are being applied to improve the economic situation of the countries.*

*We analyzed the phenomenon disparities, where we measured and highlighted the economic and social disparities between EU countries. Also, we plan to study whether there are significant differences between the economic and social European Union countries by the year of adherence.*

*The main indicator highlighting economic disparities is GDP per capita. It will be analyzed both with other economic indicators and social indicators, as follows: labor productivity, investment, report export-import, inflation, unemployment, poverty and social exclusion, the rate of employment, social protection expenditure (% of GDP) and overcrowded rate.*

**Keywords:** disparities, economic convergence, economic indicators

## 1. Introduction

The EU is one of the richest regions in the world but despite this, it is very different in terms of key economic and social indicators between countries and regions. The European Union consists of 28 member states representing a community and internal market of almost 500 million people, which effectively represents 7.3% of the world, and which trough diversity of member countries is influenced by economic and social disparities between these countries and regions to which they belong.

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European Union through its policies of European convergence, cohesion and integration, proposes that these economic and social disparities be reduced. Perhaps the question is "Why is there still so much difference between countries?" The answer to this question is quite complex. One reason could be that most countries in Eastern Europe and part of the Central Europe were under the occupation of communist regime, an authoritarian regime that has not invested in creating prosperous economy, but rather some of the economies of these countries were "sacrificed". Another cause could be the major economic events of the beginning of the current millennium, such as the global economic crisis began in 2008, the current wave of migration unprecedented, the existence of divergences between countries, both within the EU and between non-European countries .

European integration has brought together countries, regions, but with a very different level of economic development and created a market economic space with very large differences in terms of competitiveness and living standards. Very important was the security for closer integration, involving political negotiations between member states anxious to protect national interests, while the popular legitimacy of the European project required a certain degree of redistribution of resources to maintain limits potential losses associated integration project.

The study of social and economic disparities have always aroused questions and many economists over time have tried to study this phenomenon and to establish a theory of reducing the distances that exist between the EU economy.

The nature, causes and consequences of economic inequality have preoccupied economists, at least since Adam Smith (1723-1790) onwards. The famous Scottish himself considered income distribution was dependent on the institutions of society but largely independent of economic progress or decline. In relation to this, revenues rise or fall more or less in proportion.

According to Vorauer (2007), regional disparities are conditioned by several factors related to the inequality of economic potential of development in different regions.

Heidenreich and Wunder M. Ch. (2007) conclude that economic inequalities are rising in most Member States of the European Union, while inequalities between nations in an enlarged Europe are decreasing in recent years.

The concept of convergence translates as the reduction of the differences between the economic indicators of various countries belonging to a geographical area.

EU cohesion policy, built into the Treaties since 1986, has the objective of reducing the gap between the level of development of the various regions in order to enhance economic and social cohesion. The Single European Act (SEA- 1886) lays the foundation of real cohesion policy, designed to offset the constraints of the single market for southern countries and other disadvantaged areas.

The etymology of disparity comes from the Latin *disparitas* , which means divided. Most dictionaries referring to a disparity correlates it with inequality or disproportionality of different phenomena.

Disparities could be:

- Social disparities that relate to quality of life, standard of living, aging of a

population, crime and other factors that tend to increase inequality.

- Economic disparities that relate to economic performance (economic structure, productivity, employment etc.), the countries or regions concerned.
- Regional disparities are directly related to geographical factors or location.

In general, the term, disparity is used by practitioners as an inequality in expressing differences with appropriate mathematical techniques using specific indicators.

In this paper we propose to highlight economic and social disparities between EU countries by applying different statistical methods, graphs and numerical explaining this phenomenon. The structure of the paper, we suggested that the economic and social phenomena, to be studied independently, and later they will also be compared.

The main indicator highlighting economic disparities is GDP per capita. It will be analyzed both with other economic indicators and social indicators, as follows: labor productivity, investment, report export-import, inflation, unemployment, poverty and social exclusion, the rate of employment, social protection expenditure (% of GDP) and overcrowded rate.

## **2. Description of the data and methodology**

We can define statistics as the practice or science of collecting and analyzing numerical data in large quantities, especially.

**2.1 Descriptive statistics** include numerical and graphical procedures aggregating and processing data. This is used to transform data into information.

Multivariate analysis aims to highlight the links between statistical variables, numeric or nonnumeric, but also in the group of statistical units in clusters, by how much these units fit after recorded variables. Methods of this type of analysis can be grouped into two categories, namely methods of factor analysis and classification methods of statistical units. We will use in this paperwork only the methods of factor analysis, so the methods most important part of this group are the principal component analysis and components factor analysis.

Principal components analysis deals with analysis of the links or associations between numeric variables. This is a descriptive method of multidimensional data analysis.

Application of principal component analysis may be performed to achieve the three major objectives:

- A first objective is to highlight the statistical links between the variables considered. For this, the software provides graphical representation Issues variables and values of correlation coefficients between these variables and the factorial axes.
- A second objective is to explain similarities or differences between individuals in terms of the variables considered. To do this, the results of the statistical units will be correlated with the results for the statistical variables.
- A third objective is to highlight the similarities or differences between statistical units considered after all the variables recorded. To achieve this goal, specialized software provides specific numerical indicators and in the

same time a graphical representation that is easy to interpret.

Principal components analysis results can be interpreted as follows:

- The determinant of the correlation matrix, can have values in the range [0, 1]. A value close to 0 indicates that there are strong links between variables, null indicates that between variables are not perfect connection, and a value of 1 is the unit matrix.
- $\chi^2$  statistic and Kaiser-Meyer-Olkin statistics (KMO and Barlett's Test) used to test the hypothesis of independence of variables. The range of statistics KMO is [0, 1] and can be applied only if  $KMO > 0.05$ .

Also, principal component analysis should take into account three criteria, namely:

- Kaiser's criterion (1960) according to which the factor axes are chosen to be analyzed if they have values greater than 1.
- Evrard's criterion (1966) according to which the plot is represented by their values and are chosen the axes that are preceding the breaks between variables.
- Benzecri's criterion that says that choosing to be analyzed factorial axes for which the variance is explained by at least 70%.

## 2.2 Regression models

The term regression is due to Francis Galton (1886). He has conducted a study on the height of the population, showing that on average, parents of stature, children are born with a lower height than the parent, that is performing "regression" in height.

In the literature, the regression analysis is a statistical method for the analysis of dependence between a variable called the dependent variable, and one or more variables called independent variables. Mainly, regression analysis involves estimating a model that explains how the dependent variable is influenced by the independent variable.

ANOVA model is the simplest model with one independent variable alternative form:  $Y = \alpha_0 + \alpha_1 * D + \varepsilon$ , where D is the independent variable is the coefficient  $\alpha$  alternative independent variable.

## 2.3 Presentation of statistical variables

To identify economic disparities, we have taken into account in the analysis the following variables:

- *Real GDP / capita (in PPS\_EU28)* - GDP is calculated initially in the national currencies of the countries and then converted using the slide PPS (Purchasing power parities) which takes into account the difference in price levels between EU countries, creating thus a fair comparison of the data. Using this indicator, there is an opportunity to study and compare the purchasing power of EU countries using different currencies and where the price is different.
- *The inflation rate* is calculated as the ratio of the average price index in a year and the previous year minus 100.

- *Labour productivity* per hour worked (euro) is one of the most importance indices of economic efficiency of enterprises, reflecting the effectiveness of labour consumed in the production process. Labour productivity growth is the most important factor to increase output, reduce production costs and increase the profitability and competitiveness of products. Labour productivity is determined either as a ration of production volume and the amount of labour expended to acquire it, either by reporting work time spent on production volumes achieved.
- *Total investment (% GDP)* shows how the % of the GDP of a country is allocated investments.
- *Export - import ratio* is the value of exports of goods and services divided by imports of goods and services. Values greater than 1 indicate a positive trade balance while values less than 1 indicate a negative trade balance.

To highlight the social disparities, we study the following variables:

- *Poverty rate and social exclusion* reflects the low income levels in comparison with other residents of the same country.
- *Unemployment rate (%)* is the ratio between the number of unemployed, according to The International Labour Office and the total active population.
- *Employment rate of labor resources (%)* is the ratio of the employed population aged 15 and over and the total population in the same age group.
- *Social protection expenditure (% of GDP)* include: social benefits, which consist of transfers, in cash or in kind, to households and individuals to relieve them of the burden of a defined set of risks or needs; administration costs, which represent the costs charged for the management and administration; other expenditure, which consists of miscellaneous expenses of social protection systems (payment of property income and other). It is calculated in current prices.
- *The rate of population in overcrowded households* - defined as the percentage of people living in a household overcrowded. A person is considered as living in a household overcrowded if the household has at least a minimum of rooms equal to: room for household room the couple in the home, a room for each single person aged 18 and more, a camera pair of single people of the same sex between 12 and 17 years, room for each single person between 12 and 17 years and not included in the previous category, a camera pair of children under 12 years. The indicator is presented to the people of both sexes.

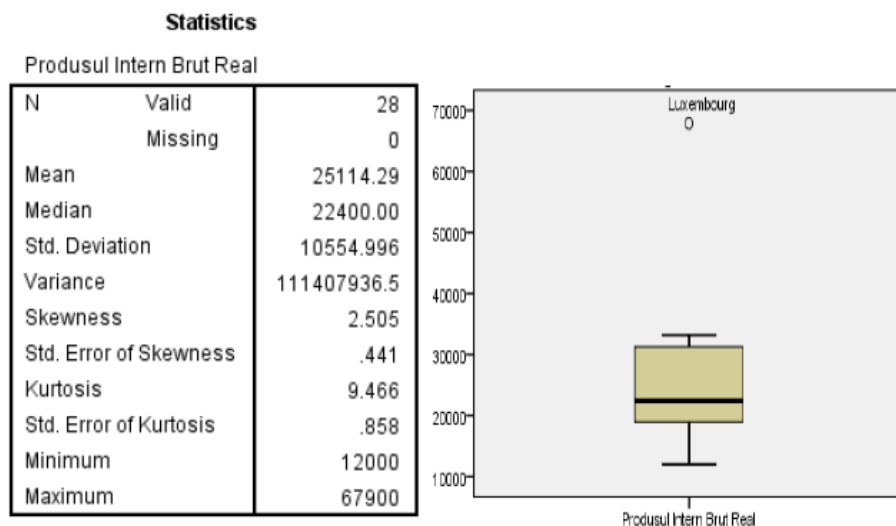
### **3. Empirical results**

In this chapter we apply statistical methods to highlight the economic and social disparities between EU countries. Thus, we highlight the countries with the lowest values for the variables studied, but also the countries with the highest values. We will also highlight the biggest differences between developed and less developed. To achieve this we will study primarily real GDP per capita, reflecting largely the phenomenon disparities.

### 3.1 Analysis of the distribution of real GDP / capita in EU countries

To highlight these disparities, we considered most important macroeconomic indicator, namely real GDP / capita and we use both numerical methods and graphs.

**Figure 3.1** Distribution of real GDP / capita in EU countries Statistics Proclusul Intern Brut Real



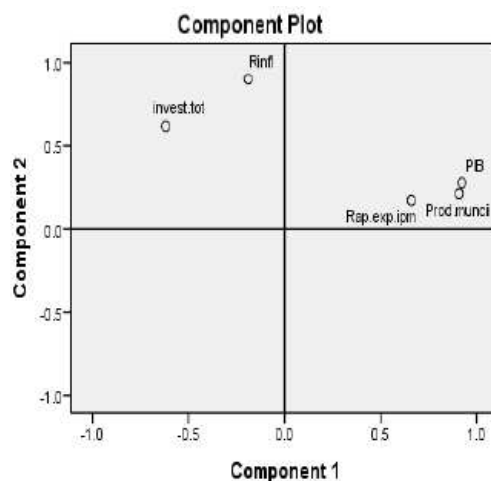
From the point of view of form, we notice that the asymmetry indicator shows that the distribution of real GDP, the European Union, is asymmetrical to right. Box-plot diagram above, we can notice that it is highlighted the extreme point, and that is the value of real GDP of Luxembourg.

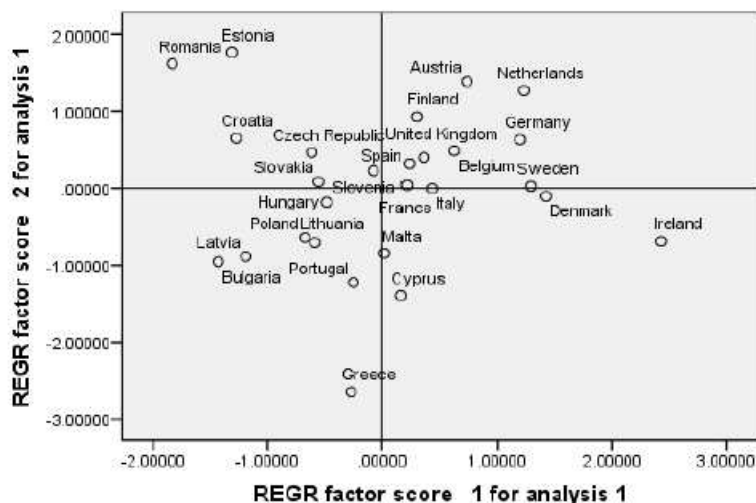
### 3.2 Economic disparities between EU countries

To identify disparities in EU economies, we use Principal Component Analysis method.

Economic indicators considered in this analysis are real GDP, labor productivity, inflation rate, total investments and export-import ratio.

**Figure 3.2** Graphical representation of economic statistical variables and statistical units





By overlaying the two charts we see that the first group of countries consisting in Ireland, Denmark, Sweden, Germany and Netherlands is characterized by the highest values for the Real GDP, Labour productivity and Report export-import and lowest values for Total investments, while group other countries consisting in Romania, Croatia, Latvia, Bulgaria and Estonia have the lowest values for the variables real GDP, Labour productivity, and export-import ratio and the highest values for total investments.

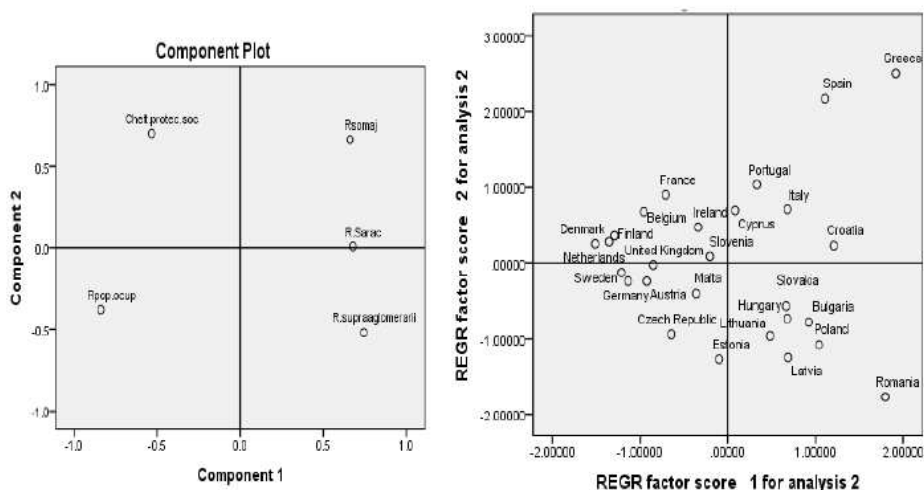
Second axle factorial highlights countries like Austria, Netherlands, Romania, Estonia which are characterized by higher values for the variables inflation rate and total investments (% of GDP), while Greece recorded the lowest values for them.

### 3.3 Social disparities between EU countries

To achieve this analyze we will use Principal Component Analysis method.

In this analysis, social indicators that will be considered include employment rates, unemployment, poverty and social exclusion, overcrowded population rate in households and expenditure on social protection.

**Figure 3.3** Graphical representation of social statistical variables and statistical units



By overlaying the two charts we see that the first group countries, Croatia, Bulgaria, Romania and Greece, is characterized by the highest values for the variables poverty rate and population rate of overcrowding in households while another the group of countries, Denmark, Netherlands, Sweden, Finland and Germany, indicated in the left diagram shows the lowest values for these variables.

### 3.4 Measurement of economic and social disparities between EU countries

To see which disparities are a larger, we chose to represent graphically standardized variables analyzed so far. Standardized Z values were calculated by the formula:

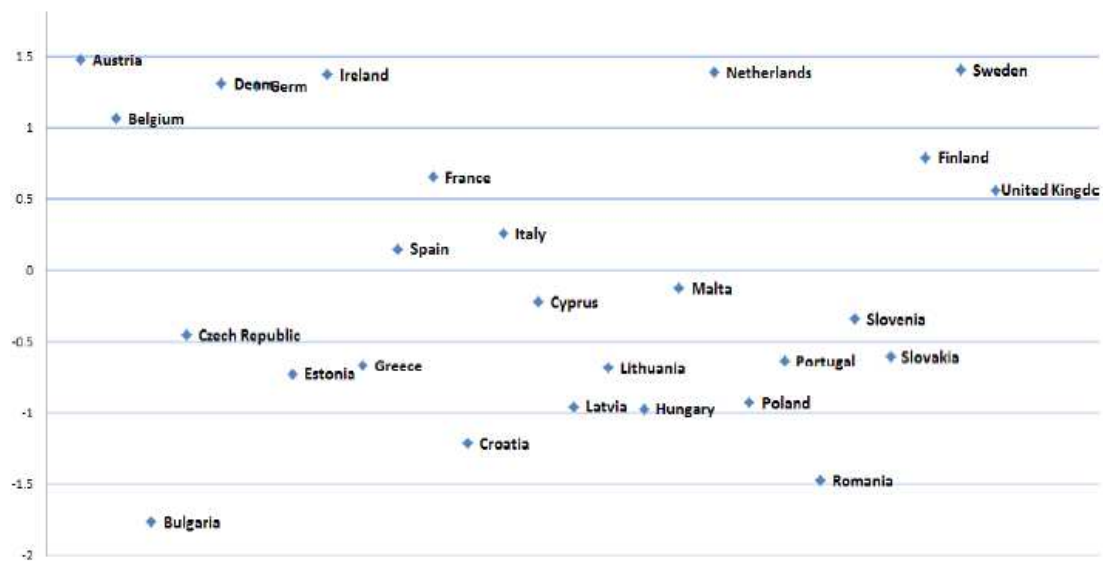
$$z = \frac{x - \bar{x}}{s}$$

#### 3.4.1 Measurement of economic disparities between EU countries

To measure economic disparities, we chose variables real GDP/capita and labour productivity per hour worked, because they explain most first factorial axis, expressed in a previous analysis.

The plot of standardized values of GDP

**Figure 3.4.1.1** The plot of standardized values of GDP



From what we can see from the chart above there are two groups of countries, some of which have values of real GDP above 0, and others that are below 0.

The biggest differences we see between the countries Austria, Belgium, France, Denmark, Germany, Netherlands, Sweden, characterized by the highest values of GDP and Bulgaria, Romania and Croatia have the lowest values for GDP.



- *The plot of standardized values of labor productivity*

**Figure 3.4.1.2** The plot of standardized values of labor productivity



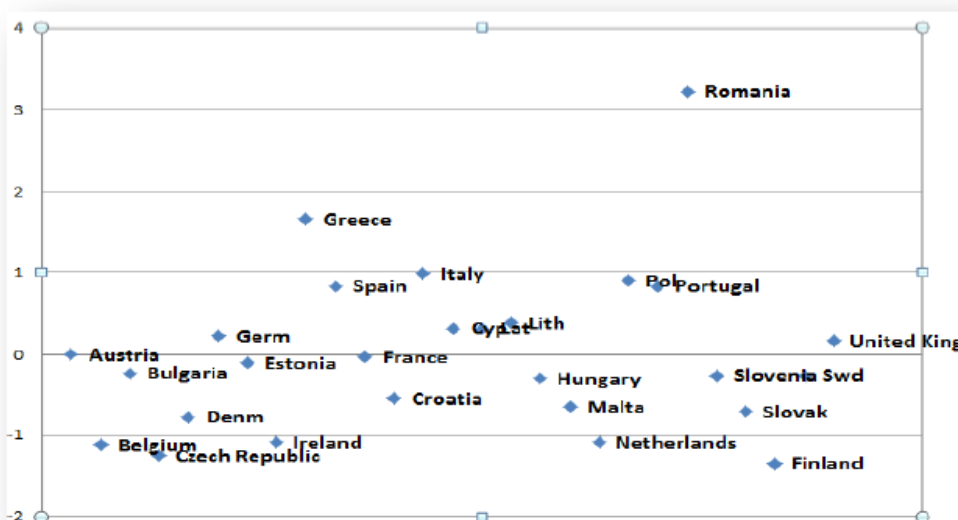
The biggest differences that we can see between countries Denmark and Ireland, characterized by the highest values of productivity and Bulgaria, Romania, Croatia and Hungary that have the lowest values for labor productivity.

### 3.4.2 Measurement of social disparities between EU countries

To measure social disparities, we chose variables poverty and social exclusion rate and overcrowded population rate, the reason being the same as the economic variables, and that is that these variables explain most first factorial axis.

- *The plot of standardized values of poverty rate and social exclusion*

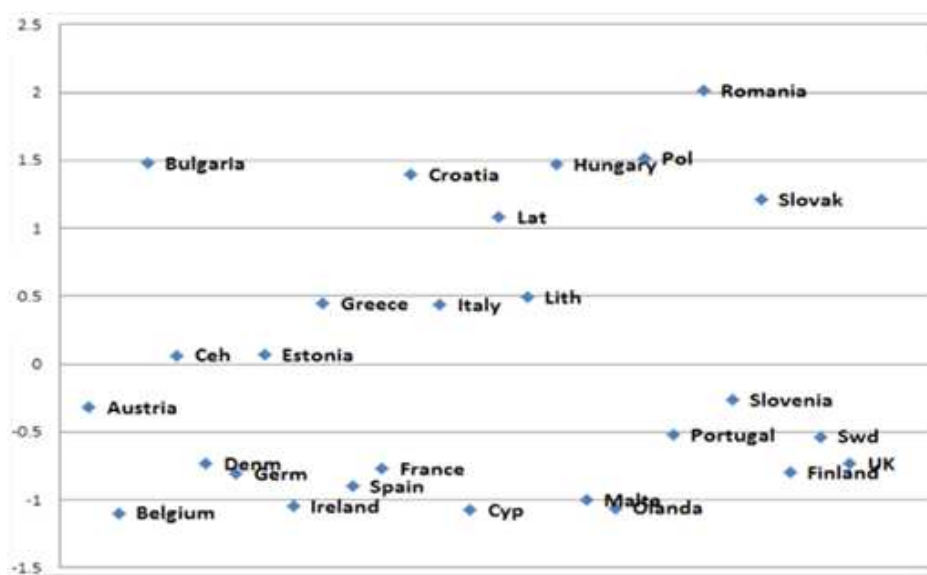
**Figure 3.4.2.1** The plot of standardized values of poverty rate and social exclusion



For variable rate of poverty and social exclusion is highlighted first country with highest value, namely Romania, then the country with the lowest such rate, namely Finland. Secondly it highlights two groups of countries that have either positive or negative. Between the two groups of countries which highlights the biggest differences can be seen between Greece, which has a poverty rate and social exclusion high, and Belgium, Ireland, Czech Republic, Netherlands, which are characterized by the lowest rates of poverty the European Union.

- *The plot of standardized values of overcrowded population rate*

### 3.4.2.2 The plot of standardized values of overcrowded population rate



For variable rate of overcrowding in households primarily highlights the country with the highest value of this rate, namely Romania, then the country with the lowest such rate namely Belgium. Secondly it highlights two groups of countries that have either positive or negative. Between the two groups of countries which highlights the biggest differences can be observed between Hungary, Poland, Bulgaria, Latvia, Croatia, Slovakia, showing a rate of overcrowding sea, Ireland, Cyprus, the Netherlands, Malta, which are characterized the lowest rates of overcrowding in the European Union.

### 3.5 Comparative analysis of the economic and social disparities between EU countries

In this analysis we intend to see which of disparities, or economic or social, are greater in EU countries. For this we compared the Z scores for the 4 variables discussed above, choosing for each of them lowest five values (showing levels below average) and the five highest values (which show above average levels) by country. I chose the smallest representation, namely the 5 largest values to highlight the greatest economic and social disparities, which are presented in the table below.

**Figure 3.5** Highest and lowest Z scores

Level of values	GDP	Labor Productivity	Poverty rate and social exclusion	Overcrowded Rate
values above average	Austria (1.48029)	Denmark (1.65445)	Romania (3.23453)	Romania (2.01129)
	Sweden (1.40375)	Ireland (1.51824)	Greece (1.66242)	Poland (1.51661)
	Netherlands (1.3884)	Belgium (1.22725)	Italy (0.98866)	Bulgaria (1.47997)
	Ireland (1.37314)	Netherlands(1.22106)	Poland (0.89241)	Hungary (1.46775)
	Denmark (1.31191)	France (1.20867)	Spain (0.82824)	Croatia (1.39447)
values below average	Lithuania (-0.9536)	Lithuania (-0.96446)	Netherlands (-1.09679)	Malta (-0.99954)
	Hungary (-0.96891)	Latvia (-1.09448)	Ireland (-1.09679)	Ireland (-1.04839)
	Croatia (-1.21383)	Croatia (-1.14401)	Belgium (-1.12888)	Netherlands(-1.06061)
	Romania (-1.47406)	Romania (-1.26784)	Czech Republic (-1.25721)	Cyprus (-1.07282)
	Bulgaria (-1.7649)	Bulgaria (-1.30498)	Finland (-1.35346)	Belgium (-1.09725)

According to the comparison that we made, we can say that social disparities are greater than economic disparities. Thus, we conclude that to improve the economic situation of EU countries requires that, firstly, social protection expenditure and all the social investment must grow for social disparities to be as small as possible.

What we can say from this comparison is that most countries that have values above average economic indicators have values below the average social indicators and vice versa countries that economic indicators below the average, have values of social indicators above average, which highlights the close link between economic and social disparities.

This analysis shows the obvious differences between the region of Central and West which is developed from the point of view of economic disparities, as well as social and Eastern Europe region is much less developed compared with the Region of Central and West.

#### 4. Conclusion

The comparison made between the social and economic indicators we can say that social disparities are greater than economic disparities in the European Union. Thus we can conclude that for improving the economic situation of EU countries requires that, firstly, social protection expenditure and all the social investment for social disparities grow to be as small as possible. What we can add from this comparison is that most countries that have values above average economic indicators have values below the average social indicators and vice versa, the countries economic indicators below the average, have values of social indicators above average .

From the measurement of the economic and social disparities between countries, we noticed that the biggest differences in terms of GDP / capita is registered between Austria, Belgium, Denmark, Germany, Ireland, the Netherlands and Sweden are characterized by the highest values GDP and Bulgaria, Romania, Croatia which have the lowest GDP values. Also, the biggest differences in terms of labor productivity we see Denmark and Ireland among countries characterized by the highest values of productivity and Bulgaria, Romania, Latvia and Croatia who have the lowest values for labor productivity.

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