Changes of the European countries distributions based on entrepreneurship and social economic sustainable development indicators

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Abstract: Entrepreneurship and sustainable development are considered two of the most important key-elements to assure the social-economic development. Our paper analyses indicators of the entrepreneurial activities and sustainable development indicators in European countries before the international crises has begun. The research results are based on data and information collected from Eurostat and Global Entrepreneurship Monitor (GEM) data bases. In a previous research, we have obtained new factors, respectively principal components based on entrepreneurship and sustainable development indicators, applying Principal Components Analysis (PCA), using SPSS software package. The results show the similarities and the differences of the European countries distribution based on the indicators of both entrepreneurship and sustainable development which are combining with each other.

Key-Words: social economic development, sustainable development, entrepreneurship, Principal Components Analysis, correlation, distribution

1 Introduction
The importance of entrepreneurship and sustainable development is well represented not only in the literature, but also in the documents of the international organizations, both being considered as solutions to assure the future development of the entire society. In the UE Strategy 2020, entrepreneurship, sustainable development, competitiveness and innovation are the key elements. This strategy establish only the path which should be followed by European countries, but the influence on national development differs, based on the current development level of each country, the particularities of the economic environment, the legal framework. Thus, analyzing the countries distribution we can identify the specific place each country belongs to, as well as the differences recorded compared to other countries with similar conditions.

2 Methodology
In order to analyze and identify the similarities and differences between European countries regarding entrepreneurship and social economic development indicators we applied Principal Components Analysis (PCA).

The basic principle of this method is to extract the smallest number of components to recover as much of the total information contained in the original data, these new components expressing new attributes of individuals and constructed so as to be uncorrelated with each other, each of these new variables is a linear combination of original variables [5].

This method provides a graphical view of the countries distribution map of the study, according to the similarities between them and the variables map according to their correlations.

PCA phases are illustrated in Figure 1.

Fig 1 – Analysis stages in principal components [6]
The stages shown above are followed by the interpretation of analysis results. G. Saporta and M.V. Stefanescu [9] indicate two kinds of interpretations to be made in the case of PCA, the "internal" interpretation namely the correlations between components and original variables (represented by the circle of correlations) and the "external" interpretation between variables and additional individuals, the explanation of the results being based on data that was used to obtain them.

3 Data collection
This research is based on the results obtained in a previous study which analyzed the correlations between entrepreneurship indicators and sustainable development social economic indicators.

Data collected from Global Entrepreneurship Monitor (GEM) regards the main important entrepreneurship indicators, respectively 4 rates [4]:

- nascent entrepreneurial activity (nea) – the percent of individuals, between the age category of 18 and 64 years old, who have taken some actions towards creating a new business in the past year. In order to qualify in this category, these individuals are expected to own a share of the business they are setting up and the business must not have paid any wages or salaries for more than three months.

- new business owner-manager (nbom)- New business owners are individuals who are active as owner-managers of a new business that has paid wages or salaries for more than three months, but less than 42 months.

- early-stage entrepreneurial activity (tea) - combining the prevalence rate of nascent entrepreneurs (people in the process of starting a new business) and new business owners.

- established business-owner managers (ebom) - indicates the percentage of the population actively involved in running businesses that proved to be sustainable.

The European countries considered are those which are included in GEM data base. Since 2008, GEM divided the analyzed countries in three categories: factor-driven economies; efficiency-driven economies and innovation-driven economies, but for the period 2006-2007 there were other 3 categories: high-income countries, middle-low-Europe and Asia, respectively middle –low –Latin America and Caribbean.

The European countries presented in this study belong to the last two categories, as follows:
- high-income countries: Austria (AU), Belgium (BL), Denmark (DK), Germany (GM), Ireland (IR), Greece (GR), Spain (SP), France (FR), Italy (IT), Netherlands (NE), Austria (AU), Portugal (PR), Slovenia(SL), Finland (FL), Sweden (SW), United Kingdom (UK), Norway (NW), Switzerland (SW).

- middle-low economies: Latvia (LV), Hungary (HU), Romania (RO), Croatia (CR), Turkey (TK).

The social economic indicators of sustainable development, used by Eurostat, and included in our research are as follows:
- Real GDP per capita, growth rate (gdp_cap);
- Investment by institutional sectors as percentage in GDP (invest_s);
- Dispersion of regional GDP per inhabitant as % of the national GDP per inhabitant;
- Net national income as % of GDP (gdp_reg);
- Household saving rate (%), (h_saving);
- Total R&D expenditure percent of GDP (r_d);
- Real effective exchange rate (reer);
- Energy intensity of the economy as Gross inland consumption of energy divided by GDP (kilogram of oil equivalent per 1000 Euro), (eie);
- Employment rate (ert);
- Employment rate, by highest level of education attained, as % of age group 25-64 years (er_ed);
- Dispersion of regional employment rates (er_reg);
- Unemployment rate (urt);
- Unemployment rate, by age group (ur_age).

Thus, our study is based on 4 variables regarding entrepreneurship indicators and 13 variables related to social economic indicators of sustainable development. The data collected characterized two years, 2006 and 2007, before the international crises affected European countries, in order to analyze the situation in an ordinary context.

Our hypothesis is that countries are distributed differently, depending on their economic development level.

4 Results
Applying PCA on the data described above, we have obtained 5 components, presented in table 1, which explain 77.320% of the total variance. We focused our research on the combination of the first three components CP1, CP2, CP3 with all the others, based on the fact they explain the most part of the variance, respectively 51.335%. Based on the components presented in Table 1, we focus on the
countries distributions, taking into consideration the components two by two.

<table>
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<tr>
<th>Variables</th>
<th>Components</th>
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</table>

Table 1

In Figure 2 are presented the first 2 components, CP1, CP2. CP1 is the result of all 4 entrepreneurship indicators combination used in this study. Thus, we can consider CP1 as being the entrepreneurial component. CP2 is based on three of the economic indicators and one social indicator – employment rate.

- in quadrant 2 -Q2 (+,-) are situated mainly countries from the north part of Europe, Norway, Sweden, Denmark, United Kingdom, Ireland but also other high-income countries: Greece, Spain, Portugal;
- in quadrant 3 -Q3 (-,-) there is an atypical situation for Portugal, which is placed in this quadrant in 2006, but it moves in the second quadrant in 2007.
- quadrant 4 -Q4 (-,+) presents an interesting case regarding Romania, which is almost exclusively isolated by all the other countries, mentioning that in 2007 Romania is positioned and, thus, totally defined by the variables which compose CP2. Romania has a comparable evolution as Latvia, in 2007.

This distribution could be explained by the characteristics of the national economic policies and the development level of the entrepreneurial activity of Romania. It is different from the other ex-socialist countries, with a low level of entrepreneurial activity and also lower levels of the macroeconomic indicators.

In Figure 3 it is shown the combination between components CP1 and CP3.

Component CP3 is formed by two social indicators related to the employment rate and dispersion of regional employment rates, on one hand, and two economic indicators such as investment by institutional sectors and national net income.
Based on Figure 3, a different distribution of the countries is recorded. Taking into consideration the fact that component CP3 includes the variable er_reg which has a negative contribution to its formation; we can notice that it separates Turkey from other countries, for both analyzed periods of time. Turkey maintains the position only in quadrant Q2, highlighting the characteristic of this country to be sensitive to this variable.

The grouping of the countries in the four quadrants formed by CP1 and CP3 is as follows:

- Q1 includes mainly Nordic countries, respectively high-income countries, changing the place of their group from the quadrant Q2, formed by the components CP1 and CP2, to the quadrant Q1, formed by CP1 and CP3.
- Q2 includes a group of ex-socialist countries and it also records the movement between the two quadrants, from Q1 with the combination of components CP1 and CP2, to quadrant Q2. Practically, countries from the high-income category exchanged their place with the middle-low income countries.
- Q3 groups Romania, an ex-socialist and a middle-low income country, with Belgium, Italy, which belong to high-income countries.

Figure 4 presents the graphical representation of the components CP1, regarding entrepreneurship, and CP4, based on household saving rate and unemployment rates.

As it is shown in Figure 4, most of the countries are grouped around the axis, maintaining their quadrant in both analyzed years. There are a few exceptions, e.g. Portugal changes its place from the quadrant Q4 in 2006, being positioned by component CP4 and negatively related to the component CP1, to quadrant Q1 in 2007, being positioned next to Greece, Spain, and Finland. Sweden also changed the quadrant Q3 in 2006 to the quadrant Q2 in 2007. Component CP1 could also be studied in relation with the component CP5, the last available component formed from the indicators taken into consideration.

Component CP5 is based only on two economic indicators, real effective exchange rate and total R&D expenditure % of GDP. Analyzing the countries distribution shown in Figure 5, we can notice that some ex-socialist countries are atypical, compared to other countries, maintaining their quadrant in both analyzed years. Thus, in quadrant Q1, respectively the positive space created by the two components CP1 and CP5, Hungary is placed next to Turkey, Spain, and Portugal. In quadrant Q2 we find Croatia, which means that it is positive in relation to the component CP1 regarding entrepreneurial rates, but it is negatively positioned relative to CP5, registering the tendency to approach to the axis regarding component CP5.

Quadrant Q3 groups only a few high-income countries, such as Sweden, Belgium, France, and Germany. Quadrant Q4 presents a situation comparable to that from Figure 2, which combines components CP1 and CP2, isolating Romania from all the others countries; mentioning that in 2007 Romania is positioned and thus, totally defined by the variables composing CP5.

Analyzing the combinations of entrepreneurial component CP1 with all the other four components which combined social-economic indicators, we noticed that most of the high income countries are grouped together in most cases, but the ex-socialist countries, with middle-low income, are grouped together only in a few cases. More than that, some of the countries from this category are totally different defined by the principal components.
Further on, we combine the components which are based on social-economic indicators, in order to determine the changes registered by high-income countries compared to the middle-low income countries. In this way, we can observe the stability or the imbalance which manifests at the macroeconomic level.

In Figure 6 it is shown the distribution obtained by combining component CP2, based mostly on economic indicators, with component CP3, based on social-economic indicators.

As it could be noticed in Figure 6, the middle-low income countries considered are distributed at significant distances from the axes, meanwhile the high-income countries are grouped together around the origin of the axes. This distribution reveals the stability and the highest level of development regarding those countries. Latvia and Slovenia are situated in quadrant Q1, being positioned in the positive space determined by components CP1 and CP2. In quadrant Q2, Romania, Croatia and Hungary are grouped together and, at an important distance, Turkey is positioned in the same quadrant, being negatively defined by component CP3. These countries are maintaining their quadrant in both analyzed years.

By combining component CP2 with CP4, both related mainly to social indicators, the high-income countries are not as concentrated as they are in the previous combination, as it is shown in Figure 7. We can consider in this case that the middle-low income countries are atypically positioned. But some of the countries from quadrant Q1, based on the previous combination, moved to quadrant Q2 and vice versa, for example Latvia and Slovenia, on one hand, and Hungary and Croatia on the other hand. Turkey is positioned in the same quadrant Q2, but in 2007 compared to 2006 it reduces the distance from the axis related to component CP4.

The combination between component CP2 and CP5 is presented in Figure 8. We have to take into consideration the fact that both components are based on economic indicators, even more, component CP5 relies only on economic indicators. In this case, the distribution is more similar to the combination between components CP2 and CP3; meaning that high-income countries are concentrated around the two axes, while middle-low income countries are distributed in different quadrants. Thus, Romania and Hungary are positioned in quadrant Q1, in both 2006 and 2007, with the tendency to increase the distance from the axis, as well as Latvia which have moved in this quadrant in 2007, from quadrant Q2 in 2006. Croatia is isolated in quadrant Q2, being negatively related to component CP5, and positively related to component CP2.

Combining component CP3 with CP4, we obtain the distribution presented in Figure 9. Most of the high-income countries are concentrated in quadrant Q1 and Q2, and some of the middle-low income countries registered high distance from one axis or the other. Latvia is included in this category, in quadrant Q2, and Croatia in quadrant Q4. Turkey is
positioned at the highest distance from the both components axes, in quadrant Q3, which means that it is placed in a negative space defined by the two components.

Fig 9 REGR factor for CP3 and CP4
In Figure 10 it is shown the distribution based on components CP3 and CP5, which is comparable with the previously presented one.

Fig 10 REGR factor for CP3 and CP5
Thus, the high-income countries are concentrated around the origin of the axes and most of the middle-low income countries are situated at some distance from an axis or another. More than that, Latvia has changed the quadrant, being positioned in Q2 in 2006 and has moved in Q1 in 2007, maintaining the distance from the component C5. Turkey is again at an important distance from the axis of the component C5, being placed in 2007 in quadrant Q4.

4 Conclusion
The results of this research reveal that using entrepreneurship and social-economic indicators, by applying PCA, we can obtain a different distribution of the European countries. Considering the components two by two, each country is replaced in the bi-dimensional space created and it allows us to study more variables in the same graphic. Each combination of the components shows the particularities of the country we are interested in and also allows us to identify the changes registered by each country in time.

Our hypothesis was confirmed by the results, meaning that high-income countries are grouped together in most of the cases, meanwhile middle-low income countries are placed at some distance from the others countries.

These types of analyses represent an important source of information regarding the main objectives of the national economic policy.

References:

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