

Cluster and Factor Analysis of Structural Economic Indicators for Selected European Countries

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Abstract: - The last wave of EU enlargement ended on 1st January 2007 with the accession of Romania and Bulgaria. Many countries of the South-Eastern Europe aspire to join the EU. Croatia appears to be the next prospective member, so the aim of this paper was to classify Croatia and EU 27 Member States according to the structural economic indicators. These countries were gathered into homogenous groups in terms of the following structural economic indicators: GDP per capita, total employment rate, comparative price levels, employment rate of older workers, long term unemployment and productivity of national economies expressed in relation to the European Union (EU-27) average. Firstly, the cluster analysis was used on three structural economic indicators: GDP per capita, total employment rate and comparative price levels. The hierarchical cluster analysis and non-hierarchical cluster analysis were applied and gave similar results. The factor analysis was then provided to find out the common factors of six structural economic indicators: GDP per capita, total employment rate, comparative price levels, employment rate of older workers, long term unemployment and productivity of national economies. Two factors were extracted and the factor scores for each observation were calculated. The factor scores were used in further cluster analysis and again similar results of classification was given.

Key-Words: - Classification, Structural economic indicators, Multivariate methods, Hierarchical cluster analysis, Non-hierarchical cluster analysis, Factor analysis.

1 Introduction

At the end of the 1980s and the beginning of 1990s, after the Cold war, and after the collapse of communism there was an opportunity for the European integration process to focus on countries of former Eastern Bloc [14]. This enlargement is distinguished by its importance, however, both politically and economically. Indeed, it is for the first time when countries belonging to the former communist bloc have become members of the single market [10].

The increasing openness of the Eastern European countries [4] during the gradual transition to market economy makes these to become targets for foreign investors. Their specificities have played an important role in the attractiveness of different types of investments, leading to changes in the market structure [9].

After the unification of Germany, or to be more precise, ten years later, 5th expansion wave of European Union took place and it symbolised the biggest swing in the integration of European continent by the number of new members as well as by abolition of segmentation on European East and West. On 1st May 2004, EU expanded on 10 new countries: Estonia, Lithuania, Latvia, Poland, Czech Republic, Slovakia, Hungary, Slovenia, Malta and Cyprus. The last (5th) wave of enlargement ended on 1st January 2007 with the accession of Romania and Bulgaria. Many countries of South-Eastern Europe aspire to join the EU [14].

The integration of these countries raises one third of the population and the area of EU, while wealth increases only by five percent. In fact, the real convergence is at the centre of all economic issues of EU enlargement towards East. The

existence of wealth difference among members brings up the question of economic sustainability of this enlargement. This integration represents a challenge for the EU, integrating countries whose per capita income is less than 40% of EU average measured in purchasing power parity [10].

However, yet many countries of South-Eastern Europe aspire to join the EU [14] and Croatia appears to be the next prospective member. Apart from Croatia, Macedonia and Turkey already have the candidate status, while Albania, Bosnia and Herzegovina, Serbia and Montenegro participate to a different extent in the Stabilisation and Association process (which provides a legal framework for the relations between the EU and potential members in the period prior to possible accession). In many cases, these partnerships are seen as a first step towards closer integration, but they are not a guarantee for full membership [6]. It is a common view that enlargement poses a severe challenge for EU structural and cohesion policies. Far less clear and uncontroversial is the empirical and analytical basis for that statement.

At its meeting in Lisbon in March 2000, the European Council set a strategic goal for the next decade of making Europe "the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion" (the Lisbon agenda for reform in Europe, whose goal is to improve Europe's global competitiveness [11]). In 2005, a new approach to the Lisbon strategy was decided upon, focusing on growth and employment. The structural indicators provide a tool for the objective assessment of progress made towards the Lisbon objectives and are used by the European Commission to support their analysis in the Annual Progress Report to the European Council [15].

This paper focuses on chosen structural economic indicators of Croatia in comparison to the ones of EU 27. The main purpose is to investigate to what extent Croatian economy resembles economies of EU 27 Member States in terms of structural economic indicators. In other words: in what group of countries does Croatia come under, since it's natural to suppose that it should group with the countries with a similar historical and political background (Central and Eastern European countries).

According to the research of Christian Weise (German Institute for Economic Research), despite recent growth rates above EU 15 average, economic convergence remains limited. Poland, Slovenia, Hungary, Slovakia and Czech Republic

display the most positive macroeconomic indicators. Considerable labour market changes have occurred associated with the process of economics restructuring, privatisation and liberalization. These include a sharp fall in industrial employment and a substantial rise in service sector employment, but noticeable differences with the employment structure of the EU Member States remain. Unemployment has risen in all CEE countries to varying extents. Income levels and standard of living have declined and poverty has spread considerably with a variation between countries and a disproportional effect on certain social groups. The spread of sub-national disparities in GDP and unemployment in the CEECs is smaller than in other EU Member States.

According to the previously mentioned research, disparity patterns (at NUTS II level) include the following: GDP per capita in CEE regions is considerably less than EU average (only Prague and Bratislava lie above this level), regional unemployment is relatively low in CEE in comparison to the EU 15 (with noticeable sub-national variation), CEE regions are in general more sparsely populated than the EU 15 and agriculture dominates regional employment structures in, for example, Romania and Poland to much greater extent than in the EU 15. However, the increasing uncertainties regarding the EU absorption capacity and its future enlargements, as well as unsorted institutional issues seem not to be affecting Croatia's current path towards the accession [12].

Croatia's small size causes little concern about the impact it would have on EU institutions, policies and its budget. Therefore it has been repeatedly confirmed by EU officials that Croatia would join the EU as quickly as possible, provided that it fulfils all the required accession criteria which primarily relate to the progress with adopting and implementing the EU law. In some areas, however, they also include broader political and economic reforms [6].

2 Problem Formulation

In this paper the following structural indicators of Croatian economy (CR) were analysed: GDP per capita (GDPpc), total employment rate (EMPL), comparative price levels (PRICE), employment rate of older workers (EMPOLD), long term unemployment (UNEMPL) and productivity of Croatian economy expressed in relation to the

European Union (EU-27) average (PROD). The enumerated indicators were analysed in comparison with those of the following countries: Belgium (BE), France (FR), Italy (IT), Greece (GR), Spain (SP), Czech Republic (CZ), Lithuania (LI), Estonia (ES), Latvia (LA), Cyprus (CY), Portugal (PT), Slovenia (SN), Bulgaria (BU), Hungary (HU), Poland (PL), Romania (RO), Slovakia (SK), Malta (MA), Denmark (DE), Germany (GE), Austria (AU), United Kingdom (UK), Netherlands (NE), Sweden (SW), Ireland (IR), Finland (FI) and Luxembourg (LU). Using cluster as well as factor analysis, the main purpose of the paper was to explore in which group of countries Croatia fits in, based on enumerated structural economic indicators [1, 2, 3, 5, 7, 8]. The data for the analysis were taken from Eurostat web site for the year 2007.

As an indicator of economic activity, Gross domestic product (GDP) was chosen. It is defined as the value of all goods and services produced less the value of any goods or services used in their creation. The volume index of GDP per capita in Purchasing Power Standards (PPS) is expressed in relation to the European Union (EU-27) average set to equal 100. Basic figures are expressed in PPS, i.e. a common currency that eliminates the differences in price levels between countries allowing meaningful volume comparisons of GDP between countries.

Another structural indicator of interest is total employment rate. The employment rate is calculated by dividing the number of persons aged 15 to 64 in employment by the total population of the same age group. The indicator is based on the EU Labour Force Survey. The survey covers the entire population living in private households and excludes those in collective households such as boarding houses, halls of residence and hospitals. Employed population consists of those persons who during the reference week did any work for pay or profit for at least one hour, or were not working but had jobs from which they were temporarily absent.

However, the employment rate of older workers is calculated by dividing the number of persons aged 55 to 64 in employment by the total population of the same age group.

Long-term unemployed (12 months and more) persons are defined as those aged at least 15 years not living in collective households who are without work within the next two weeks, are available to start work within the next two weeks and who are seeking work (have actively sought employment at some time during the previous four weeks or are not seeking a job because they have already found a job to start later). Where as the total active

population (labour force) is the total number of the employed and unemployed population. The duration of unemployment is defined as the duration of a search for a job or as the length of the period since the last job was held (if this period is shorter than the duration of the search for a job).

Comparative price level is also an indicator chosen for this analysis. Comparative price level is the ratio between Purchasing power parities (PPPs) and market exchange rate for each country. The ratio is shown in relation to the EU average (EU27 = 100).

Finally, GDP per person employed that intended to give an overall impression of the productivity of national economies expressed in relation to the European Union (EU-27) average last entered the analysis. If the index of a country is higher than 100, this country's level of GDP per person employed is higher than the EU average and vice versa. Basic figures are expressed in PPS where it should be noted that in this indicator 'persons employed' does not distinguish between full-time and part-time employment

Although this analysis is accompanied by a number of constraints that have to be taken into account when interpreting the results, it is quite interesting to know in which groups of EU 27 countries was Croatia classified.

3 Problem Solution

The cluster analysis and factor analysis were applied to classify EU 27 countries and Croatia according to the following structural economic indicators: GDP per capita, total employment rate, comparative price levels, employment rate of older workers, long term unemployment and productivity of national economies expressed in relation to the European Union (EU-27) average.

Firstly, the hierarchical cluster analysis was run on three following variables: GDP per capita, total employment rate and comparative price levels. The non-hierarchical cluster analysis was then used to improve the results of the given hierarchical cluster solution.

The cluster analysis was also run to classify Croatia and 12 European countries which joined during the last two waves of enlargement. The hierarchical and non-hierarchical cluster analyses were also applied.

The factor analysis was then applied to find out the common factors of six structural economic indicators: GDP per capita, total employment rate, comparative price levels, employment rate of older

