Evaluating Romania's regional competitiveness using Analytic Hierarchy Process

OANA STĂNCULESCU[1]

In recent years, the evaluation of regional competitiveness aroused the interest of academics as well as policymakers. In the specialized literature many definitions for the concept of regional competitiveness and also several evaluation methods of the level of regional competitiveness can be found. From our point of view, regional competitiveness is regarded as a matter of decision, in which all factors of influence, seen as criteria, should be analyzed in order to identify the best method to improve the regional competitiveness level. In our paper we applied the Analytic Hierarchy Process (AHP) method, a multi-criteria decision-making method by which we can evaluate the competitiveness of the Romanian regions using quantitative data and define the position of these regions in the national ranking.

Keywords: regional competitiveness, analytic hierarchy process, factors, pair wise comparison.

JEL codes: C61, P25, P48, R11, R58.

Introduction

There are many ways in which regional competitiveness can be assessed either by analyzing a single factor, or a set of factors, using theoretical models of competitiveness (Lengyel 2003, Ecorys Group 2003) or by creating composite indices (Snieska and Bruneckiene 2009).

In this paper, regional competitiveness is seen as a decision-making process where determinants are the criteria of the process. Based on this approach, the competitiveness of the Romanian regions (except for the Bucharest-Ilfov region) will be evaluated through a multi-criteria analysis method, namely the Analytic Hierarchy Process (AHP).

The purpose of the paper is to rank the Romanian regions taking into

[1] PhD student, Babeş-Bolyai University, Faculty of Economics and Business Administration, e-mail: stanculescu.oana@yahoo.com

account a set of criteria in the form of measurable indicators. This method can be used to examine the influence factors of regional competitiveness and to provide directions to improve the regional competitiveness level.

Literature review

As a concept, regional competitiveness is not very sharply defined and there is no universally accepted definition in the literature. As a phenomenon, regional competitiveness is strongly exploited in the regional development strategies; authors such as Porter, Storper, Camagni and Krugman admit that the regions play a key role in terms of stimulating economic growth and competitiveness (Bosma et al. 2011).

In order to assess regional competitiveness, we must first understand its meaning. The literature is not devoid of economists' interventions tackling the regional dimension of competitiveness; for example, Michael Porter tried to define regional competitiveness by connecting it with the regional living standard. He believes that productivity is the most suitable definition of regional competitiveness, as it depends on the value of goods and services and the efficiency with which they are produced (Porter 2002).

According to Storper, one of the meanings of regional competitiveness is „the ability of an economy to attract and maintain firms with stable or rising market shares in an activity while maintaining or increasing standards of living for those who participate in it" (Storper 1997. 20).

Lengyel (2003) groups the different approaches of competitiveness into two categories:

1. „Ex-post competitiveness" or „revealed competitiveness" aimed at measurable results of the economy, represented by indicators such as the GDP growth rate, productivity, trade balance and export market shares;

2. „Ex-ante competitiveness" focuses on sources of competitive advantages of firms, rather than on a set of indicators of economic performance, an approach that aims primarly business conditions, seen as inputs. Briefly, this approach offers a number of arguments which may be useful for assessing regional competitiveness: knowledge base, skilled labour, infrastructure etc.

Other studies address this issue in terms of increasing the level of living standards and reducing the differences between revenues. In most of these studies, regional competitiveness is correlated with high levels of employment.

The most common method for assessing regional competitiveness, widely accepted in the European Union, is based on the calculation of per capita GDP, considered to be the indicator that best describes the development of the regions, respective its level of competitiveness. This indicator is representative for the measurement of the generated revenue volume per capita in a region, offering a high degree of comparability. According to Lengyel, the measurement of regional competitiveness can be achieved through three economic categories. The correlation between these categories is the following (Lengyel 2003):

$$\text{Regional income} \approx \text{Labour productivity} \times \text{Employment rate}$$

Lengyel (2003) treats regional competitiveness as the growth generated by high labour productivity (measurable indicator: GDP/employment) in the region, a higher employment rate (measurable indicator: employment rate) and the degree of economic openness of the region (meaurable indicators: the values of imports and exports). He also built a pyramid model that classifies the factors influencing the quality of life and living standard and hence the regional competitiveness on three levels, as follows (Lengyel 2003):

1. Basic factors: consisting of measurable indicators of competitiveness: labour productivity, employment and the economic openness of the region.

2. Growth factors: influencing the first category, are being used to improve the competitiveness of a territory: R&D, SMEs, FDI, infrastructure and human capital, institutions and social capital;

3. Success factors: which build up over time; their influence is visible only after long periods of time: economic structure, innovation, regional accessibility, qualified labour, social structure, regional identity.

In our opinion, GDP/capita could also be considered a basic factor.

Experts of the Ecorys Group assessed regional competitiveness by taking into account a number of factors and grouping them in an

arborescent structure (Competitiveness tree model): human resources, innovation, connectivity and industrial structure are the factors which form the roots of the tree, the productivity represents the trunk; income, employment, profits and taxes are the branches. The most important components are considered those from the roots, as they represent the deteminants of competitiveness. (Ecorys Group 2003)

Regional competitiveness is a topical issue partially covered; regional competitiveness evaluation methods are not standardized. At national level, several studies that address this issue were identified. Most of them establish a hierarchy of the Romanian regions based on the calculation of a regional competitiveness index. The Group of Applied Economics (GAE 2007) developed a regional competitiveness index based on economic, social and technology-related indicators and obtained a ranking of the Romanian regions using this index. In the study conducted by the IRECSON Institute regional competitiveness level was calculated based on the analysis of 171 indicators and the situation of the regions was also compared. (IRECSON 2012)

However, competitiveness can't realistically be measured by analyzing a limited set of indicators, because it is a complex concept. We can believe that the assessment of competitiveness should be carried out using an easy to apply method which offers some indication of the factors that should be supported in the future. The AHP method helps breaking the complex problem down into several easily understandable and less complex pieces (sub-problems) by establishing priorities. The strategic decisions in the planning process should be based on the results of the competitive position measurement and the regions' potential.

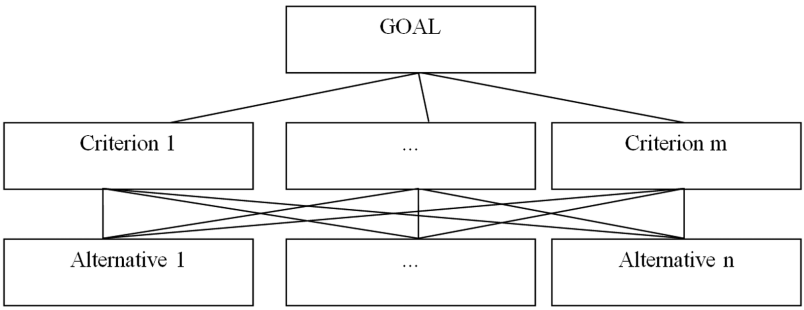
The AHP method is accessible and allows a rapid assessment of the regional competitiveness level. There have been studies in which regional competitiveness has been evaluated using the AHP method, applied to the Czech Republic and Slovakia between 2000-2006, taking into account measurable macroeconomic indicators (GDP, gross fixed capital formation, gross domestic expenditures on research and development, net disposable income, knowledge intensive services and

patents). The results of these studies showed that GDP has the greatest influence on regional competitiveness. (Kiszová and Nevima 2012)

Methodology

As mentioned above, the evaluation of regional competitiveness is a decisional process. Starting from this premise, the AHP multi-criteria analysis method can help us with our approach. Through this method we will try to evaluate the regional competitiveness in Romania – with the exception of Bucharest-Ilfov region which, from a development point of view, is situated at quite a distance from the other regions –, in the 2006-2010 time frame, using official statistical data. The final result of applying the AHP method will be the hierarchy of these regions within the chosen analysis margins.

The multi-criteria analysis helps with the evaluation of more options in case of a problem or complex decision-making situation. In the case at hand, regional competitiveness is a problem and a complex decision. The analysis implies the existence of a set of methods: for each objective, one or more methods of measuring each option's performance in solving the problem will be used.



Source: Nevima and Kiszová 2012

Figure 1. Three-level hierarchic structure

The multi-criteria analysis implies:

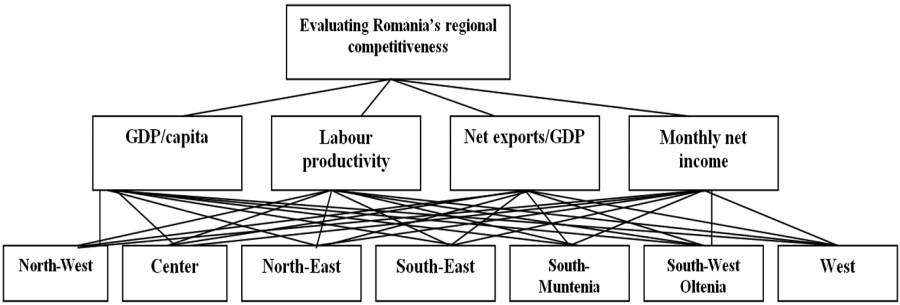
• very well expressed objectives: the goal, in this case, is the evaluation of Romania's regional competitiveness;

• each criteria must be assigned a certain weight/value based on its importance: in this case, the criteria will be the indicators which we will be using for comparing the regions;

• each alternative must be evaluated/noted according to each criteria (the extent to which each alternative leads to achieving the goals of the public policies): in this case, the alternatives are the regions;

• for each alternative the sum of all the given grades is computed, the alternatives being ranked based on each result.

Thus, in our case, the hierarchical structure levels will look like Figure 2.



Source: own research

Figure 2. Regional competitiveness – Three-level hierarchic structure

The method's criteria (the indicators which are at the base of the evaluation) were selected by taking into consideration the influence that each of them has on the region's competitiveness, representing that category of base factors described in the literature review. They are measurable indicators, offering a high degree of comparability. Of course, the research can be extended by using other indicators, such as: business environment structure, research and development activities, infrastructure, FDI, etc. However, the paper at hand is confined to the base indicators of regional competitiveness, unanimously accepted in the specialized literature: GDP per capita, labour productivity (GDP/employment), net exports/GDP and monthly net income.

As already mentioned, GDP/capita is one of the most representative indicators of regional competitiveness. It measures the economic activity generated by the production of new goods and services in a certain region. This indicator was chosen because it reflects the living standard of a region's inhabitants. The source of these data is the National Institute of Statistics (NIS).

Labour productivity (GDP/employment) is an indicator agreed upon by the majority of specialists from this field, considering it to be at the essence of regional competitiveness. This indicator measures how effective is the use of human capital in obtaining the regional GDP, as well as how competitive a certain region is in comparison with the others by evaluating the contribution of its human capital to the regional GDP. The data has been provided by the National Institute of Statistics.

Net exports represents the difference between the total value of exports and imports at regional level. In the comparative analysis, the absolute value of the net exports is less relevant, because it shows the excess of demand in the region regardless to the size of the regional economy. That is why we consider it is necessary to report net exports to the regional GDP (net exports/GDP). The value of a region's exports is dependent on the size of the economy of that region, and a high level of exports represents a high level of competitiveness.

Monthly net income represents the difference between the gross income and the income tax, contributions for health and social insurance and any taxes on other income generating assets, setting the effective purchasing power of a regions population.

The AHP method (Analytical Hierarchy Process) is a method practiced in order to solve a complex decisional problem which implies the comparison of attributes or variants. Generally speaking, the method developed by Saaty (1982) allows the deciders to represent the interaction of multiple factors, attributes, characteristics or variants. The AHP method is based on building a series of "pair comparison" matrices which compare all the criteria between each other. Saaty elaborated a scale for the Intensity of Importance with 9 points which properly reflect the priorities of the comparison between the two elements (Table 1).

Table 1. Saaty's fundamental scale

Intensity of importance	Definition
1	Equal importance
3	Moderate importance
5	Strong importance
7	Very strong importance
9	Extreme importance

Source: Saaty 1982

The values 2, 4, 6 and 8 represent intermediate values or compromise values. They can be used to represent shades of judgment in completing the 5 base evaluations. (Roman 2012)

The Analytical Hierarchy Process has at its base three stages of decision-making:

1. Initiation – the criteria used to define the decision are set, by brainstorming or based on the decision-maker's judgment. The hierarchical relations between the criteria are represented using a matrix;

2. Evaluation – the criteria added in the hierarchical matrix are compared based on their relative importance;

3. The final evaluation – the potential solutions are sorted out based on each criteria.

The application of the AHP method involves the following steps: building the hierarchical structure of the decision problem, determining the alternative relative weights compared with the hierarchy attributes and sub-attributes, calculating the total score of each alternative, determining the indicators of consistency by the pairwise comparison and developing the final decision based on the results.

Results and discussion

This research aims to assess the competitiveness of the Romanian regions for each particular year in the period 2006-2010 (the last year for which official data are available).

According to the methodology, the alternatives are the Romanian regions, namely North-West (NW), Center (C), North-East (NE), South-East (SE), South-Muntenia (S), South-West Oltenia (SW) and West

(W). These alternatives were evaluated from the perspective of the following criteria: GDP/capita, labour productivity (GDP/employment), net exports/GDP and monthly net income. Table 2 presents the values of the indicators for 2010.

Table 2. The absolute values of the indicators, in 2010

2010	GDP/capita (RON)	Labour productivity (RON)	Net exports/GDP	Monthly net income (RON)
NW	21827.2	51393.3	-0.000037	2307.9
C	23428.3	59013.9	-0.000333	2299.0
NE	15014.8	46114.2	-0.000129	2047.4
SE	20076.8	56628.3	-0.000054	2029.7
SM	20288.2	57252.2	0.000002	2369.2
SWO	18735.1	50361.7	0.000014	2134.1
W	27640.0	65306.7	0.000028	2344.6

Source: own calculations based on official statistical data

In the second stage, pairwise comparison between alternatives was applied, with the aim to establish a hierarchy between the decisional alternatives. The pairwise comparison is used in order to determine the degree of relative importance of the elements. In other words, regions will be compared to each other in terms of the proposed criteria. Note that if the information is quantitative, as in the present case, the comparison has as the result the ratio between the alternatives' values. The comparisons should be made to determine the relative importance of the criteria to achieve the intended purpose. Thus, the criteria pairwise comparison matrix is as follows:

Table 3. Pairwise comparison matrix

	GDP/capita	Labour productivity	Net exports	Monthly net income	Total score	Overall weights or priorities
GDP/capita	1	3	7	5	16	**0.557892**
Labour productivity	1/3	1	5	3	9.33	**0.263345**
Net exports/GDP	1/7	1/5	1	1/3	1.68	**0.056890**
Monthly net income	1/5	1/3	3	1	4.53	**0.121873**
Total					31.54	**1.00**

Source: own calculations

For example, value 3 in the first row of Table 3 shows that, in our opinion, the GDP/capita criteria is contributing in a greater degree to accomplish the established objective (which is regional competitiveness), than labour productivity.

From the comparison of the four criteria a square matrix resulted. This comparison can be considered subjective by the fact that the ranking criteria is left to the appreciation of the decision-maker. We considered that GDP/capita is the most important criteria which best reflects the state of regional competitiveness, associating it with the living standard of the inhabitants; the next indicator, in the order of their importance, is labour productivity. The monthly net income is the third in the order of importance as it shows the purchasing power and living standard of the regions' inhabitants. The "net exports/GDP" indicator was considered the least important; therefore it obtained a lower score.

The results obtained by applying the AHP method have ranked the Romanian regions, capturing some influences of the indicators used in the analysis.

Table 4. The results obtained by considering the overall weights

2010	NW	C	NE	SE	SM	SWO	W	Overall weights or priorities
GDP/capita	0.148474	0.159365	0.102134	0.136567	0.138005	0.127441	0.188014	0.557892
Labour productivity	0.132689	0.152364	0.119059	0.146205	0.147815	0.130025	0.171842	0.263345
Net exports/GDP	0.074788	0.666395	0.258818	0.108187	-0.00425	-0.02934	-0.05682	0.056890
Monthly net income	0.148588	0.148016	0.131819	0.130679	0.152538	0.137403	0.150957	0.121873
Results	**0.140139**	**0.184983**	**0.119123**	**0.136773**	**0.134267**	**0.120416**	**0.165310**	1.00

Source: own calculations

While analyzing the impact of the indicators, we observed different results on how they influence the competitiveness of each region across the years. What we also noticed is that some regions tend to be more influenced by a certain indicator rather than the rest. For example, net exports/GDP has a high and constant impact on the Center regions'

competitiveness, while GDP/capita tends to determine the competitiveness of the West region; out of all the indicators, labour productivity has the biggest impact on the South-Muntenia regions' competitiveness. It is a rather peculiar result, that the competitiveness of the North-East region, where living standards are the lowest, is greatly influenced by the monthly net income.

Table 5. Ranking of the regions, 2006-2010

Rank	2006	2007	2008	2009	2010
NW	3	3	3	7	3
C	1	1	1	1	1
NE	7	7	7	5	7
SE	4	5	4	6	4
SM	5	4	5	4	5
SWO	6	6	6	3	6
W	2	2	2	2	2

Source: own calculations

The hierarchy of the regions is presented in Table 5. We notice that, for some of the regions, substantial changes were captured in 2009. The least competitive region in the mentioned year was the North-West region that had registered the highest deficit. This result has significantly influenced its economic performance. In all the analysis years, the region which topped the rankings was the Center region, followed by the West region. Due to the fact that the analysis is based on complex indicators, it is difficult to identify some other types of influences on regional competitiveness. However, the AHP method has provided an alternative ranking of Romania's regions.

Conclusions

The research at hand aimed at prioritizing the Romanian regions (except for the Bucharest-Ilfov region) using the AHP multi criteria analysis. Thus, the most relevant indicators were selected in order to properly assess the competitiveness of the Romanian regions.

Among the advantages of this method we can mention: the ease with which it can be used, the use of qualitative and quantitative factors and

that different hierarchies can be performed according to the complexity of the problem. The method gives the freedom of choosing the most appropriate criteria with the purpose of making a good decision. The study is intended to the local governments, in order to assess regional competitiveness and compare their policies with those of other regions; the business community, to achieve investments plans, and to academics, who can use it to better understand and analyze how regions compete in the market.

Like any other method, the AHP has also some limitations. It is important to note that this method involves a high degree of subjectivism especially in the stage of establishing the weight of each indicator.

In the future, we will try to prove the applicability of the method by applying at industry level (as alternatives) in one specific region and choosing specific indicators (such as the turnover, number of employees, labour productivity etc.) in order to identify the most competitive industry in the regional economy.

References

Bosma, N., Stam, E. and Schutiens, V. (2011). Creative destruction and regional productivity growth: evidence from the Dutch manufacturing and services industries. *Small Business Economics*, 36, 401-418.

Ecorys Group (2003). *A study on the factors of regional competitiveness. A draft final report for the European Commission*. http://ec.europa.eu/ regional_policy/sources/docgener/studies/pdf/3cr/ competitiveness.pdf, downloaded at 16.10.2013.

Filip, F. G. (2007). *Sisteme suport pentru decizii. Ediţia a II-a, revăzută şi adăugită*. Bucureşti: Editura Tehnică.

GAE (2007). *Manual de evaluare a competitivităţii regionale*. http://www.adrmuntenia.ro/documente/manual-de-evaluare-a-competitivitatii-regionale.pdf, downloaded at 15.10.2013.

IRECSON (2012). *Competitivitatea la nivelul regiunilor de dezvoltare - 2011*: http://www.roinno.ro/pdf/Competitivitate2011.pdf, downloaded at 17.10.2013.

Kiszová, Z. and Nevima, J. (2012). *Evaluation of regional competitiveness in case of the Czech and Slovak Republic using analytic*

hierarchy process. http://www.wseas.us/e-library/conferences/2012/Zlin/EPRI/EPRI-44.pdf , downloaded at 18.10.2013

Lengyel, I. (2003). Economic Growth and Competitiveness of Hungarian Region. In *Reinventing Regions in the Global Economy Regional Studies Association Conference*, 12-15th April, Pisa, Italy. http://www2.eco.u-szeged.hu/region_gazdfejl_szcs/pdf/Economic_growth_and_competitiveness_of_Hungarian_regions.pdf, downloaded at 20.10.2013.

Porter, M. E. (2002). *Regional Foundations of Competitiveness. Issues for Wales-Conference*. http://www.isc.hbs.edu/Wales%20Reg%20Comp%2004-02-02%20CK.pdf, downloaded at 10.10.2013.

Roman, M. (2012). *Analiza multi-criterială – Manual*. http://www.fonduri-ue.ro/res/filepicker_users/cd25a597fd-62/Documente_Suport/Studii/0_Studii_Instrumente_Structurale/Pag.3_ACB/19_Analiza_Multicriteriala.pdf, downloaded at 18.10.2013.

Saaty, T. (1982). *Decision-making for Leaders*. California: Wadsworth.

Snieška, V. and Bruneckienë, J. (2009). Measurement of Lithuanian Regions by Regional Competitiveness Index. *Engineering Economics*, 1(61), 45-57.

Storper, M. (1997). *The Regional World: Territorial Development in a Global Economy*. New York: The Guilford Press.