A POSSIBLE METHOD OF MEASURING THE COMPETITIVENESS OF HUNGARIAN COUNTIES

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Key words: regional competitiveness, regional economic development, typology of regions.

SUMMARY FINDINGS, CONCLUSIONS, RECOMMENDATIONS

The main challenge of regional economic development is undoubtedly to increase the living standard and welfare of the local population. Usually the state of development of regions within one country significantly differs. In Hungary, the capital dominates in development, the Western part is emerging, and the Eastern territorial units, mostly the ones by the boarder are lagging behind. Due to their different starting conditions they cannot be developed by the same action plans.

The present paper aims to rank the Hungarian counties and the capital alongside development phases, with the help of multi-variable data analysing methods based on a determined system of viewpoints, and adequate theoretical models and statistical data. We developed a weighting system of the indicators, following the logic of the adequate theoretical models. We are convinced that the theoretical model presented and the methodology based on it is suitable for making regional competitiveness measurable. Through this and with the help of statistical data, the competitiveness of any spatial unit of any level can be determined.

CONCLUSIONS

In Hungary, there are significant disparities in regional competitiveness among the Hungarian counties and the Capital. These disparities stem from structural deficiencies in key factors of competitiveness, like inadequate endowment of physical and human capital (of infrastructure and work force skills), a lack of innovative capacity, and of effective business support, etc.

This paper presents the classification of Hungarian counties based on the pyramid model of competitiveness. The use of various methods with different logics lead to similar results, therefore, it is likely that we managed to map the competitiveness of counties realistically. Based on this, we believe that the pyramidal model and the methodology based on it are suitable to make regional competitiveness measurable and to outline the possibilities of economic development. The results introduced in this paper constitute one of the first steps of our research; in the following we would like to test the statistical methodology, with special emphasis on checking the weight of indicators. Furthermore, we would like to define types of competitiveness that may also serve as the basis of realistic economic development strategies.

Economic development should not be executed homogeneously, one should take into consideration the attributes and starting conditions of that certain territorial unit. The variety of starting conditions requires different interventions and strategies of economic development from region to region. Spatial units with different levels of competitiveness should take variant steps on the road of economic development in order to achieve competitiveness in the global world.

INTRODUCTION

The access of Hungary to the EU, the regional policy and the supporting system of the EU highlight the issue of regional disparities. The developed regions are able to embed in the international economy more efficiently and the FDI (foreign direct investment) flows to these regions first. As a result the danger of a further deepening of the competitiveness gap is real, since the process of economic development comes alongside the growth of regional disparities for a while.

During the beginning of the 1990s after the transformation of the political system in Hungary the regional differences sharpened remarkably. This process hasn't stopped by the beginning of the 21st century. Parallel to the catching-up process of Hungary at the national level, there is another discernible process at the regional level: regional disparities are widening because the growth of the most developed regions and counties is increasing while the less favoured regions and counties are lagging behind (*Lengyel, 2004; Lukovics, 2004*). One of the possible tools to prove the above mentioned statements can be the notion of regional competitiveness. Since 2004, the year of the enlargement of the European Union to 25 member states, the concept of economic and social cohesion, furthermore the notion of regional competitiveness, are becoming key factors. "Competitiveness and cohesion reinforce each other" (*CEC, 2004, p. 4.*). There are several definitions of regional competitiveness. Perhaps, the approach of regional competitiveness, published in the Sixth Periodic Report of the EU is based on the widest consensus: "*The ability of companies, industries, regions, nations and supra-national regions to generate, while being exposed to international competition, relatively high income and employment levels"* (*CEC, 1999, pp. 75.*).

The above-mentioned standard definition and the resulting economic indicators enable us to measure competitiveness fairly precisely. The *pyramid model of regional competitiveness* seeks to provide a systematic account to describe the basic aspects of improved competitiveness (*Lengyel, 2004*). Because of the logical framework and transparency of the pyramid model based on wide professional consensus, it is serving as the basis of our empirical research. The development (programming) factors and success determinants placed in the model significantly affect regional disparities (*EC, 1999*).

POSSIBLE TYPOLOGY OF REGIONS

In connection with the notion of competitiveness there are several well-known typologies of regions available. In this paper we will emphasise three of them, which are the most important from the aspect of our research:

I. the stages of economic development by Porter,

II. the region types arising from the spatial aspects of the fordist and the post-fordist cycle,

III. the typology of the University of Cambridge regarding the European regions.

According to *Michael E. Porter's (2003)* well-known typology, successful economic development is a process of successive upgrading. Regions at different levels of development face distinctly different challenges. He distinguished three different types of regions: *factor-driven* economy, *investment-driven* economy and *innovation-driven* economy.

The three types of regions, which has been developed by the extension of the fordist and the post-fodist cycles, are based on the knowledge-based economy (*Lengyel, 2003*):

1. *Neo-fordist regions*: the primary motivation of the investor companies to this region is some kind of cost advantage (cheap labour force, tax reduction). The R&D activity of these countries is low, they use technologies bought delayed from other regions.

2. *Knowledge applying regions*: the role of innovation is more significant, than in the neo-fordist regions. The companies of this type of region buy the best technology available outside the region.

3. *Knowledge creator regions*: the source of permanent competitive advantages is innovation. The companies cooperate successfully with the universities. High tech companies are characteristically concentrated in science parks. They use self-invented technologies.

The University of Cambridge analysed the factors underlying differences in regional competitiveness, which will be of direct use in ensuring the appropriate formulation of the EU cohesion policy 2007 to 2013. Their research separated three different types of regions along two dimensions: GDP (gross domestic product) growth/capita and population density (*Martin, 2003, pp. 6-23.*):

1. *Space regions*: according this typology these are the least developed regions with low GDP per capita, population density and attractiveness of FDI.

2. *Regions as production sites*: regions with lower to medium income levels, which derive their productivity above all from cheap inputs. Determinants of competitiveness often lie in the field of basic infrastructure and accessibility, such as low-cost sites and availability of human resources at reasonable costs.

3. a) *Regions as sources of increasing returns*: high growth regions with an average population density. A selected number of industries are an important source of wealth, this provides high and sustainable incomes for these regions.

b) *Regions as hubs of knowledge*: regions with a higher population density and high and sustained GDP growth. These regions are open to international activities, they offer the best career opportunities that attract talented workers, they bring about the best matches between labour demand and supply, and are characterized by high levels of R&D, entrepreneurship, new firm formation and patent activity.

As shown above, the most important typologies of regions segregate three types of regions (Figure 1). This fact encourages us to classify the Hungarian counties and the capital into three relatively homogenous clusters.

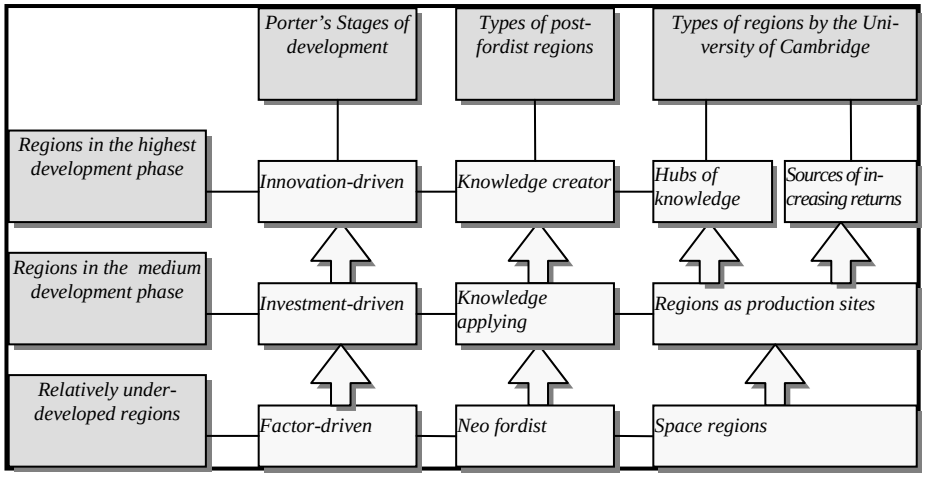
ATTEMPT TO MEASURE COMPETITIVENESS

Regional competitiveness is a very complex notion, which can't be described with one or two indicators alone. The measuring of competitiveness can be achieved by using indicator-systems. The key issue is to select the relevant

and adequate indicators. In our survey, selection of the indicators is based on the logical framework of the pyramid model, which seeks to provide a systematic account of the measuring and to describe the basic aspects of improved competitiveness (*Lengyel, 2004*). According to the build-up of the chosen logical model, in our research we would like to characterise the basic categories (ex post) and the development factors (improve competitiveness in short term directly) with at least three indicators. The success determinants at the bottom of the pyramid (have indirect, long term impact on basic categories and development factors) won't be discussed in this research. We would like to design a complex competitiveness picture of the Hungarian counties and Budapest with a multi-variable data analysis about the correctly chosen indicators.

Figure 1

Comparison of the typologies



Source: Own compilation on the basis of Lengyel 2003, Martin 2003

Henceforth, inspired by the three theoretical types of regions, we will try to classify the above-mentioned Hungarian territorial units into three relatively homogenous groups. The classification will be based on the notion of regional competitiveness and the pyramid model. The relevancy of the indicators chosen in the first instance have been tested with the linear correlation coefficient (*r*) between the tested indicator and one of the three named indicators of the standard competitiveness definition (indicators number 1, 4, and 7). The selected variables, which have significant correlation with the accentuated indicator, representing the basic categories of the pyramid model are:

Income level

1. Gross Domestic Product per capita in PPS[1]
2. Gross income serving as the basis of personal income tax, per permanent resident
3. Average monthly net earnings of employees

Labour productivity

4. Gross Domestic Product per employer in PPS[1]

[1] Key indicator, named in the standard definition of regional competitiveness (EC 1999).

5. Gross Value Added per employer
6. Gross income serving as the basis of personal income tax, per tax-payer

Employment

7. Employment rate[1]
8. Unemployment rate
9. Number of tax-payers per 1000 inhabitants
10. Economic activity rate of population aged 15-74

Global integration

11. Export per inhabitant
12. Integration of the trade ($\frac{Export}{GDP}$)
13. Number of international tourist nights at public accommodation establishments

The development factors of the pyramid model will be typified with the following indicators in our model:

R&D, technology, innovation capacity

14. Proportion of scientists and engineers among actual staff numbers
15. Total R&D expenditures of the research and development units as a ratio of annual GDP
16. Investment in machines, equipment, and vehicles per inhabitant
17. Total investments per inhabitant
18. Industrial companies' investment in machines, equipment, and vehicles, per 1000 inhabitants

Small and medium-sized enterprises (SMEs)

19. Number of active companies and partnerships per 1000 inhabitants
20. Number of active small businesses (10-49 employers) per 1000 inhabitants
21. Number of active corporations with legal entity per 1000 inhabitants
22. Proportion of partnerships from the active enterprises

Investments from outside the region, FDI

23. Foreign direct investment per inhabitant
24. Enterprises with foreign direct investment per 1000 inhabitants
25. Size of foreign shareholding in the equity of enterprises with FDI
26. Owner's equity of industrial enterprises with FDI
27. Foreign machinery investment in the industry

Infrastructure and human capital

28. Proportion of disability pensioners below retirement age from the population aged 40-59
29. ISDN-lines per 1000 inhabitants
30. Hotel beds per 1000 inhabitants
31. Telephone main lines per 1000 inhabitants
32. Number of dwellings connected to the cable television network per 1000 inhabitants

Institutions and social capital

33. Active non-profit institutions per 1000 inhabitants
34. Full-time students of higher educational institutions per 1000 inhabitants

CLASSIFYING THE HUNGARIAN COUNTIES AND THE CAPITAL

To fulfil classification, a multi-variable data analysis method, the cluster analysis, will first be performed. This is an exploratory data analysis tool, which aims to sort different objects into groups in such a way that the degree of association between two objects is maximal if they belong to the same group and minimal otherwise. The theoretical background (the notion of competitiveness and the pyramid model) of our empirical research requires us to weight the indicators according to their relevancy to competitiveness. The above mentioned and counted correlation coefficient seems to be appropriate as the basis of our weighting system, since basic categories representing revealed competitiveness are located one level higher in the pyramid than the development factors, representing immediate impact on basic categories. Therefore, the weights used in the model are:

– in the case of indicators representing basic categories: *2r*

– in the case of indicators representing development factors: *r*

Since the number of clusters to be generated has been previously defined and proved (three theoretical types of regions), K-mean clustering method has to be used. The output will be three different clusters of the greatest possible distinction. This algorithm first computes the core for all three sets, then each point is assigned to the cluster whose core is closest to that point. These two steps are alternated until an end criterion is met, i.e., when there is no further change in the assignment of the data points. The classification of the 19 counties and the capital into three clusters could be characterised as very stable, because after the first iteration the end criterion has been met (Table 1).

MULTIDIMENSIONAL SCALING

After achieving the cluster analysis, objects of a similar kind were successfully grouped into respective categories. But we have no information about the location of the territorial units inside each cluster. This information can be provided by another multi-variable data analysis method, multidimensional scaling (MDS). It attempts to arrange objects in a space with a particular number of dimensions so as to reproduce the observed distances. MDS will be performed with the same 34 weighted variables, as the cluster analysis, but the logic of the used methods is very different: MDS reduces the number of dimensions of our observations, while cluster analysis classifies without reducing the number of dimensions. First we use two dimensions to represent geometrically the competitiveness of the examined territorial units. The most common measure that is used to evaluate how well a particular configuration reproduces the observed distance matrix is the S-Stress[2] measure. In this case, S-Stress=0.04807, which can be appreciated as excellent, so our model with a reduced number of dimensions is likely to contain all relevant information.

Territorial units located above the *x*-axis are able to catch-up relatively quickly to the highest development level of the examined territorial units. Budapest, as the most competitive examined territorial unit shouldn't catch-up to the development level defined by itself. Borsod-Abaúj-Zemplén County's competitiveness doesn't contain quick catch-up potential; contrarily the competitiveness of Vas County is expected to catch-up quickly.

COMPARING FINDINGS

As mentioned above, the geometrical map generated by MDS is able to suggest evident concentrations of cases. Figure 2 suggests three clusters, which contain the same elements as the three clusters classified by the K-mean clustering method (Figure 3). On the two-dimensional map (Figure 2), Budapest is the one and only member of the relatively highly developed cluster, which is located relatively far from the two other concentrations in the coordinate system. The cluster in the first quarter consists of those counties, which are less competitive than Budapest, but more competitive than the regions lagging behind, concentrated in the second and third quarter. The competitive-

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[2] $$S-stress=\sqrt{\frac{\sum_{i=1}^{n}\sum_{j=1}^{n}(\delta_{ij}-d_{ij})^2}{\sum_{i=1}^{n}\sum_{j=1}^{n}\delta_{ij}^2}}$$

In this formula, d_{ij} stands for reproduced distances, given the respective number of dimensions, and δ_{ij} stands for the input data distances. Implicitly, if the original distances and the reproduced distances are equivalent, S-stress=0.

ness of the regions in the medium development phase (second cluster) contains quick catch-up potential. One part (above the *x*-axis) of the relatively underdeveloped regions are able to catch-up quickly, but the counties below the *x*-axis are likely to lag behind even more.

Table 1

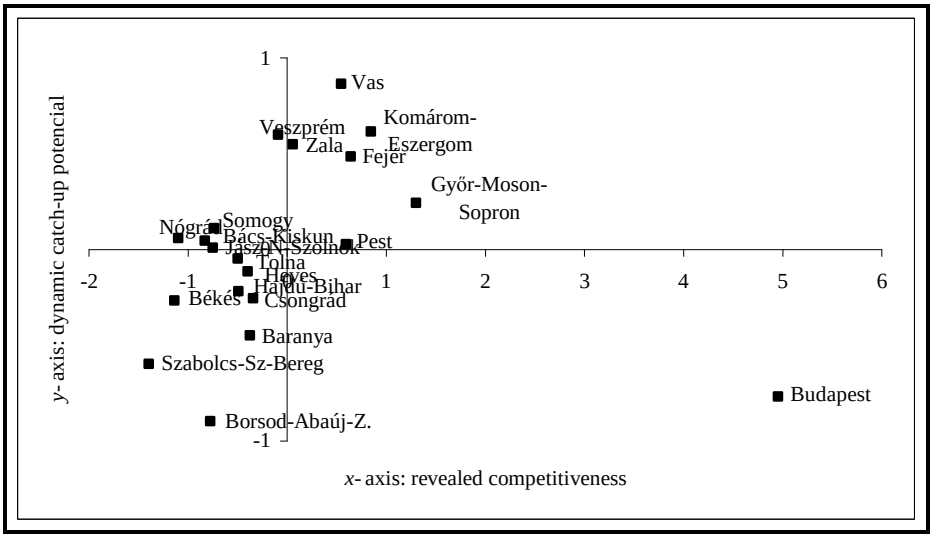
Cluster memberships, and distances from the cluster centres of each case

Counties and Capital	Cluster	Distance
Budapest	region in the highest development phase	0.000
Pest	regions in the medium development phase	3.333
Fejér	regions in the medium development phase	2.059
Komárom-Esztergom	regions in the medium development phase	3.155
Veszprém	regions in the medium development phase	3.291
Gyõr-Moson-Sopron	regions in the medium development phase	3.936
Vas	regions in the medium development phase	2.442
Zala	regions in the medium development phase	3.724
Baranya	relatively underdeveloped regions	2.484
Somogy	relatively underdeveloped regions	2.704
Tolna	relatively underdeveloped regions	2.339
Borsod-Abaúj-Zemplén	relatively underdeveloped regions	4.097
Heves	relatively underdeveloped regions	1.815
Nógrád	relatively underdeveloped regions	2.771
Hajdú-Bihar	relatively underdeveloped regions	1.989
Jász-Nagykun-Szolnok	relatively underdeveloped regions	1.672
Szabolcs-Szatmár-Bereg	relatively underdeveloped regions	3.800
Bács-Kiskun	relatively underdeveloped regions	1.970
Békés	relatively underdeveloped regions	2.442
Csongrád	relatively underdeveloped regions	3.065

Source: Own compilation on the basis of KSH (Central Office of Statistics) 2004, 2005a, 2005b

Figure 2

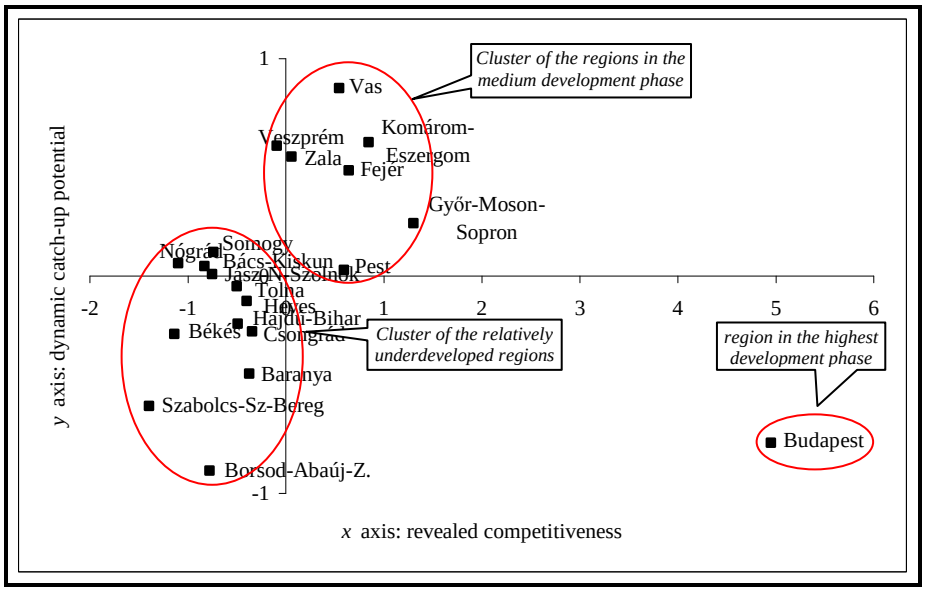
Geometrical mapping of the distance matrix



Source: Own compilation on the basis of KSH (Central Office of Statistics) 2004, 2005a, 2005b

Figure 3

Classifying clusters based on the output of the MDS



Source: Own compilation on the basis of KSH (Central Office of Statistics) 2004, 2005a, 2005b

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