Tendencies to EU Regional Convergence or Divergence by Efficiency Analysis

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Abstract

European Union faces increased competition from other continents, their nations, regions and cities. To respond to this challenge, the EU has agreed a strategies to promote economic growth and job creation, known as the Lisbon strategy for the period 2000-2010 and current for the period 2010-2020 the Strategy Europe 2020 which aims to make the EU the world's leading knowledge-economy, based on the principle of sustainable development. But does the EU have sufficient endowment to achieve these objectives? Does the EU use its sources and opportunities effectively enough? Actions are needed at all levels of government - European, national and especially regional/local levels – if these ambitions are to be realised. Europe's global competitiveness depends on a multiplicity of actions that can optimise the potentials within its regions because regions are increasingly becoming the drivers of the economy. All regions possess development opportunities – however, use these options enough and hence is at regional level tendency to convergence of competitiveness and its broaden aspects, or vice versa prevailing tendency to divergence? From this point of view, the main aim of the paper is to distinguish if the EU NUTS 2 regions have tendencies to convergence or divergence of competitiveness level by efficiency analysis with the help of Data Envelopment Analysis. DEA seems to be a convenient method for measuring regional efficiency because it is based on the Regional Competitiveness Index having dimension of driving forces of competitiveness and direct or indirect outcomes of a competitive society and economy. The analysis will be divided in growth period, crisis period and post-crisis period and thus, it will be possible the evaluate changes in tendencies to convergence or divergence across European regions.

Key words: DEA, efficiency, EU, NUTS 2 region, RCI.

JEL Classification: C61, O18, R15, R58

1 Introduction

It is generally accepted that the level of economic development is not uniform across territories. On the contrary, it substantially differs. The dynamics of economic, social, political and cultural change in the contemporary world are increasingly shaped by the pursuit and promotion of competitiveness. The economy's entry into globalisation phase has radically altered the nature of competition. This new competition has accentuated the interdependence of the different levels of globalisation. Globalisation has obliged all countries to raise their standards of economic efficiency, whence the growing interest in and concern about competitiveness: nations, regions and cities have no option but to strive to be competitive in order to survive in the new global market place and the 'new competition' being forged by the new information or knowledge driven economy (Gardiner, Martin and Tyler, 2004). From this point of views and at a time when European Union (EU) Member States have to deal with increased pressures on public balances, stemming from demographic trends and globalisation, the improvement of the efficiency and effectiveness of public spending features high on the

political agenda. Current economic situation determined by persisting effects of the crisis is causing the governments of countries worldwide to streamline their processes in terms of collecting revenue from the state budget and then redistributing it on the principle of performance and economic efficiency. Comparative analysis of efficiency in public sector is thus starting point for studying the role of efficiency, effectiveness and performance regarding economic governance of resources utilization by public management for achieving medium/long-term objectives of economic recovery and sustainable development of national economies (Mihaiu, Opreana and Cristecu, 2010). But with the process of globalisation, backgrounds of economic activities are shifting to the regional level and regions are thus increasingly becoming the drivers of the economy. And much more, as Porter (2003) mentioned, one of the most striking features of regional economies is the presence of clusters, or geographic concentrations of economic activities, thus existence of economic zones which have different level of competitiveness and different type of competitive advantages and disadvantages. With respect to all mentioned facts, the main aim of the paper is to distinguish if the EU NUTS 2 regions have tendencies to convergence or divergence of competitiveness level by efficiency analysis with the help of Data Envelopment Analysis (DEA) approach – Malmquist index (MI) in reference period 2004-2012.

2 Importance of Efficiency for Competitiveness

The EU competitiveness depends on contributions from regions, cities and rural areas in all corners of the continent. An asset for Europe is its rich regional diversity which for each region and larger territory represents a unique set of potentials and challenges for development calling for a corresponding targeted policy mix to become reality. This regional diversity represented by specific territorial endowment is also possible to consider as a competitive advantage of each region. European policy development has thus moved towards recognising the territorial dimension in many policies and the added value from an integrated approach when searching for development opportunities. Opportunities and challenges of different territorial types such as regions, cities, rural areas and areas with specific characteristics and important themes as accessibility, innovation and hazards should be part of this. Trends and perspectives can be identified, and the impacts of policies can be seen. The interplay of all these factors underpins a territory's demographic, economic, social, cultural and ecological development dynamics. Thus each territory has its own unique settings and development conditions. Knowledge and understanding of the territory is an important prerequisite for ensuring a future development for competitive attractive and liveable places. In the EU, the process of achieving an increasing trend of performance and a higher level of competitiveness is significantly difficult by the heterogeneity of countries and regions in many areas. Although the EU is one of the most developed parts of the world with high living standards, there exist significant and huge economic, social and territorial disparities having a negative impact on the balanced development across EU, and thus weaken EU's performance in a global context.

In recent years, the topics about measuring and evaluating of competitiveness and efficiency have thus enjoyed economic interest. Nowadays competitiveness is one of the fundamental criteria for evaluating economic performance and reflects the success in the broader comparison. Territories need highly performing units in order to meet their goals, to deliver the products and services they specialized in, and finally to achieve competitive advantage. Moreover, performance, if it is recognized by others organizations, is often rewarded by benefits, e.g. better market position, higher competitive advantages, financial condition etc.

Performance is a major prerequisite for future economic and social development and success in the broader comparison. Differences in productivity performance across territories are seen by government as important policy targets. For a number of years, government objectives have been set not only in terms of improving national productivity performance against other countries but also in creating conditions to allow less productive countries to reduce the 'gap' between themselves and the most productive ones. Based on information mentioned above, the concept of competitiveness is usually linked to productivity (Porter, 1990). Competitiveness may be defined as a measure of the degree in which each economic entity can compete with economic entity. However, the concept of competitiveness may be applicable not only to firms, but also to whole economies. An economy is competitive if firms in that economy face lower unit costs than firms from other economies. Every factor that increases the productivity and, therefore, lowers the unit costs of firms in an economy contributes to the competitiveness of the respective economy (Charles and Zegarra, 2014). Comparative analysis of efficiency in public sector is thus starting point for studying the role of efficiency, effectiveness and performance regarding economic governance of resources utilization by public management for achieving medium/long-term objectives of economic recovery and sustainable development of national economies (Mihaiu, Opreana and Cristescu, 2010). Increasing productivity is generally considered to be the only sustainable way of improving living standards in the long term. Efficiency is thus a central issue in analyses of economic growth, the effects of fiscal policies, the pricing of capital assets, the level of investments, the technology changes and production technology, and other economic topics and indicators. According to the Institute for Management and Development (2012), competitiveness is ''a field of economic knowledge, which analyses the facts and policies that shape the ability of a nation to create and maintain an environment that sustains more value creation for its enterprises and more prosperity for its people'' (p. 502). In other words, competitiveness measures ''how a nation manages the totality of its resources and competencies to increase the prosperity of its people'' (IMD, 2012, p. 502). This understanding of competitiveness and interpretation of this concept is thus very closely linked with understanding of efficiency concept (for more details see e.g. Staníčková, 2013; Staníčková and Skokan, 2013).

3 Background of Empirical Framework

The analysis of efficiency is about the relationships between inputs (entries) and the outputs (results). The efficiency can be achieved under the conditions of maximizing the results of an action in relation to the resources used, and it is calculated by comparing the effects obtained in their efforts. In a competitive economy, therefore, the issue of efficiency, resp. dynamic efficiency, can be resolved by comparing these economic issues. In, 1957, Farrell already investigated the question how to measure efficiency and highlighted its relevance for economic policy makers (Färe, 1994). Since that time techniques to measure efficiency have improved and investigations of efficiency have become more frequent, see e.g. (Hančlová, 2013; Melecký, 2013a, 2013b). These works solved only the national context of efficiency which is key for macroeconomic competitiveness, but as was mentioned above, nowadays it is more important to pay attention to regional competitiveness because regions are considered as sources/locomotives of competitiveness. Nevertheless, the measurement of efficiency of countries and regions remains a conceptual challenge. Problems arise because public spending has multiple objectives and because public sector outputs are often not sold on the market which implies that price data is not available and that the output cannot be quantified. Efficiency is thus a central issue in analyses of economic growth, the effects of fiscal policies,

the pricing of capital assets, the level of investments, the technology changes and production technology, and other economic topics and indicators related to competitiveness. As suitable data set for analysis, the Regional Competitiveness Index (RCI) 2013 was chosen because this approach seems to be convenient with respect to used methodology of DEA and its division to input and output nature of indicators. The RCI is based on eleven pillars describing both inputs and outputs of territorial competitiveness, i.e. inputs mean driving forces of competitiveness, and outputs are direct or indirect outcomes of a competitive society and economy (Annoni and Dijkstra, 2013). RCI 2013 consists of 73 indicators describing basic, efficiency and innovative factors of competitiveness; thus a large number of information regarding the most important determinants of competitiveness. Subject of analysis are 272 NUTS 2 regions of 28 EU Member States and reference period is 2004-2012 which is divided in 2 parts, i.e. years 2004-2007 characterize a growth period and years 2008-2012 is possible to consider as crisis, resp. post-crisis period. All RCI indicators are not used in the paper, because they were not available for each evaluated region. In this paper, only 23 indicators are used in analysis – 6 for inputs and 17 for outputs. Input indicators represent (1) Motorway Transport - Length of Motorways (MTLM), (2) Air Transport of Freight (ATF), (3) Air Transport of Passengers (ATP), (4) Hospital Beds (HB), (5) Infant Mortality Rate, (6) Early Leavers from Education and Training. Output indicators represent (1) Employment Rate 15 to 64 years (ER), (2) Long-term Unemployment Rate (LtUR), (3) Unemployment Rate (UR), (4) Male Employment (ME), (5) Female Employment (FE), (6) Male Unemployment (ME), (7) Female Unemployment (FU), (8) Gross Domestic Product (GDP), (9) Compensation of Employees (CoE), (10) Employment in Sophisticated Sectors (EISS), (11) Human Resources in Science and Technology - Core (HRSTcore), (12) Patent applications to the EPO (EPO), (13) Total R&D Expenditure (GERD), (14) Human Resources in Science and Technology (HRST), (15) High-tech Patent Applications (HTI), (16) ICT Patent Applications (ICT), (17) Biotechnology Patent Applications (BioT).

Gained values of available indicators are coming as initial variables into Data Envelopment Analysis (DEA). In DEA, there are several methods for measuring efficiency, besides the basic DEA models, certain modifications exist. DEA is mathematical approach for providing a relative efficiency assessment and evaluating performance of a set of peer entities called Decision Making Units (DMUs) which convert multiple inputs into multiple outputs. In recent years, research effort has focused on investigation of the causes of productivity change and its decomposition Charnes, Cooper and Rhodes (1978). The Malmquist Index (MI) has become the standard approach in productivity measurement over time within the non-parametric research. The MI has been introduced firstly by Caves, Christensen and Diewert in 1982. Färe et. al (1994) defined an input-oriented productivity index as the geometric mean of the two MPIs developed by Caves et al. The MI allows measuring of total productivity by means of distance-functions calculation, which can be estimated by solution of mathematical programming problems of DEA kind. Suppose there are *n* DMUs which consume *m* inputs to produce *s* outputs. If a performance measure is added or deleted from consideration, it will influence the relative efficiencies. Empirically, when the number of performance measures is high in comparison with the number of DMUs, then most of DMUs are evaluated efficient – the obtained results are not reliable. There is a rough rule of thumb (Cooper, Seiford and Tone, 2007) expresses the relation between the number of DMUs and the number of performance measures as follows (1):

$$n \geq \max\{3(m+s), m \times s\}. \tag{1}$$

Nevertheless, in some applications the number of performance measures and DMUs do not meet the mentioned formula (3). To tackle this issue, it should select some performance

measures in a manner which comply (3) and impose progressive effect on the efficiency scores. These selected inputs and outputs calls selective measures. But formula (3) needs more considerations. Toloo et al. checked more than 40 papers that contain practical applications and statistically, they found out that in nearly all of the cases the number of inputs and outputs do not exceed 6 (Toloo, 2012). A simple calculation shows that when $m \leq 6$ and $s \leq 6$, then $3(m + s) \geq m \times s$. As a result, in this paper instead of using (3), following formula (2) is applied:

$$n \geq 3(m+s). \tag{2}$$

In the case of this paper, the rule of thumb is met, because number of DMUs is three times higher than sum of input and outputs, i.e. $272 \geq 3\,(6 + 17)$, $272 \geq 3\,(23)$, $272 \geq 69$.

Suppose we have a production function in time period t as well as period $t+1$. MI calculation requires two single period and two mixed period measures. The two single period measures can be obtained by using the CCR model with Constant Returns to Scale (CRS). Suppose each DMU_j $(j=1, 2,\ldots, n)$ produces a vector of output $y_j^t = \left(y_{1j}^t,\ldots,y_{sj}^t\right)$ by using a vector of inputs $x_j^t = \left(x_{1j}^t,\ldots,x_{mj}^t\right)$ at each time period t, $t=1\ldots T$. MPI measuring the efficiency change of production units between successive periods t and $t+1$, is formulated via (3):

$$MI_0\ \left(x^{t+1},\ y^{t+1},\ x^t,\ y^t\right)\ =\ E_0 * P_0, \tag{3}$$

where E_0 is change in the relative efficiency of DMU_0 in relation to other units (i.e. due to the production possibility frontier) between time periods t and $t+1$, it means catch-up effect (technical efficiency); P_0 describes the change in the production possibility frontier as a result of the technology development between time periods t and $t+1$, it means frontier-shift effect (technological efficiency). Modification of MI_0 (4) makes it possible to measure the change of technical efficiency and the movement of the frontier in terms of a specific DMU_0:

$$MI_0 = \frac{\theta_0^t\left(x_0^t, y_0^t\right)}{\theta_0^{t+1}\left(x_0^{t+1}, y_0^{t+1}\right)}\left[\frac{\theta_0^{t+1}\left(x_0^{t+1}, y_0^{t+1}\right)}{\theta_0^t\left(x_0^{t+1}, y_0^{t+1}\right)} \cdot \frac{\theta_0^{t+1}\left(x_0^t, y_0^t\right)}{\theta_0^t\left(x_0^t, y_0^t\right)}\right]^{1/2}. \tag{4}$$

where $\theta_0^t\left(x_0^t, y_0^t\right)$ is a function that represents the production technology S^t in the time period t and assigns to evaluated DMU_0 the efficiency rate. Function $\theta_0^{t+1}\left(x_0^t, y_0^t\right)$ gives the relationship of inputs and outputs of the time period t with production technology S^t in the time period $t+1$ and function $\theta_0^t\left(x_0^{t+1}, y_0^{t+1}\right)$ present inputs and outputs of the time period $t+1$ with production technology S^t in the time period t. Function $\theta_0^{t+1}\left(x_0^{t+1}, y_0^{t+1}\right)$ gives the relationship of inputs and outputs of the time period $t+1$ with production technology S^t in the time period $t+1$. The first component E_0 measures the magnitude of technical efficiency change (TEC) between time periods t and $t+1$. Obviously, $E_0 <\ =\ > 1$ indicating that technical efficiency declines, remains and improves. The second terms P_0 measures the shift in the possibility frontier, i.e. technology frontier shift (FS), between time period's t and $t+1$. As a result, the MI < 1 indicates deterioration in productivity of the DMU_o from Period 1 to Period 2; result of the MI = 1 shows there is no change in total factor productivity and the MI > 1 shows progress in the total factor productivity (Cooper, Seiford and Tone, 2007).

4 Findings about Competitive Zones of EU Regions Created by MI

According to the efficiency analysis (see Table 1, Table 2 and Table 3) and derived results from the solution of MI, it emerges that the 2004-2007 efficiency ratios of NUTS 2 regions within EU28 countries range from 0,0364 (the totally lowest level for RO41 – Dolj region in Romania) to 24,1272 (the totally highest level for FI20 – Åland region in Finland), so the differences are huge. In the case of 2008-2012 period, the efficiency ratios of NUTS 2 regions within EU28 countries range from 0,1018 (the totally lowest level for DEB2 – Trier region in Germany) to 5,7735 (the highest level again for FI20 – Åland region in Finland), so the differences are still huge, but not so much and among EU regions is possible to seen convergence trend in their efficiency. What are the reasons for it? Is there any impact of crisis on these results? Are efficiency changes caused only by internal changes of utilization of sources, i.e. technical change, or is there also any external factors, e.g. technological improvement? How well are the EU's regions performing, and what makes a region competitive?

Consistent with the theory on economic growth and economic development, the RCI results confirm that the most competitive regions are those with the highest level of economic development. At the other end of the competitiveness scale, it is possible to find some regions which are unfortunately steadily worst performers. The RCI 2010 and the RCI 2013 results also underline that competitiveness has a strong regional dimension, which national level analysis does not capture (Annoni and Dijsktra, 2013). The RCI then also results demonstrate that territorial competitiveness in the EU has a strong regional dimension, which national level analysis does not properly capture in the EU. The gap and variation in regional competitiveness should stimulate a debate to what extent these gaps are harmful for their national competitiveness and to what extent the internal variation can be remediated. Part of the explanation to the large inequalities within EU NUTS 2 regions may then have to do with the differences in competitiveness. An economic entity in region which has low competitiveness may not have similar opportunities as an economic entity in a highly competitive region. This fact remains and is confirmed. But what does it mean for efficiency in competitiveness? In the case of efficiency analysis of competitiveness and in time comparison analysis of change in 2004-2012, the results are just a little bit different. Why? The concept of competitiveness may then be important not only to evaluate why some regions grow faster than others, but also why some regions have a better and more efficient distribution of competitiveness over time than others. Is it a high level of competitiveness necessarily associated with a high level of efficiency, and vice versa?

Based on comparison of the first top 10 regions (see Table 1), it is possible to say that results of efficiency and MI level was higher in growth period of years 2004-2007 than in crisis/post-crisis period of years 2008-2012. These results are the same in the case of the 10 lowest regions thus regions with the lowest of MI and represented thus deteriorating trend in their efficiency (see Table 3). The opposite situation is only in the case of the middle part of total analysis, thus in the case of regions which were placed from 132th position to 141th position (see Table 2). In this case, better results in efficiency were recorded in the crisis/post-crisis period of years 2008-2012 in growth period of years 2004-2007. At this place is convenient to note, if MI is higher than one, it signifies productivity getting better, while if MI equals to one, it indicates unchanging productivity and if MI is lower than one, it signifies productivity getting worse, as was mentioned above. From this point of view, it´s necessary to say that increasing trend of MI present positive information; in reality it means that in comparison of 2008-2012 periods with 2004-2007 periods, productivity of evaluated regions has recorded

increasing trend what support a convergence process in the EU. This result is not surprising because of nature of comparing periods: years 2004-2007 are characterized by economic growth and improving living standard in all EU Member States and with convergence process of "new" EU13 Member States to "old" EU15 Member States. For years 2008-2012 is typical that all evaluated European countries have solved with impacts of financial and economic crisis, and nowadays, most of them must solve still these problems.

In the case of the first top 10 regions (see Table 1), there is possible to state the total level of MI is caused at least by catch-up effect, it means by relative efficiency (changes to the production possibility frontier in comparison with other regions, i.e. changes in using inputs for production of outputs), but most in frontier-shift effect. This nature of change means that positive development is caused much more due to technological changes, i.e. movement of the production possibility frontier and in more effective utilization of sources and using technological improvement for production of outputs. With respect to the fact which countries (from EU15: Finland, United Kingdom, Ireland, Italy, Belgium, Portugal, Spain and Greece, from EU13 only Poland), resp. regions fall into this zone, it is not surprising that this kind of changes is their competitive advantage. In both reference periods, it is important to note that Finish region FI20 was the most efficient and much more that other regions, not only within this competitive zone, but in the whole sample of 272 NUTS 2 regions.

Tab. 1 Results of MI for 2004-2007 and 2008-2012 period – the first top 10 regions

2004-2007					2008-2012				
Rank	**NUTS 2**	**MI**	**Catch-up**	**Frontier-Shift**	**Rank**	**NUTS 2**	**MI**	**Catch-up**	**Frontier-Shift**
1	FI20	24,1272	1,0000	24,1272	1	FI20	5,7735	1,0000	5,7735
2	ITF5	3,0617	1,0000	3,0617	2	UKG1	2,1321	1,0886	1,9585
3	BE31	2,8353	1,0000	2,8353	3	UKJ1	2,1269	1,1416	1,8632
4	ES63	2,2566	1,0000	2,2566	4	ES43	1,9979	1,0352	1,9300
5	BE23	2,2034	1,9592	1,1246	5	UKG2	1,9931	1,1166	1,7850
6	ES64	1,9640	1,0000	1,9640	6	PT18	1,9848	1,0000	1,9848
7	PL34	1,9455	1,1850	1,6418	7	FR83	1,9512	1,0000	1,9512
8	BE21	1,7593	1,4850	1,1847	8	EL12	1,9418	1,2058	1,6103
9	EL13	1,7039	1,0000	1,7039	9	ES70	1,9315	1,0000	1,9315
10	PL12	1,6907	1,0000	1,6907	10	IE01	1,9160	1,0114	1,8944

Source: own calculation and elaboration, 2014

In the case of the middle 10 regions (see Table 2), there is necessary to say that the total level of MI is caused by more or less equal results of technical and technological efficiency changes. In both reference periods, the catch-up effect and the frontier-shift effect have very similar values of changes, which look evenly. These results are not also surprising because of regions belonging to this zone. Also the overall results of regions within the middle placement are at the frontier of no-efficiency change and very slightly efficiency improvement. With respect to the results, it seems that it is not easy to state what are the key factors of changes – if it is relative efficiency change (change to the production possibility frontier, i.e. change in using inputs for production of outputs), or technological change, i.e. movement of the production possibility frontier with technological improvement for production of outputs. To this economic zone with ambiguous nature of change and competitive advantage belong regions mostly from EU15 countries – Spain, Germany, Netherlands, United Kingdom, Italy, Portugal, Austria, Finland and the only 1 region from EU13 country – Romania.

Tab. 2 Results of MI for 2004-2007 and 2008-2012 period – the 10 middle regions

2004-2007					2008-2012				
Rank	**NUTS 2**	**MI**	**Catch-up**	**Frontier-Shift**	**Rank**	**NUTS 2**	**MI**	**Catch-up**	**Frontier-Shift**
132	ES52	1,0559	1,0000	1,0559	132	NL42	1,1758	1,0137	1,1600
133	DE12	1,0554	1,0000	1,0554	133	PT30	1,1741	0,5555	2,1137
134	UKE4	1,0540	1,0273	1,0260	134	RO31	1,1701	0,7924	1,4767
135	ITC1	1,0532	1,0000	1,0231	135	UKF2	1,1700	1,1600	1,0086
136	NL33	1,0512	1,0000	1,0512	136	AT11	1,1676	1,1299	1,0334
137	DEF0	1,0503	0,9481	1,1077	137	FR22	1,1670	0,8941	1,3053
138	DEA1	1,0482	0,9856	1,0635	138	FI19	1,1624	1,0000	1,1624
139	UKK4	1,0436	1,0894	0,9579	139	UKE1	1,1570	1,0617	1,0897
140	NL32	1,0418	0,9692	1,0749	140	UKM2	1,1562	1,1145	1,0374
141	DE30	1,0407	1,0000	1,0407	141	PT16	1,1535	0,9007	1,2806

Source: own calculation and elaboration, 2014

In the case of the 10 lowest regions (see Table 3), there is possible to state the total level of MI is caused at least by frontier-shift effect than by catch-up effect. This fact is not surprising because to this zone belong regions from Romania, but also from Sweden, Italy and Germany – especially in period 2008-2012. With respect to the fact that Germany is the economically strongest country which during the crisis acted consciously and implemented tough reforms, this is not unexpected. The nature of MI is caused more or less by catch-up effect in the form of changes to the production possibility frontier in comparison with other regions, what means relative efficiency, but this level is many times at level of one or below one. The frontier-shift effect shows regress in the frontier technology, what means negative status and inability to apply technological improvement.

Tab. 3 Results of MI for 2004-2007 and 2008-2012 period – the 10 lowest regions

2004-2007					2008-2012				
Rank	**NUTS 2**	**MI**	**Catch-up**	**Frontier-Shift**	**Rank**	**NUTS 2**	**MI**	**Catch-up**	**Frontier-Shift**
263	DE80	0,7376	1,0000	0,7376	263	DE24	0,6182	0,7305	0,8462
264	DE27	0,7294	1,0000	0,7294	264	DE23	0,5847	1,0000	0,5847
265	DE22	0,6824	1,0000	0,6824	265	DE73	0,4869	0,7040	0,6917
266	DEE0	0,6634	1,0000	0,6634	266	DE22	0,4744	0,7822	0,6065
267	SE33	0,6179	1,0000	0,6179	267	DEE0	0,3636	0,8196	0,4436
268	RO22	0,5202	1,0000	0,5202	268	DE13	0,3607	1,0000	0,3607
269	RO21	0,4907	1,0000	0,4907	269	DE91	0,3571	1,0000	0,3571
270	DE23	0,4184	1,0000	0,4184	270	DE94	0,3105	0,6732	0,4612
271	RO12	0,4134	1,0000	0,4134	271	ITH2	0,1512	0,7532	0,2007
272	RO41	0,0364	0,6252	0,0582	272	DEB2	0,1018	0,5301	0,1920

Source: own calculation and elaboration, 2014

The RCI indicators affect the convergence trend of new EU Member States and their regions to old EU Member States, and the growth in old EU Member States has implicative impact on growth in new EU Member States. This growth may have the same degree in EU13 countries as in EU15 countries, or rather is a higher and multiplied. Many of the differences in economic growth and quality of life within a country may be explained by the differences in competitiveness. Regions with more paved roads, with better institutions, with better business environment, and with better human capital, for example, may experience faster economic growth and a clearer reduction in poverty levels (Charles and Zegarra, 2014). All these trends and facts have very significant on competitiveness of all EU Member States and changes of its level and efficiency/inefficiency development. The gaps and variation in regional competitiveness should give rise to a debate on to what extent these gaps are harmful for their national competitiveness, and to what extent the internal variation can be remediated (Dijsktra, Annoni and Kozovska, 2011). The internal variation and heterogeneity also underlines the inevitable steps needed to make at national level. Policies oriented to solve the main economic and social problems of their citizens may then not focus only on the improvement of the aggregate or average indicators of competitiveness but also on the reduction of the regional differences in competitiveness.

5 Conclusions

Nowadays, the EU consists of 28 Member States and is constantly expanding to include new countries. Large geographic, demographic and cultural diversity of the EU brings also differences in socio-economic position of the EU Member States, and especially of its 272 NUTS 2 regions. Different results in economic performance and living standards of the population indicate the status of the competitiveness of every country and its each region. Each territory should know were lying its competitive advantages and advantages and aim to strengthen advantages and reduce disadvantages, i.e. key factors of competitiveness. The competitiveness of territory resides not only in the competitiveness of its constituent individual firms and their interactions, but also in the wider assets and social, economic, institutional and public attributes of the country itself. The notion of competitiveness is as much about qualitative factors and conditions (such as untraded networks of informal knowledge, trust, social capital, and the like) as it is about quantifiable attributes and processes (such as inter-firm trading, patenting rates, labour supply and so on). Furthermore, the causes of competitiveness are usually attributed to the effects of an aggregate of factors rather than the impact of any individual factor.

From efficiency analysis, it is evident that there are significant economic disparities between European regions, especially in the context of sources of efficiency changes – it is caused by internal factors and using in-puts for production outputs, or if regions is able to apply some technological improvements for enhancing the effectiveness of overall production. For smoothing of these disparities, the EU authorities are developing various strategies to further the economic growth of all EU Member States and especially their regions. Also many European countries, even those with an acceptable level of economic growth, are developing new strategic plans aiming at keeping up in the 'rat-race' of international and interregional competition to attract the best investments. A policy focusing on improving the physical and social environment may be one of the important tools to attract the territorial native sources of economic growth. This competition may be seen as the result of an increasing variety of production opportunities in a growing number of regions across the EU (Lambooy and Boschma, 1998). New variety has evolved by the development of new technologies and new organizational structures. Many countries feel the threat of being outperformed by other countries, and therefore they have to efficiently utilize theirs competitive advantages.

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References

ANNONI, P., DIJKSTRA, L. 2013. *EU Regional Competitiveness Index 2013*. Luxembourg: Publication Office of the European Union.

CHARLES, V., ZEGARRA, L.F. 2014. Measuring regional competitiveness through Data Envelopment Analysis: A Peruvian case. In: *Expert Systems with Applications*, Vol. 41, No. 11, pp. 5371 – 5381.

CHARNES, A., COOPER, W.W., RHODES, E. 1978. Measuring the efficiency of decision making units. In: *European Journal of Operation Research*. Vol. 2, No. 6, pp. 429 – 444.

COOPER, W.W., SEIFORD, L.M., TONE, K. 2007. *Introduction to Data Envelopment Analysis and its Uses with DEA-solver Software and References*. New York: Springer.

DIJKSTRA, L., ANNONI, A., KOZOVSKA, K. 2011. A New Regional Competitiveness Index: Theory, Methods and Findings. European Commission, *RP Working Paper n° 2/2011*.

FÄRE, R., et al. 1994. *Production Frontiers*. Cambridge: University Press.

GARDINER, B., MARTIN, R., TYLER P. 2004. *Competitiveness, Productivity and Economic Growth across the European Regions*. [online]. Available at: http://www-sre.wu-wien.ac.at/ersa/ersaconfs/ersa04/PDF/333.pdf.

HANČLOVÁ, J. 2013. Econometric Analysis of Macroeconomic Efficiency Development in the EU15 and EU12 Countries. In: *Proceeding of 11th International Conference of Liberec Economic Forum.* Liberec: Technical University of Liberec, pp. 166 – 175.

INSTITUTE FOR MANAGEMENT AND DEVELOPMENT. 2012. *IMD World Competitiveness Yearbook 2012*. Lausanne: IMD.

LAMBOOY, J.G., BOSCHMA, R.A. 1998. *Evolutionary economics and regional policy*. Vienna: European Regional Science Association.

MELECKÝ, L. 2013a. Comparing of EU15 and EU12 Countries Efficiency by Application of DEA Approach. In: *Proceedings of 31st International Conference Mathematical Methods in Economics 2013*. Jihlava: The College of Polytechnics Jihlava, pp. 618 – 623.

MELECKÝ, L. 2013b. Use of DEA Approach to Measuring Efficiency Trend in Old EU Member States. In: *Proceedings of 11th International Conference on Liberec Economic Forum*. Liberec: Technical University of Liberec, pp. 381 – 390.

MIHAIU, D. M., OPREANA, A., CRISTESCU, M. P. 2010. Efficiency, effectiveness and performance of the public sector. In: *Romanian Journal of Economic Forecasting*, Vol. 1, No. 4, pp. 132 – 147.

PORTER, M. E. 2003. The Economic Performance of Regions. In: *Regional Studies*. Vol. 37, No. 6-7, pp. 549 – 578.

PORTER, M.E. 1990. *The competitive advantage of nations*. New York: The Free Press.

STANÍČKOVÁ, M. 2013. Measuring of efficiency of EU27 countries by Malmquist index. In: *Proceedings of 31th International Conference Mathematical Methods in Economics 2013*. Jihlava: The College of Polytechnics, pp. 844 – 849.

STANÍČKOVÁ, M., SKOKAN, K. 2013. Multidimensional Approach to Assessment of Performance in Selected EU Member States. In: *International Journal of Mathematical Models and Methods in Applied Sciences*, Vol. 7, No. 1, pp. 1 – 13.

TOLOO, M. 2012. Alternative solutions for classifying inputs and outputs in data envelopment analysis. In: *Computers and Mathematics with Applications*, Vol. 63, No. 6, pp. 1104 – 1110.