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HOW DID THE TIME GO WITH THE EU REGIONAL COMPETITIVENESS INDEX? ANALYSIS OF CONTENT AND METHODOLOGICAL CHANGES ACROSS EDITIONS

Jak šel čas s indexem regionální konkurenceschopnosti EU? Analýza obsahových a metodických proměn napříč edicemi

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Annotation

Why measuring regional competitiveness is so important? Because if you cannot measure it, you cannot improve it. A quantitative score of competitiveness will facilitate the European Union (EU) in identifying possible regional weaknesses together with factors mainly driving these weaknesses. This, in turn, will assist regions in the catching up the process. In doing so, the paper looks at the impact of a variety of competitiveness factors, taking into account regional differences which will affect their relative importance. In this case, the Regional Competitiveness Index (RCI) can be used to help regions assess which aspects of competitiveness are the strongest and which ones need improvement. RCI provides the first synthetic picture of the EU competitiveness at the level of NUTS 2 regions representing, at the same time, a well-balanced plurality of different fundamental aspects. It takes into account both social and economic aspects, including the factors which describe the short and long-term potential of the economy. It is very important to understand the extent to which regions compete with each other, where this competition comes from, and what factors determine a territorial, economic attractiveness. Therefore, regional development strategies could use RCI to identify possible regional development priorities. By systematic analysis of scientific literature comprehensive analysis of the EU regional competitiveness is performed.

Key words

composite index, edition, EU Regional Competitiveness Index, methodology, NUTS 2 region

Anotace

Proč je měření regionální konkurenceschopnosti tak důležité? Pokud není možné něco změřit, není možné to zlepšit. Kvantitativní skóre konkurenceschopnosti usnadní Evropské unii (EU) postup při identifikaci možných regionálních slabín spolu s faktory, které tyto slabiny nejvíce ovlivňují. To však napomůže regionům v rámci konvergenčního procesu. Příspěvek se zabývá dopadem různých faktorů konkurenceschopnosti s přihlédnutím k regionálním rozdílům, které ovlivní jejich relativní význam. V tomto případě lze použít Regionální index konkurenceschopnosti (RCI) k tomu, aby regionům pomohl posoudit, které aspekty konkurenceschopnosti jsou nejsilnější, a které je třeba zlepšit. RCI představuje první syntetický obraz o konkurenceschopnosti EU na úrovni NUTS 2 regionů, který zároveň představuje vyváženou pluralitu různých základních aspektů. Zohledňuje sociální i ekonomické aspekty, včetně faktorů, které popisují krátkodobý a dlouhodobý potenciál ekonomiky. Je velmi důležité pochopit, do jaké míry si regiony navzájem konkurují, odkud tato konkurence pochází a jaké faktory určují územní ekonomickou atraktivitu. Strategie regionálního rozvoje by proto mohly využít RCI k identifikaci možných priorit regionálního rozvoje. Prostřednictvím systematické analýzy odborné literatury je provedena komplexní analýza regionální konkurenceschopnosti v kontextu EU.

Klíčová slova

kompozitní index, edice, Index regionální konkurenceschopnosti EU, metodologie, NUTS 2 region

JEL classification: B41, O18, P51, R11, R58

1. Introduction

A casual look at the geographical map of any territory reveals an uneven distribution of population across space. These maps often feature small 'nodal' points of high population density, as opposed to the less inhabited surrounding. Indeed, the uneven distribution of population and economic activity across space can be somewhat attributed to natural causes. Certain climatic conditions and terrain configuration render chunks of territory uninhabitable. On the other hand, fertile land along water sources provides favourable conditions for growth and development of settlements. However, much of the pattern of uneven spatial distribution of economic activity cannot be attributed solely to geographical reasons, but to a range of endogenous factors (De Bruyne, 2006). In this context, it is the socio-institutional framework which becomes the determinant of the attractiveness of territory for inflows of economic activity. As stated Danon (2014), given that the activity is unevenly distributed in function of some endogenous factors, across a set of different territories, these inter-regional differences can induce migrations of footloose factors of production between locations. In this context, as long as we assume a finite set of factors of production with a limited level of mobility; territories can be considered to be competing for attraction and retention of economic activity. Following this logic, then, a degree of successfulness in this competition can be called territorial competitiveness (Camagni, 2002). Thus a competitive region, experiencing the prevalence of agglomerative over dispersive forces, enjoys constant net positive migration of mobile factors of production. On the other end of the scale, an uncompetitive region faces constant danger of desertification of footloose factors the regional focus reflects the increasing consensus that they are the primary spatial units where increasing returns to scale are created, while knowledge is generated and circulated, all resulting in creation of agglomerations of economic activity (Huggins, 2003). In this context, it is affirmed the position that it is areas – sub-national territories – rather than nation-states, which compete. A region is a useful choice principally because it is more or less homogeneous, with a relatively similar institutional framework, economic and social structure within its territory, while it usually doesn't dispose of nation-state prerogatives. Therefore, the region has only recently become a terrain of strenuous economic research. With the New Economic Geography integrating into the mainstream, many spatial subjects, including territorial, or regional, competitiveness are being increasingly inquired. In line with Krugman (2003), it is plausible to discuss competitiveness on a regional level, as a capacity of territories to attract and retain mobile factors of production, which is an increasingly important subject in an ever integrating global economy. However, this branch of economic geography is relatively underdeveloped, while it even lacks a universally accepted definition and metrics. In the European Union (EU), the debate about measuring and evaluation competitiveness at regional level resulted in the EU Regional Competitiveness Index (RCI), a joint project between Directorate General (DG) Joint Research Centre and DG Regional Policy.

Generally, the framework of analysis presents the following sequence of steps, from the development of a theoretical framework to the presentation and dissemination of the RCI. Each step is significant, but coherence in the whole process is equally vital. Therefore, the special emphasis is put on theoretical background, methodological application and finally to empirical results via systematic literature review approach investigating research works on the issues of competitiveness. The paper highlights competitiveness and analyse its components in the context of regional development. The study discusses background of regional competitiveness, address related questions on the meaning and explanation of regional competitiveness and provides the regional competitiveness factors. In this sense, the paper aims at aspects of regional competitiveness and methodological restrictions and obstacles for measuring in the EU area what have an impact on the empirical analysis and practical using for policy-makers and decision-makers. The purpose is thus measuring of competitiveness of the EU regions at the NUTS 2 level by developing a composite index approach, and to look at methodological and empirical changes over time 2010, 2013 and 2016.

2. Development of methodology across the RCI editions

The concept of competitiveness has in the last decades extended from the micro-level of firms to the macro-level of countries. Between the two levels stands the concept of regional competitiveness which is the focus of the EU RCI. The EU RCI is inspired by the Global Competitiveness Index (GCI) of the World Economic Forum (WEF). Therefore, GCI has been the leading reference framework for RCI construction. This choice has been driven by the fact that GCI is the most internationally recognised and acclaimed index in the field of competitiveness and its framework covers a very comprehensive set of aspects relevant to competitiveness. There are, however, some key differences that distinguish RCI from GCI due to RCI European and regional dimension. RCI has been published every three years since 2010, coinciding with the European Commission reports on economic, social and territorial cohesion. It covers regions at NUTS 2 level. RCI is based on indicators grouped in eleven pillars corresponding to various aspects of regional competitiveness. Pillars are designed to capture short- as well as long-term capabilities of the region. They are classified into three major groups: the pillars Institutions, Macro-economic stability, Infrastructure, Health and Quality of Primary and Secondary Education are included in the first group and represent the key basic drivers of all types of economies. As the regional economy develops, other factors

enter into play for its advancement in competitiveness and are grouped in the second group of pillars – Higher Education/Training and Lifelong Learning, Labour Market Efficiency and Market Size. At the most advanced stage of development of a regional economy, key drivers for regional improvement are factors related to Technological Readiness, Business Sophistication and Innovation, included in the third group. These aspects have been selected in line with the definition of competitiveness used by the EC for RCI (the ability of a region to offer an attractive and sustainable environment for firms and residents to live and work). According to authors of RCI editions (Annoni, Kozovska, 2010; Annoni, Dijkskra, 2013; Annoni, Dijkskra, Gargano, 2017), this allows the extension of traditional analysis of competitiveness to integrate perspectives of both businesses and inhabitants, taking into account both business success and personal well-being.

RCI is the first measure providing a European perspective on the competitiveness of all NUTS 2 regions in the EU. RCI makes it easy for a region to compare itself to all other regions, to spot regions with a similar level of competitiveness, and to identify regions it could learn from. Through its eleven pillars, it assesses not only aggregate competitiveness but also the strength and weaknesses of a region, using the main dimensions relevant for competitiveness. Therefore, RCI offers a comprehensive picture on the situation of regions, allowing for a cross-regional comparison among the EU Member States. As mentioned, RCI adopts and builds on the methodology developed by the WEF in the form of GCI with some key differences, mainly due to RCI's European and regional dimension. The guidelines which drove RCI analysis are major references of applied statistical analysis (Knoke et al., 2002; Morrison, 2005; and OECD (2008)). RCI is a composite indicator. As with all combined measures, it has both advantages and disadvantages. It is a metric which quantifies with a single number what is otherwise not directly measurable: the level of competitiveness of a region. The underlying phenomenon remains intrinsically multidimensional. It is a combination of a large set of indicators which are observed, statistically treated, weighted, and finally aggregated. RCI is, therefore, the result of a long list of subjective choices. The heated debate within the scientific community regarding the pitfalls of summarising a multi-dimensional concept in a single index – see for example Stieglitz's Commission Report (Stieglitz et al., 2009) – is not addressed here. RCI aims to provide a measure of the regional level of competitiveness by following two interconnected principles: simplicity and transparency. Simplicity is driven by the general necessity of the composite to be easily understood by a non-technical audience – policymakers, stakeholders, and citizens. But simplicity did not prevail over technical soundness: appropriate statistical analyses drove RCI construction.

2.1 Framework of the dataset and geographical coverage

The set of indicators which populate each pillar is carefully chosen according to the literature review, experts' opinion and data availability. Staníčková (2018) provides detailed information on indicators relevant for all RCI editions. The dataset consists of total of 113 candidate indicators (90 construct indicator, and 23 candidate indicators discarded) used RCI edition 2010, 2013 and 2016. Their code, description and type can be found in original RCI publications, for more information see Annoni, Kozovska (2010), Annoni, Dijkskra (2013), Annoni, Dijkskra, Gargano (2017). Data sources for RCI indicators are Eurostat, national statistical institutes, the World Bank Worldwide Governance Indicators, Global Competitiveness Index (World Economic Forum), the Quality of Government Index (Quality of Government Institute), OECD Programme for International Student Assessment (PISA), Regional Innovation Scoreboard, Eurobarometer, Scopus indicators on publications by Science-Metrix, and other indicators developed by DG Regio. Data for two RCI pillars are available at the country level only (Macroeconomic stability; Quality of Primary and Basic Education), while the Institutions and Technological Readiness pillar also include a national component.

One important note to the used working definition of competitiveness concept and tool in the form of RCI for its measurement having a background in the database of indicators. It refers to a point in time and not to changes over time. Likewise, all indicators included in RCI refer to the situation at one point in time and not to changes over time. In line with a database of indicators must also be geographical coverage of analysis. The literature raises two issues related to the selection of the appropriate regional level. First, competitiveness should be calculated for functional economic regions. The second is that the region should have an important political and administrative role. In most countries, however, functional regions are not administrative and vice-versa. Thus in practice, these two recommendations can be rarely combined. RCI focuses on NUTS (Nomenclature of territorial units for statistics) classification in the EU, specifically NUTS 2 regions are administrative or statistical regions which do not take into account functional economic links. Even though RCI is not entirely comparable over time, due to recurrent and often unavoidable revisions of regional indicators and NUTS classification, three RCI editions provide a unique policy tool for monitoring and assessing regional competitiveness in the EU. For subsequent relevant analysis of competitiveness across editions, a number of NUTS 2 regions must be the same. Due to the fact, that number of evaluated NUTS 2 regions differs from RCI editions 2010, 2013 and 2016 – number of evaluated NUTS 2 regions in RCI was unified based on the same classification in the fields of their names, codes and geographical coverage (some regions were merged and joined across different RCI editions). The investigated

territory of analysis is based on the EU NUTS classification, i.e. a hierarchical system for dividing up the EU economic territory for several purposes, i.e. collection, development and harmonisation of the EU regional statistics, socio-economic analyses of the regions and the framing of the EU regional policies (Eurostat, 2018). Geographical coverage for RCI construction consists of 269 total regions (the official number of the EU28 NUTS 2 regions being 276 by Eurostat NUTS 2 2013 classification valid from January 1, 2015).

Related to RCI, it is necessary to note that edition 2010, 2013 and 2016 incorporates improvements and slight modifications. However, these do not affect the overall structure of RCI. The reasons for the changes are multiple: new indicators become available at the regional level, while others are not updated or no longer fit the statistical framework of the index. Also, methodological improvements, especially between the first and the second RCI editions, and changes in NUTS regions make these comparisons complex. Nevertheless, the method has not changed substantially, and there is a high degree of continuity in the list of indicators. Changes in RCI editions are presented in Table 1.

Tab. 1: Comparison of RCI editions

Edition	Data Reference Year	Geographical Level/Pillars	Indicators
RCI 2010	Most recent data for all indicators, temporal range differs: individual years 2000, 2005, 2006, 2007, 2008, 2009 and their variable combinations in averages	<i>National:</i> country level (Institutions, Macroeconomic Stability, Quality of primary & secondary education, Technological readiness-part enterprises, not households) <i>Regional:</i> NUTS 2 level: all the other pillars; 268 NUTS 2 regions – Eurostat classification 2010	Indicators: 81 candidate, 69 construct
RCI 2013	Most recent data for all indicators, temporal range differs: individual years 2006, 2009, 2010, 2011 and their variable combinations in averages	<i>National:</i> country level (Institutions, Macroeconomic Stability, Quality of primary & secondary education, Technological readiness-part enterprises, not households) <i>Regional:</i> NUTS 2 level: all the other pillars; 273 NUTS 2 regions – Eurostat classification 2010	Indicators: 80 candidate, 73 construct
RCI 2016	Most recent data for all indicators, temporal range differs: individual years 2009, 2011, 2013, 2014, 2016 and their variable combinations in averages	<i>National:</i> country level (Institutions, Macroeconomic Stability, Quality of primary & secondary education, Technological readiness-part enterprises, not households) <i>Regional:</i> NUTS 2 level: all the other pillars; 275 NUTS 2 regions – Eurostat classification 2013	Indicators: 79 candidate, 74 construct

Source: Annoni, Kozovska (2010); Annoni, Dijkstra (2013); Annoni, Dijkstra, Gargano (2017); analysed and elaborated by Staničková (2018)

2.2 Statistical assessment of RCI

Constructing a composite is a multidisciplinary exercise which involves expertise both in the concept to be measured and in the statistical techniques used to assess the developing methodology. Statistical assessment of RCI is carried out with a twofold intention, i.e. to assess the quality of each indicator selected to populate RCI framework: it includes the treatment of missing values and outliers (univariate analysis, i.e. indicator by indicator), and to verify whether the set of indicators within each dimension is jointly consistent (multivariate analysis, i.e. on each pillar as a whole). The key driver for RCI computation has been to keep it simple, to be easily understood by non-statisticians, and at the same time consistent (Annoni, Kozovska, 2010).

The former allows for detecting possible problems with: i) missing data; ii) distribution asymmetry and outliers and iii) different measurement scales. These problems are addressed by adopting: i) specific imputation methods; ii) power-type transformations to correct for skewness; iii) standardisation. The multivariate analysis is carried out at the pillar level on the set of indicators as a whole. The aim is to assess their contribution in describing the latent dimension behind each pillar. Anomalous indicators are in some cases detected and excluded from further analysis. A number of the candidate and construct indicators differs across RCI editions 2010, 2013 and 2016. Following the structure of statistical assessment presented in RCI, a separate discussion of each of the eleven pillars was outlined in each edition. For each pillar, the chosen indicators are individually analysed by univariate statistical methods and as a whole by the multivariate approach. The indicators used have a direct positive relationship with competitiveness, i.e. the higher their value, the higher the level of competitiveness. Whenever necessary, original indicators have been reversed. Multivariate analysis has been used to verify the existence of a single latent dimension. In few cases indicators which do not describe this universal dimension, underlying the specific pillar, have been discarded. The geographical distribution of the pillar sub-score, computed as a simple average of the transformed/standardised indicators, is shown. Sub-scores are presented as min-max normalised scores (as a

percentage) and are divided into six classes, with high values associated with high competitiveness. Tables with corresponding sub-scores and the regions' ranks are also presented in each edition in a pillar by pillar analysis.

Construction of final RCI consists of a step-by-step aggregation process. The first step consists of computing the scores for each RCI dimension as a simple arithmetic average of the transformed and normalised indicators which passed the Principal Component Analysis (PCA) test. It is important to remark that RCI is not based on PCA weights. The derivation of weights through principal component or other latent variable models is neither straightforward nor transparent. Pure statistical approaches may lead to inappropriate normative results such as, for example, the assignment of negative weights to some dimensions (Decancq, Lugo, 2009). High correlation within each pillar also reduces the possibility of compensability across indicators, where compensability is understood as the undesirable offsetting of low scores in some indicators with high scores in others.

The second step consists of computing the scores for the three groups of dimensions – Basic, Efficiency and Innovation – as arithmetic means of the dimension scores. For each pillar, RCI sub-scores have computed as a simple average of the standardised (z-scores) indicators values. Scores at the pillar group level (sub-indices) are computed as an average of the corresponding sub-scores. A sub-index is thus calculated for each of the three pillar groups (Basic, Efficiency and Innovation) as the simple average of the pillar scores belonging to each of the pillar groups.

For each region i the sub-scores associated to the dimension groups are:

$$RCI_{basic}(i) = \frac{1}{5} \sum_{j=1}^5 score(i, j) \quad (1)$$

where $score(i, j)$ is the score assigned to region i for dimension j ; RCI_{basic} presents sub-index of RCI for i -th region; i is EU28 NUTS 2 region; $i \in \{1 = AT11, \dots, 269 = UKN0\}$; j is pillar of competitiveness relevant for dimension of sub-index RCI_{basic} ; $j \in \{1 = Institutions, 2 = Macroeconomic stability, 3 = Infrastructure, 4 = Health, 5 = Quality of primary and secondary education\}$.

$$RCI_{efficiency}(i) = \frac{1}{3} \sum_{j=6}^8 score(i, j) \quad (2)$$

where $score(i, j)$ is the score assigned to region i for dimension j ; $RCI_{efficiency}$ presents sub-index of RCI for i -th region; i is EU28 NUTS 2 region; $i \in \{1 = AT11, \dots, 269 = UKN0\}$; j is a pillar of competitiveness relevant for the dimension of sub-index $RCI_{efficiency}$; $j \in \{6 \text{ Higher education and training and Lifelong Learning, } 7 \text{ Labour market efficiency, } 8 \text{ Market size}\}$.

$$RCI_{innovation}(i) = \frac{1}{3} \sum_{j=9}^{11} score(i, j) \quad (3)$$

where $score(i, j)$ is the score assigned to region i for dimension j ; $RCI_{innovation}$ presents sub-index of RCI for i -th region; i is EU28 NUTS 2 region; $i \in \{1 = AT11, \dots, 269 = UKN0\}$; j is pillar of competitiveness relevant for dimension of sub-index $RCI_{innovation}$; $j \in \{9 \text{ Technological readiness, } 10 \text{ Business sophistication, } 11 \text{ Innovation}\}$.

In the last step, the RCI score is computed as a weighted average of three sub-scores:

$$RCI(i) = w_{basic} RCI_{basic}(i) + w_{efficiency} RCI_{efficiency}(i) + w_{innovation} RCI_{innovation}(i) \quad (4)$$

$$w_{basic} + w_{efficiency} + w_{innovation} = 1 \quad (5)$$

$$w \in < 0, 1 > \quad (6)$$

where $RCI_{(i)}$ presents composite weighted index RCI for i -th region; w is normalised weight (based on the stage of development) of i -th region for j -th pillar of competitiveness representing relevant sub-index.

Final RCI score is the result of a weighted aggregation of three sub-indices, and the set of weights is chosen according to the development stage of the region. For final aggregation, RCI follows the approach that the WEF adopts for GCI with the aim of taking into account the level of heterogeneity of the EU regions, especially after the enlargements. GCI takes into account the stage of development (SoD) of a country and accordingly assigns a different weighting scheme to groups of pillars (Schwab, Porter, 2007). Given that some variability across the development stages of the EU NUTS 2 regions is expected, a similar approach is adopted for RCI. The set of weights adopted for aggregating the sub-indices depend on the level of development of the regions, classified into the medium, intermediate and high stage on the basis of their GDP value. Table 2 and Table 3 show weights assigned to SoD based on GDP threshold. On the basis of GDP thresholds, the EU NUTS 2 regions were classified into different SoD. It is evident that in the RCI 2010 edition, only three SoD categories were recognised. In RCI

2013 and 2016 editions, the weighting system and the classification of the regions into SoD have been slightly modified, also following the suggestions by the WEF team in charge of GCI (Annoni, Dijkstra, 2013). Five classes, instead of three of RCI 2010 edition, are used to allow for a smoother change in the weighting values across SoD. RCI does not have any transition stages which are instead used in WEF-GCI with the country-specific set of weights. By adding two more classes, RCI tries to cope with this issue.

Medium SoD is associated with regional economies primarily driven by factors such as lower skilled labour and basic infrastructures. Aspects related to good governance and quality of public health are considered basic inputs in this framework. Intermediate SoD is characterised by labour market efficiency, quality of higher education and market size, factors which contribute to more sophisticated regional economies and more significant potential for competitiveness. In the high SoD, factors related to innovation, business sophistication and technological readiness are necessary inputs for innovation-driven regional economies. The level of competitiveness of more developed economies, on the other hand, takes into account to a more significant extent their innovation capability as a critical driver for their advancement (Annoni, Kozovska, 2010). The weighting scheme of pillar groups has the effect of not penalising regions on factors where they lay too far behind. RCI message is then more constructive: it provides a measure of competitiveness which allows for fair comparison of the EU regions and highlights realistic areas of improvement. As for almost every CI, the procedure followed for the setting up of RCI is affected by a certain degree of subjectivity.

Tab. 2: RCI 2010 normalised weights

Average GDP/p.c. in PPS expressed as an index (EU =100)	SoD	SoD description	Weight-Basic	Weight-Efficiency	Weight-Innovation	Sum of Weights
<75	1	Medium (M)	0.4000	0.5000	0.1000	1.0000
≥ 75 and < 100	2	Intermediate (I)	0.3000	0.5000	0.2000	1.0000
≥ 100	3	High (H)	0.2000	0.5000	0.3000	1.0000

Source: Annoni, Kozovska (2010); elaborated by Staničková (2018)

Tab. 3: RCI 2013–2016 normalised weights

Average GDP/p.c. in PPS expressed as an index (EU =100)	SoD	SoD description	Weight-Basic	Weight-Efficiency	Weight-Innovation	Sum of Weights
<50	1	Medium (M)	0.3500	0.5000	0.1500	1.0000
[50–75)	2	Medium /Intermediate (M/I)	0.3125	0.5000	0.1875	1.0000
[75–90)	3	Intermediate (I)	0.2750	0.5000	0.2250	1.0000
[90–110)	4	Intermediate/High (I/H)	0.2375	0.5000	0.2625	1.0000
≥ 110	5	High (H)	0.2000	0.5000	0.3000	1.0000

Source: Annoni, Dijkstra (2013); Annoni, Dijkstra, Gargano (2017); elaborated by Staničková (2018)

3. Time comparison analysis of the RCI results: Regional evidence of the EU competitiveness

It has been initially assumed that the suggested measure of competitiveness can take both positive and negative scores. Its positive score indicates that a region is competitive, whereas a negative one informs about the absence of competitiveness. So, have regions improved their competitiveness in time?

Results show the level of heterogeneity in RCI results in time, a certain level of homogeneity across the EU is expected and the diversity suggests substantial differences in the sophistication of regional economies across and within countries. RCI shows a more polycentric pattern with substantial capital and metropolitan regions in many parts of Europe. Similarly competitive regions surround some capital regions, but in many countries, the regions neighbouring the capital are less competitive. The substantial disparities within several countries also highlight the need for regional analysis and the limits of a purely national approach. RCI scores have been modified to mimic the regions used in 2010, 2013 and 2016 editions, based on used indicators and changes in NUTS classification (especially numbers, names and codes on regions) and combine regions with different stages of development which makes the comparison every more fraught and captures results more relevantly as possible – this makes it possible to compare RCI and RRI results. Table 4 and Table 5 show scores and ranks of the best and worst EU28 NUTS 2 regions. In all RCI editions, most of the top regions host either capitals or large metropolitan areas which help to boost the region's competitiveness; to this group belong only regions of the so-called old EU Member States, i.e. United Kingdom, Netherlands, Denmark, Sweden and Finland, and also France and Belgium too). At the other end of the scale, we find Greek, Portuguese, Bulgarian and Romanian regions.

Tab. 4: RCI TOP 10 position of NUTS 2 regions during reference periods

NUTS 2	RCI 2010		NUTS 2	RCI 2013		NUTS 2	RCI 2016	
	Score	Rank		Score	Rank		Score	Rank
NL31	1.253	1	NL31	1.358	1	UKH2	1.214	1
FI1B	1.134	2	UKH2	1.192	2	UKH3	1.214	1
DK01	1.130	3	UKH3	1.192	2	UKI3	1.214	1
NL32	1.116	4	UKI3	1.192	2	UKI4	1.214	1
SE11	1.081	5	UKI4	1.192	2	UKI5	1.214	1
FI1C	1.031	6	UKI5	1.192	2	UKI6	1.214	1
NL33	1.024	7	UKI6	1.192	2	UKI7	1.214	1
FR10	1.017	8	UKI7	1.192	2	UKJ1	1.150	8
NL41	0.993	9	UKJ1	1.174	9	NL31	1.149	9
BE24	0.969	10	SE11	1.149	10	SE11	1.138	10

Source: calculated and elaborated by Staničková (2018)

Tab. 5: RCI BOTTOM 10 position of NUTS 2 regions during reference periods

NUTS 2	RCI 2010		NUTS 2	RCI 2013		NUTS 2	RCI 2016	
	Score	Rank		Score	Rank		Score	Rank
BG33	-1.294	260	EL61	-1.337	260	BG34	-1.334	260
RO12	-1.294	260	RO41	-1.360	261	RO31	-1.341	261
EL51	-1.311	262	RO12	-1.362	262	RO41	-1.345	262
RO41	-1.369	263	EL30	-1.371	263	EL62	-1.364	263
EL64	-1.376	264	EL64	-1.376	264	EL63	-1.410	264
RO22	-1.385	265	EL42	-1.403	265	EL65	-1.443	265
BG31	-1.387	266	BG34	-1.403	266	BG31	-1.445	266
EL52	-1.465	267	EL54	-1.417	267	EL64	-1.446	267
PT20	-1.485	268	RO22	-1.479	268	EL51	-1.490	268
EL63	-1.511	269	BG31	-1.481	269	RO22	-1.494	269

Source: calculated and elaborated by Staničková (2018)

In relation to findings from RCI 2010 edition, the most competitive EU regions are the three Dutch provinces that cover the Randstad (Utrecht, North and South Holland); Hovedstaden which includes Copenhagen; London; Stockholm; South Finland which includes Helsinki; Ile de France which includes Paris; North Brabant; and the UK region Berkshire, Buckinghamshire and Oxfordshire. In many countries, the capital region is far more competitive than the other regions in the same country, and many countries have highly heterogeneous RCI scores. Based on findings from RCI 2013 edition, the best group includes again Utrecht, the highest competitive region in both editions, the London area and the area including Oxford, the two Netherland regions of Noord and Zuid Holland which comprise Amsterdam, the Danish region Hovedstaden (including Copenhagen), Stockholm and Île de France (including Paris). The new entries in the top-ten are the Frankfurt region (Darmstadt) and the Surrey, East & West Sussex in the United Kingdom. It is striking that seven out of the top ten are either capital regions or regions including large cities. At the other end of the competitiveness scale, we find some regions which are unfortunately steadily worsted performers. These are the Bulgarian region Severozapaden, the Greek region Notio Aigaio, and two southern Romanian regions Sud-Est and Sud-Vest Oltenia. Findings from RCI 2016 edition, show a polycentric pattern, with capital regions and regions with large metropolitan areas scoring the highest on the index. In most of north-western Europe, such regions tend to generate spillovers (i.e. boost the competitiveness of the neighbouring regions), while this is less the case in eastern and southern states. The best performers in RCI 2016 edition were several UK regions (London and its commuting zone; Berkshire, Buckinghamshire and Oxfordshire; Surrey, East and West Sussex; Hampshire and the Isle of Wight), Utrecht (the Netherlands), Stockholm (Sweden), Hovedstaden (Denmark), Luxembourg, Ile de France (France) and Oberbayern (Germany). The bottom performers were several Romanian regions (Sud-Muntenia, Sud-Vest Oltenia, Sud-Est), Greek regions (Ionia Nisia; Dytiki Ellada; Peloponnisos; Sterea Ellada; Anatoliki Makedonia, Thraki), the Bulgarian region of Severozapaden and French Guyane. As in the previous two editions, the geographical distribution of competitiveness features wide variations not only between but also within countries. Compared with the last two editions (2010 and 2013), Malta and several regions in France, Germany, Sweden and the UK have improved, while scores went down in Cyprus and some regions in Greece, Ireland and the Netherlands. In eastern EU regions, competitiveness has mostly remained stable. High within-country variations were often observed due to a significantly outperforming capital region. This gap was unusually wide in Romania, Greece, Slovakia, Bulgaria and France, and relatively small in the United Kingdom, Austria and Belgium. However, the capital region was not the most competitive region in Germany, Italy or the Netherlands.

4. Conclusion

Comparing RCI over time is complicated because each edition 2010, 2013 and 2016 incorporates improvements and slight modifications. These do not affect the overall structure of RCI, but they limit the possibilities to measure change over time. The reasons for the changes are multiple: new indicators become available at the regional level, while others are not updated or no longer fit the statistical framework of the index. Also, methodological improvements, especially between the first and the second RCI editions, and changes in NUTS regions make these comparisons complex. Nevertheless, the method has not changed substantially, and there is a high degree of continuity in the list of indicators. Necessary to note that, in the paper, scores for RCI have been modified to mimic the regions used in 2010, 2013 and 2016 editions, based on used indicators and changes in NUTS classification and combine regions with different stages of development which makes the comparison every more fraught and captures results more relevantly as possible (with respect to negatives of RCI). Although this approach allows comparison of RCI editions, it is not possible to identify whether the differences in the score is due to changes in data or changes in method. In some cases, it may be primarily due to changes in values of indicators included; in other cases, it may be mainly due to changes in methodology and indicator selection. Changes in a region's ranking over time are not always meaningful. Rankings are based solely on the sequence of the scores and do not take into account the actual differences between scores. Comparison of RCI ranks is not feasible because RCI implements some improvements and modifications that, even if not affecting the overall index structure, make the direct score comparison not meaningful. Ranking comparability over time is also troublesome as ranks are mutually dependent. A change in the ranking may be due to a minimal difference in scores, which is not significant. This is often the case for scores around the average. Analysing the significant changes in the scores, as opposed to the rankings, over time can be highly informative. RCI has three editions and includes updated and more data together with method refinements. It is important to note that the increased number of indicators, but also their internal changes and the methodological improvements reduce the comparability over time. However, despite all its shortcomings in all editions, RCI proved to be a robust way to summarise many different indicators into one index.

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