The entrepreneurial performance of the Central and Eastern European regions[1]

Balázs Páger[2]

The theoretical concepts about entrepreneurship have changed since the last three decades. It has become one of the most crucial factors in the economic processes. These changes in the theories about entrepreneurships have been supported by the shift in the whole economic environment. Entrepreneurships are embedded in that socio-economic environment, where they continue their economic activity. It can be assumed that the regional context of the institutional and individual factors has a crucial role in the entrepreneurial performance of a given territory.
This paper focuses on the entrepreneurial performance of Central and Eastern European (CEE) regions which have been measured by the REDI Index (Regional Entrepreneurship and Development Index). Its methodology based on the Global Entrepreneurship and Development Index (GEDI) and it is applied for the regional measurement of entrepreneurial performance. The performances of the CEE countries are compared with other European regions and they have been analysed on their own as well. It can be observed that CEE regions have relatively poor entrepreneurial performance amongst the European regions. As the regions' performance were compared to one another it can be observed that there are some factors which are weak not only on the regional but on the national level as well. One of the most important characters in the CEE regions is the high difference between the capital city and the other regions. It could mean that the economic weight and the entrepreneurial performance of the non-capital regions are relatively small.

Keywords: entrepreneurship, regional development, CEE regions

JEL Codes: L26, O18

1. Introduction

The paper is dealing with the entrepreneurial performance of the Central and Eastern European (CEE) regions. These regions faced with hard and important challenges to find their own development path. After the transition the regulations and economic environment changed to provide opportunities for individuals to start their own private business. *Smallbone* and *Welter* (2001) reported different ways about the entrepreneurial activities in Central and Eastern European countries. They investigated what kind of processes characterized the establishment and the entrepreneurial environment during the transition at the end of 1980s and in the early 1990s years. Many positive and negative effects influenced the formation of new firms, like foreign direct investments, supports from the European Union, legal barriers or the economic heritage of the regions. Some of them are national factors (like acts or regulations), but there are regional factors as well like the regional socioeconomic environment which might create an adequate background for the new businesses.

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[2] Junior research fellow, Centre for Economic and Regional Studies Hungarian Academy of Sciences, 7621 Pécs, Papnövelde u. 22. (Hungary), email: pagerb@rkk.hu

Although some of the CEE regions represented a strong development in the last decade, many of them haven't found their own development path yet (regional GDP comparison of CEE regions see in Appendix 1).

One of the reasons may be the relatively low regional entrepreneurial performance. In this paper we try to point at those strengths and weaknesses which may influence the entrepreneurial performance in the Central and Eastern European regions. We apply the recently developed REDI Index (Regional Entrepreneurship and Development Index)[3] which captures the entrepreneurial performance of a region in a complex way. The investigation has two main parts. On the one hand we demonstrate the differences between the averages of European regions and the CEE regions. On the other hand the CEE regions will be analysed in their own.

In the next section we summarize the most important findings about the relationship of entrepreneurship and regional development. The REDI Index and the methodology are represented in the third section and the main results are shown in the fourth section. Our experiences about the CEE regions' entrepreneurial performance and further improvements of the study are mentioned at the end of the paper.

2. Regional approach of entrepreneurial performance

We summarize shortly those key concepts which influenced the regional level entrepreneurial investigation. The theoretical concepts about entrepreneurship has changed over the last three decades. Entrepreneurship is believed to be one of the most crucial factors in the economic progress. Furthermore, new firms and enterprises may play a significant role in the regional economies due to their knowledge and novelties what they bring in the market. Many studies proved that the new entrepreneurships have a positive effect on economic growth in the developed countries (*Acs–Audretsch* 1988; *Acs–Varga* 2005; *van Stel et al.* 2005; *Acs–Szerb* 2007).

Changes in the economic theories about entrepreneurship have been supported by the shift in the *whole economic environment* as well. *Audretsch* and *Thurik* (2001) summarized in 14 trade-offs what kind of differences are between the "managed economy" and "entrepreneurial economy". The "managed economy" marked the post-war decades after the Second World War. The source of its competitiveness was capital and labour. The production concentrated in relatively big and dominant enterprises. This period was characterized by the

[3] The development of REDI Index was conducted by the European Union represented by the European Commission Directorate-General Regional and Urban Policy under contract number NO 2012.CE.16.BAT.057.

homogenous mass production and the economies of scale and the leading concept of firms was the stability and continuity. The relationship of cooperation and competition was complementary. Some changes on the job market as well as in consumption lead to the stepped shift of the economic systems. The emerging concept of the entrepreneurial economy has been characterized by the small and medium firms which strategy builds on diversity and flexibility. Its leading concept has become the change and different products. Instead of complementary relationship, there has been a substitute nexus among cooperation and competition in the entrepreneurial economy. The role of local policies and the focus on the local and regional space became more significant than in the managed economy (*Audretsch–Thurik* 2001; *Audretsch* 2009).

Diversity has been also playing a leading role in the entrepreneurial economy. It has an important characteristic as being one of the sources of agglomeration economies as well. Namely, a diverse industry mix helps the actors to get in touch with one another and change their ideas, methods and practices across the different industries (*Frenken et al.* 2007). According to *Audretsch* and *Keilbach* (2004) a new firm may inject diversity onto the market and "entrepreneurship is an important source of diversity by transforming knowledge into economic knowledge that otherwise would have been remained uncommercialized" (*Audretsch–Keilbach* 2004, 608.). The regional diversity has an impact on entrepreneurships, but the variation of diversity is also important (*Audretsch* 2010). *Fritsch* and *Müller* (2004) distinguished direct and indirect effects of the new business formation on the regional development. They count the "greater variety of products" to the indirect effects of the new incomers. Their presence on the labour and product markets may stimulate the division of labour, and create innovations. Thus, it may generate regional development. However, it should be taken into consideration that these effects have a lagged influence on the entrepreneurial performance (*Fritsch–Müller* 2004; *Fritsch* 2012).

The *regional level investigation of entrepreneurial performance* and the effects of entrepreneurship on the regional development as research topics have emerged very fast in the last decade. There has been many special issues published in relevant journals (like Small Business Economics, Regional Studies, Entrepreneurship and Regional Development) which dealt expansively with this field. In this paper, we highlight only some recent studies which interpreted by different measures and methods analyzing the entrepreneurial activity variations of the different regions. *Beugelsdijk* and *Noorderhaven* (2004) investigated the regional entrepreneurial attitudes as a cultural characteristic across 54 regions. They pointed out that there is a link between entrepreneurial attitude and economic growth. *Bosma* and

Schutjens (2011) conducted an investigation about the entrepreneurial attitudes and activity on 127 European regions using GEM (Global Entrepreneurship Monitor) data. Their results showed that urban regions in developed countries had the best performance in the analysed entrepreneurial factors. *Beugelsdijk* (2007) found out that the entrepreneurial culture has an important role in the regional entrepreneurial performance and it may explain why some regions perform better than others (*Beugelsdijk* 2007). *Fritsch* and *Wyrwich* (2014) analysed the effect of regional entrepreneurship culture on the region's self-employment rate. They concluded that the entrepreneurship culture seems to be an important factor that has a positive effect on the new business formation and on the economic growth as well (*Fritsch–Wyrwich* 2014). These studies showed that there are differences in the influential factors of entrepreneurial activities and these differences have an effect on the entrepreneurial performance and the regional development as well.

Most of the studies related to the investigation of entrepreneurial activity or culture, deal with the Western European regions and territories. Some studies referred about barriers in the investigation of entrepreneurship in Central and Eastern European regions (like the short time period since the transition or the rejection of private enterprises in the socialist period). For example *Fritsch* and *Wyrwich* (2014) mentioned in their study what kind of difficulties may come up during the investigation of entrepreneurial culture in East German regions. The studies about the eastern part of Europe dealt with the institutional frames of entrepreneurial activity (like *Welter* 1997; *Smallbone–Welter* 2012), but there were less numerous study about the entrepreneurial performance of these countries and regions. In this paper we attempt to capture the most important individual and institutional attributes which characterize the entrepreneurial performance of Central and Eastern European regions. We have two research questions:

- What kind of differences can be discovered in the comparison of the entrepreneurial performance between Western and Eastern European regions?
- What are the main attributes of the entrepreneurial performance in the Central and Eastern European regions?

3. The methodology of REDI Index

The importance of regional level investigation of entrepreneurship has been emerging for years, but many of them focus only on the analysis of one or two factors related to entrepreneurial activity. GEM research is one of the largest from this aspect. One of its main

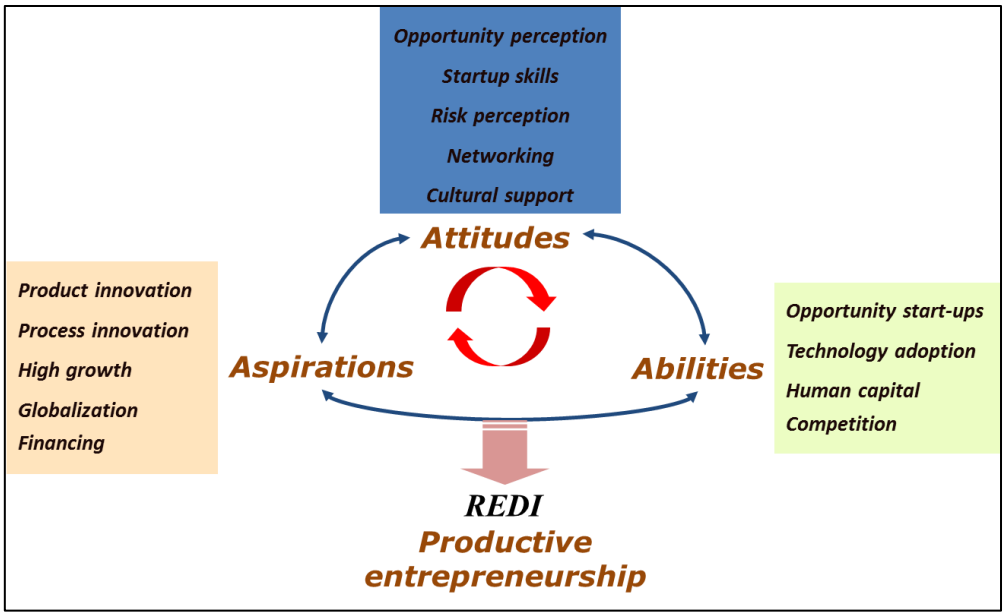
indicators is the Total early-stage Entrepreneurial Activity which measures the rate of the population of a country aged 18-64 years who own a nascent or young business. But the GEM researches take into consideration only quantitative parts of entrepreneurial activity and there is a lack of qualitative aspects of the entrepreneurial activity. Entrepreneurship is a complex phenomenon, hence it is not easy to capture and measure. Furthermore it may cause difficulties in the measurement of entrepreneurship that there is a lack of consensus about exact definition or conceptualization (*Szerb et al.* 2013a). *Wennekers* and *Thurik* (1999) identified at least 13 different roles of entrepreneurs which are related to their activities.

The structure of REDI Index is based on the conception of the Global Entrepreneurship and Development Index (GEDI). It was developed by the Global Entrepreneurship Development Institute lead by Zoltan J. Acs and László Szerb. The GEDI approach of measuring entrepreneurial activity involves a composite index which measures productive entrepreneurship in a multidimensional way. It examines the connection between entrepreneurship and economic development, and provides policy recommendations regarding economic policies (*Szerb et. al* 2013b). The basic idea of the GEDI Index is based on the theory of National System of Entrepreneurship that "(…) is the dynamic, institutionally embedded interaction between entrepreneurial attitudes, ability, and aspirations, by individuals, which drives the allocation of resources through the creation and operation of new ventures." (*Acs et al.* 2014). On the one hand, the index builds on individual data derived from the Global Entrepreneurship Monitor (GEM) Adult Population Survey. On the other hand, it focuses not only on the process of business creation, but it captures the qualitative aspects, the so called "contextual features" as well.

The same systematic approach was used to capture the regional level entrepreneurship in the case of REDI Index. The Regional System of Entrepreneurship[4] gives the theoretical background for this index (Figure 1). This theory is based on the idea of National System of Entrepreneurship (*Szerb et al.* 2014).

Figure 1 – The dynamic of Regional System of Entrepreneurship

[4] Qian et al. (2013) identifies the frames and model of the regional systems of entrepreneurship.



Source: Szerb et al. 2014, 48.

This figure represents not only the systematic view of productive entrepreneurship but the structure of REDI Index as well. The REDI Index is a multi-level index, it has six levels: REDI Index, sub-indexes, pillars, variables, indicators, sub-indicators. The main index consists of three sub-indexes: attitudes (ATT), abilities (ABT) and aspirations (ASP)[5] (*Szerb et al.* 2013c).

The entrepreneurial attitudes sub-index measures the attitudes of the population aged 18-64 years about the entrepreneurial activities. It summarizes these attitudes with five pillars. Opportunity perception indicates the recognition and exploration of the opportunities for a new business. Start of a new enterprise bears a relation to the own personal networks and adequate skills related to new business formation. Risk perception represents the attitude about the fear of failure which may have a negative effect on the entrepreneurial attitude. Cultural support indicates the population's main believes about the entrepreneurs like career opportunities, success stories or negative impressions (for e.g. corruption).

Entrepreneurial abilities indicate those skills which may contribute the high growth of a start-up. These four pillars are measured among the early-stage entrepreneurs[6]. Opportunity start-up represents the individual entrepreneurial motivation on the one hand and the business environment in which the start-up embedded on the other hand. The technological orientation of the start-up (Technology adoption) and its human resources (Human capital) are in relation to the entrepreneurship's high-growth as well. The competition pillar indicates how many

[5] The pillars are reviewed here shortly, a detailed description of them can be found in Appendix 2.
[6] It is important to notice that the REDI Index measures the attitudes of the whole population aged between 18-64 and the abilities and aspirations of nascent and new startups (not elder than 42 months).

competitors have the new business. Namely, start-ups with fewer competitors may grow faster than those which have many rivals on the market.

Entrepreneurial aspirations represent the conceptions of the early-stage entrepreneurs about their own business by five pillars. Product and process innovations represent the abilities of the start-up for new products and/or newly organized parts in the production process. The high growth indicates the expansion ambitions of the early-stage entrepreneurship. Globalization measures the international orientation and the foreign customers of the start-up. It indicates the accessibility of the given region where the start-up locates as well. Financing refers to the financial background of the entrepreneurial activities which is measured by the informal investments on the one hand and the regional concentration of the financial sector on the other hand.

The data of REDI Index had many sources. There were two broad types of data: individual and institutional level data. Almost all of the individual data were based on the Adult Population Survey of Global Entrepreneurship Monitor (GEM) except two innovation based variables. The regional innovation performance variable was derived from the Poli-KIT database (*Capello–Lenzi* 2013). The NUTS level of individual data was various in the countries and it determined the number of regions from a country. NUTS 1 level data were available for Austria, Belgium, Czech Republic, France, Germany, Greece, Italy, Netherlands, Poland, Romania and United Kingdom and NUTS 2 level data for Croatia, Denmark, Estonia, Finland, Hungary, Ireland, Latvia, Lithuania, Portugal, Slovakia, Slovenia, Spain and Sweden. Altogether 24 European countries and 125 regions were involved in the investigation. The institutional data were collected from different relevant databases and sources (*Szerb et al.* 2014).[7]Some of these data represent country level values. Most institutional variables have at least one regional level indicator (except Risk perception), and many of the variables consist country and regional level data as well.

Here we introduce the computation of REDI in nutshell, the detailed description can be found in *Szerb et al.* (2014). The computation of REDI Index started with the creation of variables and pillars. The variables were created by the adequate indicators. The methods of aggregating the indicators depended on the characteristics of data. The *pillars* were built up from an individual and an institutional variable. The descriptive statistics of the pillars were

[7] EUROSTAT Regional Database; United Nations, Department of Economic and Social Affairs, Population Division; EU Regional Competitiveness Index 2010; World Bank – World Development Index; Legatum Prosperity Index; World Economic Forum; EU QoG Corruption Index; Heritage Foundation database; ESPON database; Cluster Observatory database; DG Regio Individual Datataset (not-published); Groh et al (2012) Global Venture Capital and Private Equity Country Attractiveness Index and OECD-PISA database

checked as well. We paid an extraordinary attention on the *skewness values*, because the lack of normal distribution might disfigure the final values and cause false benchmarking value application. Pillars were transformed if skewness values fall out the [-1;1] range. Creating the pillar values was followed by the handling of extreme values. We used the *capping* method. It means that the 95 percentile score was determined in the case of each pillars and it served as a benchmark in each case. Hence the extreme positive values were cut down to the 95 percentile of the original values. The next step was the *normalization* of the pillars. The min-max normalization technique was applied in the REDI Index (*Szerb et al.* 2014) (2).

$$x_{i,j} = \frac{z_{i,j}}{\max z_{i,j}} \qquad (2)$$

for all j= 1, …, m; m=14 is the number of pillars
$x_{i,j}$ is the normalized score value for region i and pillar j
$z_{i,j}$ is the original pillar value for region i and pillar j
$\max_i z_{i,j}$ is the maximum value for pillar j

The normalized pillars had different averages and it foreshadowed that reaching the same performance in pillars requires different efforts and resources. To apply REDI Index for determining public policy recommendations the average values should be the same for all of the 14 pillars. Therefore we needed a transformation to equate the average values of the 14 pillars.

After normalization we made the following average adjustment (*Szerb et al.* 2014). X_i is the normalized score for region i for pillar j. The arithmetic average of pillar j for n regions is:

$$\bar{x}_j = \frac{\sum_{i=1}^{n} x_{i,j}}{n} \qquad \text{for all pillars} \qquad (4)$$

We wanted to transform the $x_{i,j}$ values, that the potential values to rescale in the [0,1] range.

$$y_{i,j} = x_{i,j}^{k} \qquad (5)$$

where k is the "strength of adjustment", the k^{th} moment of x_j is exactly the needed average, $\bar{y}_j$.

We had to find the root of the following equation for k:

$$\sum_{i=1}^{n} x_{i,j}^{k} - n\bar{y}_j = 0 \qquad (6)$$

This function is decreasing and convex which means it can be quickly solved using the well-known Newton–Raphson method with an initial guess of 0. After getting k, the computations are straightforward. If

$$\bar{x}_j < \bar{y}_j \; then \; k < 1$$
$$\bar{x}_j = \bar{y}_j \; then \; k = 1$$
$$\bar{x}_j > \bar{y}_j \; then \; k > 1$$

that is *k* be thought of as the strength (and direction) of adjustment. Because of the average equalization the REDI index should be computed again only for the CEE regions at their analysis. It may cause such REDI scores that vary from the original values but these will be values will be used only at the investigation of distinctions in entrepreneurial performance in the CEE regions.

The most important part of the computation of REDI Index is the applying of the *Penalty for the Bottleneck* (PfB) method (*Rappai–Szerb* 2011). It enables to create the dynamic interaction among the pillars. In this case the bottleneck is the worst performing pillar which performance may determine the whole entrepreneurial performance. The method compares the bottleneck pillar to the other pillars of a given territory and it makes a penalization in the measure of differences between the best and worst pillars. The bigger differences are among the pillars, the higher penalization will be realized on the values of a give region. The model of the Penalty for Bottleneck was developed by alteration the original function of *Tarabusi* and *Palazzi* (2012) (*Szerb et al.* 2014). (7)

$$h_{(i),j} = min\, y_{(i),j} + (1 - e^{-(y_{(i),j} - \min y_{(i),j})}) \qquad (7)$$

$h_{(i),j}$ is the modified, post-penalty value of pillar j in region i
$y_{(i),j}$ is the normalized value of index component j in region i
min $y_{(i),j}$ is the lowest value of $y_{(i),j}$ for region i.
i = 1, 2, …, n = the number of regions
j= 1, 2,…, m= the number of pillars

As the last step the pillar values were aggregated. Formerly we have already determined which pillars belong to the adequate sub-indexes. To obtain the sub-index values we computed the arithmetical average of the penalized pillar values. These were on a scale from 0 to 1. To get a range from 0 to 100 points the values were multiplied by 100 after averaging the pillars.

After creating the REDI Index and rankings we created groups within the European and CEE regions. The different entrepreneurial characteristics of groups give an opportunity to investigate the main strengths and weaknesses. We used k-means cluster analysis to investigate the entrepreneurial performance of the CEE regions (29 regions). After some attempts we found that four clusters are optimal for the comparison of European regions and CEE regions in their own as well.

4. Results

4.1. Comparison the Central and Eastern European regional performance to all European regions

The highest REDI score has the Danish Hovedstaden (DK01) region (the capital city region) which obtained 82.2 REDI Index score. The lowest performance was measured in the case of Romanian Macroregiunea doi (RO2) region which showed only 18.4 REDI Index score. We compared these two regions with three other average values. These were computed for the Western, Southern and Central and Eastern European regions. The average REDI Index value of the Western European regions is 58.5 which significantly higher than the Southern European and CEE regions' performance. Their average REDI Index values are 34.7 and 30.1 REDI points (Table 1).

Table 1 – The REDI and sub-index values of four observations

Region	ATT	ABT	ASP	REDI
DK01 (Hovedstaden)	79.7	89.6	77.2	82.2
Western European regions average values	59.5	61.6	54.5	58.5
Southern European regions average values	33.8	35.4	35.0	34.7
Central and Eastern European regions average values	29.5	23.3	37.6	30.1
RO2 (Macroregiunea doi)	19.7	10.3	25.2	18.4

Source: own calculation and edition

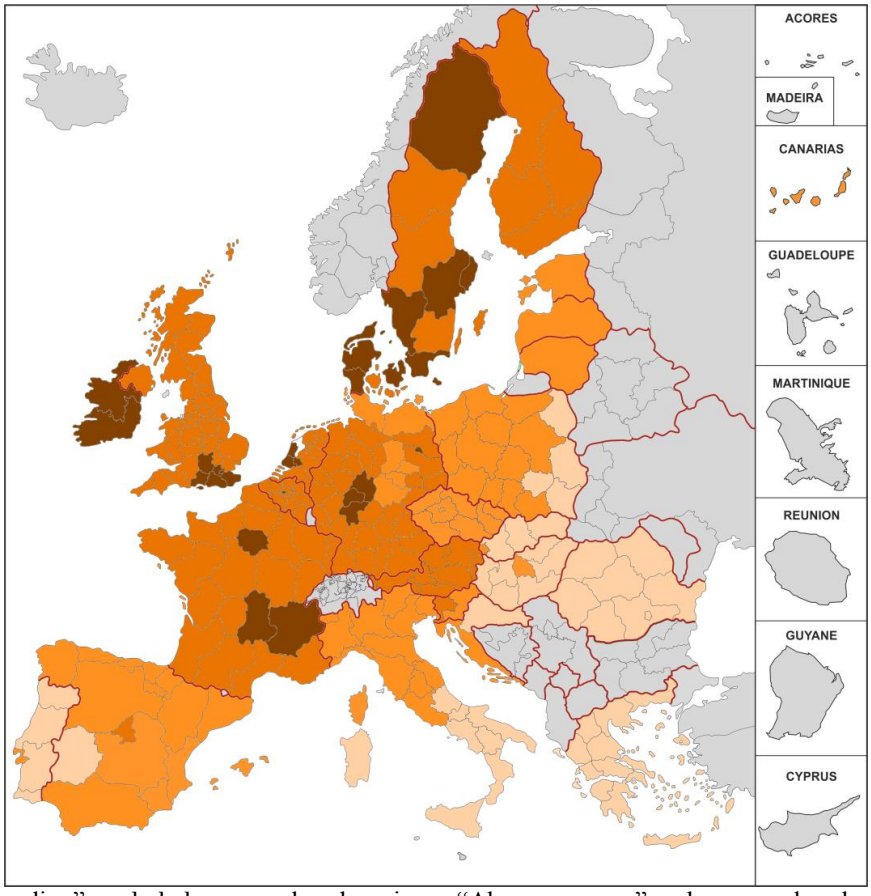
The Danish capital city region has an outstanding performance in almost all of the pillars. The Romanian region performs well only in one pillar related to Entrepreneurial Aspiration (Risk perception)[8], but it lags behind the CEE regional average value in all the other pillars. The sub-index values of Southern European and CEE regions lag behind the Western European regional average in general. CEE regions have some advantages only in pillars related to Entrepreneurial Aspiration. However this can't balance those laggings which can be observed in pillars concerning Entrepreneurial Attitudes and Abilities.

Based on the REDI Index scores we created four clusters for the 125 regions[9]. According the cluster results the best performing regions locate in the Scandinavian countries and in Western Europe. The lowest entrepreneurial performances are indicated in Central and Eastern European regions and in Southern European countries (like Greece, Spain, Portugal and Italy) (Figure 2).

[8] All the Romanian regions have relatively high Risk perception rate, which is surprisingly. These values might be explained by the low rate in fear of closure the business on the one hand and the country level indicator data on the other hand.

[9] The detailed results of centroid values in each group can be found in Appendix 3.

Figure 2 – The entrepreneurial performance of European regions according the REDI Index scores



Legend: "Outstanding" – dark brown colored regions, "Above average" – brown colored regions, "Below average" – orange colored regions, "Lowest" – light orange colored regions

Source: own calculation and edition

The results proved that the capital city and highly urbanized regions (like London, Paris, Berlin, Copenhagen or Stockholm) has an outstanding performance in entrepreneurial performance. There are such regions among the best performing ones that are not capital cities but have an important nationwide functional role like Southeast England in the United Kingdom, Hessen in Germany, Västsverige in Sweden or Centre-Est in France. They were ranked from 1st to 19th positions in REDI Index ranking. Almost all of the Northern and Western European regions belong to the "Outstanding" or "Above average" performance.

The Central and Eastern European regions were grouped in the "Below average" and "Lowest" groups. The best performing CEE region, Zahodna Slovenija (SI02), got the 51st position in REDI Index ranking. The Baltic states, Czech Republic[10], Slovenia, some Polish regions and the capital city territories of Hungary and Slovakia are among the "below

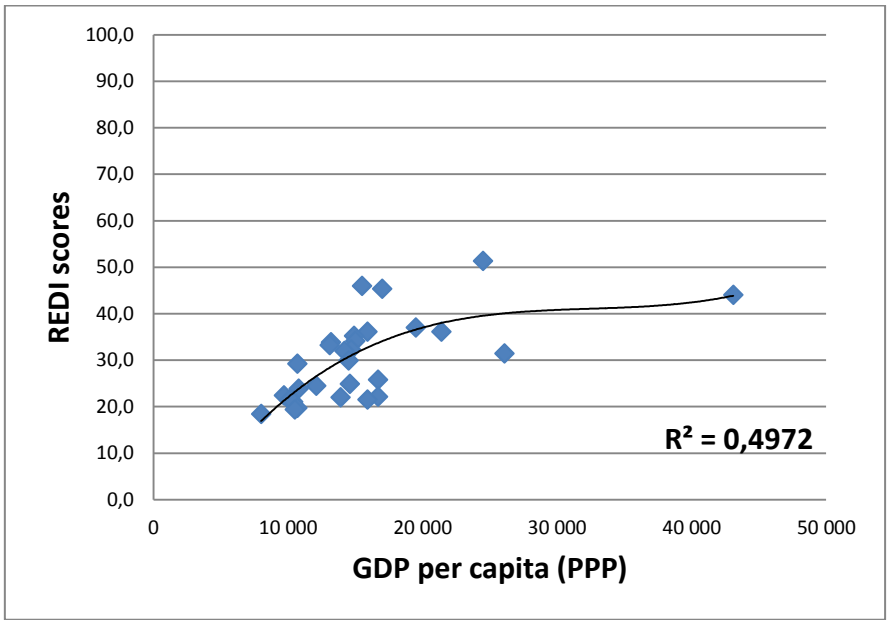
[10] We assume that in the case of NUTS 2 level data from the Czech Republic, the capital city Prague would have overtop the other Czech regions. However we had only NUTS 1 level data, hence we investigated the country as a whole.

average" performing regions. They have a bit worse entrepreneurial performance than the East German, North Italian or Spanish regions (except Vzhodna Slovenija and Estonia). However it should be noticed that the Polish and Czech regions were measured by NUTS 1 level data which may overlap many differences within the regions. All the Polish NUTS 1 regions[11] except Eastern Poland have a significant metropolitan area which may serve as the engine of the local and regional economy. The worst performing regions lag behind almost in all of the pillar values. Here belong all of the Romanian regions, the non-capital Hungarian and Slovakian territories and Eastern Poland amongst others. Furthermore Greek, Portuguese and a Spanish region can also be found in this cluster. They ranked from the 99th to the 125th positions.

4.2. The entrepreneurial performance of CEE regions

To examine the CEE regions we used only the REDI index and pillar values of these regions. The new values may help to distinguish the entrepreneurial characters of CEE regions. 29 regions were involved in the research. We checked how influences the entrepreneurial performance the economic development (Figure 3).

Figure 3 – The connection between GDP per capita and REDI scores of CEE regions



Notes: Third degree of polynomial adjustment. Number of observations = 29.

Source: own computation

There is a medium-strong relationship between the entrepreneurial performance and the economic development. This correlation value is a bit weaker than in the case as all European

[11] Like Cracow, Poznan, Lodz, Gdansk, the Silesian Metropolitan area or Szczecin.

regions were analysed (see the Appendix 4). The 1st ranked region is Zahodna Slovenija (SI02) and Macroregiunea doi (RO2) get the last position among the CEE regions. We group the 29 regions in four clusters according their REDI index values.[12]

Table 2 – The REDI index scores and ranking of the CEE regions

REDI rank	Code	Region	**REDI score**	REDI rank	Code	Region	**REDI score**
51	SI02	Zahodna Slovenija	**51.3**	105	PL3	Region Wschodni	**29.2**
64	EE	Estonia	**45.9**	110	SK02	Západné Slovensko	**25.8**
66	SI01	Vzhodna Slovenija	**45.3**	111	SK03	Stredné Slovensko	**24.9**
68	SK01	Bratislavsky Kraj	**44.0**	112	SK04	Vychodné Slovensko	**24.5**
80	CZ	Czech Republic	**37.0**	113	HU23	Dél-Dunántúl	**23.8**
87	PL5	Region Poludniowo-Zachodni	**36.1**	115	HU31	Észak-Magyarország	**22.4**
88	PL1	Region Centralny	**36.1**	116	RO3	Macroregiune a trei	**22.1**
91	LT	Lithuania	**35.2**	117	HU21	Közép-Dunántúl	**22.0**
92	PL2	Region Poludniowy	**34.1**	118	HU22	Nyugat-Dunántúl	**21.5**
93	LV	Latvia	**33.8**	119	HU32	Észak-Alföld	**21.4**
94	PL6	Region Pólnocny	**33.2**	121	HU33	Dél-Alföld	**21.0**
96	PL4	Region Pólnocno-Zachodni	**32.3**	122	RO4	Macroregiune a patru	**19.7**
98	HR03	Jadranska Hrvatska	**32.0**	124	RO1	Macroregiune a unu	**19.4**
99	HU10	Közép-Magyarország	**31.4**	125	RO2	Macroregiune a doi	**18.4**
103	HR04	Kontinentalna Hrvatska	**29.9**				

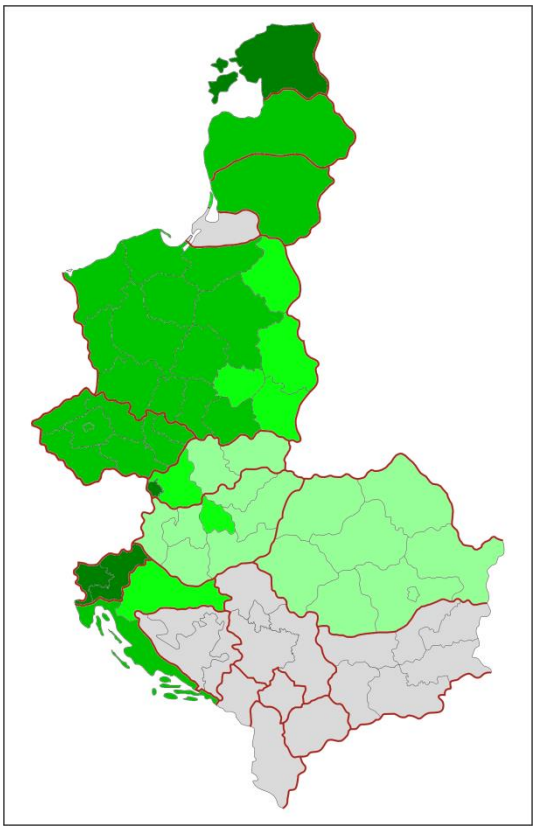
Source: own edition

The two Slovenian regions (Zahodna Slovenija and Vzhodna Slovenija), Estonia and Bratislava's agglomeration (Bratislavsky kraj) belong to the "Outstanding CEE regions" group (Figure 4). This group show relatively strong performance in each sub-index and they have only few pillars which are relatively weak among the CEE regions. The cluster member regions have relatively balanced sub-index values. The entrepreneurial abilities, aspirations and attitudes (except Bratislava's region) are significantly higher in these regions as in other CEE regions. The case of Bratislava region may be interesting, namely its entrepreneurial aspirations are much higher than the other two sub-index values. Its entrepreneurial attitudes

[12] The detailed results and centroid values of each group can be found in Appendix 5.

and abilities show only an average performance if we compare them to the other CEE regions. It may mean that they belong to this cluster because of the high aspiration values.

Figure 4 – The entrepreneurial performance of CEE regions according the REDI scores



Legend: "Outstanding in CEE" – dark green colored regions, "Above CEE average" – green colored regions, "CEE average" – light green colored regions, "Lowest performing in CEE" – lightest green colored regions

Source: own calculation and edition

The entrepreneurial performances of the next cluster lag behind the best regions, but these are still above the CEE regional average. These regions have at least one weak sub-index from the three. A weak sub-index value refers not only one or two weak pillars, but these values may influence the whole entrepreneurial performance negatively. The two Baltic countries (Latvia and Lithuania) showed much less difference among the sub-indexes than other cluster members. But in their case the NUTS 2 region is parallel with the country. The Czech Republic is an exception from this aspect because it has much (almost twice) higher entrepreneurial aspiration values than attitudes and abilities. The Polish regions have relatively good performance in entrepreneurial aspirations and attitudes but their abilities values are much weaker than the other cluster member regions. The Croatian regions were grouped in two different clusters. Adriatic Croatia (the coastal region) performs a shade better in entrepreneurship than the continental region in Croatia. This difference may be explained by the role of tourism in the coast of Croatia and the economic poor territories in the Eastern

part of Croatia. The “advantage” of the coastal region derived from the better values of entrepreneurial aspirations.

The third group’s entrepreneurial performances show the CEE regions average values. Four regions belong to this cluster. There aren’t any outstanding sub-index values in the case of these regions. Some strong pillar values can be observed, but many of them are moderate compared to other CEE regions. Eastern Poland showed similar characters as other Polish regions but its values (mostly the abilities sub-index) weaker. The Western Slovakian region represented similar characters as Bratislava: relatively good aspiration values but weak scores in entrepreneurial attitudes and abilities. The entrepreneurial performance of the Hungarian capital city region (Közép-Magyarország) indicates relatively balanced, there are very small differences among the sub-index values. The last group involves regions with the lowest entrepreneurial performance among CEE: all of the Romanian regions, the Hungarian regions except the capital city’s region and two Slovakian regions. There are low values in each sub-index.

In sum there are only some regions which may obtain the average values of Western European territories. We could see from the REDI scores, that the capital city’s regions are much better performance than other non-metropolitan regions (except Croatia). It is the same trend that could be observed in other European countries. The entrepreneurial aspiration values of many regions are higher than the entrepreneurial attitudes and abilities. The low attitudes values may refer to the lack of the adequate skills to perceive and exploit entrepreneurial opportunities on the one hand and the relatively low acceptance of the entrepreneurship as a high career status on the other hand. The low level of abilities may represent that the number of enterprises with high-technology level and highly qualified labour force is relatively low.

5. Conclusion

It could be seen from the literature that the entrepreneurship have a significant role in the regional economic development. We attempted to discover the main attributes of the entrepreneurial performance in Central and Eastern European regions in this paper. We applied in our study a new and composite measure, the REDI Index. It measures the regional entrepreneurial performance in a complex way. We represented that the best entrepreneurial performance had those regions that locate in Western or Northern European countries and are highly urbanized. Furthermore, the nationwide important role of some region in national economy or higher education may influence positively their entrepreneurial performance. The

Central and Eastern European regions lag behind the Western and Northern European regions significantly. There are only few CEE regions which may obtain the European regional average values. These are small countries or capital city regions mostly and they are the best performing territories among the CEE regions. These differences among the Western and CEE regions are influenced by the historical background on the one hand and the lack of the entrepreneurial attitudes and abilities on the other hand. The entrepreneurial performance is highly influenced by these factors and the relatively good values in entrepreneurial aspirations are not enough to emerge the entrepreneurial activities in these regions.

There were some barriers of the research as well which correction may help to improve studying the entrepreneurial performance in the CEE regions. The use of NUTS 1 data instead of NUTS 2 data overlapped some differences among the regions. The REDI Index builds up from institutional and individual variables. The separated analysis of the two groups of variables may be useful in the future to determine the difficulties in individual and institutional aspects. After clustering the regions it would be good to determine some regions as examples and continue the research of the entrepreneurial performance by a detailed analysis. Such regional investigation may confirm the results of the REDI Index in the CEE regions.

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Appendices

Appendix 1 – The best and worst regional GDP values in CEE countries (EU27 in PPS = 100%)

Country	Regional GDP value in PPS (%) (2001)	Regional GDP value in PPS (%) (2004)	Regional GDP value in PPS (%) (2007)	Regional GDP value in PPS (%) (2010)
Bulgaria	41	51	66	76
	23	27	27	27
Croatia	52	56	61	60
	49	56	60	56
Czech Republic	149	163	177	173
	57	62	64	64
Estonia	47	58	70	64
Hungary	91	101	102	109
	38	41	39	40
Latvia	39	47	57	55
Lithuania	42	52	62	62
Poland	74	78	87	103
	34	35	37	42
Romania	58	72	96	114
	20	23	26	30
Slovakia	116	129	160	179
	40	42	46	50
Slovenia	95	104	107	101
	67	72	73	70

Appendix 2 – The detailed structure of the REDI Index

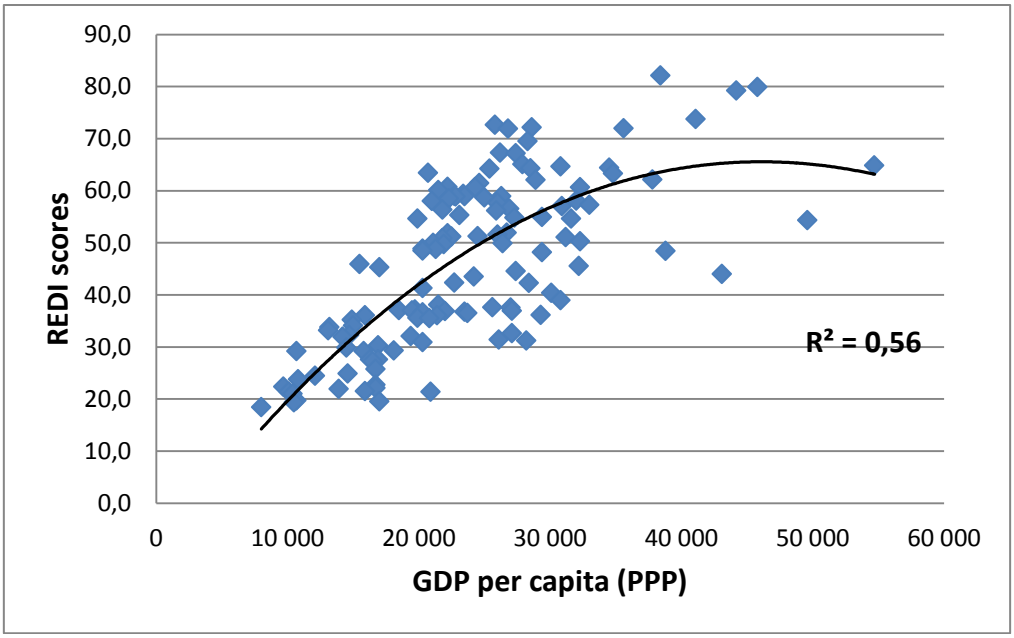
Sub-index	Pillar	Individual variable	Institutional variable
Entrepreneurial attitudes (ATT)	Opportunity perception	Opportunity recognition	Market agglomeration
	Startup skills	Skill perception	Quality of education
	Risk perception	Business acceptance	Business risk
	Networking	Know entrepreneurs	Social capital
	Cultural support	Carrier status	Open society
Entrepreneurial abilities (ABT)	Opportunity startup	Opportunity motivation	Business environment
	Technology adoption	Technology level	Absorptive capacity
	Human capital	Education level	Education & training
	Competition	Competitors	Business strategy

Entrepreneurial aspirations (ASP)	Product innovation	New product	Technology transfer
	Process innovation	New technology	Technology development
	High growth	Gazelle	Clustering
	Globalization	Export	Connectivity
	Financing	Informal investment	Financial institutions

Appendix 3 – The detailed results and values of each group structure of the REDI Index

Clusters	Centroids		Members of group (regions)
	REDI Index scores	GDP per capita (2010, in PPS)	
"Outstanding" (19 regions)	69,6	32920	NL3, BE1, FR1, FR7, UKI, UKJ, DK01, DK03, DK04, DK05, SE11, SE12, SE22, SE23, SE33, DE3, DE7, IE01, IE02
"Above average" (44 regions)	55,2	26430	NL1, NL2, NL4, BE2, BE3, FR2, FR3, FR4, FR5, FR6, FR8, ES30, AT1, AT2, AT3, UKC, UKD, UKE, UKF, UKG, UKH, UKK, UKL, UKM, UKN, DK02, SE21, SE31, SE32, DE1, DE2, DE4, DE5, DE6, DE9, DEA, DEB, DEC, DED, FI19, FI1B, FI1C, FI1D, SI02
"Below average" (35 regions)	37,9	22260	ES11, ES12, ES13, ES21, ES22, ES23, ES24, ES41, ES42, ES51, ES52, ES53, ES61, ES62, ES70, ITC, ITH, ITI, PL1, PL2, PL4, PL5, PL6, DE8, DEE, DEF, DEG, PT17, LT, LV, EE, HR03, SI01, CZ, SK01
"Lowest" (27 regions)	25,0	15370	EL1, EL2, EL3, EL4, ES43, HU10, HU21, HU22, HU23, HU31, HU32, HU33, ITF, ITG, RO1, RO2, RO3, RO4, PL3, PT11, PT15, PT16, PT18, HR04, SK02, SK03, SK04

Appendix 4 – The connection between GDP per capita and REDI Index scores



Notes: Third degree of polynomial adjustment. Number of observations = 125.

Source: Szerb et al. (2014)

Appendix 5 – The detailed results and values of each group structure of the REDI Index in CEE regions

Clusters	Centroids		Members of group (regions)
	REDI Index scores	GDP per capita (2010, in PPS)	
"Outstanding CEE" (4 regions)	46.64	25000	EE, SI01, SI02, SK01
"Above CEE average" (9 regions)	34.42	15800	PL1, PL2, PL4, PL5, PL6, HR03, LT, LV, CZ
"CEE average" (4 regions)	29.07	17000	HU10, PL3, HR04, SK02
"Lowest performing CEE" (12 regions)	21.77	11950	HU21, HU22, HU23, HU31, HU32, HU33, RO1, RO2, RO3, RO4, SK03, SK04