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TOWARDS A FRAMEWORK FOR EVALUATING SOCIOECONOMIC DEVELOPMENT OF REGIONS: SERBIAN PERSPECTIVE

Socioeconomic development of countries/regions always represented a challenge for researchers. In particular, large number of variables with different measurement units must be included into analysis. As a possible remedy to the issue, the use of statistical I-distance method was proposed and applied on the dataset concerning 25 regions in the Republic of Serbia. Further on, the results presented in this study clearly demonstrate the importance of Internet connectedness as one of the most significant indicators for measuring countries/regions welfare.

Keywords: *socioeconomic development; countries/regions welfare; I-distance method; ranking of countries/regions; Internet connectedness.*

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ДО ОСНОВ ОЦІНЮВАННЯ СОЦІАЛЬНО-ЕКОНОМІЧНОГО РОЗВИТКУ РЕГІОНІВ: ЗА ДАНИМИ СЕРБІЇ

У статті підкреслено, що соціально-економічний розвиток країн/регіонів завжди був складною дослідницькою задачею. Зокрема, велике число змінних з різними одиницями виміру має бути включене в аналіз. Як можливий показник розвитку запропоновано і застосовано статистичний метод I-відстані для даних 25 регіонів Республіки Сербії. Результати, представлені в даному дослідженні, наочно продемонстрували важливість Інтернет-покриття як одного з найбільш значущих індикаторів виміру добробуту країн/регіонів.

Ключові слова: *соціально-економічний розвиток, добробут країн/регіонів, метод I-відстані, ранжирування країн/регіонів, Інтернет-покриття.*

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К ОСНОВАМ ОЦЕНКИ СОЦИАЛЬНО-ЭКОНОМИЧЕСКОГО РАЗВИТИЯ РЕГИОНОВ: ПО ДАННЫМ СЕРБИИ

В статье подчеркнуто, что социально-экономическое развитие стран/регионов всегда было сложной исследовательской задачей. В частности, большое число переменных с различными единицами измерения должно быть включено в анализ. В качестве возможного показателя развития был предложен и применен статистический метод I-расстояния для данных по 25 регионам Республики Сербии. Результаты, представленные в данном исследовании, наглядно продемонстрировали важность Интернет-покрытия как одного из наиболее значимых индикаторов измерения благосостояния стран/регионов.

Ключевые слова: *социально-экономическое развитие, благосостояние стран/регионов, метод I-расстояния, ранжирование стран/регионов, Интернет-покритие.*

1. Introduction. Measuring country's welfare is one of the most critical and highly debated issues in economic research (Grimm et al., 2008; Caminada et al., 2010; Erich, 2011). Certain researchers (Davidson, 2000) addressed the hypothesis that

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GNP (or GDP) per capita cannot be considered as being the only indicator of the performance of a country since it does not capture the overall well-being of its population (Gverovski et al., 2011). Nevertheless, it is very common to rank countries by their GDP (or GNP) in current literature on the subject.

One potential improvement is the World Bank's Human Development Index (HDI), which is based on a country's per capita GDP, life expectancy at birth and adult literacy rate (UNDP, 2008; Lind, 2010). However, this instrument had much disagreement; in particular, its simple weighing of each variable and the usual high correlation between GDP and certain background variables (Cuffaro et al., 2008). Besides the above mentioned issues, real problem concerning HDI is a small number of variables (just 3) incorporated into the ranking process. Therefore, in order to evaluate countries/regions welfare, it is crucial to incorporate far more indicators.

One of the essential components of HDI is literacy rate. Its significance is undoubted and in this paper we want to emphasize its importance by incorporating Internet connectedness as the indicator of socio-economic development. There are several reasons for this. Many previous articles pointed out that people's ability to handle information is crucial for their success (Murray, 2003; Farmer and Henri, 2008). These skills – known as IT literacy – can be considered a 21st-century form of literacy (Leung, 2010). In today's globalized world, it is virtually impossible to imagine any business process without IT experts. Further on, whole range of our daily activities (shopping, banking) is dependant upon Internet. Super-fast broadband, numerous WiFi access points, all of them are characteristics of wealthy and powerful countries/regions. Consequently, it is essential to elaborate Internet connectedness as hugely important in determining countries/regions welfare.

This paper is organized as follows: section 2 focuses on methodology used to perform the analysis. Section 3 features the results of the analysis. The final section of the paper gives the conclusions.

2. The I-distance Method. Quite frequently, ranking of specific marks is done in such a way that it can seriously affect the process of taking exams, entering competitions, UN participation, medicine selection and many other areas (Ivanovic, 1973; Ivanovic and Fanchette, 1973; Jeremic, and Radojicic, 2010; Al-Lagilli, et al., 2011; Radojicic et al., 2012).

I-distance is a metric distance in an n-dimensional space. It was originally proposed and defined by B. Ivanovic, and appeared in various publications since 1963 (Ivanovic, 1977). Ivanovic devised this method to rank countries according to their level of development on the basis of several indicators; many socio-economic development indicators were considered and the problem was how to use all of them in order to calculate a single synthetic indicator which would thereafter represent the rank.

For a selected set of variables $X^T = (X_1, X_2, \ldots, X_k)$ chosen to characterize the entities, the I-distance between the two entities $e_r = (x_{1r}, x_{2r}, \ldots, x_{kr})$ and $e_s = (x_{1s}, x_{2s}, \ldots, x_{ks})$ is defined as

$$D(r,s) = \sum_{i=1}^{k} \frac{|d_i(r,s)|}{\sigma_i} \prod_{j=1}^{i-1} (1 - r_{ji.12\ldots j-1}), \quad (1)$$

where $d_i(r, s)$ is the distance between the values of variable X_i for e_r and e_s, e.g. the discriminate effect,

$$d_i(r,s) = x_{ir} - x_{is},\ i \in \{1,\ldots,k\} \quad (2)$$

the standard deviation of X_i, and $r_{ji.12\ldots j-1}$ is a partial coefficient of the correlation between X_i and X_j, $(j<i)$, (Ivanovic, 1973; Jeremic et al., 2011b). The construction of the I-distance is iterative; it is calculated through the following steps:

- Calculate the value of the discriminate effect of the variable X_1 (the most significant variable which provides the largest amount of information on the phenomena that are to be ranked);
- Add the value of the discriminate effect of X_2 which is not covered by X_1;
- Add the value of the discriminate effect of X_3 which is not covered by X_1 and X_2;
- Repeat the procedure for all the variables (Jeremic et al., 2011c; Jeremic et al., 2012).

In order to rank the entities (in this case, regions), it is necessary to have one entity fixed as a referent in the observing set using the I-distance methodology. The entity with the minimal value for each indicator or a fictive minimal, maximal or average value entity all may be utilized as the referent entity, as the ranking of the entities in the set is based on the calculated distance from the referent entity (Jeremic et al., 2011d; Jeremic et al., 2011e; Knezevic et al., 2012).

3. Results. In this paper, the attention is focused on examining and measuring social, economic and health components of welfare in 25 Serbian regions (4 regions in Kosovo & Metohia were not included since no data is available). All of the input data were obtained from Serbian Statistical Office (RZS, 2011). In order to rank Serbian regions, the following 8 variables were used: (I) unemployment rate, (II) average salary, (III) economic dependency ratio, (IV) life expectancy, (V) number of physicians per 1000 people, (VI) number of dentists per 1000 people, (VII) percentage of population with university degree and (VIII) the Internet connectedness rate. Those variables were carefully selected with respect to the previous researches concerning issues of countries welfare (Ferguson et al., 2010; Hauner and Kyobe, 2010; World Bank, 2010). Mostly used social indicators (Grimm et al., 2008) are upgraded with a new indicator – Internet connectedness. The results achieved through the use of the I-distance ranking method for regions welfare are presented in Table 1.

Table 1. **The Results of the Square I-distance Method, I-distance Value and Rank**

Region	I-distance	Rank I-distance	Cluster
City of Belgrade	48.720	1	1
Kolubarski region	47.949	2	1
Sremski region	25.653	3	2
Severno-backi region	24.373	4	2
Juzno-backi region	23.367	5	2
Branicevski region	22.153	6	2
Zlatiborski region	21.747	7	2
Moravicki region	21.166	8	2
Rasinski region	20.495	9	2
Juzno-banatski region	20.077	10	2
Mawanski region	18.662	11	3
Severno-banatski region	17.933	12	3
Zajecarski region	17.630	13	3
Zapadno-backi region	17.223	14	3

The End of *Table 1*

Region	I-distance	Rank I-distance	Cluster
Sumadijski region	16.356	15	3
Borski region	16.340	16	3
Srednje-banatski region	14.998	17	3
Podunavski region	14.036	18	3
Raski region	10.337	19	4
Nisavski region	9.994	20	4
Pomoravski region	8.821	21	4
Pcinjski region	8.506	22	4
Jablanicki region	7.708	23	4
Pirotski region	6.723	24	4
Toplicki region	5.738	25	4

The city of Belgrade topped the list according to the I-distance method, with Kolubarski region just a step behind. These two regions are included into single cluster as the absolute leaders (Ward's method of hierarchical clustering was performed). Several regions are at the bottom of the list and all of them are in South Serbia (see Figure 1). These 4 regions have highest negative migration rate in Serbia. On the other hand, the North is far more developed than the rest of the country and it seems to be the main strength of Serbia.

Figure 1. **Regions in Serbia (black colour is Kosovo & Metohia, while 4 grey coloured regions are the least developed according to the I-distance methodology)**

This data set was further examined and a correlation coefficient of each indicator with the I-distance value was determined, the results of which are presented in

Table 2 (Pearson correlation test has been used). Two most significant variables for determining the socio-economic development of the regions is unemployment rate and average salary, with r=.704, p<.01 and r=.677, p<.01. This result is far from surprising; various papers already elaborated upon these indicators as being key factors for a region's welfare (Diaz, 2011; Halkos and Tzeremes, 2011; Liargovas and Daskalopoulou, 2011). Our research implies that the Internet connectedness rate is quite significant for the determining development level of the regions. This finding clearly shows that IT plays a very important role in determining a region's welfare.

Table 2. **The Correlation between I-distance and Input Indicators**

Indicators	r
Unemployment rate	.704**
Average salary	.677**
Internet connectedness rate	.588**
Number of dentists per 1000 people	.520*
Percentage of population with university degree	.502*
Economic dependency ratio	.444*
Number of physicians per 1000 people	.130
Life expectancy	.105

** p<.01; *p<.05.

4. Discussion. Knowledge economy is becoming the most important factor in the development of society and regions (Jednak and Kragulj, 2010; Milovic, 2010; Toma, 2010; Tunuguntla and Berjan, 2011). As crucial components of knowledge, IT literacy and Internet connectedness have long been in the focus of research. Some papers tried to examine the influence of sociocultural factors on the level of Internet connectedness (Jung, 2008a). On the other hand, the same author compared PC internet connectedness and mobile Internet connectedness (Jung, 2008b). Nonetheless, only a few researchers tried to explore the interlinkage between Internet connectivity and economic development (Florida, 2010). As a way to enhance the importance of this indicator, a novel approach has been proposed in this work in which future research on economic and social performance of regions can be based on. By using the I-distance method, a synthesized indicator that incorporates many social and economic indicators can be created. The results presented in this study clearly show that Serbia has a long way ahead before achieving the European Union development goals and becoming full member of the EU (Gabrscek and Isljamovic, 2011). This is particularly the case since ICT plays a significant role in determining a country's welfare. With only 25.8% of population which owns personal computers and 11.6% being Internet subscribers (Word Bank, 2011), it is crucial for Serbia to focus its attention on ICT industry (especially green IT) and consequently improve its country welfare (Petrovic, 2010; Petrovic et al., 2010; Gajus-Lankamer and Wojcik, 2011; Isljamovic et al., 2011; Pawul and Sobczyk, 2011; Petrovic et al., 2011a, Petrovic et al., 2011b).

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