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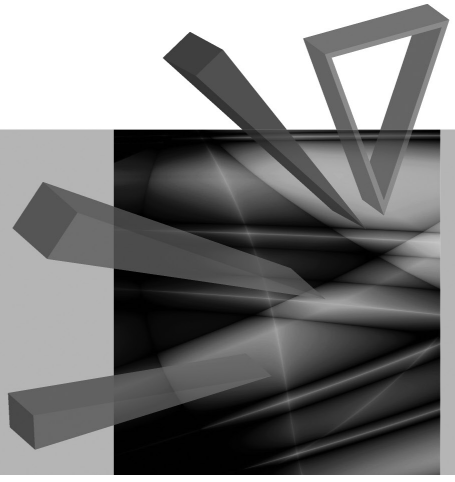
282

Local Economy in Theory and Practice
Planning and Evaluation Aspects



edited by
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Publishing House of Wrocław University of Economics
Wrocław 2013

Copy-editing: Elżbieta Macauley, Tim Macauley, Marcin Orszulak

Layout: Barbara Łopusiewicz

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Cover design: Beata Dębska

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Information on submitting and reviewing papers is available on
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www.wydawnictwo.ue.wroc.pl

ISSN 1899-3192
ISBN 978-83-7695-329-8

The original version: printed

Printing: Printing House TOTEM

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PRACE NAUKOWE UNIWERSYTETU EKONOMICZNEGO WE WROCŁAWIU
RESEARCH PAPERS OF WROCŁAW UNIVERSITY OF ECONOMICS nr 282 • 2013

Local Economy in Theory and Practice
Planning and Evaluation Aspects

ISSN 1899-3192

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MULTI-DIMENSIONAL EVALUATION OF ECONOMIC PILLAR OF TERRITORIAL ANALYTICAL DATA

Summary: The aim of this paper is to design a process of evaluation of the economic pillars of the territorial analytical data for the administrative districts of municipalities with extended powers in the Czech Republic. The proposed evaluation procedure is based on the results of a factor analysis of 27 indicators used to evaluate the economic status of municipalities. The results of the factor analysis were then used to determine the weights of individual indicators and factors. The position of the municipalities in the administrative district was examined using the Weighted Sum Average method.

Keywords: evaluation, administrative districts, municipalities, Weighted Sum Average method.

1. Introduction

In the Czech Republic, territorial analytical materials, which are a tool for processing the assignment of a municipality development plan and for the analysis of the sustainable development of the territory, serve to examine the state and development of municipalities, or municipalities with extended powers. The sustainable development of a territory is based on the compliance of the economic, social and environmental pillars. There are currently no available methodical procedures for the creators of territorial analytical data to evaluate the situation and potential of communities in these pillars. There are only methodologies describing the desired output [Jáč et al. 2011 pp. 135–137]. The aim of this article is to propose a methodology for the evaluation of the economic pillars of the territorial analytical materials, and to show its application on a selected administrative district of a municipality with extended powers.

2. Literature overview

The evaluation of the social, economic and environmental status of regions of different levels (from the administrative districts of municipalities to cohesion

regions, or according to NUTS[1] nomenclature from LAU 1 to NUTS 2), is closely related to the problem of the measurement of regional disparities. Regional disparity can be understood as a differentiation or inequality of signs, phenomena or processes having a unique spatial location and occurring in at least two entities of this spatial structure [Kutscherauer et al. 2010, p. 9]. In literature, there can be found different approaches to the quantification of regional disparities.

Some of them are then used to define regions that require concentrated state support at both national level and determination of supported areas at regional level. The regions that require concentrated state support in 2007–2013 are listed in the Regional Development Strategy of the Czech Republic, which has been prepared by the Ministry for Regional Development. These regions were established at the level of districts and in the case of regions with above average unemployment; they were enlarged by the administrative districts of municipalities with extended powers. The regions were evaluated using weights based on four indicators: unemployment, income tax, entrepreneurs and purchasing power [*Strategie regionálního* rozvoje… 2006, p. 102].

In the case of areas supported by the region, there is no uniform methodology. Each region approaches this problem differently. Differences are apparent both at the level of territorial determination, indication of problem regions, and in the methodology. Therefore, regional approaches are basically incomparable [Jáč et al. 2011, p. 36].

Among many other research teams involved in the quantification of regional disparities, we can include an approach developed at the Technical University of Ostrava. The database of indicators for monitoring regional disparities here consists of four levels: disparities sphere (social, economic and territorial), a problem unit characterizing every sphere, descriptor (overall indicators for each problem unit) and other indicators entering descriptors [Kutscherauer el al. 2010, pp. 233–243]. The application of this system was then implemented in a simplified form[2] using the example of regions in the Czech Republic.

In 2006–2007, the CZSO made an analysis of regional differences in demographic, social, economic and infrastructure development over the period of 2000–2005 for each region. The administrative districts of municipalities with extended powers were evaluated by a multi-criteria method using 52 indicators. For each reference group, there was then determined a synthetic indicator [Choun et al. 2007, pp. 11–14].

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[1] Nomenclature of Territorial Units for Statistics was introduced by Eurostat in 2003 and divides the territory of each EU country according to the number of inhabitants into three regional levels (NUTS 1 up to NUTS 3). Apart from NUTS levels, there are also lower levels of territorial administrative statistical division called Local Administrative Units (LAU). LAU level 2 is a municipality. For more details, see http://epp.eurostat.ec.europa.eu/portal/page/portal/nuts_nomenclature/history_nuts.

[2] The main pitfall of complex indicator systems is the lack of official statistical data. It is necessary to identify data for some indicators by unique surveys, which increases the costs of data acquisition and complicates the evaluation in a time line.

Another description of regional differences is represented by economic n-squares. The literature describes eighteen-squares consisting of three basic areas (macroeconomic performance, growth potential, quality of life), which are always divided into 7 indicators, the first and the last indicator is common with the neighboring area. To compare regions, arithmetic averages of individual areas are then calculated [Martinčík 2008, p. 17].

Generally, the methods of quantification of regional disparities can be divided into one-criterion and multi-criteria. One-criterion approaches compare a value of a selected indicator among various territorial units. This group of methods also includes comparing minimal and maximal value, coefficient of variation, the Herfindahl and the Gini Index. Multi-criteria approaches use, for example, the weighted coefficient of variation, the geographical concentration index or the Theil index [Tvrdoň, Skokan 2011, p. 504]. Multi-criteria methods are based on the use of a bigger amount of indicators which are usually assigned to weights according to their importance when evaluating.

It is clear from the above review that there is a broad variety of approaches to the evaluation of the economic and social level of regions.

3. Methodology

The research is based on two main theses: the basic building block of every region is a municipality, at the same time, there is no completely underdeveloped municipality which would show only weaknesses.

The research had two main goals – to reveal factors which stand behind the economic level of a municipality and to propose suitable indicators of its measurement. The research was divided into several phases:

1) Determining indicators which can describe the economic state of a municipality. This phase was carried out in cooperation with the CZSO in several periods between 2006 and 2010. During this period, the methodology of monitoring some indicators changed. In 2010 the resulting database contained 33 indicators for all 6,249 municipalities in the Czech Republic. Obviously, the indicators whose Kaiser-Meyer-Olkin measure value was lower than 0.5 were excluded, which concerned 6 variables.

2) The resulting 27 indicators (see Table 2) were processed with the help of factor analysis; details are given in [Žižka 2011, pp. 786–791]. An original file of indicators was reduced into 7 common factors called unemployment, domicile attractiveness, population density, age structure, civic amenities, branch structure and economic activity. These seven factors explain ca. 61% variability in original data.

3) For each municipality, there was set a factor score. According to the above factor score the order of the individual communities in each of the seven factors was determined. At the same time, the municipalities were divided into quartiles according

to the value of the factor score. The first quartile contained the lowest rated factor in the municipalities, while the last quartile included the top rated ones.

4) The original idea of the research was to determine the factors that affect the economic status of a municipality. Practice, and the requirements for the processing of territorial- analytical data, have shown the need to comprehensively assess the state of the economic pillar, which allows a more general view of the administrative district of the municipality with extended powers.

5) For a comprehensive assessment of the economic pillar, the Average Weighted Sum (WSA) method was used. This method is based on the design of linear utility function on a scale from 0 to 1, see for example [Jablonský 2002, p. 280]. The worst municipality, according to the indicator, has a zero utility, while the top rated resort has a benefit 1 and other municipalities are then located between the two extreme values. When applying the WSA method, it was only necessary to replace the original elements of y_{ij} criterion matrix (i.e. the values of specific indicators) by transformed values y_{ij} *, which represent the assessment of the municipality X_i according to Y_j indicators on a scale of <0; 1>. During the transformation, it is necessary to take into account that some indicators are of a minimization type (e.g. the registered unemployment rate) and others are of a maximization type (e.g. employees' share in the total population of a municipality). The transformed values for the maximization criteria were obtained using equation (1), the minimization criterion using the formula (2). The overall rating of a municipality $EVAL(X_i)$ is given by the product of the transformed criteria values and the relevant criteria weights v_j, see relation (3).

6) To determine the weighting of criteria the results of factor analysis were used. The initial step in the design of the weight parameters was a matrix of factor loadings after the Varimax rotation method. The square of factorial loads represents a share of the total variance indicator, which is explained by the given factor [Nardo 2008, pp. 90–91]. The procedure can be divided into the following steps:

a. For all indicators the squares of factor loadings are set.

b. The squares of factor loadings in each factor are added.

c. The share of each parameter on the total sum of squares of factor loadings in each factor is calculated.

d. The obtained shares are summarized in all indicators across factors. The resulting sum is the weight of a given indicator. The sum of the weights of all indicators in this case is equal to the number of extracted factors. If we require the sum of the weights to equal one, we will make a simple normalization: we will divide the sum of shares by the number of factors.

e. Similarly, the weight of individual factors can be determined. In this case, the sum of the squares of each factor load is divided by the total sum of the squares of factor loads.

$$y_{ij}^{*} = \frac{y_{ij} - MIN\left(Y_j\right)}{MAX\left(Y_j\right) - MIN\left(Y_j\right)}, \tag{1}$$

$$y_{ij}^{*} = \frac{MAX\left(Y_j\right) - y_{ij}}{MAX\left(Y_j\right) - MIN\left(Y_j\right)}, \tag{2}$$

$$EVAL\left(X_i\right) = \sum_{j=1}^{n} y_{ij}^{*} v_j. \tag{3}$$

4. Results

To test the proposed methodology, the administrative district of the municipality with extended powers,[3] Železný Brod, which includes 11 municipalities in the Liberec Region, was selected. According to the above factor score, the order of municipalities in the administrative area was determined, initially for each factor separately. The results, summarized in Table 1, can be interpreted as the strengths and weaknesses of each municipality.

For example, the administrative center of the micro-region, the town of Železný Brod, shows favorable parameters of population, civic amenities, economic structure and economic activity. On the contrary, the weaknesses of this town are high unemployment and the population age structure. The attractiveness of the place of residence can also be rated as below average. In an analogous way, we can assess all the remaining municipalities in this administrative district.

In terms of territorial analytical data, however, it proved necessary to synthesize the evaluation for the whole economic pillar, which allows obtaining a more general view of the whole territory of the administrative district of the municipality with extended powers.

For this reason, two alternative methods of evaluation were tested. In the first case, (method of indicators) weights for all 27 indicators entering the evaluation were determined (see Table 2), criteria values were transformed on scale <0; 1> and for each municipality the $EVAL(X_i)$ value was set. The procedure is clarified in Chapter 2. This method enables working with the original values of all 27 indicators, regardless of their classification to individual factors.

In the second case, (method of factors) weights of individual factors were determined (see Table 3) and the evaluation was made according to factor scores of municipalities which were also transformed on scale <0; 1>. This method is easier for calculation as it works with a lower amount of values. At the same time, the basis of factor analysis remains, that is, the reduction of the number of variables. The interpretation of numerical values of the $EVAL(X_i)$ indicator is given in Table 4.

[3] Municipality with extended powers exercises delegated powers of the government. It represents the interface between regional and local authorities.

Table 1. Order of municipalities according to individual factors

Order	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
1.	Loužnice	Pěnčín	Železný Brod	Skuhrov	Železný Brod	Zásada	Líšný
2.	Vlastiboř	Zásada	Skuhrov	Koberovy	Zásada	Pěnčín	Železný Brod
3.	Pěnčín	Koberovy	Koberovy	Jílové u D.	Pěnčín	Železný Brod	Zásada
4.	Zásada	Skuhrov	Loužnice	Držkov	Koberovy	Skuhrov	Jílové u D.
5.	Skuhrov	Jílové u D.	Držkov	Pěnčín	Skuhrov	Koberovy	Radčice
6.	Radčice	Držkov	Radčice	Zásada	Líšný	Líšný	Vlastiboř
7.	Koberovy	Železný Brod	Líšný	Líšný	Držkov	Jílové u D.	Držkov
8.	Držkov	Radčice	Vlastiboř	Železný Brod	Vlastiboř	Držkov	Koberovy
9.	Líšný	Líšný	Zásada	Loužnice	Jílové u D.	Vlastiboř	Skuhrov
10.	Jílové u D.	Loužnice	Pěnčín	Vlastiboř	Radčice	Radčice	Loužnice
11.	Železný Brod	Vlastiboř	Jílové u D.	Radčice	Loužnice	Loužnice	Pěnčín

Source: own calculation.

Table 2. Weights of indicators

Name of indicator	Weight (%)
General population density	8.92
Specific population density	6.38
Average age of living inhabitants in total (men and women)	4.63
Age index	2.35
Intensity of natural and migration increment of inhabitants during the last 5 years	5.37
The number of inhabitants in pre-productive (0–14 years) and post-productive (65+) age to the average number of inhabitants of productive age	4.35
Gross divorce rate	2.14
Registered unemployment rate in job applicants total	4.87
Long-term unemployment rate	3.77
Job pressure rate	4.53
Proportion of employees to the total number of inhabitants	0.11
Proportion of active economic subjects to population aged between 15–64 years	5.16
Proportion of private entrepreneurs to population aged 15–64 years	4.86
Proportion of subjects active in agriculture/forestry to the total number of active economic subjects	4.96
Proportion of active subjects in services to total number of active economic subjects	6.04
Proportion of self-employed individuals to total number of economic subjects	0.50
Number of completed apartments during the period of 2005–2009 per 1,000 inhabitants	4.94
Average floor space in one apartment in family or apartment houses during period of 2005–2009	2.69
Capacity of mass accommodation facilities (number of beds) per one thousand inhabitants	3.76
Proportion of beds in hotels and guesthouses to total mass accommodation facilities capacity	2.51
Number of inhabitants per general practitioner's office for adults, children and youth	2.81
Number of inhabitants per one outpatient medical facility	2.75

Number of chemists per 1,000 inhabitants	1.62
Number of inhabitants aged between 3–5 years per one nursery school	2.49
Number of inhabitants aged 6–14 years per one primary school	2.54
Number of inhabitants aged 15–19 years per one secondary school	2.13
Voter turnout (%) during elections to the Chamber of Deputies of the CZ Parliament	2.81

Source: own calculation.

Table 3. Weight of factors

Factor	Weight (%)
F1 Unemployment	16.90
F2 Domicile attractiveness	12.96
F3 Population density	8.86
F4 Age structure	11.00
F5 Civic amenities	26.73
F6 Branch structure	9.81
F7 Economic activity	13.75

Source: own calculation.

Table 4. Verbal interpretation of evaluation according to the EVAL(Xi) indicator

Range of values $EVAL(X_i)$	Interpretation of evaluation	Code
0–0.19	very unfavourable	− −
0.20–0.39	unfavourable	−
0.40–0.59	neutral	0
0.60–0.79	positive	+
0.80–1.00	very positive	++

Source: own calculation.

The comparison of the results of both methods is given in Table 5.

Table 5. Overall evaluation of economic pillar

Municipality	Method of indicators			Method of factors		
	$EVAL(X_i)$	Evaluation	Order	$EVAL(X_i)$	Evaluation	Order
Držkov	0.3933	−	9.	0.3537	−	8.
Jílové u D.	0.3858	−	10.	0.3528	−	9.
Koberovy	0.4028	0	6.	0.3716	−	5.
Líšný	0.3947	−	8.	0.3606	−	6.
Loužnice	0.4133	0	5.	0.3482	−	11.
Pěnčín	0.4284	0	3.	0.4306	0	3.
Radčice	0.3948	−	7.	0.3491	−	10.
Skuhrov	0.4139	0	4.	0.3766	−	4.
Vlastiboř	0.3812	−	11.	0.3544	−	7.
Zásada	0.4418	0	1.	0.4417	0	1.
Železný Brod	0.4347	0	2.	0.4362	0	2.

Source: own calculation.

5. Conclusion

The results of the analysis show that the evaluation of the socio-economic level of municipalities using particular indicators and common factors are largely similar. In both cases, the municipality of Zásada had the best evaluated economic pillar, the least favorable situation was found in Vlastiboř, Radcice, Loužnice and Jílové u Držkova. A major difference in the evaluation using the methods of indicators and factors was identified only at the municipality of Loužnice, which was evaluated significantly better using the method of indicators. From the input data for the analysis, it is clear that Loužnice shows favorable characteristics regarding age structure, natural and migration increase, unemployment, business activity of the population and industry structure. On the other hand, it had zero housing and missing civic amenities. The municipality has also below average settlement characteristics. Yet the results of factor analysis showed that the civic amenities factor explains the largest share of variability in the data, and therefore has the highest weight in the evaluation. Therefore, an overall assessment of the municipality using the method of factors shows negative results.

At first sight, the results of the factor analysis somewhat blur the detailed differences between the above municipalities, but also have the advantage that enables us to evaluate municipalities using only a few variables. Thus, not only major weaknesses can be revealed but also the strengths of each municipality. Obviously, an evaluation using a wide group of sub-indicators is also possible, but the interpretation of the results in this case is considerably more challenging. A synthesis of the results in the case of the use of particular indicators is more difficult because at first sight, there are no clear correlations between the indicators.

Findings from the multi-criteria evaluation of municipalities also point to the fact that the outputs cannot be interpreted mechanistically. The analysis using statistical data is always the first step, which must be followed by the complex evaluation of the position of a municipality within the whole administrative district (including field research). Furthermore, it is necessary to respect the catchment area and municipality ties in a broader territory. These links need to be examined locally in municipalities.

This paper was prepared with the financial support from the Technology Agency of the Czech Republic under the project TD010029 Definition of subregions for the distinguishing and the solution of social and economic disparities.

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WIELOWYMIAROWA EWALUACJA GOSPODARCZEGO FILARU TERYTORIALNYCH DANYCH ANALITYCZNYCH

Streszczenie: Celem artykułu było zaprojektowanie procesu ewaluacji gospodarczych filarów terytorialnych danych analitycznych dla administracyjnych dystryktów samorządów lokalnych z rozszerzonymi uprawnieniami władczymi w Republice Czeskiej. Zaproponowana procedura ewaluacji bazuje na wynikach analizy czynnikowej opartej na 27 wskaźnikach, użytej do oceny gospodarczego stanu samorządów lokalnych. Rezultaty analizy czynnikowej zostały następnie wykorzystane do określenia wag poszczególnych wskaźników i czynników. Pozycja samorządów lokalnych w dystrykcie administracyjnym została zbadana przy użyciu metody średniej sum ważonych.

Słowa kluczowe: ewaluacja, dystrykt administracyjny, gminy, metoda średniej sum ważonych.