COMPARISON OF SLOVAKIA REGIONS BASED ON SCORING METHOD

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Abstract: *The aim of the paper is to analyse the regions of Slovakia using selected indicators related to housing. Indicators entering the analysis are: the proportion of households that consider paying of total housing cost to be very encumbering, the proportion of people below the poverty line (60% of median), the unemployment rate, the proportion of households who own a flat/house, average real estate prices, average nominal monthly wage of employee, regional gross domestic product per capita. We will use one of the multi-criteria comparison methods for the analysis, namely the scoring method. Based on this method, we rank the regions according to the value of the integral indicator from the best to the worst. From the results of the analysis, we found out that from the point of view of the analysed indicators the best were placed Trenčín, Nitra and Žilina regions, and the worst Košice and Prešov regions. The application of the statistical method was carried out through the program Microsoft Office Excel.*

Keywords: *Housing, Scoring method, Slovakia regions.*

1. INTRODUCTION

Statistical examination in most cases focuses on the analysis of only one monitored statistical feature and it´s only characteristic in the examined file. In many cases, however, this is not enough and it is necessary to examine the statistical file from several aspects, taking into account its several characteristics, represented by several statistical features (Hair, Black, Babin, Anderson, 2009). In such an analysis, it is necessary to use multi-criteria statistical methods, which include simple multi-criteria comparison methods, namely the order method, the scoring method, the standard variable method and the distance method from a fictitious object.

This paper aims to analyse the individual regions of Slovakia based on indicators related to housing. The issue of housing is actual, because housing at an adequate level is one of the basic human needs. Therefore, it was decided to resolve this issue.

One of the most important indicators in terms of housing is average real estate prices in individual regions stated in €/m^2. Table 1 and Figure 1 show the values of the above indicator in the years 2002 – 2018. We see (Table 1) that the highest real estate prices are in Bratislava and Košice regions, specifically, the highest value of this indicator was recorded in Bratislava region in 2008, during the economic crisis, namely 1 972 €/m^2. The lowest prices are in Nitra and Trenčín regions; the lowest value was found in Trenčín region in 2005, namely 345 €/m^2. In total, for Slovakia, average real estate prices ranged from 592 €/m^2 (in 2002) to 1 511 €/m^2 (in 2008). In 2018, this indicator reached the value of 1 431 €/m^2 for the whole of Slovakia.

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Table 1. Average real estate prices in €/m² in Slovakia and individual regions in years 2002-2018

Year	Slovak Republic	Region							
		Bratislava	Trnava	Trenčín	Nitra	Žilina	Banská Bystrica	Prešov	Košice
2002	592	779	370	457	361	404	356	359	462
2003	827	1 180	400	437	405	504	472	465	490
2004	954	1 285	659	630	573	439	505	505	779
2005	856	1 148	648	345	365	452	422	592	522
2006	1 000	1 376	712	473	387	507	512	612	581
2007	1 238	1 666	799	612	517	709	686	747	812
2008	1 511	1 972	1 006	830	744	945	851	1 051	1 137
2009	1 344	1 749	937	759	709	864	789	899	922
2010	1 291	1 726	850	685	620	790	791	826	941
2011	1 251	1 677	834	695	624	757	769	822	975
2012	1 237	1 661	824	657	612	760	764	803	971
2013	1 226	1 660	826	642	585	776	737	787	928
2014	1 216	1 648	823	629	580	782	740	765	920
2015	1 227	1 693	830	633	556	753	712	745	946
2016	1 279	1 790	863	653	587	812	714	784	932
2017	1 360	1 896	936	740	663	864	745	833	1 015
2018	1 431	1 973	1 060	786	748	936	777	875	1 071

Source: National Bank of Slovakia (2019)

From Figure 1, we found that average real estate prices recorded the highest values in Bratislava region during the entire period, the values of which are over the values for the entire Slovak Republic. As for the development trend, real estate prices rose from 2002 to 2008, reached their maximum values in 2008, then slowly decreased until 2014 and have risen again since then, almost reaching the values from the economic crisis.

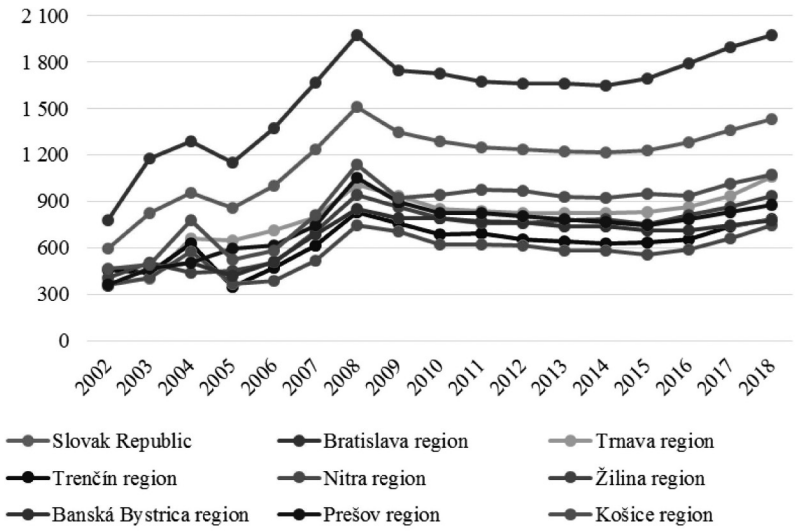

Figure 1. Real estate prices in €/m² in Slovakia and in individual regions in the years 2002-2018

Source: own processing in Excel

2. LITERATURE OVERVIEW

Several foreign authors dealt with the issue of housing.

Christensen et al. (1992) in their study examined objective housing indicators and their relationships with subjective housing quality evaluations for a representative national sample of independent elderly households. Hierarchical regression analyses revealed that two indicators of physical housing quality (structural adequacy and maintenance quality) provided significant and meaningful predictions of subjective housing evaluations. Discussed are study findings in terms of their implications for environmental assessment research, the development of housing quality indicators, and practical applications in social gerontology.

Bogdon and Can (1997) in their paper focused on the measurement of local housing affordability problems. There is number of different housing market indicators that help identify the magnitude and nature of housing affordability problems and their geographic distribution.

Saldaña-Márquez et al. (2019) presented a comparative analysis of the housing indicators used by the single-family housing rating systems, in which the residential urban environment influences buildings' certification scores, emphasizing the relationships of six systems developed by middle-income countries (MICs) and the two most-recognized rating systems. The aim was to provide new housing indicators that are capable of bringing the concept of sustainability into the cities of MICs. The results revealed that the percentage of influence that single-family housing can achieve in the metric established by each system is relatively low. However, considering all of the identified indicators, this influence could increase to 53.16% of the total score in multi-criteria evaluations.

The following authors dealt with the issue of housing in Slovakia.

Šoltés (2007) in his paper analysed the impact, which the selected factors have on households' accommodation costs each month. For his analysis used report called Income and Living Findings EU SILC 2005. By using methods of regression and correlation analyse he found out which factors influence accommodation costs. He considered their influence.

Cár (2009) concluded that the significant rise in estate prices was largely due to the favourable development of the Slovak economy, which was the basis for the positive expectations of the population and the growing willingness to procure housing with relatively well available credit resources. The growing demand for housing and not adequate supply resulted in relatively dynamic growth in estate prices in recent years. The turning point came in the second half of 2008, when and estate prices fell between quarters. Among the factors that significantly affect the development of residential property prices, Cár includes the population aged 25 to 44, gross domestic product, the volume of housing loans provided, the volume of construction output associated with the construction of residential buildings.

Vidová (2014) in her paper analysed investments in housing in the context of household behavior in the housing market.

Žuffová and Pilch (2015) in their paper focused on young clients, whom the state supports in housing issues.

3. THE SCORING METHOD

We use for analysis Slovakia regions based on one of the multi-criteria comparison methods – the scoring method.

Multi-criteria comparison methods aim to replace several selected indicators, with which we want to compare selected objects (in our case the regions of Slovakia), with one quantitatively expressed integral indicator. Selected indicators are usually heterogeneous (expressed in different units of measure), which means that we can´t aggregate them by direct addition and therefore we must transform them into homogeneous indicators, from which an integral indicator is formed.

We can divide indicators into (Pažitná, Labudová, 2007):

- stimulants - in which there is positive growth of values,
- destimulants - in which there is positive decrease of values,
- nominants - their increasing values have a positive effect on the observed indicator, but only up to a certain value.

The most commonly used methods of creating an integral indicator are (Vojtková, Stankovičová, 2020):

- the order method,
- the scoring method,
- the standard variable method,
- the distance method from a fictitious object.

The independence of individual indicators is important for the mentioned methods of multi-criteria comparison. Therefore, before applying the methods themselves, we must quantify the correlation matrix, which will help us identify variables for which there is no statistically significant dependence. In determining whether the correlation coefficient is statistically significant, we will consider the following hypotheses (Pacáková et al., 2009):

H_0: $\rho_{xy} = 0$ (correlation coefficient is not statistically significant)

H_1: $\rho_{xy} \neq 0$ (correlation coefficient is statistically significant)

So that we can´t reject hypothesis H_0, which talks about independence, respectively statistically insignificant dependence, it must be true that all values of the correlation coefficient have a *P*-value higher than the significance level α – *P*-value > 0.05.

The scoring method

In the scoring method, we replace the values of the individual indicators X_j with the appropriate number of points. For each indicator X_j we find an object (region) in which the indicator reaches the maximum value ($x_{max.j}$), if it is a stimulating variable or the minimum value ($x_{min.j}$), or a destimulating variable. We will assign 100 points to the given object for the given indicator. Other objects get from 0 to 100 points, depending on how many % represents the value of the indicator x_{ij} from the maximum value ($x_{max.j}$), resp. minimum value ($x_{min.j}$). We assign the number of points to the object according to the relation (Glaser-Opitzová and Myslíková, 2001):

if X_j is a stimulating indicator: $z_{ij} = \frac{x_{ij}}{x_{max.j}}\ 100$ (1)

where: z_{ij} is the number of points for the j-th indicator in the i-th object,
x_{ij} is the value of the j-th indicator belonging to the i-th object,
$x_{max.j}$ is the maximum value of the j-th indicator,

if X_j is a destimulating indicator: $z_{ij} = \frac{x_{min.j}}{x_{ij}}\ 100$ (2)

where: $x_{min.j}$ is the minimum value of the j-th indicator.

We determine the resulting integral indicator as the average number of points:

$$d_i = \frac{1}{k}\sum_{j=1}^{k} z_{ij} \quad (3)$$

The order of individual objects is determined as follows: the first in the order will be the object with the highest value of d_i, the last will be the object whose value of the integral indicator d_i is the lowest (Jílek, 1997).

4. APPLICATION OF THE SCORING METHOD

In this part of the paper, we will analyse the regions of the Slovak Republic based on selected indicators related to housing in the year 2017:

- **The proportion of households that consider paying of total housing costs to be very encumbering (X_1)** – the indicator is expressed in percentage of the total number of households.
- **The proportion of people below the poverty line (60% of the median)** (X_2) – the indicator expresses the at-risk-of-poverty rate. This is the proportion of people with equivalent disposable income below 60 % of the national median equivalent income (Statistical Office of Slovak Republic, 2018).
- **The unemployment rate according to LFS[2] (X_3)** – calculated as the proportion of the number of unemployed persons according to LFS (persons aged 15 to 74 who do not have a job in the observed week, who are actively looking for a job in the last four weeks - or have already found a job and start work within 3 months - and who are able to start work within two weeks at the latest, these persons may or may not be registered in Employment, social affairs and family offices as jobseekers) and the number of economically active population according to the LFS (excluding persons on parental leave) (Statistical Office of Slovak Republic, 2019). The indicator is given in percentage.
- **The proportion of households that own a flat/house (X_4)** – the owner must be a member of the household and have an acquisition deed regardless of whether the house is fully paid or not (Statistical Office of Slovak Republic, 2018). The indicator is given in percentage.
- **Average real estate prices (X_5)** – this indicator tells us about the amount of real estate prices in individual regions of the Slovak Republic in €/m^2.

[2] LFS is a labour force sample survey. It is a monitoring of the workforce based on a direct survey in selected households. The basis for the survey is a stratified selection of flats, which evenly covers the entire territory of Slovak Republic. The sample includes 10 250 flats on a quarterly basis, which represents 0.6% of the total number of permanently inhabited flats in Slovak Republic. The subject of the survey are all persons aged 15 and over living in households of selected flats. Each selected household remains in the sample for five following quarters.

- **Average nominal monthly wage of employee (X_6)** – includes benefits that belong to the basic (tariff) wage determined according to wage regulations, including the basic components of contractual salaries and wages for overtime, wage compensation for the time when employees did not work, monthly and long-term bonuses and bonuses paid depending on performance and fulfilment of evaluation criteria, overtime rates, cash allowances to night workers, premium pay for work on Saturdays and Sundays, holidays, harmful environment, noise, risky and hard work, natural wages expressed in cash and other wages in the form of wage benefits, whose amount and periodicity are determined in advance regardless of the situation of the company (Statistical Office of Slovak Republic, 2019). The indicator is expressed in € /employee.
- **Regional gross domestic product per capita (X_7)** – is the proportion of two indicators – regional gross domestic product and the average number of permanent residents in the region (Statistical Office of Slovak Republic, 2019). This indicator is given in €/inhabitant.

Before proceeding with the analysis, we must verify based on the correlation matrix whether the indicators are independent – the correlation coefficients are not statistically significant. From the correlation matrix (Table 2) it is clear that some correlation coefficients have *P*-values less than 0.05, so they are statistically significant. In this case, we must remove from the analysis the indicators that show the highest dependence. After the gradual removal of indicators, we obtained a correlation matrix that contains only those indicators between which there is no statistically significant dependence. This correlation matrix is in Table 3.

Table 2. Correlation matrix of all variables

	X_1	X_2	X_3	X_4	X_5	X_6	X_7
X_1	1.0000	-0.2244 0.5931	-0.1576 0.7093	-0.3095 0.4557	0.4429 0.2718	0.3595 0.3818	0.3288 0.4265
X_2	-0.2244 0.5931	1.0000	0.8784 0.0041	-0.0677 0.8734	-0.5915 0.122	-0.8037 0.0162	-0.7803 0.0223
X_3	-0.1576 0.7093	0.8784 0.0041	1.0000	-0.4069 0.3171	-0.3417 0.4075	-0.6028 0.1137	-0.5615 0.1476
X_4	-0.3095 0.4557	-0.0677 0.8734	-0.4069 0.3171	1.0000	-0.0033 0.9937	0.0555 0.8962	0.0872 0.8373
X_5	0.4429 0.2718	-0.5915 0.1225	-0.3417 0.4075	-0.0033 0.9937	1.0000	0.9432 0.0004	0.9468 0.0004
X_6	0.3595 0.3818	-0.8037 0.0162	-0.6028 0.1137	0.0555 0.8962	0.9432 0.0004	1.0000	0.9812 0.0000
X_7	0.3288 0.4265	-0.7803 0.0223	-0.5615 0.1476	0.0872 0.8373	0.9468 0.0004	0.9812 0.0000	1.0000

Source: own processing in statistical program STATGRAPHICS Plus

After adjustments, we have only four indicators left, between which there is no statistically significant dependence. We will continue to work with these indicators. We need to determine the direction of the trend of individual indicators – to determine whether it is desirable for their values to increase or decrease:

X_1 The proportion of households that consider paying of total housing costs to be very encumbering – destimulant

X_3 The unemployment rate according to LFS – destimulant

X_4 The Proportion of households that own a flat/house – stimulant
X_5 Average real estate prices – destimulant

Table 4 shows the values of the individual indicators, with the lowest value highlighted for each destimulating indicator and the highest for the stimulating indicator.

Table 3. Correlation matrix of independent variables

	X_1	X_3	X_4	X_5
X_1	1.0000	-0.1576 0.7093	-0.3095 0.4557	0.4429 0.2718
X_3	-0.1576 0.7093	1.0000	-0.4069 0.3171	-0.3417 0.4075
X_4	-0.3095 0.4557	-0.4069 0.3171	1.0000	-0.0033 0.9937
X_5	0.4429 0.2718	-0.3417 0.4075	-0.0033 0.9937	1.0000

Source: own processing in statistical program STATGRAPHICS Plus

Table 4. Values of analysed indicators in the regions of Slovak Republic in 2017

Region	X_1 **(v %)**	X_3 **(v %)**	X_4 **(v %)**	X_5 (v €/m²)
Bratislava (BA)	26,7	4,2	90,2	1 896
Trnava (TT)	27,8	5,9	87,9	936
Trenčín (TN)	25,5	**4,1**	89,5	740
Nitra (NR)	23,7	6,3	92,0	**663**
Žilina (ZA)	23,1	6,7	**92,9**	864
Banská Bystrica (BB)	**22,1**	12,3	86,7	745
Prešov (PO)	26,1	12,9	90,4	833
Košice (KE)	27,6	11,1	87,1	1 015
Character	-	-	+	-
Average	25,3250	7,9375	89,5875	961,5000
Standard deviation	1,9942	3,3675	2,0979	368,7577

Source: EU SILC 2017 (2018), Statistical yearbook of Slovakia regions 2018 (2019), National Bank of Slovakia (2019)

The scoring method

The base of this method is to determine the point evaluation of each indicator for all compared regions. We assign the maximum number of points (100) to the region that achieves the best value of the indicator. To the other regions we assign the number of points, which indicates the percentage of the indicator from the best value of this indicator according to equations (1) and (2). For each region, we determine the average number of points that the region achieved. We will put descending order of all points that the regions have achieved. The region with the highest number of points was placed first, and the region with the lowest number was placed last.

From Table 5 and Figure 2, we can see that when using the scoring method, Trenčín region comes first, followed by Nitra region and, similarly to the order method, Žilina region. The order in the last place is the same as in the previous method, the last is the Košice region, before it Prešov.

Table 5. Comparison of Slovakia regions using the scoring method

Region	X_1	X_3	X_4	X_5	d_i	Order
Bratislava	82,77	97,62	97,09	34,97	78,11	6
Trnava	79,50	69,49	94,62	70,83	78,61	5
Trenčín	86,67	100,00	96,34	89,59	93,15	1
Nitra	93,25	65,08	99,03	100,00	89,34	2
Žilina	95,67	61,19	100,00	76,74	83,40	3
Banská Bystrica	100,00	33,33	93,33	88,99	78,91	4
Prešov	84,67	31,78	97,31	79,59	73,34	7
Košice	80,07	36,94	93,76	65,32	69,02	8

Source: own calculation in Excel

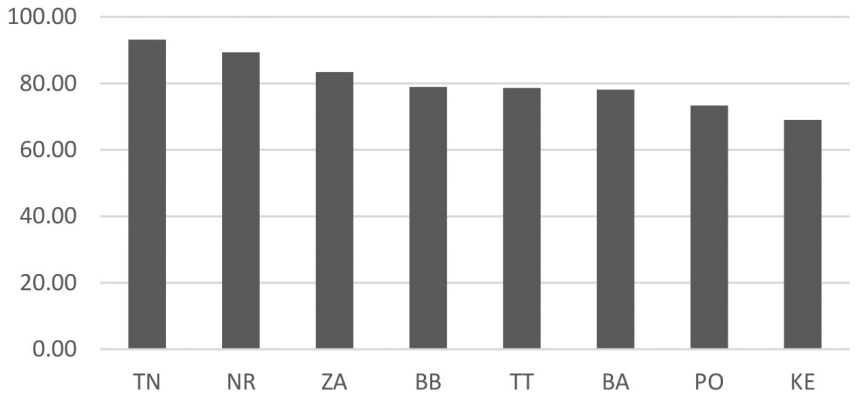

Figure 2. Ranking of Slovakia regions based on integral indicator using the scoring method

Source: own processing in Excel

5. CONCLUSION

The results obtained using the scoring method could be summarized as follows:

- In the first three places are the west Slovakian regions (Trenčín, Nitra and Žilina region). The reason is that they reach the best values in all analysed intensity indicators. It follows that in terms of housing there are the best conditions in comparison with other regions of the Slovak Republic. Trenčín region has the lowest unemployment rate – the inhabitants of this region have a permanent source of income and here are the second lowest real estate prices. In Nitra region there is a lower demand for flats, so real estate prices are also the lowest here. One of the reasons is that there are not enough job opportunities, so the inhabitants of this region are forced to go to work in other regions. The large automotive company KIA has its headquarters in Žilina Region, providing employment opportunities for almost 4,000 employees (the figure is for year 2017 based on data from the KIA Annual Report).
- In the last places are east Slovakian regions (Košice and Prešov region). Košice region has the second highest average real estate prices and in this region is the second lowest proportion of households, which are the owners of house / flat, and there is the third highest unemployment rate. In both regions there is a high share of households that consider the payment of total housing costs very encumbering.

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