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Article

Evaluation of the Financial Performance of the Municipalities in Slovakia in the Context of Multidimensional Statistics

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Abstract: In some studies, only financial aspects are emphasized, but we also see cases of assessing the financial health of municipalities through socio-economic indicators. Public organizations worldwide have had to increase their financial performance by adopting management practices. Nonetheless, financial performance might be mostly predicted by contingencies that are not within direct managerial control. The purpose of this paper is to identify clusters of municipalities on the basis of agglomerate cluster analysis, the results of which will point to the financial situation of the municipalities in the selected region. The main aim of this contribution is to identify the location of the municipalities of the chosen self-governing region of Slovakia using the clustering method by selected financial indicators. Individual clusters have similar properties and they differ from the characteristics of businesses in other clusters. The results show that organizational and environmental contingencies affect financial performance, but a significant amount of variation in financial performance is unexplained—indicating that management creates better financial health in the municipality and creates a clearer budget for the management, employees, and residents of the municipality.

Keywords: financial performance; administration; cluster analysis; financial indicators; Slovakia



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1. Introduction

Presently, there is pressure on municipalities to make more efficient use of their property to receive the greatest possible benefit in terms of economic, social, and territorial development (Papcunová 2013). The purpose of this paper is to identify clusters of municipalities on the basis of agglomerative cluster analysis, the results of which will point to the financial situation of the municipalities in the selected region. We performed a statistical analysis with the research question of whether there are financial indicators (variables) that significantly affect the financial situation of municipalities in eastern Slovakia. The reason for the use of clustering was to create relatively homogeneous groups with the consequent determination of an appropriate number of groups. Due to the lack of studies orientated to the evaluation of the financial performance of municipalities, especially in post-communist countries such as Slovakia, the results of this contribution may provide novel insights into municipalities' management.

2. Literature Review

The literature contains many financial health assessments using revenue, cost, and debt indicators. In some studies, only financial aspects are emphasized, but the literature also contains studies assessing the financial health of municipalities through socio-economic indicators (Goeminne and George 2019).

Berne (1992) considers the financial capacity of the municipality to meet its obligations to creditors, employees, taxpayers, and other stakeholders and to provide them with services both now and in the future. Chaney et al. (2002) see the financial condition as the ability to adequately offer services and meet current and future liabilities. Wang et al. (2007) claim that the financial condition is the ability to meet financial obligations on time.

There are also differences in the number of indicators that represent financial health. Some authors, such as Clark (1977) and Zafra-Gómez et al. (2009), report several ratios, while others, such as Brown (1993), Cohen et al. (2012), Kloha et al. (2005), and Mercer and Gilbert (1996), create a comprehensive financial health assessment index.

The results of Dynowska and Cereola's (2018) survey show that the greatest expectation in implementing the task budget was the desire to create better financial management in the municipality and to create a clearer budget for the management, employees, and residents of the municipality. According to respondents in Poland, persons who should be involved in the process of budget preparation in the new task system should include the commune's administrator and the treasurer of the commune. Most municipalities, as a means of transferring information about the budget's assumptions, propose using the commune's website and an information board at the commune's office.

Cohen (2008) used end-of-year financial statements for the period 2002–2004 to compute nine commonly used ratios for the assessment of financial performance in Greece. Cohen found corroborative evidence that those factors that are exogenous to the municipalities' control, such as their wealth and size, have a statistically significant impact on the ratio values. Thus, as financial ratios are significantly influenced by economic factors such as municipal wealth and size, cross-sectional comparisons on the basis of these ratios should be made with caution and performed for municipalities that exhibit similarities in terms of size and wealth.

The results of studies on Italian municipalities during the period 2012–2015 (for 45 companies) show the existence of a very high general connection and a slight positive linear correlation, which means that if one variable grows, the other one also increases, even if the proportion varies. In other words, for the analyzed companies, the research findings seem to exclude the possibility that the financial results may deteriorate as a consequence of improved environmental practices in the form of separate waste collection (Bartolacci and Michela 2018).

The main conclusion of the investigation of Gomes is that larger cities in Brazil are more likely to manage revenue and expenditure better than smaller cities, which aligns with the discussion of amalgamation versus fragmentation. This conclusion stems from the finding that, in small municipalities, mayors have fewer opportunities to improve the financial performance due to difficulties with raising and collecting taxes and reducing expenditures, which make their administrations far more dependent upon external sources of money. Therefore, this dependent relationship can be seen as the cause of poor financial performance to the extent that it lowers the discretion that mayors have when making decisions (Gomes et al. 2013).

According to Zafra-Gómez et al. (2009), one of the main problems in evaluating financial performance arises when carrying out comparisons between municipalities, as no account is taken of the impact of certain factors of the social and economic environment on the indicators in question. In this study, the concept of 'financial condition' was applied to reveal the influence of such factors and a methodology was proposed to decrease their effects on the results of the evaluation. The results of applying these factors to a sample of municipalities in Spain show that the model is useful for reinforcing the value of benchmarking between municipalities with similar characteristics.

The financial performance of municipalities is significantly affected by state funding, and it is important to check non-financial factors (Lindermüller et al. 2020). Based on Altman's Z-score, the researchers examined how predictions of the financial health of Turkish municipalities can be developed. If more municipalities have recently produced worse results (moved into the gray zone), no overwhelming majority has remained safe,

and such municipalities are not in danger of going bankrupt (Kablan 2020). The other approach used is the relation between fiscal pressure and equilibrium (Batrancea 2021).

The financial performance in municipalities has been studied in concrete countries, such as local English governments (Arcas and Martí 2016) and Baltic nations (Larissa et al. 2020). Authors from a Swedish municipal area checked the relationship between political competition and adjustments to the reported financial results in Swedish municipalities. The results showed that municipal officials deliberately adjusted the financial results of the municipalities before elections to improve the financial situation (Donatella 2019). However, little attention has been paid to Slovakia and other post-communist countries. The aim of this contribution is to fill this gap in the literature.

3. Materials and Methods

Statistical analysis was used to perform the research. First of all, we conducted a cluster analysis, which Stankovičová and Vojtková (2007) understands to be a set of statistical as well as mathematical techniques through which clusters can be identified. A cluster is a set of identifiable objects that are similar to each other, but objects belonging to other clusters have different characteristics. The clustering analysis procedure involved:

- entering input data;
- selecting the variables;
- creating object names;
- choosing the agglomeration process;
- choosing the type of bonding method—in our case, we used Ward's method;
- selecting the degree of similarity of objects, which was adjusted on the basis of the Euclidean distance;
- determining the number of significant clusters; and
- interpreting the results.

The main aim of this contribution is to find the location of the municipalities of the self-governing region of Prešov using the clustering method. The data represent a database of financial indicators in 2017. The data obtained from this portal were first analyzed by a cluster analysis using the mathematical and statistical software R-studio.

The selection of the degree of similarity of objects was made by applying a distance measure called the Euclidean distance, which is formulated as follows:

$$d_{ij} = \sqrt{\sum_{k=1}^n (X_{ik} - X_{jk})^2} \quad (1)$$

where:

X_{ik} is the value of the k th variable for the i th municipality; and

X_{jk} is the value of the k th variable for the j th municipality.

This distance assumes an orthogonal coordinate system, which entails mutual non-correlation of variables. The disadvantages of this type of distance include the significant influence of the absolute values (amounts) of input data. This can be avoided by standardizing the used variables as presented by Stankovičová and Vojtková (2007).

For the clustering, we used Ward's method, according to which the clusters are created by maximizing the homogeneity of the clusters. Such homogeneity reflects the sum of the squares of deviations from the cluster average. The following equation was used:

$$ESS = \sum_{i=1}^{n_h} \sum_{h=1}^q (X_{hi} - \bar{X}_{C_h})^2 \quad (2)$$

where:

n_h is the number of objects in the cluster C_h ;

\bar{X}_{C_h} is the vector of the value averages for the cluster's character C_h ; and

X_{hi} is the vector of values for the i th object character in the cluster C_h .

The reason for using clustering was to create relatively homogeneous groups with the consequent determination of an appropriate number of groups. Such a determination was made according to various criteria, such as a hierarchical tree (also called a dendrogram) (Stankovičová and Vojtková 2007).

Through correlation of the input variables at 5% ($\alpha = 0.05$), variables' dependence was determined. However, variables can have a high degree of dependence, influencing the classification results. This problem can be solved through the main component method, in which input indicators are changed to new variables called main components. Such new variables are independent of each other. Two main rules must be observed during the selection of the optimal number of components:

- the number of main components must resolve at least 70% of the data's total spread; and
- the number of main components must be determined by using a graphical representation of the spread, reasoning by the main components.

This research used a basic description of the data collected. This practice of statistics is very important. It is also called descriptive statistics, which indicates its basic use. It is also largely exploratory in nature, but provides a thorough explanation of the data, which is essentially the basis of statistical practice. Based on the obtained descriptive statistical data, it is obvious that the total debt ratio does not exceed 60% by law and has been reported to the current income for the previous year; however, the largest value is 1.08, which is considered a breach of the public administration rules governing budgetary stability.

The legal limit of debt service is 25%. If a municipality exceeds this limit, it cannot legally accept other repayable sources of financing. If the municipal debt service level is at 0%, the lower this debt, the better for the municipality.

The volume of municipal loans from the State Housing Development Fund to income was calculated as (loans from the SFRB)/(current income for the previous year), while loans from the SFRB also include liabilities arising from interest. From the descriptive statistics, it is obvious that several municipalities do not use this form of financing at all.

The economic result of the municipality per inhabitant was calculated as (economic result for the current accounting period after tax)/(number of inhabitants at the beginning of the year). Municipalities from the Prešov region show in several cases a negative result per inhabitant, which is not an ideal situation.

From the correlation analysis, it is obvious that the dependence between the total debt and debt services variables is almost 0, which indicates that there is no linear relationship between these variables. Conversely, a strong direct linear dependence between several variables was observed; e.g., overdue liabilities vs. liabilities due for more than 60 days (0.98) and total debt vs. debt per capita (0.9). This was mainly because these variables are based on a single source of data (financial documentation) and their calculation is similar. Most of the correlation coefficients oscillate around a value of 0, which indicates a nonlinear relationship (Equation (1)).

The sum is extended over the M variables that characterize each pair of objects i and j . It is clear that $d_{ij} = 0$ when $i = j$, and $d_{ij} > 0$ when $i \neq j$, which leads to the definition of a similarity matrix S , whose elements are

$$s_{ij} = \frac{d_{ij}}{d_{max}} \quad (3)$$

The degree of similarity ranges in the interval $[0, 1]$ and assumes higher values the more similar the two objects i and j are.

4. Results

We analyzed 665 municipalities and towns from the Prešov region. The sources of data were financial statements from the INECO portal, from which the indicators were then calculated. The statistical analysis and the application of the clustering method were

performed in the RStudio statistical program. The data used in the analysis were based on the accounting statements of 665 selected municipalities and towns that, on 31 December 2017, compiled financial statements in accordance with Slovak accounting legislation.

Table 1 shows descriptive statistics (mean values, the standard deviation, the variance, and maximum and minimum values). An interesting value is that for the profit per head indicator, from which it can be seen that the maximum per capita profit achieved is EUR 1793.93 and the lowest per capita profit is a loss of EUR 585.63.

Table 1. Descriptive statistics for selected indicators.

Indicator	Median	Standard Deviation	Variance	Minimum	Maximum
total_debt	0	0.129637	0.016806	0	1.08
debt_services	0.01	0.482052	0.232374	0	11.18
liabilities_more60days	0	0.061848	0.003825	0	1.56
debt_per_capita	0	70.10719	4915.019	0	803.37
overdue_liabilities	0	0.06317	0.00399	0	1.56
current_account_balance	0.1	0.102027	0.01041	−0.46	0.64
investment_intensity	0.06	1.386149	1.92141	−10.45	25.83
loan from the ŠFRB	0	0.444963	0.197992	0	7.56
property	3.425	3.439398	11.82946	−0.13	37.13
property_per_capita	1648.055	1837.058	3,374,783	−52.8	18,518.6
profit_per_capita	24.995	134.564	18,107.47	−585.63	1793.93

Source: Own processing according to financial statements from the municipalities.

According to the selected financial indicators, an assignment of the companies to the unique clusters was performed. The respective clusters have some similar characteristics that are different from the business character in the different cluster. The process of clustering required the use of Ward's method and the Euclidean distance to determine the degree of similarity of the examined objects.

A prerequisite for cluster analysis is testing the dependencies between variables. The starting point was the correlation matrix containing Pearson's correlation coefficients. Testing the dependencies between variables by Pearson's correlation coefficients is given in Figure 1.

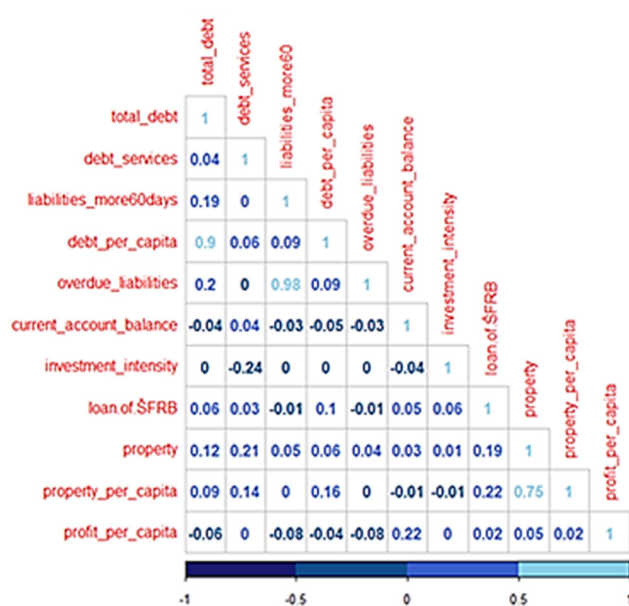


Figure 1. Testing the dependencies between variables using Pearson's correlation coefficients. Source: own processing (R Studio).

The results of the correlation matrix can be used to determine what the relationship between the different variables is. For some variables, this dependency is higher; for other variables, this dependency is lower. In a cluster analysis, it is necessary to exclude statistically significant but weaker dependencies because they might distort the results of the cluster analysis. It is also necessary to test the statistical significance of Pearson's correlation coefficients. Figure 2 shows the output of the R software's automatic detection of statistically significant factors at the significance level of 0.05 using crosses.

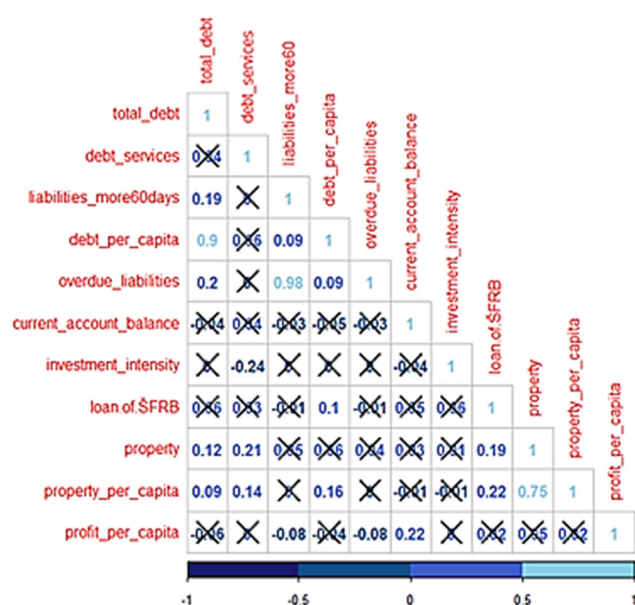


Figure 2. The marked dependence between variables. Source: own processing (R Studio).

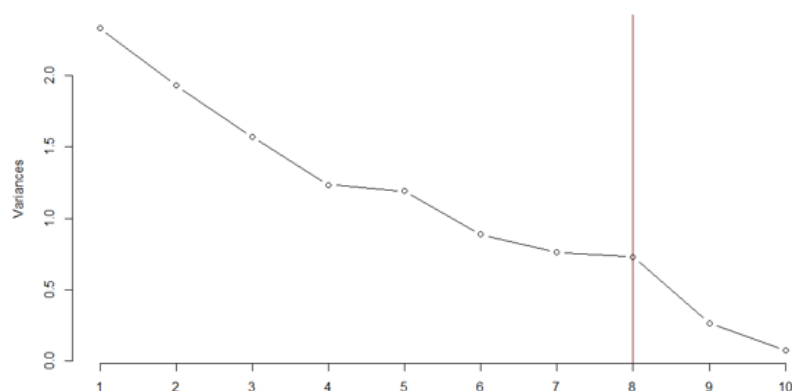
Figure 2 shows that, e.g., in the case of the current account balance variable, all coefficients are statistically insignificant. In the case of the profit per head and loan from the ŠFRB variables, some of their mutual correlations are statistically significant. This means that there may be a problem with the clustering in the cluster analysis. Therefore, it is necessary to analyze the main components. An analysis of the main components was conducted, and we applied a type of main component analysis that works with standardized variables. Then, we calculated the proportion of component variability in the total variability to determine the number of significant components from which components were calculated (see Table 2).

From the results shown in Table 2, the first component explains the least variability and the last component explains the most variability. At the same time, it can be seen that eight components are sufficient to explain 96.74% of the variation in the original file. It can be concluded that the rule stating that the number of main components must explain at least 70% of the total data dispersion has been followed. Figure 3 shows the explanation of the variability in the original file graphically using a screenplot. The screenplot explains the variance in the main components and shows a break in the graph.

Table 2. Variance in main components.

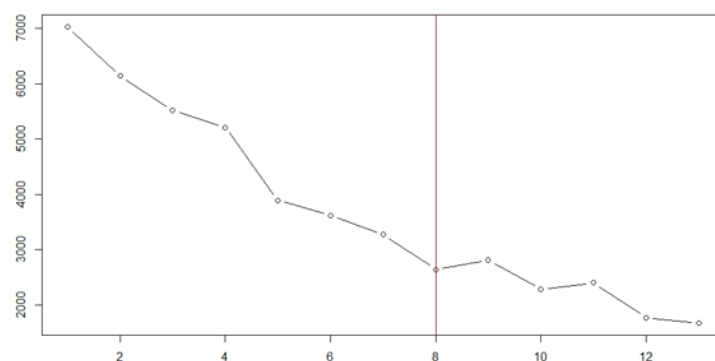
	PC1	PC2	PC3	PC4	PC5
Standard deviation	1.528164	1.390042	1.253923	1.111289	1.091277
Proportion of Variance	0.212300	0.175660	0.142940	0.112270	0.108260
Cumulative Proportion	0.212300	0.387950	0.530890	0.643160	0.751420
	PC6	PC7	PC8	PC9	PC10
Standard deviation	0.9416353	0.8718078	0.8539837	0.5135944	0.2721569
Proportion of Variance	0.0806100	0.0691000	0.0663000	0.0239800	0.0067300
Cumulative Proportion	0.8320300	0.9011300	0.9674300	0.9914100	0.9981400
	PC11				
Standard deviation	0.1430524				
Proportion of Variance	0.0018600				
Cumulative Proportion	1.0000000				

Source: own processing (R Studio).

**Figure 3.** The screenplot of the main components. Source: own processing (R Studio).

Another approach was to select the number of enterprise clusters in this analysis. Based on a heuristic approach, a set of enterprises was categorized into eight clusters.

However, the information was also obtained from a screenplot, in which the x -axis shows the number of clusters and the y -axis the noise in the sum of squares (see Figure 4).

**Figure 4.** A screenplot of the number of clusters. Source: own processing (R Studio).

The line dividing the axis determining the eight clusters represents the optimum state—in this case, the inside of the cluster has the optimum value of the squares.

The process was continued by selecting the number of enterprise clusters. According to the heuristic approach, eight clusters were made using a screenplot. The number of clusters is illustrated by the x -axis, and the intra-cluster square is illustrated by the y -axis. The decision was made by minimizing the intra-cluster sum of the square. The number of enterprises in each cluster is shown in Table 3.

Table 3. Clusters of municipalities.

Cluster	1	2	3	4	5	6	7	8
Municipalities	476	161	3	4	8	8	1	1

5. Discussion and Conclusions

Based on hierarchical agglomerative cluster analysis, the aim of this paper was to establish clusters for towns and municipalities with regard to selected financial indicators. A measure of distance using the Euclidean distance was used. Ward's method was used as a clustering method. The main component method was used to create clusters of businesses, which were drawn in a dendrogram. The dendrogram organized companies based on the selected financial indicators. Towns and municipalities were grouped into clusters having similar properties and different characteristics from those in other clusters. First, we examined relationships between variables, and then moved on to clustering. In our case, the characteristics of enterprises represent the characteristics of the selected financial indicators. To determine the optimal number of clusters, a heuristic approach was used. It was accompanied by a graphical overview using a screenplot, where the number of clusters and sum of intra-cluster squares are shown. The result was the identification of eight clusters. Centroids (the average) of the original variables in the individual clusters are recorded in Table 4.

Table 4. Centroids of clusters.

Group	Total_Debt	Debt_Services	Liabilities_Morethan60days	Debt_per_Capita
1	0.02153361	0.03216387	0.0007983193	10.59277
2	0.23900621	0.06080745	0.0034782609	126.32882
3	0.00000000	0.03000000	0.0000000000	0.00000
4	0.06750000	0.16500000	0.0000000000	24.07000
5	0.07250000	0.02875000	0.0012500000	32.50875
6	0.09875000	0.02625000	0.0050000000	37.16375
7	0.00000000	11.18000000	0.0000000000	0.00000
8	0.66000000	0.07000000	1.5600000000	174.94000
	Overdue_Liabilities	Current_Account_Balance	Investment_Intensity	
1	0.001176471	0.111470588	0.1219118	
2	0.008136646	0.098881988	0.1493789	
3	0.000000000	0.003333333	17.6100000	
4	0.000000000	0.147500000	0.9225000	
5	0.005000000	0.036250000	−0.1375000	
6	0.005000000	0.210000000	0.3537500	
7	0.000000000	0.210000000	−10.4500000	
8	1.560000000	0.080000000	0.0700000	
	Loan from the ŠFRB	Property		
1	0.06663866	4.151933		
2	0.08869565	3.626770		
3	0.00000000	4.793333		
4	4.64000000	10.302500		
5	0.21875000	19.701250		
6	0.20000000	8.048750		
7	0.00000000	18.280000		
8	0.00000000	8.290000		

Source: own processing (R Studio).

Clusters 1 and 2 are the most numerous. Average values were observed for these most numerous clusters—centroids for financial indicators of the financial health of municipalities. Clusters that are less numerous contain cities and municipalities with extreme values of the selected financial indicators. Prešov region scores 4.6 points out of 6 and has good financial health. The Prešov region achieves excellent scores in terms of debt service, overdue liabilities, investment intensity, and immediate and prompt liquidity. The Prešov region is worse at managing its basic balance sheet, its net assets, and its liabilities that are 60 days overdue.

Similar results were obtained by Larissa et al. (2020), who evaluated municipalities in Baltic nations that are also post-communist countries similar to Slovakia, so they can be compared together. Such a comparison may also be the frame for future research. To the results the note has to be added that the financial performance of municipalities is a highly political environment in which incentives for manipulation can exist and financial reporting may be problematic (Collin et al. 2017; Donatella 2019). In order for financial reports to provide complete and reliable information, research of a proper level of specificity in terms of rules and regulations needs to be carried out as well.

Although the topic of financial performance has received much attention in public management and administration, it is mainly explored using financial indicators. Further attention should be paid to non-financial indicators that influence the financial performance of municipalities (Budding et al. 2021). Moreover, demographic diversity influences the outcomes of public sector organizations (Opstrup and Villadsen 2014) and could provide a direction for future research. A detailed evaluation of financial performance contributes to the better and more effective control of municipalities, for example by an internal control unit in the municipality (Ahmaro 2014). Observing the effects of the financial performance of municipalities can help to avoid crises and the bankruptcy of the system (Lopez-Hernandez et al. 2012).

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