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Performance measurement and evaluation of the property in regional cities in Slovakia and the Czech Republic in the context of their local economic development: comparative study

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Abstract

Motivation: Property is an important part of the economic development of local governments. Not only from the point of view of its use for providing services to inhabitants, but also from the point of view of generating income for local budgets. However, the evaluation of its use is very complicated, since cities first of all use it for non-market purposes and only then for market purposes. There are very few studies devoted to the evaluation of property utilization at the level of local self-governments.

Aim: The financing of cities in Slovakia and Czechia is strongly linked to the state budget, and a large part of these financial resources are earmarked. One of the possibilities for obtaining additional financial resources, as well as increasing their competitiveness, is the efficient use of municipal property. The aim of this paper is to look at the competitiveness of regional cities by evaluating the use of property in Slovakia and Czechia, in the time series 2000–2019 and based on selected indicators.

Results: The results of the analysis showed significant differences between regional cities in Slovakia and the Czech Republic. Prague is overcapitalized, whereas Bratislava is undercapitalized in selected indicators. At the same time, in the Czech Republic we observe the significant dominance of large cities, while the results of the others cities do not show significant differences. Property as its own economic resource is becoming an important part of the competitiveness of cities. Municipal property consists of things owned by the municipality, which are primarily immovable (land, buildings, individual components of the technical infrastructure), and it is this property that significantly affects the development of cities. The research method represents a new way to evaluate the efficiency of municipal property. Municipal property, which is made up primarily of long-term intangible property, represents an important element of the competitiveness of cities, because cities can use it as a tool to attract investors to the territory, thereby increasing the overall socio-economic development of the territory.

Keywords: municipal property; performance measurement; regional city; FAMA indicators
JEL: H70; R11; R51

1. Introduction

Performance measurement and evaluation at the level of public sector organizations is an extremely complicated process. The fact that the activities of such organizations should be carried out in accordance with the public interest and with the best use of public resources often serves as a sufficient argument to confirm and demonstrate the sound management of public resources by such organizations (Štrangfeldová & Štefanišinová, 2020, pp. 15–17). The idea that organizations should measure and actively manage their performance is also a key element of recent public sector reforms in many countries (Orszaghova et al., 2017, pp. 408–412; Špalková et al., 2015, pp. 69–87). The management

of municipal property should focus on: (a) changing the nature of municipal property management; (b) better recognition of municipal real estate as productive property that generates cash flows; and (c) the application of private sector practices in the management of municipal property (Constantin et al., 2018, pp. 122–139). In addition, opportunities have been created to introduce new techniques and models from the private to the public sector (Gavriluță (Vatamanu) et al., 2020, pp. 3–24; Rocha & de Araujo, 2007, pp. 583–590).

Recently, this problem has been particularly relevant to ensuring the efficiency of the management of municipal property. Municipal property management has become a distinctive discipline in terms of broader global trends. In the private sector, companies have responded to globalization and competition with greater efficiency and revised business processes. Shkilnyak (2018, pp. 96–100) notes that the effective use of municipal property is one of the main tasks of local self-government, but also points out that the failure of local self-government to set up an effective management system can lead to the total or partial loss of municipal property. However, it should be borne in mind that, according to Smentyna (2006, pp. 9–16) the concept of efficiency in relation to municipal property (as a collective form of ownership) differs from the concept of economic efficiency used in private ownership. Efficiency in the use of private property is generally assessed using commercial indicators such as the profitability of the property or the business as a whole. However, in relation to municipal property, according to the author, not only economic efficiency should be evaluated, but also social efficiency, i.e., the efficiency of the use of property should be ascertained in terms of the interests of the residents of the local self-government, the community that owns it. However, this places increased demands on the conceptualization of property management and on the perception of development trends in the long term. Municipal property consists of things owned by the municipality, which are primarily immovable (land, buildings, individual components of the technical infrastructure), and it is this property that significantly affects the development of cities. In this context, the research evaluates the competitiveness of regional cities in Slovakia and the Czech Republic from the point of view of property management, in the time series 2000–2019 and based on selected indicators. We evaluated the use of property on the basis of selected FAMA indicators and, at the same time, we used two methodological approaches, namely the regression model and multi-criteria analysis, which are complemented by selected moment characteristics and correlation analysis in the form of Kendall's coefficient. The innovativeness of the research is that it points to the fact that the indicators of financial analysis used in the private sector can also be used for the evaluation of city property. This creates space for elected city officials to evaluate the performance of city property, which can ultimately lead to the creation of additional revenues for cities and, at the same time, increase their competitiveness in the territory.

2. Literature review

In order for the public sector and its organizations to be competitive, it is important to optimize their performance. Performance is addressed as a matter of priority within the private sector. This is confirmed by Jahanshahi & Bhattacharjee (2020, pp. 1–6), who state that there are few studies that look at public sector performance, as the public sector's priority is to provide services that ultimately benefit society as a whole. The public sector has an allocation, redistribution and stabilization function in relation to public finances, and it is therefore important to avoid long-term imbalances, which can be achieved simply by improving public sector performance (Postula & Raczkowski, 2020, pp. 125–140). Balasubramanian et al. (2019, pp. 1–13) state that the pillars of performance can include innovation, the quality of public services provided and their operational efficiency. They note that knowledge management is an innovative way to increase performance, and its processes have a significant impact on innovation, as well as on the quality and operational performance of the public sector, but found that the strength of this impact varies across public sector organizations. The importance of innovation and education is also confirmed by Dima et al. (2018, pp. 1–11), who consider them to be determinants of competitiveness and economic convergence. However, Bercu & Vatamanu (2019, pp. 25–32) mention three critical aspects — institutional (logic of formal procedures), technical (limits of measuring results) and management (difficulties in applying rational evaluation models), which complicate the applicability of these systems to the public sector. An essential element of performance in the public sector is not only management itself, but above all the implementation of new social and economic policies (Luna-Arocas & Lara, 2020 pp. 1–11). One such challenge in improving the competitiveness of the public sector is the management of employee performance itself, in the context of improving the efficiency of the public services provided (Anh Vu et al., 2021, pp. 49–59; Ohemeng et al., 2018, pp. 75–80). There are many leadership styles, but servant leadership and entrepreneurial leadership are increasingly emerging in the public sector (Shim et al., 2016, pp. 3–15). Measuring public sector performance thus represents the choice and implementation of quantitative metrics of source, process and outcome, in order to obtain information on the essential activities of the public sector, including their impact on the public (Lichiello & Turnock, 2022, pp. 9–15). The performance of individual activities provided or implemented at individual levels of the public sector is determined by a number of factors, processes and phenomena, the share and impact of which depend on the nature of the specific service. One of the determinants is also the property which they have at their disposal to ensure the performance of individual public services.

A property is a unique resource in that it is both a source and a user of funds. It is a capital property that requires a long-term financing decision, and it is also an operating property that an organization uses as a factor of production (Sever-

ová et al., 2017, pp. 326–332; Šrédl & Mikhalkina, 2015, pp. 107–112). In most European countries, the structure of property and approaches to property management are the result of a long historical development. In the past, real estate was usually held as an investment target. As a result, regional development inequalities have been created as a consequence of "real estate finance" (FoRE), which is a way of linking financial markets to the geographical location of real estate. Therefore, the unevenness of regional development is closely linked to real estate finance (Kikuchi et al., 2022, pp. 128–135). In general, the largest differences are between continental European and Anglo-Saxon perceptions of the role of municipalities. In the Anglo-Saxon countries (common-law countries), the legislation applicable to municipal property does not differ from that applicable to other legal entities. In the continental system, legislation is divided, according to the type of ownership, into public ownership and private ownership. In the member states of the European Union, the same applies to municipal property as to state property, since both are subject to a public law regime. In Western European countries, there is no specific legislation for municipal property; the general rules for public property and their application apply (Binek, 2008, pp. 44–46).

In order for municipalities to be able to fulfil all competences, tasks and functions, they must have an adequate economic base, and ownership of property is one of the basic prerequisites for development, as it enables them to run their own business or create space for the provision of quality public goods (Mihaliková et al., 2011, pp. 102–110). The importance of municipal property is also underlined by Prigozhin (2018, pp. 1–5), according to which it is an important factor in the sustainable socio-economic development of a municipality. Municipal property must meet the needs of the population, which requires the efficient use of methods and forms of management of municipal property.

Another issue in the effective management of municipal property is the relationship between the size of local units (municipalities) and the efficiency of their operations, which has long been an open problem in shaping the development of local self-government. Several foreign empirical research studies, namely Christoffersen & Larsen (2007, pp. 77–80) and Moisio (2001, pp. 2–15), have shown a significant relationship (correlation) between the size of the municipality, measured by the number of inhabitants, and indicators of the economic condition of municipalities. Since municipalities are the largest providers of public services, some approaches from micro-economic theory can be applied to them when analyzing their economic efficiency, such as the concept of economies of scale, which is based on the assumption that if there are fixed costs in the budget of municipalities, their average costs tend to decrease with increasing population (Šebová, 2011, pp. 107–108). Thus, the efficiency of municipalities is expressed by a decreasing cost function. Frequent examples from practice point to the fact that small municipalities with inadequate properties often underperform their tasks and are essentially limited to performing only the basic functions of local government. This is confirmed by Binek (2008,

pp. 32–35), who states that the smallest municipalities in the Czech Republic try to keep their land and flats and, on the contrary, sell the shares. The medium-sized municipalities sell land and flats, and also keep only a few shares. The large municipalities get rid of land, do not sell flats, and also sell shares. Kaganova & Kopanyi (2014, pp. 276–290) note that local self-governments control large portfolios of physical property, which usually contain the largest share of local public wealth, and are managed by these governments on behalf of local taxpayers and residents. In many countries, municipalities are not only owners but also managers of property. They control a large number of such properties, including public buildings, infrastructure facilities, schools, healthcare facilities, social housing and surrounding land. It is therefore necessary to optimize municipal property portfolios. Currently, only about 25% of large European cities are able to provide data on the size and value of their managed property (Deloitte Real Estate Group, 2011, pp. 1–5). Local authorities have already found that being a property manager not only allows them to reduce costs, but also helps them to address social and developmental problems, as well as problems related to urban sprawl (Halfawy, 2008, pp. 216–221). Shkilnyak (2018, pp. 96–100) states that municipalities must constantly monitor and manage the process of not only the movement but also the functioning of municipal property, regardless of its nature and purpose. The result of such work should be the establishment of a property register. In practice, however, the vast majority of local authorities do not keep such records of municipal property. FAO (2007, pp. 1–8) confirms that municipal property is often mismanaged and that there are many problems associated with the management of this type of property. Some of the authorities responsible for their management do not even know what income they have from the property or what rights they have over the property. A typical problem associated with property management is therefore a lack of relevant information. Stattev et al. (2012, pp. 24–36) consider municipal property as a key element and driver of change in local self-government, and one which is fundamentally linked to municipal policy aimed at creating targeted and sustainable strategic development, shaping high living standards, increasing the well-being of the population, improving the quality of public services, and maintaining and creating a functional environment and quality infrastructure. In addition to its primary role of providing community services, municipal property can also create employment opportunities. In addition, it can be a catalyst for the further economic and social development of the territory. According to Matushevskaya & Kuzminova (2020, pp. 78–81), evaluating the efficiency of municipal property is an acute problem, especially given the imperfection of the system of legal regulation of the management of municipal property, as well as the conflict of interests of the local authorities that have it at their disposal. Therefore, they consider it expedient to distinguish several types (criteria) of evaluation when assessing the results: target efficiency (objectives/actual needs); performance efficiency (results achieved/objectives set); and overall efficiency (results achieved/actual needs).

The innovative approach assumes the existence of an effective local self-government system. This can be achieved by certifying the activities of municipal authorities under quality-management models, which will promote: improving the level and quality of life of residents; serving as a tool for introducing innovation and investment in the municipal economy; streamlining administrative work; increasing the performance of municipal property; reducing administrative costs of the management system, etc. (Prigozhin, 2018, pp. 1–5). However, Fiľa et al. (2020, pp. 267–274) and Schulte & Ecke (2006, pp. 231–240) point to an important distinction between corporate governance and public governance, as public administration is guided by the public interest and the constitutionality of its roles. Municipalities are, on the one hand, holders of hereditary property; on the other hand, they are confronted with an acute shortage of local revenues. As a result, municipalities have useful tools at their disposal for managing public property, as well as valuable information on the true value of property (Constantin et al., 2018, pp. 122–139). Nevertheless, in transitional and developing countries, local property management is non-existent or in its infancy, and management decisions continue to be made in a non-strategic way, and in an ad hoc manner (Benešová & Smutka, 2016, pp. 31–35; Benešová et al., 2019, pp. 736–741). This is confirmed by Golova (2014, pp. 218–225), who notes that local self-governments do not currently demonstrate any innovative approaches to the management of municipal property. However, the creation of a strategic portfolio of municipal real estate is necessary for the good functioning and development of the territory (Stattev et al., 2012, pp. 24–36). However, according to Constantin et al. (2011, pp. 436-437; 2018, pp. 122-139) in practice, we find that public real estate in cities is owned and managed by different agencies and possibly different levels of government. At the local level, there are various departments of self-government that control public property, and there are also several public agencies that own the property. Based on this con-text, it can be noted that local public property in one city can be divided between different portfolio managers. It is worth noting that municipal real estate management focuses on some specific types of property rather than all local public property. According to Jencova et al. (2016, pp. 569–571), the indicators should be measurable and clearly defined, including during the reference period, so that the required comparisons can be made on the basis of the information provided. It is therefore necessary to ensure that the selected performance indicators provide as comprehensive a picture of quality or efficiency as possible (not a partial one), and one which does not present potentially misleading information (Markic, 2014, pp. 22–26). Propper & Wilson (2003, pp. 250–260) note that good indicators should have two characteristics: they are theoretically sound and accurately represent reality, and they are robust to limitations in the underlying data. Delorme & Chatelain (2011, pp. 1–5) note that the quality indicators should be: cost-effective, timely, reliable, valid and concrete. Performance indicators should follow the SMART principle (Vojtech et al., 2019, pp. 597–601). However, experience has often shown that the selec-

tion of performance indicators is largely guided by the criterion of availability of the required data (Shan Wu & Jung-Cheng Chen, 2014, pp. 565–575). However, the current way of evaluating effectiveness needs to be complemented by a social effectiveness evaluation; however, in theory and practice, such an evaluation is still poorly developed (Markwart, 2018, pp. 22–31).

Effective management of municipal property becomes a tool for increasing the competitiveness of cities. According to Činčikaitė & Meidutė-Kavaliauskienė (2022, pp. 1–15), it is important to perceive the competitiveness of cities as a change in the competitive position over time, and in relation to other cities in the national and international urban system. According to Kitson et al. (2004, pp. 991–995), it is possible to define regional and urban competitiveness simply as the success with which regions and cities compete with each other in some way. This can be acquiring shares in (national and especially international) export markets, or it can be attracting capital or workers to the territory (Levicky et al., 2019, pp. 20–25). The overall competitiveness of a city is multidimensional and multi-layered. It is a manifestation of the economic strength of the city. The overall competitiveness of a city refers to its ability to compete for regional and international resources through the integrated use of its own economic, social, environmental and cultural resources. It is a reflection of the overall development of the city in areas such as the economy, society and environment. Overall competitiveness also reveals the city's ability to exchange and accumulate goods, energy and information from the outside environment. It also reflects the city's capacity for manufacturing, commerce, technological innovation and social progress, and its ability to influence the external environment (China Institute of City Competitiveness, 2013, pp. 2–5). And it is property as its own economic resource that becomes an important part of the competitiveness of cities. Municipal property consists of things owned by the city that are primarily immovable (land, buildings, and individual components of the technical infrastructure), and it is this property that significantly affects the development of cities. City infrastructure is a necessary precondition for city development, and its use creates positive impacts on the city's economy, society and environment (Sun & Cui, 2018, pp. 1–10). City infrastructure also affects the creation of new jobs, which increases the level of employment in the city and thus disposable income (Albiman & Sulong, 2017, pp. 555–561). Recently, less tangible determinants of competitiveness (such as human capital, areas of competence, responsiveness, intelligence, etc.) have increasingly come to the fore; these are the most important areas in light of the opportunities and peculiarities offered by globalization (Činčikaitė & Meidutė-Kavaliauskienė, 2022, pp. 1–15). This is also confirmed by (van den Berg & van der Meer, 2014, pp. 1–5), who state that cities, as the main sources of human and material resources, support their own competitiveness and innovation. Regardless of what types of cities are involved, competitiveness- and innovation-oriented policies can hardly be imagined without the significant participation of cities as "engines" within regions and nations. Competitive countries have competitive

cities, i.e., cities with a dynamic ability to grow and develop over time and that nurture and attract jobs, people and skills (van Winden & Carvalho, 2008, pp. 203–210).

Competitiveness is no longer just a macroeconomic phenomenon. It has also acquired key importance at the regional and local levels (Bicekova et al., 2015, pp. 76–80). Interest in the "competitive performance" of individual regions and cities has grown in government circles, through the identification of key determinants of regional and city competitiveness, and the proposing of policies to support these determinants. In the United Kingdom, for example, the question of increasing the competitiveness of cities and regions has become a central topic for the Ministry of Finance (Kitson et al., 2004, pp. 991–995).

3. Methods

A system of special indicators needs to be developed to monitor and evaluate the property of the municipality. Using this system, the municipality implements a property management program that has two key objectives: to identify opportunities to maximize the value or benefit of the property; and to identify potential problems in the use of municipal property (Constantin et al., 2018). One such system is FAMA (Financial and Property Management Analysis), which works with a number of indicators and has proven itself as an analytical approach for the design of urban and municipal development programmes (Peková et al., 2019). This approach aims to use a broader and more comprehensive concept of socio-economic development than the standard financial analysis, working with 22 indicators, including, for example, the coefficient of investment share, gross savings, and the coefficient of self-sufficiency rate. This group of indicators also includes indicators related to the municipality's property, which we are also working with in this research:

- A1 — property value per capita in EUR;
- A2 — value of tangible fixed property per capita in EUR;
- A3 — land value per capita in EUR;
- A4 — value of buildings per capita in EUR.

The aim of this paper is to look at the competitiveness of regional cities through the evaluation of property use in Slovakia and the Czech Republic, in the time series 2000–2019 and on the basis of selected indicators.

The database of data for regional towns in Slovakia is obtained from the Datacentre, an independent budgetary organisation of the Ministry of Finance of the Slovak Republic. Data for Czech regional cities were obtained from the Monitor portal, a specialised information system of the Ministry of Finance of the Czech Republic. Almost 90% of the total value of city property is long-term intangible property (mainly buildings). Increasing the value of this group of property is very demanding for cities from a financial and time point of view. Cities increase the value of such property primarily through its modernization and reconstruction, which usually takes several years, and thus we

chose a relatively long time series (2000–2019) so that the research could reflect on these changes. The years 2020 and 2021 were marked by the COVID-19 pandemic, when municipalities had to immediately deal with a situation that arose for which they were not prepared; in this period services for residents came to the fore rather than property valuation, which also affected the availability of data. All analyses are processed in MS Office Excel, Statistica 13.4 and Statgraphics XVIII.

The research is based on two methodological approaches, namely the regression model and multi-criteria analysis, which are complemented by selected moment characteristics and correlation analysis in the form of Kendall's coefficient.

The purpose of the regression model is to identify the unilateral relationship (covariance) between the dependent and independent variable, i.e., to identify the change in the dependent variable as a function of the change in the independent variable. For the purpose of our research, the independent variable is the population of the regional city. The dependent variable is the value of property efficiency indicators, i.e., indicators A1, A2, A3 and A4 in turn. Using the Ordinary Least Squares (OLS) method, used in the research studies Baillie & Kim (2018), Bergantino et al. (2020), Oberfichtner & Tauchmann (2021) and others, the predictive power of the regression model is expressed through the coefficient of determination:

$$R^2 = \frac{\sum_{i=1}^{n}\left(y_i - \hat{y}_i\right)^2}{\sum_{i=1}^{n}\left(y_i - \overline{y}_i\right)^2}, \tag{1}$$

where:

y_i — measured value of the dependent variable;

$\hat{y}_i$ — estimated value of the dependent variable;

$\overline{y}_i$ — average value of the dependent variable.

The intention in using the regression model is to identify observations (regional cities) that differ in their values for individual indicators of property efficiency, or are out of line with the others (without regard to the nature of the deviation).

In the regression model, only one indicator of property efficiency is worked with at a time. Multi-criteria analysis allows working with all four indicators simultaneously, and the TOPSIS method is used for this purpose.

According to Zavadskas et al. (2016), the method is frequently used and represents an alternative to methods such as Elimination and Choice Expressing the Reality (ELECTRE), Vlse Kriterijumska Optimizacija Kompromisno Resenje (VIKOR), and the Preference Ranking Organization Method for Enrichment Evaluations (PROMETHE). An overview of the use of this method is offered by Tramarico et al. (2015), while its selection is supported by its previous use in solving similar problems. Its use can be found in a variety of fields, such as environmental science (Rozentale & Blumberga, 2019; Suharevska &

Blumberga, 2019), transport (Djordjević & Krmac, 2019; James et al., 2021), and management (de Lima & Gomes, 2022). It is used in connection with the assessment of towns and cities, for example in Vavrek et al. (2015). For the purpose of multi-criteria analysis using the four indicators of property evaluation, these indicators are considered equivalent, i.e., their weight is the same (Vavrek, 2019). This method has also been implemented more deeply in many previous research studies (see Seyedmohammadi et al., 2018; Vavrek & Bečica, 2022), and is calculated as follows:

$$D=\begin{pmatrix} & X_1 & X_2\ldots & X_j\ldots & X_n \\ A_1 & x_{11} & x_{12}\ldots & x_{1j}\ldots & x_{1n} \\ A_2 & x_{21} & x_{22}\ldots & x_{2j}\ldots & x_{2n} \\ : & : & : & : & : \\ A_i & x_{i1} & x_{i2}\ldots & x_{ij}\ldots & x_{in} \\ : & : & : & : & : \\ A_m & x_{m1} & x_{m2}\ldots & x_{mj}\ldots & x_{mn} \end{pmatrix}, \tag{2}$$

where:

A_i — i-th alternative;

x_{ij} — value of the j-th criteria, which was achieved by the i-th alternative;

In the next step this matrix is standardised using the formula:

$$r_{ij}=x_{ij}\Big/\sum\nolimits_{j=1}^{j}x_{ij}^2, \tag{3}$$

where:

r_{ij} — standardised value of the j-th criterion;

x_{ij} — value of the j-th criterion, which was achieved by the i-th alternative.

The acquired data matrix is multiplied by the weights of the relevant criteria using the formula:

$$v_{ij}=w_{ij}r_{ij}, \tag{4}$$

where:

v_{ij} — weighted standardised value;

w_{ij} — weight of the criterion.

$$H_j=max\left(w_{ij}\right),D_j=min\left(w_{ij}\right), \tag{5}$$

where:

H_j — Positive Ideal Solution (PIS);

D_j — Negative Ideal Solution (NIS).

The distance from the PIS and NIS acquired in this manner is calculated according to:

$$d_i^+=\left[\sum\nolimits_{j=1}^{k}\left(w_{ij}-H_j\right)^2\right]^{1/2},d_i^-=\left[\sum\nolimits_{j=1}^{k}\left(w_{ij}-D_j\right)^2\right]^{1/2}, \tag{6}$$

where:

d^+ — distance from PIS;

d^- — distance from NIS.

The key criterion according to which the order of alternatives is arranged is represented by the relative distance from (nearness to) PIS, which takes both identified distances from the previous step into consideration by means of the formula given below.

$$c_i = \frac{d_i^-}{d_i^- + d_i^+}, \quad (7)$$

where:

c_i — relative distance from PIS.

Based on different national legislative conditions in each country our research hypothesis (H1) is set as follows: We assume that the results of the multi-criteria evaluation of cities in the Czech Republic and Slovakia using the TOPSIS technique will be different.

4. Results

Cox (2007) identifies the reputation of the community as an overlooked strategic resource, with community property, represented primarily by municipal buildings, representing the image of the community and therefore contributing significantly to its reputation. In this context we evaluated, for a 10-year period (2010–2019), the total value of the property as well as the most important components of the property — tangible fixed property, land and buildings. However, the main focus is on the analysis of the first (2010) and last (2019) years of this period, with only partial illustrations of changes over this period, as no significant year-on-year changes were identified. Slovak regional cities (4.1.) and Czech regional cities (4.2.) were evaluated separately. The last part of this chapter is a multi-criteria evaluation of the 10 years and a comparison of the results obtained (4.3.).

4.1. Evaluation of property in regional cities of the Slovak Republic

We evaluated the property through four indicators; the basic parameters of these indicators are captured in Table 1. In terms of absolute values, it is not possible to generalise changes to each of these indicators. Increases in conjunction with narrowing gaps are observed for the value of property per capita (A1) and the value of buildings (A4). For the other two indicators, the change in skewness, i.e., the decline in the absolute level in the majority of cities, is interesting (the number of cities with below-average results increases).

Looking at the level of individual indicators in 2010, we can identify Bratislava and Košice as significantly undercapitalised, with insufficient total property value and insufficient value of tangible fixed property, land and buildings,

respectively, due to their populations. However, it is argued that in practice there may also be an underestimation of the fair value of property due to the basis of valuation. Although local self-governments are required to report the "book value" of property for capital accounting purposes, the author argues that this is a reflection of the replacement cost of buildings and not their true market value. On the other hand, the city with the highest property efficiency is Žilina, which, with the exception of land (A3), has the highest total property value. Together with Trenčín, these were the only two regional cities whose results for each of the assessed indicators can be described as "overestimated". Carpenter et al. (2006) state that a good building, well-designed and maintained, can attract people and business, acting as a catalyst for regeneration and civic pride; but conversely, poorly designed and maintained buildings can drive people and businesses away, with consequent implications for the prosperity of an area. Given the lowest deviations from the regression model, Prešov or Nitra can be considered ideal 'middle' representatives (see Chart 1).

After 10 years, the situation of the two largest cities in Slovakia did not change; their undercapitalisation still persisted for all monitored indicators. Similarly, the dominance of Žilina persisted, which in both cases may point to considerable passivity in the management of urban property. Constantin et al. (2011) note that in order to increase activity in the area of city property management, it is possible to lease property, especially land, to the private sector. When land is used only by the city, the expenditure is usually higher than the income; the only situation in which the city can capitalise land at a higher value is when it is leased to the private sector. As for the disposal of immovable property, typical methods for this are the sale and privatisation of surplus land and property to private entities, which entails high revenues. However, under the conditions of Slovak cities, under Act No 138/1991 Coll., the city is obliged to improve, protect and valorise the city property. In practice, this means that cities sell property only in very exceptional cases such as those that are "dubious" for the city, which means that the city is unable to use it in any other way. Žilina and Trenčín are joined by Trnava — for 2019 we identified three regional cities with positive deviations for all four indicators of property. The changes in the other cities are individual, with no significant impact on their position in the context of the evaluation of regional cities as a group (see Chart 2).

The results for Slovak regional cities showed the persistence of the volume of property per capita across the 10 years. The amount of property managed by regional cities is increasing. However, the proportions are changing, with this volume of property rising for individuals, which means that an increasingly large group is being labelled as below average. The state of overcapitalisation (Žilina) or undercapitalisation persists.

4.2. Evaluation of property in regional cities of the Czech Republic

Similarly to Slovak cities, the property of Czech regional cities was to be evaluated through four indicators, with their basic parameters captured in Table 2. Indicators A1 and A3 can be described as stagnant with minimal changes over the analysed 10 years. In the case of tangible fixed property and buildings (A2, A4), there is an obvious decline, which is accompanied by a more pronounced dominance of one city or a smaller number of regional cities.

In the Czech Republic, minimal differences can be noted between most regional cities in 2010. Significantly more dominant results are observed in the case of the capital city Prague as well as the largest cities, namely Brno, Ostrava and Plzeň. The results for all these cities can be described as "overestimated". This dominance of the large cities is undermined by the city of Karlovy Vary, which is "dragged down" only by the value of constructions per capita, see Chart 3.

The dominance of large cities persists across the entire 10 years. For the majority of indicators, the capital city of Prague is dominant, with large regional cities in the foreground. Due to their dominance, up to five regional cities can be classified as undercapitalised in terms of all equity indicators (Olomouc, České Budějovice, Ústí nad Labem, Hradec Králové, Pardubice), see Chart 4.

The results of the regional cities across the 10 years confirm the allocation of property mainly in the capital and the largest cities in the country. The volume of property managed by regional cities is stagnating or declining in the case of tangible fixed property and buildings.

4.3. Multi-criteria analysis and a comparison of the results obtained

A consequence of the multidimensional nature of property under Burns (2002) and Gibson (2001) complicates the measurement of the outcome. They also add that there is no simple, single or consistent way of measuring immovable property that can be used for all types of immovable property and for all organisations. One of the reason for this is that different organisations may place more emphasis on one dimension of property over others. Jolicoeur & Barret (2004) add that property management at the local level is of increasing importance, as municipalities face declining budgets but increasing liabilities for property maintenance, as well as the need to provide appropriate facilities for public services. We have therefore decided to look at property from the perspective of more than just single indicators. In order to consider the overall property evaluation when considering all four indicators simultaneously, the MW-TOPSIS method was used, the results of which are captured in Chart 5 and Chart 6.

In the time period of 2010–2019, we can say that Žilina is the absolute leader, having been ranked first every time, while since 2012 its relative distance to the PIS alternative was 1, i.e., it was the absolute leader. On the other hand, until 2015 the city with the lowest amount of property was Nitra, which

was later replaced by Trenčín. In the case of Slovak regional cities, the number of "overestimated" property indicators does not correlate linearly with the results of the multi-criteria analysis (r_K=–0.063; p=0.500).

In the Czech Republic, based on the multi-criteria analysis, the capital city of Prague is the leader, followed by a group of dominant large cities. In the case of other regional cities, with the exception of Karlovy Vary, the differences are minimal and their use of property can be described as balanced. Nevertheless, a statistically significant linear correlation of these results with the number of "overestimated" property indicators was confirmed (r_K=–0.904). p<0.01).

5. Conclusion

Within the framework of the decentralisation of public administration in the Czech Republic and Slovak Republic, there has been a large transfer not only of competences from the level of state administration to local self-government, but also of the property through which these competences are ensured. At the same time, inhabitants themselves are constantly demanding the greater accountability and transparency of elected representatives in relation to municipal property. This is ultimately reflected in the management and overall value of municipal property. However, it should be noted that, although local authorities are constrained by legislation in the management of their property, it is ultimately the decision of the councillors as to how they manage own property. This is confirmed by the results of the analyses, which show that there are significant differences in the evaluation of the capital cities of the Slovak Republic and the Czech Republic. While Prague, as the capital of the Czech Republic, can be described as overcapitalised in terms of each of the four indicators of property, Bratislava, as the capital of Slovakia, is undercapitalised with respect to the number of inhabitants. At the same time, in the Czech Republic we observe a significant dominance of large cities, while the results for the other cities do not show significant differences.

Differences in the management of city property in the two extremes were also reflected in the efficiency of property use. Property use efficiency in Slovak regional cities is more dependent on the number of inhabitants than in Czechia, i.e., the efficiency of property use in regional cities improves significantly with an increase in the number of inhabitants in Slovakia. At the same time, the number of "overestimated" property indicators predicts better results of the multi-criteria analysis only in the case of regional cities in Czechia. In terms of the volume of property, we observe an increase only in the case of Slovak regional cities. Czech regional cities experienced stagnation or decline in the volume of property. Based on these results, the research hypothesis no. 1 is confirmed.

The limiting factor of our research is the regional focus only on regional cities within two EU countries; however, this is related to the unavailability of data for individual cities and municipalities, not only at the level of the analyzed countries, but also at the level of countries within the EU. Closely related to this is

the relatively limited amount of research in this area. Nevertheless, even in this relatively small sample of regional cities, we pointed out that it is also possible to evaluate the use of property as a competitive tool on the basis of adjusted indicators used in the private sector.

The research method brings a new perspective on the possibilities of evaluating the use of property at the local level. In the current time period, not only for cities but also for municipalities, methods of assessing not only property, but its competitiveness in general, are absent. Benchmarking or selected indicators of financial analysis are rarely used; however, these are applicable only in the analysis of property intended for business. Property significantly affects the competitiveness of cities, because through it, cities can create an environment for entrepreneurs, the consequence of which is the socio-economic development of the territory. Another reason the methods are not used is the set way of financing Slovak and Czech local self-governments. In both countries, local self-government is mainly financed by the state through transfers from the state budget, and municipalities can only generate 10% of their income, on average, from the use of property. However, in the current period of the energy crisis, municipalities and cities have begun to take a more responsible approach to their property and are beginning to think more about its efficient use. For cities and municipalities, one priority is to ensure the economic stability and prosperity of the territory; property, as an important endogenous source of its development, represents one of the tools for accomplishing this.

Further research activities in this area will focus on evaluating the use of property in the context of the revenues it generates that go toward city budgets, and on the impact it is experiencing from the management of the refugee crisis, with regional cities providing accommodation and life support for people from Ukraine after the attack on 24 February 2022. The Slovak Republic and the Czech Republic, together with Poland, Romania and Hungary, as EU countries that border Ukraine, are involved in providing support for people from Ukraine.

References

Albiman, M. M., & Sulong, Z. (2017). The linear and non-linear impacts of ICT on economic growth, of disaggregate income groups within SSA Region. *Telecommunications Policy*, 41(7–8), 555–572. https://doi.org/10.1016/J.TELPOL.2017.07.007.

Anh Vu, T., Plimmer, G., Berman, E., & Ha, P.N. (2021). Performance management in the Vietnam public sector: the role of institution, traditional culture and leadership. *International Journal of Public Administration*, 45(1), 49–63. https://doi.org/10.1080/01900692.2021.1903499.

Baillie, R.T., & Kim, K.H. (2018). Choices between OLS with robust inference and feasible GLS in time series regressions. *Economics Letters*, 171, 218–221. https://doi.org/10.1016/J.ECONLET.2018.07.036.

Balasubramanian, S., Al-Ahbabi, S., & Sreejith, S. (2019). Knowledge management processes and performance: the impact of ownership of public sector organizations. *International Journal of Public Sector Management*, 33(1), 1–21. https://doi.org/10.1108/IJPSM-05-2019-0131.

Benešová, I., & Smutka, L. (2016). The post-Soviet countries: development and structure of economy: is there any potential for future regional integration. *Procedia: Social and Behavioral Sciences*, 220, 30–39. https://doi.org/10.1016/J.SBSPRO.2016.05.466.

Benešová, I., Smutka, L., & Laputková, A. (2019). Specifics of the mutual trade of the post-Soviet countries. *Entrepreneurial Business and Economics Review*, 7(1), 29–43. https://doi.org/10.15678/EBER.2019.070102.

Bercu, A.-M., & Vatamanu, A.-F. (2019). The performance paradox in the public sector in EU member states: key facts and challenges. *Journal of Public Administration, Finance & Law*, (16), 25–34.

Bergantino, A.S., Di Liddo, G., & Porcelli, F. (2020). Regression-based measure of urban sprawl for Italian municipalities using DMSP-OLS night-time light images and economic data. *Applied Economics*, 52(38), 4213–4222. https://doi.org/10.1080/00036846.2020.1733475.

Bicekova, A., Mihokova, L., & Andrejovska, A. (2015). Revenue analysis of self-governing regions in the Slovak Republic. In P. Nijkamp, K. Kourtit, M. Bucek, & O. Hudec (Eds.), *Proceedings of the 5th Central European Conference in Regional Science* (76–87). Technical University of Košice Košice.

Binek, J. (2008). *Hospodaření s majetkem obcí* [Bachelor thesis, Masaryk University]. The Information System of Masaryk University.

Burns, P. (2002). Implementing strategic asset management. In APWA international public works congress, NRCC/CPWA/IPWEA "Innovations in urban infrastructure", *Strategic asset management: implementation issues*, 1–12.

Carpenter, A., Corrigan, M. B., Levitt, R. L., & Stephen, P. (2006). T*en principles for creating value from local government property*. Retrieved 06.09.2022 from https://knowledge.uli.org/-/media/files/research-reports/2006/tenprinciplesforcreatingvaluefromlocalgovernmentproperty.pdf?rev=1b0eb63fad224b5b9dba8446828b32b8.

China Institute of City Competitiveness. (2013). *Yearbook of China city competitiveness 2012* (English). Enrich Professional Publishing.

Christoffersen, H., & Larsen, K.B. (2007). Economies of scale in Danish municipalities: expenditure effect versus quality effects. *Local Government Studies*, 33(1), 77–95. https://doi.org/10.1080/03003930601081283.

Činčikaitė, R., & Meidutė-Kavaliauskienė, I. (2022). An integrated assessment of the competitiveness of a sustainable city within the context of the COVID-19 impact. *Sustainability*, 14(13), 7575. https://doi.org/10.3390/SU14137575.

Constantin, D-L., Dragusin, M., Iosif, A.E., & Petrescu, R.M. (2011). The effective municipal property management in south-east European cities: recording issues, the case of Bucharest municipality. *Journal of Academic Research in Economics*, 3(3), 434–444.

Constantin, D-L., Mitrut, C., Mariana Grosu, R., Profiroiu, M., & Iosif, A.E. (2018). Municipal real properties and the challenges of new public management: a spotlight on Romania. *International Review of Administrative Sciences*, 84(1), 122–143. https://doi.org/10.1177/0020852315596212.

Cox, D. (2007). *Strategic asset management: cutting the Gordian knot*. Workshop at conference Creating value through public sector asset management: the key success factors.

de Lima, Y., & Gomes, L.F.A. (2022). A new hybrid method for selecting the best project manager: TODIM-FSE and behavioral TOPSIS. *Journal of Project Management*, 7, 13–22. https://doi.org/10.5267/j.jpm.2021.8.001.

Deloitte Real Estate Group. (2011). *Comparing public real estate management in European cities*. Retrieved 06.09.2022 from https://www.mondaq.com/uk/market-commentaries/156662/comparing-public-real-estate-management-in-european-cities.

Delorme, P., & Chatelain, O. (2011). *The role and use of performance measurement indicators*. Retrieved 06.09.2022 from https://europa.eu/capacity4dev/file/7788/download?token=Qxw3ARAz.

Dima, A.M., Begu, L., Vasilescu, M.D., & Maassen, M.A. (2018). The relationship between the knowledge economy and global competitiveness in the European Union. *Sustainability*, 10(6), 1706. https://doi.org/10.3390/SU10061706.

Djordjević, B., & Krmac, E. (2019). Evaluation of energy-environment efficiency of European transport sectors: non-radial DEA and TOPSIS approach. *Energies*, 12(15), 2907. https://doi.org/10.3390/EN12152907.

FAO. (2007). *Good governance in land tenure and administration land tenure studies*. Retrieved 06.09.2022 from http://www.fao.org/3/a-a1179e.pdf.

Fiľa, M., Levicky, M., Mura, L., Maros, M., & Korenkova, M. (2020). Innovations for business management: motivation and barriers. *Marketing and Management of Innovations*, 4, 266–278. https://doi.org/10.21272/MMI.2020.4-22.

Gavriluță (Vatamanu), A.F., Onofrei, M., & Cigu, E. (2020). Fiscal decentralization and inequality: an analysis on Romanian regions. *Ekonomický Časopis*, 68(1), 3–32.

Gibson, V. (2001). In search of flexibility in corporate real estate portfolios. *Journal of Corporate Real Estate*, 3(1), 38–45. https://doi.org/10.1108/14630010110811472.

Golova I.M. (2014). Substantiation the strategic priorities of innovation regional development security. *Economy of Region*, 3, 218–232.

Halfawy, M.R. (2008). Integration of municipal infrastructure asset management processes: challenges and solutions. *Journal of Computing in Civil Engineering*, 22(3), 216–229. https://doi.org/10.1061/(asce)0887-3801(2008)22:3(216).

Jahanshahi, A.A., & Bhattacharjee, A. (2020). Competitiveness improvement in public sector organizations: what they need. *Journal of Public Affairs*, 20(2), 1–10. https://doi.org/10.1002/pa.2011.

James, A.T., Vaidya, D., Sodawala, M., & Verma, S. (2021). Selection of bus chassis for large fleet operators in India: an AHP-TOPSIS approach. *Expert Systems with Applications*, 186, 115760. https://doi.org/10.1016/J.ESWA.2021.115760.

Jencova, S., Ali Taha, V., Sirkova, M., & Tej, J. (2016). Risk management and risk quantification tools: focusing on Slovak enterprises. In *Proceedings of the 3rd International Multidisciplinary Scientific Conference on Social Sciences and Arts SGEM2016* (pp. 569–576). SGEM. https://doi.org/10.5593/SGEMSOCIAL2016/B25/S07.074.

Jolicoeur, P., & Barret, M. (2004). Coming of age: strategic asset management in the municipal sector. *Journal of Facilities Management*, 3(1), 41–52. https://doi.org/10.1108/14725960510808383.

Kaganova, O., & Kopanyi, M. (2014). Managing local assets. In C.D. Farvacque-Vitkovic, & M. Kopanyi (Eds.), *Municipal finances: a handbook for local governments* (pp. 275–324). The World Bank. https://doi.org/10.1596/978-0-8213-9830-2_ch6.

Kikuchi, Y., Teshima, K., & Yoshino, K. (2022). The financialization of real estate in Japan: the formation of a core–periphery structure. *Regional Studies*, 56(1), 128–139.https://doi.org/10.1080/00343404.2021.1906409/SUPPL_FILE/CRES_A_1906409_SM2766.PDF.

Kitson, M., Martinf, R., & Tyler, P. (2004). Regional competitiveness: an elusive yet key concept. *Regional Studies*, 38(9), 991–999. https://doi.org/10.1080/0034340042000320816.

Levicky, M., Urbanikova, M., Hudakova, J., Maros, M., & Stubnova, M. (2019). Convergence tendencies in the conditions of regions of the Slovak Republic. In V. Klimova, & V. Zitek (Eds.), *22nd International Colloquium On Regional Sciences* (pp. 20–27). Masaryk University Press. https://doi.org/10.5817/CZ.MUNI.P210-9268-2019-2.

Lichiello, P., & Turnock, J. B. (2022). *Guidebook for performance measurement*. Retrieved 06.09.2022 from http://www.phf.org/resourcestools/Documents/pmcguidebook.pdf.

Luna-Arocas, R., & Lara, F.J. (2020). Talent management, affective organizational commitment and service performance in local government. *International Journal of Environmental Research and Public Health*, 17(13), 4827. https://doi.org/10.3390/ijerph17134827.

Markic, D. (2014). A review on the use of performance indicators in the public sector. *TEM Journal*, 3(1), 22–28.

Markwart, E. (2018). The effectiveness of public property management: concept, approaches, criteria. *Property Relations in the Russian Federation*, 2(197), 22–34.

Matushevskaya, E.A., & Kuzminova, A.N. (2020). Management efficiency of state and municipal property at the level of a constituent entity of the Russian Federation. *Vestnik Universiteta*, 4, 77–85. https://doi.org/10.26425/1816-4277-2020-4-77-85.

Mihaliková, E., Sedláková, S., Guzyová, K., & Čisárik, P. (2011). *Finančná situácia a výkonnosť v samospráve*. Pavol Jozef Šafárik University in Kosice.

Moisio, A. (2001). On local government spending and taxation behaviour: effect of population size and economic condition. *ERSA Conference Papers*, ersa01p170, 1023.

Oberfichtner, M., & Tauchmann, H. (2021). Stacked linear regression analysis to facilitate testing of hypotheses across OLS Regressions. *The Stata Journal: Promoting Communications on Statistics and Stata*, 21(2), 411–429. https://doi.org/10.1177/1536867X211025801.

Ohemeng, F.L.K., Amoako-Asiedu, E., & Obuobisa-Darko, T. (2018). The impact of employee perception on the successful institutionalisation and implementation of performance management systems in developing countries: the perspective from Ghana's public service. *Public Administration and Development*, 38(2), 75–86. https://doi.org/10.1002/PAD.1823.

Orszaghova, D., Horvathova, J., & Greganova, R.H. (2017). Selected professional competences of future managers. In I. Kosiciarova, & Z. Kadekova, (Eds.), *Managerial trends in the development of enterprises in globalization era* (pp. 408–414). Slovak University of Agriculture in Nitra.

Peková, J., Jetmar, M., & Toth, P. (2019). *Veřejný sektor, teorie a praxe v ČR*. Wolters Kluwer.

Postula, M., & Raczkowski, K. (2020). The impact of public finance management on sustainable development and competitiveness in EU member states. *Journal of Competitiveness*, 12(1), 125–144. https://doi.org/10.7441/joc.2020.01.08.

Prigozhin, V. (2018). Author's approach to the formation of an innovative system of the municipal property management. *MATEC Web of Conferences ICRE 2018*, 1–6. https://doi.org/10.1051/matecconf/201821209009.

Propper, C., & Wilson, D. (2003). The use and usefulness of performance measures in the public sector. *Oxford Review of Economic Policy*, 19(2), 250–267.

Rocha, J.A.O., & de Araujo, J.F.F.E. (2007). Administrative reform in Portugal: problems and prospects. *International Review of Administrative Sciences*, 73(4), 583–596. https://doi.org/10.1177/0020852307083461.

Rozentale, L., & Blumberga, D. (2019). Methods to evaluate electricity policy from climate perspective. *Environmental and Climate Technologies*, 23(2), 131–147. https://doi.org/10.2478/RTUECT-2019-0060.

Schulte, K., & Ecke, C. (2006). Public real estate management in Germany: an empirical study. In O Kaganova, & J. McKellar (Eds.), *Managing government property assets: international experiences* (pp. 231–253). Urban Institute Press.

Šebová, M. (2011). Ekonomická efektívnosť v samospráve. *Transfer Inovácií*, 21, 107–109.

Severová, L., Svoboda, R., & Kopecká, L. (2017). Increase in prices of farmland in the Czech Republic. *Property Management*, 35(3), 326–338. https://doi.org/10.1108/PM-07-2016-0036.

Seyedmohammadi, J., Sarmadian, F., Jafarzadeh, A.A., Ghorbani, M.A., & Shahbazi, F. (2018). Application of SAW, TOPSIS and fuzzy TOPSIS models in cultivate on priority planning for maize, rapeseed and soybean crops. *Geoderma*, 310, 178–190. https://doi.org/10.1016/j.geoderma.2017.09.012.

Shan Wu, C., & Jung-Cheng Chen, R. (2014). KPIs (Key Performance Indicators) in Taiwan Basic Education. *Journal of Modern Education Review*, 4(8), 565–578. https://doi.org/10.15341/jmer(2155-7993)/08.04.2014/001.

Shim, D.C., Park, H.H., & Eom, T H. (2016). Public servant leadership: myth or powerful reality. *International Review of Public Administration*, 21(1), 3–20. https://doi.org/10.1080/12294659.2016.1147753.

Shkilnyak, M.M. (2018). The criteria for effective management of the communal property of territorial communities. *Innovative Economy*, 73(1–2), 96–102.

Smentyna, N. (2006). Evaluation of the efficiency of the use of communal property. *Odessa State University of Economics Scientific Bulletin*, 6(26), 9-16.

Špalková, D., Špaček, D., & Nemec, J. (2015). Performance management and performance appraisal: Czech self-governments. *The NISPAcee Journal of Public Administration and Policy*, 8(2), 69–88. https://doi.org/10.1515/nispa-2015-0009.

Šrédl, K., & Mikhalkina, E. (2015). Regional characteristics of agricultural enterprises development in the Czech republic. In L. Čechurová (Ed.). *Opportunities and threats to current business management in cross-border comparison 2015* (pp. 107–115). Verlag der GUC.

Stattev, S., Daskalova, T., Constantin, D.L., Raleva, S., & Goschin, Z. (2012). Development of a comprehensive system for municipal real property classification. *Administration and Public Management*, 19, 17–42.

Štrangfeldová, J., & Štefanišinová, N. (2020). *Hodnotenie výkonnosti verejných služieb*. Matej Bel University.

Suharevska, K., & Blumberga, D. (2019). Progress in renewable energy technologies: innovation potential in Latvia. *Environmental and Climate Technologies*, 23(2), 47–63. https://doi.org/10.2478/RTUECT-2019-0054.

Sun, Y., & Cui, Y. (2018). Analyzing the coupling coordination among economic, social, and environmental benefits of urban infrastructure: case study of four Chinese autonomous municipalities. *Mathematical Problems in Engineering*, 2018, 8280328. https://doi.org/10.1155/2018/8280328.

Tramarico, C.L., Mizuno, D., Salomon, V.A.P., & Marins, F.A.S. (2015). Analytic hierarchy process and supply chain management: a bibliometric study. *Procedia Computer Science*, 55, 441–450. https://doi.org/10.1016/J.PROCS.2015.07.005.

van den Berg, L., & van der Meer, J. (2014). *Cities as engines of sustainable competitiveness: European urban policy in practice*. Routledge.

van Winden, W., & Carvalho, L. (2008). Urban competitiveness in the knowledge economy: evolution paths of the Portuguese metropolises. In T. Yigitcanlar, K. Velibeyoglu, & S. Baum (Eds.), *Knowledge-based urban development: planning and applications in the information era* (pp. 203–220). IGI Global. https://doi.org/10.4018/978-1-59904-720-1.ch012.

Vavrek, R. (2019). Evaluation of the impact of selected weighting methods on the results of the TOPSIS technique. *International Journal of Information Technology & Decision Making*, 18(6), 1821–1843. https://doi.org/10.1142/S021962201950041X.

Vavrek, R., & Bečica, J. (2022). Similarity of TOPSIS results based on criterion variability: case study on public economic. *Plos One*, 17(8), e0271951. https://doi.org/10.1371/journal.pone.0271951.

Vavrek, R., Kotulič, R., & Adamišin, P. (2015). District as a determinant of the evaluation of municipalities' economy. *International Journal of Applied Mathematics and Statistics*, 53(2), 1–13.

Vojtech, F., Levický, M., & Filip, S. (2019). Economic policy for sustainable regional development: a case study of Slovak Republic. *Journal of Security and Sustainability Issues*, 8(4), 597–608. https://doi.org/10.9770/jssi.2019.8.4(4).

Zavadskas, E.K., Mardani, A., Turskis, Z., Jusoh, A., & Nor, K.M. (2016). Development of TOPSIS method to solve complicated decision-making problems: an overview on developments from 2000 to 2015. *International Journal of Information Technology & Decision Making*, 15(3), 645–682. https://doi.org/10.1142/S0219622016300019.

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Appendix

Table 1.
Moment characteristics of the monitored indicators of the regional cities of the Slovak Republic in 2010 and 2019 (in EUR)

	A1		A2		A3		A4	
	2010	2019	2010	2019	2010	2019	2010	2019
average	3761.22	4105.27	2641.12	2787.51	1521.16	1629.24	784.245	1001.92
median	3429.56	3825.23	2660.8	2616.32	1754.05	1725.03	766.74	976.50
standard deviation	953.52	1002.14	433.96	580.29	556.63	546.51	291.19	306.37
coeff. of variation (%)	25.35	24.41	16.43	20.81	36.59	33.54	37.13	30.57
minimum	2926.63	3147.39	1813.27	2252.37	600.32	761.83	399.27	457.03
maximum	5750.12	6003.59	3171.28	3967.56	2027.78	2357.09	1182.80	1416.04
range	2823.49	2856.20	1358.01	1715.19	1427.46	1595.26	783.53	959.01
skewness	1.56	0.98	−0.69	1.29	−0.80	−0.31	0.24	−0.42
kurtosis	2.17	0.28	1.16	1.56	−1.05	−1.12	−1.09	0.17

Source: Own preparation.

Table 2.
Moment characteristics of the monitored indicators of the regional cities of the Czech Republic in 2010 and 2019 (in thousands CZK)

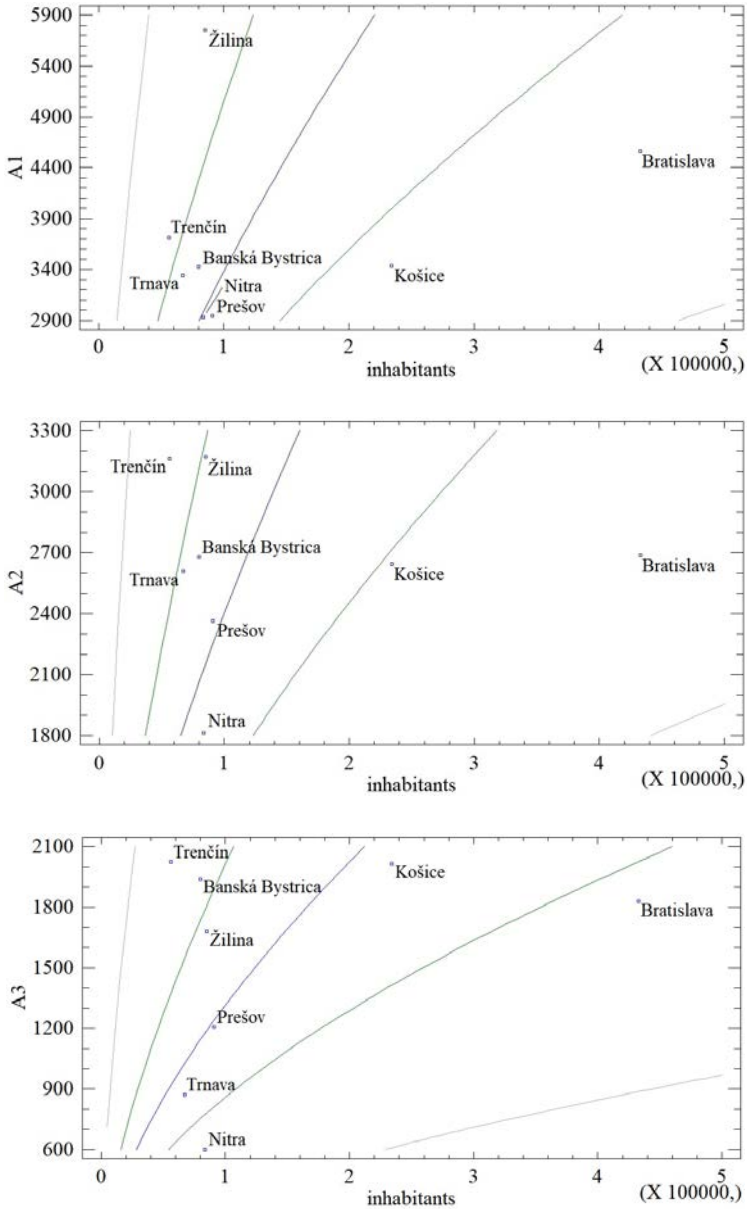
	A1		A2		A3		A4	
	2010	2019	2010	2019	2010	2019	2010	2019
average	119.97	122.57	96.48	88.04	22.07	22.84	63.12	54.30
median	78.62	80.62	63.18	59.34	18.72	19.20	45.92	40.05
standard deviation	78.59	88.82	63.51	61.41	14.94	14.58	41.96	34.43
coeff. of variation (%)	65.51	72.46	65.82	69.75	67.69	63.85	66.47	63.42
minimum	59.17	52.71	46.49	29.47	4.01	4.13	26.35	22.10
maximum	309.02	357.36	248.40	253.60	50.08	46.94	157.42	140.93
range	249.85	304.65	201.91	224.13	46.07	42.81	131.07	118.83
skewness	1.4518	1.79	1.436	1.84	0.51	0.40	1.30	1.55
kurtosis	1.37	3.18	1.29	3.72	−0.84	−1.26	0.60	2.17
Shapiro–Wilk test	0.779*	0.757*	0.781*	0.784*	0.937	0.923	0.802*	0.817*

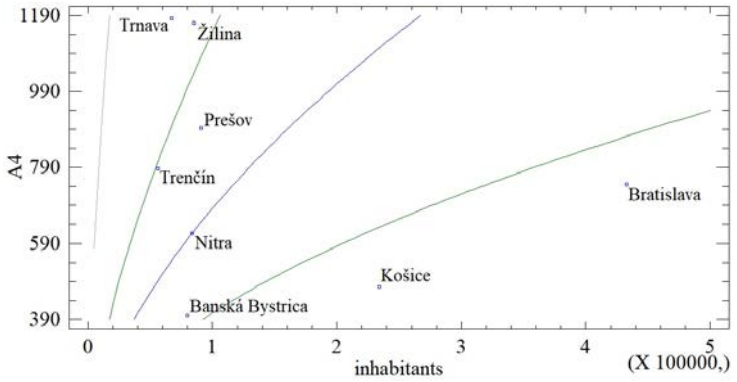
Notes:

At α=0.05 a normal distribution can be rejected.

Source: Own preparation.

Chart 1.
Results of the multiplicative regression model of parameters A1–A4 and the population of regional cities in the Slovak Republic in 2010





Notes:

A1=exp(0.705723*ln(inhabitants))

A2=exp(0.676038*ln(inhabitants))

A3=exp(0.623722*ln(inhabitants))

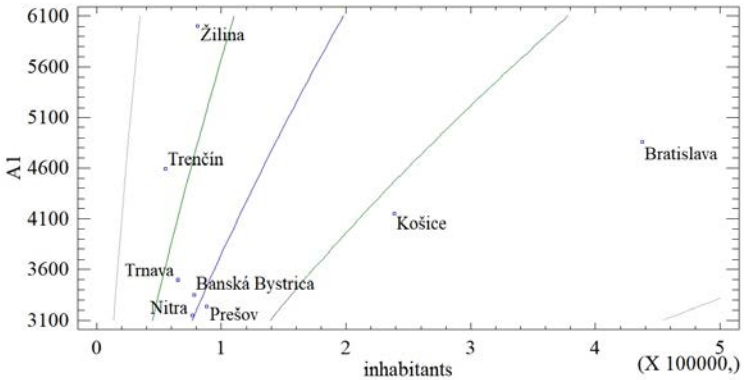
A4=exp(0.566793*ln(inhabitants))

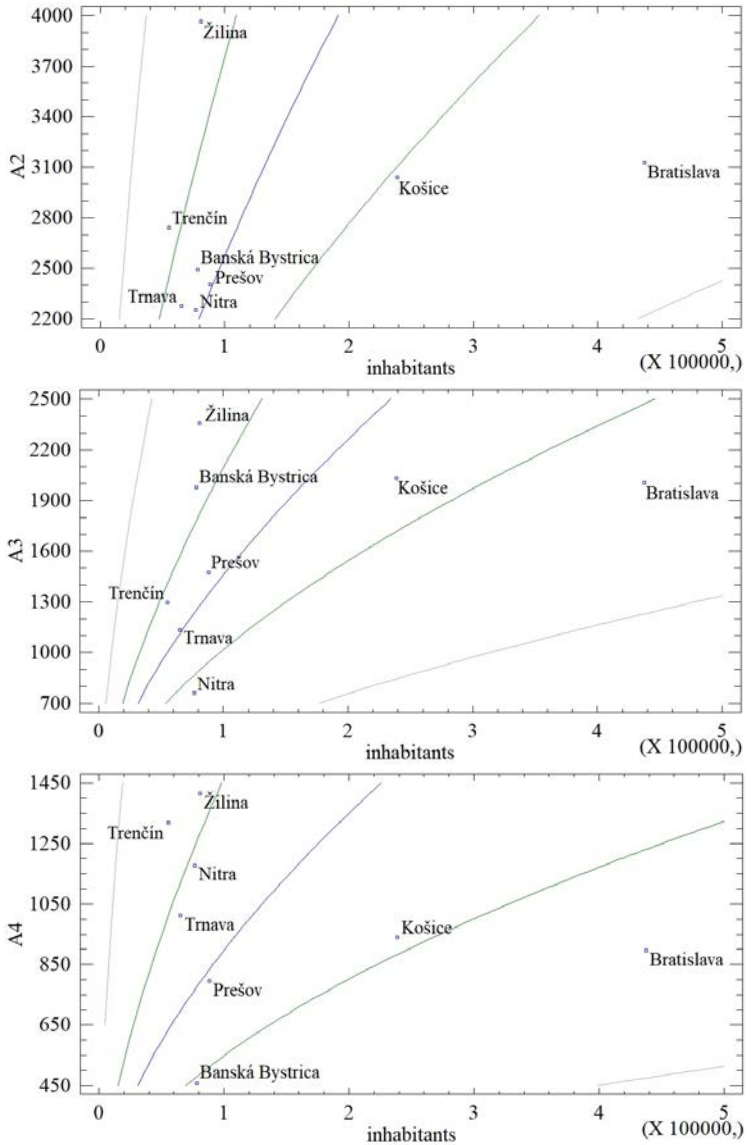
r^2>95%

Source: Own preparation.

Chart 2.

Results of the multiplicative regression model of parameters A1–A4 and the population of regional cities in the Slovak Republic in 2019





Notes:

A1=exp(0.714769*ln(inhabitants))

A2=exp(0.682066*ln(inhabitants))

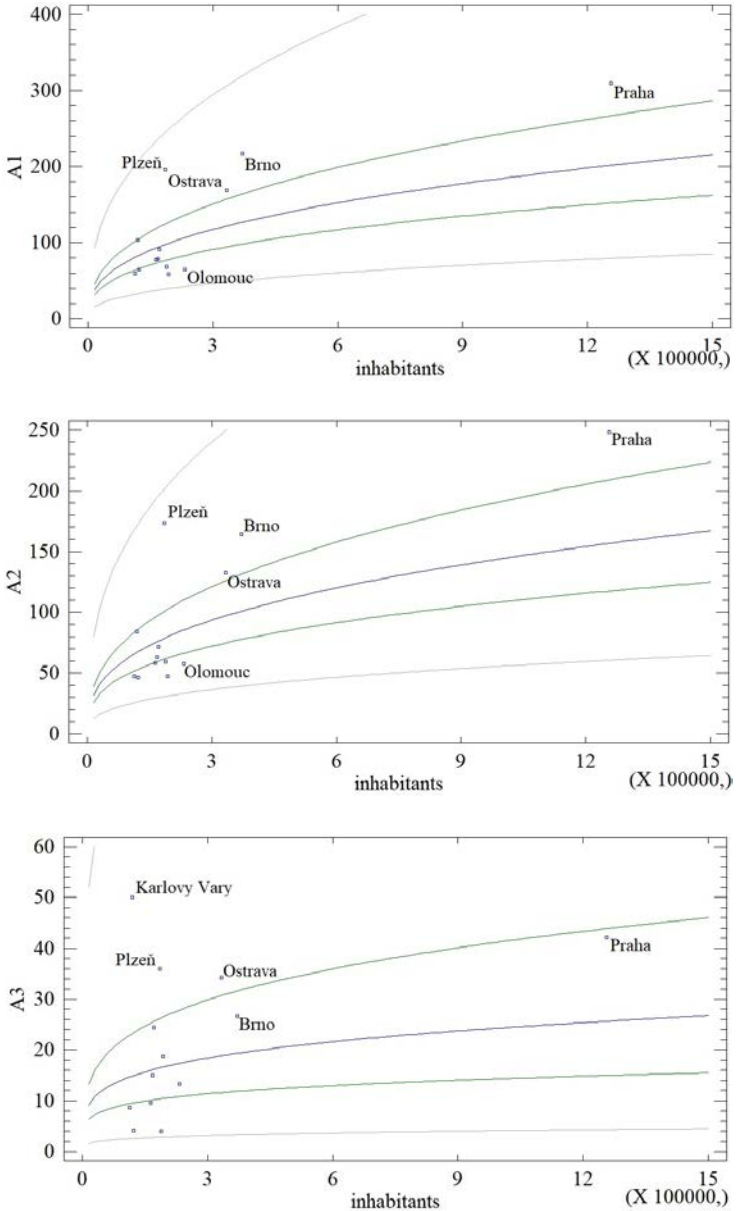
A3=exp(0.632811*ln(inhabitants))

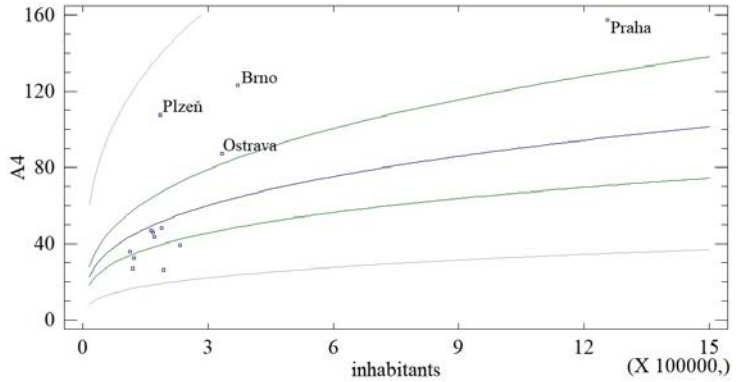
A4=exp(0.590575*ln(inhabitants))

r^2>95%

Source: Own preparation.

Chart 3.
Results of the multiplicative regression model of parameters A1–A4 and the population of regional cities in the Czech Republic in 2010





Notes:

A1=exp(0. 377769*ln(inhabitants))

A2=exp(0. 359887*ln(inhabitants))

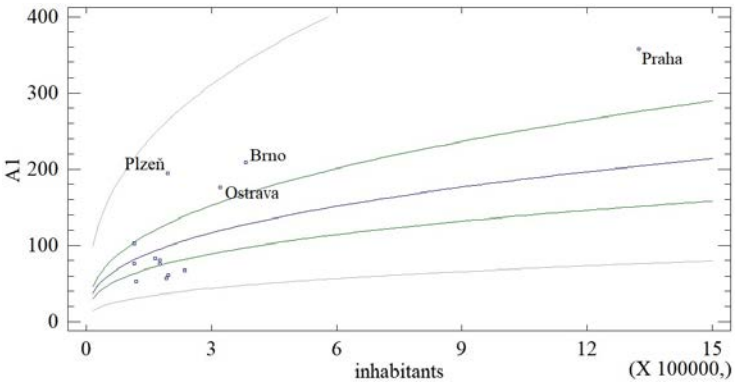
A3=exp(0. 23102*ln(inhabitants))

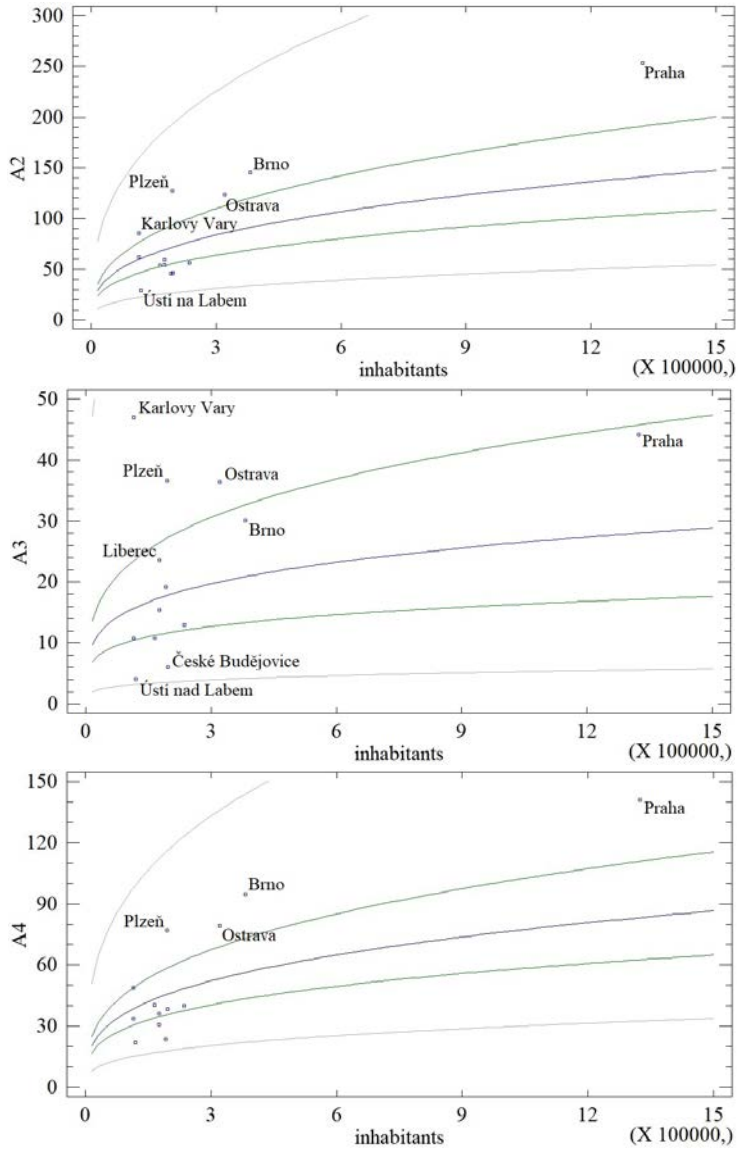
A4=exp(0. 324759*ln(inhabitants))

r^2>95%

Source: Own preparation.

Chart 4.
Results of the multiplicative regression model of parameters A1–A4 and the population of regional cities in the Czech Republic in 2019





Notes:

A1=exp(0. 37728*ln(inhabitants))

A2=exp(0. 351153*ln(inhabitants))

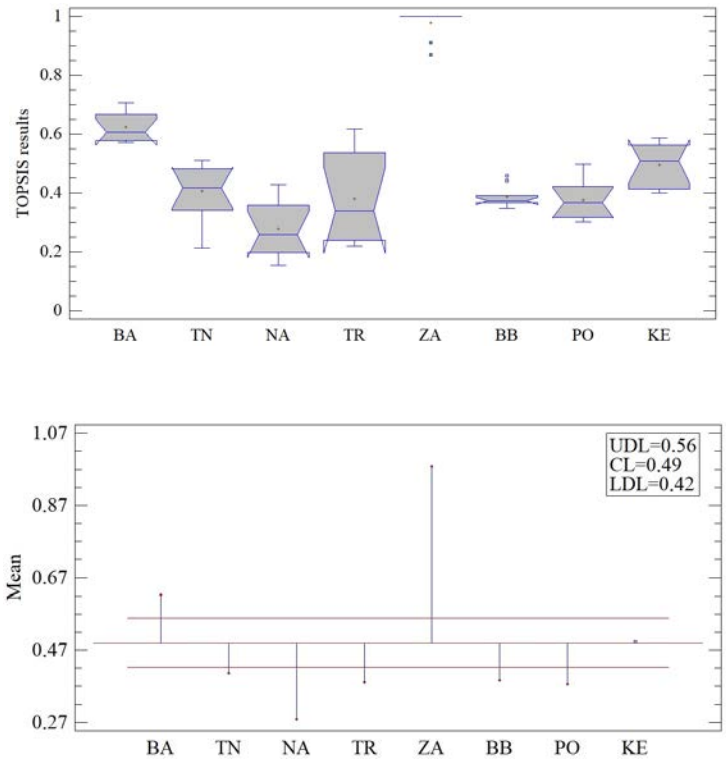
A3=exp(0. 236434*ln(inhabitants))

A4=exp(0. 313673*ln(inhabitants))

r^2>95%

Source: Own preparation.

Chart 5.
Results of multi-criteria evaluation of regional cities in the Slovak Republic using TOPSIS technique for the whole period 2010–2019

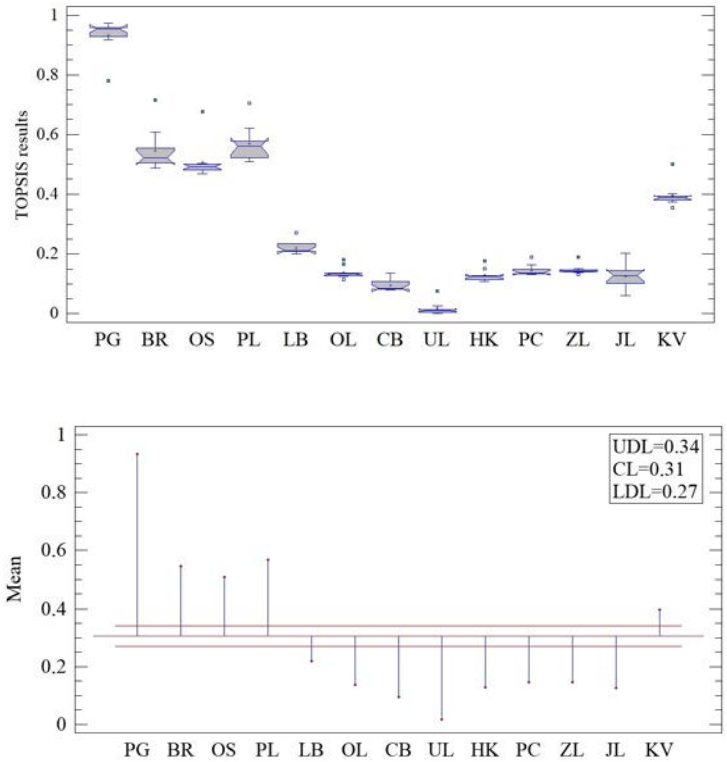


Notes:

BA — Bratislava; TN — Trnava; NA — Nitra; TR — Trenčín; ZA — Žilina; BB — Banská Bystrica; PO — Prešov; KE — Košice.

Source: Own preparation.

Chart 6.
Results of the multi-criteria evaluation of regional cities in the Czech Republic using the TOPSIS technique for the time period 2010–2019



Notes:

PG — Prague; BR — Brno; OS — Ostrava; PL — Pilsen; LB — Liberec; OL — Olomouc; CB — České Budějovice; UL — Ústí nad Labem; HK — Hradec Kralove; PC — Pardubice; ZL — Zlín; JL — Jihlava; KV — Karlovy Vary.

Source: Own preparation.