The effectiveness of real estate management in the local government – an example of voivodship capitals in Poland

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Abstract. The paper discusses the effectiveness of real estate management in voivodship capitals in Poland. The time frame of analyses: 2005-2016. The main research hypothesis was made, that voivodship cities located in voivodships with a higher level of economic development, conduct more effective real estate management. The analysis was carried out in four stages: identification and measurement of the effectiveness of real estate management, assessment of cities/ordering in terms of the degree of property management efficiency, evaluation of similarity of voivodship capitals in terms of the effectiveness of their property management, identification of the direction and strength of relations between the level of property management effectiveness in capitals and the level of economic development of the voivodships. The data came from the Local Data Bank of the Polish Central Statistical Office.

1. Introduction

Voivodship capitals, as a particular type of gmina self-government, perform a number of important functions - mainly: administrative, commercial, transport, scientific, cultural, educational, tourist, medical - playing an important role in the development of the country's territorial systems. Their main purpose (mission) is to satisfy the collective needs of the local government by providing public goods in order to ensure the best possible living conditions for the inhabitants, which means securing social and economic development [1-3]. Cities have several instruments at their disposal to achieve their various objectives: administrative, legal, financial, planning, legal and ownership-related, infrastructure development-related, informative [4, 5]. Real estate management plays an important role in the development policy of the cities, which is a deliberate process, resulting from the local social and economic development policy and correlated with the gmina's land use policy, focused on the optimal utilisation of real estate located in the gmina in view of satisfying the collective needs of the community by providing the residents with local public goods [6, 7]. An important factor, from the point of view of functions and role of voivodship capitals, is the reservoir of their operational effectiveness - also in the sphere of the real estate management [8-12].

The above correlation was the rationale behind this study which was aimed at identification, measurement and evaluation of the effectiveness of real estate management performed by voivodship capitals in Poland. The study covered 16 research objects - voivodship capitals in Poland. The time frame of analyses: 2005-2016. The main research hypothesis was made, that voivodship cities located in voivodships with a higher level of economic development, conduct more effective real estate management. The analysis was carried out in four stages: identification and measurement of the effectiveness of real estate management, assessment of cities/ordering in terms of the degree of property...
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2. Real estate management by voivodship capitals

The concept of real estate management is related to the concept of management, which has its origins in ancient times and is now the main focus of the economy. Management is based on choices regarding the allocation of scarce resources between different competing objectives [13]. The management of real estate performed by gminas in Poland is regulated by the Act on real estate management. Real estate management can be defined as a conscious and deliberate action of the gmina, in the forms provided for by law, including decision-making and carrying out factual and legal actions concerning real estate located within its area, aiming at the implementation of specific objectives subordinated to the social and economic development policy pursued by the local authorities. Real estate management in the gmina (municipality) is a deliberate process, resulting from the local social and economic development policy and correlated with the gmina's land use policy, focused on the optimal utilisation of real estate located in the gmina in view of satisfying the collective needs of the community by providing the residents with local public goods [14-16]. The real estate management can also be defined as a collection of instruments, granted by law to a gmina, that are aimed at the real estate located within the administrative boundaries of the gmina [17, 18]. In this respect, it covers five groups of instruments: related to real estate market (forms of acquiring and disposing of rights to real estate), related to the setting fees for making property rights available (prices, discounts, additional annual fees), related to real estate development (divisions, consolidations and divisions, land development), planning, information-related. The real estate management provider is the gmina, its object - two separate assets: real estate owned by the gmina and real estate owned by other entities (Figure 1).

![Real estate management in the gmina](image)

**Figure 1.** Real estate management in the gmina - the sphere of influence including the legal status of the real estate

Regarding real estate owned by the gmina, the gmina's activities are of two types: private-law, when it operates in the private sphere using its ownership rights, and public-law, resulting from the structure of local government in Poland and its participation in the exercise of public authority. In the case of real estate owned by other entities, the gmina's involvement is limited exclusively to the public and legal sphere as the local land manager, space creator and the entity controlling the development of the local system.

The concept of efficiency is one of the fundamental issues of economics. It means measuring the relationship between the effects of business activity and expenditures incurred to obtain them [19]. According to the Popular Encyclopedia, it means a method of measuring the effectiveness and purposefulness of a given activity, expressed by a comparison (relation) of the value of the obtained effects to the effort of the factors used to obtain them. Similarly, it defines Bielski, according to which
efficiency, in addition to considering the degree of implementation of the principle of economy (relation of outcomes to inputs), should also include the assessment of the results and expenditures incurred on the side of the purposefulness of action [20]. Although the concept of efficiency is derived from market-based evaluation methods, there is no doubt that the activities of public sector entities, including municipalities, should also be assessed for efficiency [21, 22]. Due to the public law character of provincial cities and their own tasks, the efficiency of real estate management by voivodship cities is a multidimensional issue and should be considered in the context of the adopted goals of socio-economic development [23, 24].

3. Methods of the analysis

The subject of the study is the effectiveness of real estate management in voivodship capitals. The general research objective is identification, measurement and evaluation of the effectiveness of real estate management performed by voivodship capitals in Poland. The study covered 16 research objects - voivodship capitals in Poland. Time frame of analyses: 2005-2016. The main research hypothesis was made that voivodship cities located in voivodships with a higher level of economic development conduct more effective real estate management.

The analysis was carried out in four stages: I - identification and measurement of the effectiveness of real estate management (12 indicators / diagnostic variables were selected), II - assessment of cities / ordering in terms of the degree of property management efficiency (a ranking was made- the standardised sums method), III – evaluation of similarity of voivodship capitals in terms of the effectiveness of their property management (voivodship classifications were carried out - Ward's method), IV – identification of the direction and strength of relations between the level of property management effectiveness in capitals and the level of economic development of voivodships (two rankings were prepared: (1) according to the effectiveness of property management, (2) according to GDP per capita in voivodships (the Spearman rank correlation coefficient was used). The data came from the Local Data Bank of the Polish Central Statistical Office.

In order to identify and measure the effectiveness of the real estate, twelve indicators were constructed. They refer to two basic categories: revenues of cities from the real estate market1 and investment expenditures of cities2. Diagnostic variables for measuring the effectiveness of real estate management in voivodship cities:

\[x_1\] - revenues from the real estate market per capita (PLN per capita),
\[x_2\] - revenues from the real estate market per unit of the city area (PLN/m²),
\[x_3\] - share of revenues from the real estate market in own revenues,
\[x_4\] - investment expenditures per capita (PLN per capita),
\[x_5\] - investment expenditures per city area unit (PLN/m²),
\[x_6\] - share of investment expenditures in total expenditures,
\[x_7\] - revenues from real estate market/investment expenditures,
\[x_8\] - revenues from the real estate market per capita - year-on-year growth,
\[x_9\] - revenues from the real estate market per unit of the city area - year-on-year dynamics,
\[x_{10}\] - investment expenditures per capita - year-on-year growth,
\[x_{11}\] - investment expenditures per city area - year-on-year dynamics,
\[x_{12}\] - revenues from the real estate market/investment expenditure - year-on-year growth.

1The analyses focused on the following three groups of revenues of cities from the real estate market: recurrent property taxes (a property tax, an agricultural tax and a forestry tax), revenue from municipal assets (income from property sale, letting, leasing and from perpetual usufruct) and taxes in respect of ownership right transfer (a civil-law action tax, an inheritance and gift tax).

2Investment expenditures of cities include two groups: investment expenditures on social infrastructure (schools, kindergartens, boarding, nurseries, orphanages, clinics and health centres, etc.) and investment expenditures on technical infrastructure (roads, bridges, networks: power, water, sewage, gas, telecommunications, etc.).
Diagnostic variables were calculated for the 12 analysed years (2005-2016). In subsequent stages of analyses, average annual values for the period of the analysis were used.

This method belongs to the group of linear ordering methods, which allow sorting the analysed objects in the order from the best to the worst, and the criterion of ordering is the development level of a complex phenomenon. The standardized sum method is a non-model method of linear ordering [25]. This method assumes that all variables are standardized and are of stimulant nature (i.e. diagnostic features whose higher values indicate a higher development level of the test object). If the set of diagnostic features includes destimulants (diagnostic features whose lower values indicate a higher development level of the test object), then they should be transformed into stimulants. Similarly, if a diagnostic feature is a nominant, it should also be converted into a stimulant [26]. Carrying out a joint analysis of the above-mentioned characteristics (diagnostic variables): x1, x2, x3, ..., x12 in order to rank voivodship cities by the highest value of the analysed values, the standardised sums method was used.

In the standardised sums method, all the variables x1, x2, x3, ..., x12 were initially standardised according to the formula [27] (1):

\[ x_{i,j}^s = \frac{x_{i,j} - \bar{x}_j}{s_j}, \]  

where:
- \( x_{i,j}^s \) - the standardised diagnostic variable of the \( i \)th city for the \( j \)th variable,
- \( x_{i,j} \) - the value of the diagnostic variable of \( i \)th city for the \( j \)th variable before standardisation,
- \( \bar{x}_j \) - the arithmetic mean of the \( j \)th variable,
- \( s_j \) - standard deviation of the \( j \)th variable,
- \( M -1,2,3,\ldots,12 \) – the number of diagnostic variables,
- \( n = 1,2,3,\ldots,16 \) – the number of cities.

The ranking of the voivodship capitals was based on a synthetic variable expressed by the formula (2):

\[ P_i = \frac{1}{m} \sum_{j=1}^{m} x_{i,j}^s, \]  

where:
- \( P_i \) – the synthetic variable for the \( i \)th voivodship.

The classification of the cities, according to the level of effectiveness of real estate management was carried out with the use of Ward’s method. The Ward’s method is one of the most popular hierarchical clustering methods, where the criterion for choosing the pair of clusters to merge at each step is based on the optimal value of an objective function [28] (Basiura 2013). There are many possibilities to choose the objective function, the most popular of which is the sum of squares of deviations of individual elements of the cluster from this cluster’s gravity centre [29] (Ward 1963). The basic idea in the method is to combine in each step of the clustering such two sub-sets whose Euclidean distance is the smallest.

The distance of clusters was measured by the Euclidean norm (3):

\[ d_{(i,j)} = \left\{ \sum_{k=1}^{m} (x_{i,k} - x_{j,k})^2 \right\}^{1/2}, \text{ for } i \neq j \]  

where:
- \( i, j \) – the number of cities,
- \( k \) – the number of analysed characteristics.

Variables \( x_{i,j} \) are the adopted standardised characteristics (4):

\[ x_{i,j} = \frac{c_{i,j} - \bar{c}_j}{\sigma(c_j)}, \]
where:
\( c_j^- \) – the mean of the \( j \)th characteristic,
\( \sigma(c_j^-) \) – standard deviation.

The classification was made based on values of 12 diagnostic variables, constituting annual averages for the period covered by the analysis.

For identification of the direction and strength of relations between the level of property management effectiveness in capitals and the level of economic development of voivodships two rankings were prepared: (1) according to the effectiveness of property management (ranking was made on the basis of values of 12 diagnostic variables, constituting annual averages for the period covered by the analysis – standardised sums method was used), (2) according to GDP per capita in voivodships (the ranking was made on the basis of the value of one diagnostic variable which is the annual average for the period covered by the analysis).

In order to investigate the power of correlation between the efficiency of real estate management cities and economic development of voivodships was used the Spearman rank correlation coefficient (5):

\[
r = 1 - \frac{6 \sum d_i^2}{n(n^2 - 1)},
\]

where:
- \( r_{1i} \) – the rank of the \( i \)-th voivodship city in the first ranking (the efficiency of real estate management),
- \( r_{2i} \) – the rank of the \( i \)-th voivodship city in the second ranking (economic development),
- \( d_i = r_{1i} - r_{2i} \),
- \( n \) – the number of voivodship cities.

4. Empirical analysis

4.1. Identification and measurement of the effectiveness of real estate management

In the years 2005-2016 the budgets of voivodship capitals were increased by the sum of PLN 80,049 billion by virtue of revenues from property market taxation, constituting 32.34% of their own revenues. Their average annual income from the taxation of the real estate market per capita amounted to PLN 881.92. During the period under review, their average annual income per capita from the real estate market increased by 75.3% from PLN 614,82 in 2005 to PLN 1,077,80 in 2016.

In the same period, the cities incurred capital expenditures totalling PLN 82,372 billion\(^3\), which accounted for 18.89% of their total expenditures. The annual average amount of capital expenditures per capita was PLN 674,46. During the analysed period, the average annual amount of capital expenditures per capita increased by 55.69% from PLN 325,01 in 2005 to PLN 506,02 in 2016.

The highest amounts of receipts from the real estate market per capita were obtained by Warsaw and Wrocław, respectively - on an annual average: 1,406,21 PLN and 1,371,49 PLN. Average annual revenues exceeding PLN 1,000 were also generated in: Gdańsk, Katowice and Opole. The lowest average annual income from the real estate market per capita (below PLN 700) was recorded in: Zielona Góra, Lublin and Olsztyn (Figure 2a). Warsaw turned out to be the leader among the cities in terms of investment property expenditures per capita, with the average annual amount of expenditures at the level of PLN 2,822.07. Wrocław, Poznań and Gdańsk were far behind, with average annual expenditure per capita at the level of, respectively: PLN 1,111.98, PLN 951.84 and PLN 849.83. The lowest capital

\(^3\) Warsaw turned out to be the leader among the cities, accounting for 26.15% of this amount, followed by: Wrocław (10.30%), Poznań (8.82%) and Łódź (8.49%). The last in the ranking were: Zielona Góra, Opole and Olsztyn, whose capital expenditures constituted, respectively: 1.18%, 1.61% and 2.40% of the total amount of property investment expenditures in all cities.
expenditures per capita were recorded in: Zielona Góra (PLN 127.75), Olsztyn (PLN 259.35) and Kielce (PLN 283.22) (Figure 2b).

A clear pattern can be observed here - cities with the highest income from property tax per capita also make the highest investment property expenditures per capita, with Warsaw, Wrocław, Gdańsk, Poznań, Katowice and Kraków at the top of the list. Cities that make lower capital investment expenditures receive much lower income from taxation of the real estate market per capita - the lowest revenues were reported by Zielona Góra, Olsztyn and Lublin.

Revenues from real estate market per capita

Investment expenditures per capita

![Figure 2a](image)

![Figure 2b](image)

Figure 2. Revenues from real estate market and investment expenditures per capita (PLN per capita) average annual values

City income from the real estate market per capita grew steadily - on average by 6.59% year on year - apart from the years 2009 and 2015, when it decreased (Table 1). The highest growth dynamics were recorded in Białystok (annual average of 13.9%), Katowice (8.71%) and Łódź (8.19%). The lowest ones were in Wrocław (1.33%), Warsaw (4.52%) and Kraków (4.57%).

Table 1. Revenues from real estate market and investment expenditures per capita (PLN per capita) – descriptive characteristics

|          | Revenues from the real estate market | Investment expenditures | Revenues from the real estate market | Investment expenditures | Revenues from the real estate market | Investment expenditures | Revenues from the real estate market | Investment expenditures |
|----------|-------------------------------------|--------------------------|-------------------------------------|--------------------------|-------------------------------------|--------------------------|-------------------------------------|--------------------------|
|          | 2005                                | 2006                     | 2007                                | 2008                     | 2009                                | 2010                     | 2011                                | 2012                     |
| minimum  | 385.29                              | 89.49                    | 446.37                              | 142.42                   | 505.73                              | 115.81                   | 577.17                              | 111.29                   |
| maximum  | 1 332.81                            | 1 536.76                 | 1 541.00                            | 1 925.67                 | 1 510.05                            | 2 678.29                 | 1 291.91                            | 3 281.79                 |
| arithmetic average | 614.82                              | 325.01                    | 732.46                              | 475.03                   | 794.22                              | 610.00                   | 804.44                              | 707.08                   |
| median   | 518.32                              | 170.84                   | 613.20                              | 303.00                   | 673.05                              | 330.00                   | 742.69                              | 425.77                   |
| standard deviation | 243.59                              | 357.31                    | 318.62                              | 449.77                   | 288.45                              | 652.72                   | 218.94                              | 795.83                   |
|          | 2009                                | 2010                     | 2011                                | 2012                     | 2013                                | 2014                     | 2015                                | 2016                     |
| minimum  | 556.41                              | 138.95                    | 535.83                              | 203.23                   | 587.87                              | 72.34                    | 674.30                              | 96.20                    |
| maximum  | 1 238.67                            | 3 178.20                 | 1 412.67                            | 4 061.51                 | 1 432.12                            | 3 290.01                 | 1 457.45                            | 3 336.25                 |
| arithmetic average | 772.83                              | 766.13                    | 841.68                              | 794.96                   | 880.07                              | 779.35                   | 924.77                              | 799.60                   |
| median   | 752.06                              | 454.44                   | 774.91                              | 508.43                   | 842.77                              | 537.14                   | 900.52                              | 606.87                   |
| standard deviation | 205.31                              | 812.64                    | 264.18                              | 942.18                   | 248.94                              | 779.95                   | 237.16                              | 801.59                   |
|          | 2013                                | 2014                     | 2015                                | 2016                     | 2017                                | 2018                     | 2019                                | 2020                     |
| minimum  | 712.89                              | 101.59                    | 787.31                              | 122.47                   | 715.07                              | 80.02                    | 780.32                              | 81.26                    |
| maximum  | 1 530.42                            | 2 861.93                 | 1 676.84                            | 3 696.44                 | 1 643.55                            | 2 072.06                 | 1 534.68                            | 1 945.90                 |
| arithmetic average | 992.02                              | 714.24                    | 1098.74                             | 834.10                   | 1049.24                             | 782.02                   | 1077.80                             | 506.02                   |
In the same period, capital expenditures of cities per capita grew dynamically until 2010, slowing down in 2011 and significantly decreasing in 2016 (decrease by 35.29% compared to 2015). The average annual growth rate was 11.99% year-on-year, being much higher than in the case of real estate tax revenues per capita. The fastest growth in per capita capital expenditures was observed in Olsztyn (annual average of 21.99%), Opole (18.33%), Gdańsk (18.29%) and Szczecin (16.52%), while the slowest growth was seen in Katowice (2.16%) and Warsaw (5.35%).

It is also worth noting that in the analysed group of cities there is a large internal variation, which manifests itself in a wide range between the recorded minimum and maximum amount of expenditures and the level of standard deviation in relation to the minimum amount. When considering the income of cities from the taxation of the real estate market and investment property expenditures in relation to the surface area of cities, one can observe equally interesting phenomena. In the period covered by the analysis, the average annual income of cities from the taxation of the real estate market per m² of city area increased by 56% - from PLN 1.38 in 2005 to PLN 2.18 in 2016. In the same period, the average annual amount of property expenditures of cities per m² of city area increased by only 32% - from PLN 0.98 in 2005 to PLN 1.29 in 2016.

The highest amounts of real estate tax receipts per m² of the city area were reported by Warsaw (annual average of PLN 4.66), followed immediately by Wrocław with PLN 2.97. Average annual receipts exceeding PLN 1.5 were also received in: Białystok, Kraków, Katowice and Gdańsk. The lowest revenues (oscillating around 1 PLN) were recorded in: Szczecin, Zielona Góra, Rzeszów and Olsztyn (Figure 3a). And again, the leader in terms of annual average capital expenditures per m² of city area was the capital city of Warsaw with an average annual expenditure of PLN 3.47. The next in the ranking were Wrocław, Poznań and Gdańsk with the expenditure exceeding PLN 2. The lowest expenditure was recorded in Szczecin, Zielona Góra and Kielce (Figure 3b).

![Revenues from real estate market](image1.png)  ![Investment expenditure](image2.png)

**Figure 3.** Revenues from real estate market and investment expenditure per city area unit (PLN/m²) – average annual values

Similarly to analyses related to a statistical person, when we compare property market-related income and expenditures of cities to the city area, we can see the same regularity, i.e. cities which earn the highest income from property market taxation per m² of city area also make the highest investment property expenditures per m² of city area - the same cities appear at the top of the list: Warsaw, Wrocław, Poznań, Gdańsk, Białystok, Kraków, Katowice and Wrocław.

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4 In the years 2005-2016, the average annual maximum amounts of capital expenditures per capita were over 26 times higher than the observed minimum amounts - the biggest differences were recorded in 2011 between Warsaw (PLN 3,290.01 per capita) and Zielona Góra (PLN 72.34 per capita).

5 The poor performance of Szczecin results from the fact that land under water (Lake Dabie and internal sea waters) occupies as much as 24% of the city area.
Gdańsk, Poznań, Katowice and Kraków, with Białystok joining this group. In the group of cities with lower investment property expenditures and much lower revenues from the taxation of the real estate market per m² of the city area, a change took place - Szczecin ranked lowest closely following Zielona Góra, Bydgoszcz and Kielce.

As in the analysis of investment property expenditures per capita, also in the case of their reference to m² of city area, a large internal variation can be observed between the cities, manifesting itself in a wide range of the observed average annual maximum amounts and minimum expenditures (Table 2).

|                | Revenues from the real estate market | Investment expenditure | Revenues from the real estate market | Investment expenditure | Revenues from the real estate market | Investment expenditure |
|----------------|------------------------------------|------------------------|------------------------------------|------------------------|------------------------------------|------------------------|
| **2005**       | minimum: 0.68                      | 0.34                   | 0.95                               | 0.40                   | 0.84                               | 0.67                   |
|                | maximum: 3.34                       | 1.89                   | 4.58                               | 2.37                   | 4.98                               | 3.29                   |
|                | arithmetic average: 1.38            | 0.98                   | 1.60                               | 1.42                   | 1.74                               | 1.66                   |
|                | median: 1.20                        | 0.98                   | 1.30                               | 1.39                   | 1.46                               | 1.50                   |
|                | standard deviation: 0.73            | 0.44                   | 0.97                               | 0.49                   | 0.99                               | 0.69                   |
| **2006**       | minimum: 0.68                       | 0.34                   | 0.95                               | 0.40                   | 0.84                               | 0.67                   |
|                | maximum: 3.34                       | 1.89                   | 4.58                               | 2.37                   | 4.98                               | 3.29                   |
|                | arithmetic average: 1.38            | 0.98                   | 1.60                               | 1.42                   | 1.74                               | 1.66                   |
|                | median: 1.20                        | 0.98                   | 1.30                               | 1.39                   | 1.46                               | 1.50                   |
|                | standard deviation: 0.73            | 0.44                   | 0.97                               | 0.49                   | 0.99                               | 0.69                   |
| **2007**       | minimum: 0.84                       | 0.40                   | 0.84                               | 0.67                   | 0.88                               | 0.85                   |
|                | maximum: 4.98                       | 3.29                   | 4.27                               | 4.04                   |                                    |                        |
|                | arithmetic average: 1.73            | 1.66                   | 1.73                               | 1.86                   | 1.73                               | 1.86                   |
|                | median: 1.54                        | 1.50                   | 1.54                               | 1.67                   | 1.54                               | 1.67                   |
|                | standard deviation: 0.83            | 0.69                   | 0.80                               | 0.85                   | 0.80                               | 0.85                   |
| **2008**       | minimum: 0.69                       | 0.34                   | 0.96                               | 0.79                   | 1.00                               | 0.75                   |
|                | maximum: 3.29                       | 4.05                   | 4.48                               | 4.10                   |                                    |                        |
|                | arithmetic average: 1.66            | 1.79                   | 1.86                               | 2.19                   | 1.96                               | 2.21                   |
|                | median: 1.40                        | 1.61                   | 1.63                               | 1.70                   | 1.83                               | 2.04                   |
|                | standard deviation: 0.78            | 0.88                   | 0.86                               | 1.09                   | 0.87                               | 1.07                   |
| **2009**       | minimum: 0.92                       | 0.74                   | 0.83                               | 0.96                   | 0.89                               | 0.79                   |
|                | maximum: 4.10                       | 4.43                   | 4.38                               | 4.05                   | 4.38                               | 4.05                   |
|                | arithmetic average: 1.66            | 1.79                   | 1.86                               | 2.19                   | 1.96                               | 2.21                   |
|                | median: 1.40                        | 1.61                   | 1.63                               | 1.70                   | 1.83                               | 2.04                   |
|                | standard deviation: 0.78            | 0.88                   | 0.86                               | 1.09                   | 0.87                               | 1.07                   |
| **2010**       | minimum: 1.20                       | 1.00                   | 1.23                               | 0.81                   | 1.35                               | 0.69                   |
|                | maximum: 5.08                       | 5.61                   | 5.53                               | 6.02                   | 5.19                               | 2.39                   |
|                | arithmetic average: 2.11            | 2.38                   | 2.14                               | 2.33                   | 2.18                               | 1.29                   |
|                | median: 1.93                        | 2.05                   | 2.06                               | 2.24                   | 2.05                               | 1.22                   |
|                | standard deviation: 0.97            | 0.87                   | 1.09                               | 1.31                   | 1.05                               | 0.59                   |

When analysing the share of real estate market tax revenues in own revenues of the analysed cities, a decrease was observed - from 35.59% in 2005 to 29.84% in 2016. The most considerable revenues from property market taxation were generated in the budgets of Wrocław (average annual 38.21% of own revenues) and Opole, Białystok and Rzeszów, while the smallest ones in Warsaw constituted 27.27% of own revenues of the city (Figure 4a). In the audited period, the share of capital expenditures in total expenditures of cities decreased from 15.7% in 2005 to 11.31% in 2016. The most substantial part of expenditures for investment purposes was incurred by Gdańsk (23.5% on average annually) followed by Wrocław (21.77%), Poznań (23.22%), Katowice (22.04%) and Białystok (20.49%) (Figure 4b).

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6 In the years 2005-2016, the average annual maximum amounts of capital expenditures per capita were over 5 times higher than the observed minimum amounts - the biggest differences were recorded in 2014 between Warsaw (4.55 PLN/m²) and Opole (0.81 PLN/m²).

7 In some cities, revenues from property market taxation played a dominant role in their own revenues, constituting over 50% - this situation occurred in Wrocław in 2005 and 2006, when revenues from property market taxation accounted for 52.02% and 51.96% of the city's own revenues, respectively. The second example is Białystok, where in 2014 revenues from property market taxation accounted for 51.54% of the city's own revenues.
The share of revenues from real estate market in own revenues

Looking at the revenues from real estate market/investment expenditures ratio, it can be seen that in the analysed period, starting from 2005 when it amounted to 1.53, the average annual value of the ratio was systematically decreasing until 2009, when it reached the level of 0.86. In 2010, a slight recovery took place and in the following years, the ratio was growing, with a leap by 53.91% in 2016 from 1.15 in 2015 to 1.77 (Figure 5a.). The highest average annual value of the index (above 1.4) was recorded in Warsaw and Wrocław, where the index assumed the values of 1.45 and 1.41, respectively - this means that on average in the years 2005-2016 one zloty allocated by cities for investment property expenditures was accompanied by revenues from property market taxation at PLN 1.45 and PLN 1.41 respectively. Further in the ranking were Bydgoszcz, Opole and Kraków with the index level oscillating around 1.3.

The lowest value of the ratio (below 1.0) was observed in Rzeszów (0.78) and Poznań (0.88), Lublin (0.9) and Kielce (0.94) - such values of ratios mean that on average in the years 2005-2016 one zloty allocated by these cities for capital expenditures was accompanied by revenues from property market taxation in the amount of, respectively: PLN 0.78, PLN 0.88, PLN 0.9 and PLN 0.94

Figure 4. The share of revenues from the real estate market in own revenues and share of investment expenditures in total expenditures (%) – average annual values

Figure 5. Income from real estate market/investment expenditures a) descriptive characteristics, b) average annual values
4.2. Ordering of voivodship capitals in terms of their property management efficiency
Carrying out a joint analysis of the above-mentioned characteristics (diagnostic variables): \( x_1, x_2, x_3, \ldots, x_{12} \) in order to rank voivodship capitals by the highest value of the analysed values, the standardised sums method was used. The ranking results are shown in the diagram below (Figure 6).

![Figure 6. Ranking of voivodeship capitals according to the efficiency of real estate management](image)

Warsaw came first followed by Białystok, that achieved a similar level of the synthetic variable \( P_i \) (Warsaw 0.505693, Białystok 0.494054). Wrocław, which until now had occupied a position just behind the capital, was the third best. Further in the top five of cities with the highest property management efficiency were Opole and Gdańsk. The last in the ranking was Zielona Góra with the synthetic variable at the level of - 0.649078, closely following Rzeszówand Kraków. Rzeszów saw relatively low revenues from the real estate market per capita and investment expenditure per capita in comparison with other cities, while Kraków reported a low growth rate of revenues from the real estate market per capita and a very low share of investment expenditures in total expenditures.

4.3. Evaluation of similarity of voivodship capitals in terms of their property management effectiveness
The classification of voivodship capitals according to the level of effectiveness of their real estate management was carried out with the use of Ward’s method. The classification is shown in the diagram below (Figure 7).

The dendrogram of cities grouped according to the total diagnostic variables shows that we can create 4 groups (below the 7th cluster/node): group I (Warszawa, Wrocław); group II (Bydgoszcz, Szczecin, Opole, Olsztyn); group III (Lublin, Łódź, Poznań, Gdańsk, Białystok) and group IV (Zielona Góra, Kraków, Rzeszów, Katowice, Kielce. It is clear from the dendrogram that Group I (Warsaw and Wrocław) clearly stands out from the other groups. The group of voivodship capitals with the lowest significantly low productivity from the real estate market per capita and very low revenues from the real estate market per capita.

In previous analyses, the city performed very poorly - in the audited period it showed the lowest investment expenditure per capita and very low revenues from the real estate market per capita.

Similar conclusions could have been drawn from the results of previous analyses. In both cities, revenues from the real estate market per capita and investment expenditure per capita were much higher than elsewhere.
real estate management efficiency included the cities from Group IV, whose indicators were significantly lower than in the remaining cities.\textsuperscript{10}

4.4. Identified directions and strength of relations between the level of property management effectiveness in voivodship capitals and the level of economic development of their voivodships

In order to identify the direction and strength of relations between the level of property management effectiveness in voivodship capitals and the level of economic development of their voivodships two rankings were prepared: (1) according to the effectiveness of property management (standardised sums method was used), and (2) according to the GDP per capita in voivodships. The rankings are shown in the bar chart below (Figure 8).

\textbf{Figure 7.} Classification of voivodship capitals according to the efficiency of real estate management in the years 2005-2016

\textsuperscript{10} What is surprising here is the position of two large dynamically developing cities - Katowice and Kraków, and the similarity of Kraków to ZielonaGóra which was ranked the lowest. It seems that this can be contributed to low investment expenditures per capita and their low dynamics.
The obtained Spearman rank correlation coefficient at $r = 0.3882$ proves an irrelevant correlation between the effectiveness of real estate management of voivodship capitals and the economic development of their voivodships. It has been observed that the capitals of voivodships with low economic development were highly ranked in terms of real estate management effectiveness (Białystok, Opole, Olsztyn and Lublin). There were also cases when capital cities of voivodships with a high level of economic development took low positions in the ranking of real estate management effectiveness (Poznań, Katowice, Łódź, Kraków). The most positive surprise was Białystok, which was placed second in the ranking of real estate management effectiveness and is the capital of Podlaskie Voivodeship, and was ranked 13th in terms of economic development. It seems to result from the agricultural nature of Podlaskie voivodship, (farming land constitutes 60.1% of the voivodship's area) and a low degree of industrialization and services. It should also be noted that there is a large share of forested area covering 31.2% of the voivodship, a substantial part of which is protected by various nature preservation programmes.

The greatest disappointment is Kraków, the capital of the Małopolskie Voivodeship, which was ranked 14th in terms of its real estate management effectiveness, while the Małopolskie Voivodeship itself was ranked 7th in the economic development ranking. As mentioned earlier, this situation seems to have been caused by low investment expenditure per capita as compared to other cities and its low dynamics. It is noteworthy that some of the cities took the same positions in both rankings (Warsaw, Gdańsk, Kielce and Rzeszów). In a few cases, the difference between the two rankings was small, amounting to one or two positions (Wrocław, Szczecin).

It should be stressed here that the authors, when formulating the research hypothesis, did not identify the direction and force of the voivodeship - voivodeship city interaction, i.e. no additional hypotheses were made that a high level of economic development in the voivodeship is the result / effect of the voivodeship capital's policies. Neither the reverse hypothesis that a high level of economic development of a region (voivodeship) pulls/ pushes the development of a voivodeship city. There are relations/feedbacks in both directions: capital cities with a high level of development have a positive impact on the area of the region, but also well-developed regions "pull up" their capital cities.

In the voivodeship there are: 4 national parks (Białowieża, Biebrza, Narew and Wigry), 3 landscape parks, 85 nature reserves and 2051 nature monuments.
5. Conclusions

The analysis results confirmed that in the years 2005-2016 that voivodship cities operated real estate management with various levels of efficiency. Warsaw, which in the period covered by the analysis had the highest investment expenditure and obtained the highest revenues from the real estate market, both per capita and per city area unit, was ranked as the best. The top seven cities the rated the best in terms of their effectiveness of real estate management also included: Białystok, Wrocław, Opole, Gdańsk, Olsztyn and Poznań. Zielona Góra was rated the lowest, achieving the lowest investment expenditure and very low revenues from the real estate market per capita in the analyzed period. Rzeszów and Kraków were ranked directly before Zielona Góra.

The obtained results did not confirm the research hypothesis that voivodship cities located in voivodships with a higher level of economic development conduct more effective real estate management. It has been observed that the capitals of the voivodeships with low economic development were highly ranked in terms of real estate management effectiveness (Białystok, Opole, Olsztyn and Lublin). There were also cases when capital cities of voivodeships with a high level of economic development took low positions in the ranking of real estate management effectiveness (Poznań, Katowice, Łódź, Kraków). This means that in the years 2005-2016 there was no strong correlation between the level of effectiveness of real estate management by voivodeship capitals and the level of economic development of voivodeships, which means that the level of economic development of a voivodeship is not a factor determining the effectiveness of the real estate management by voivodeship capitals.

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