XXI. MEZINÁRODNÍ KOLOKVIUM O REGIONÁLNÍCH VĚDÁCH. SBORNÍK PŘÍSPĚVKŮ.

21ST INTERNATIONAL COLLOQUIUM ON REGIONAL SCIENCES. CONFERENCE PROCEEDINGS.

Place: Kurdějov (Czech Republic)
June 13-15, 2018

Publisher: Masarykova univerzita, Brno

Edited by:
Viktorie KLÍMOVÁ
Vladimír ŽÍTEK
(Masarykova univerzita / Masaryk University, Czech Republic)

Publikace neprošla jazykovou úpravou. / Publication is not a subject of language check.
Za správnost obsahu a originalitu výzkumu zodpovídají autoři. / Authors are fully responsible for the content and originality of the articles.

EFFICIENCY OF ACTIVITY OF URBAN MUNICIPALITIES IN POLAND VERSUS THEIR INCOME LEVEL

Jarosław Olejniczak.

Katedra Finansów   *Department of Finance*
Wydział Nauk Ekonomicznych   *Faculty of Economic Sciences*
Uniwersytet Ekonomiczny we Wrocławiu   *Wroclaw University of Eonomics*
✉ *Komandorska 118/120, 53-345 Wroclaw, Poland*
E-mail: jaroslaw.olejniczak@ue.wroc.pl

Annotation
The conducted research aimed to verify the hypothesis about the existence of a relationship between income potential of municipalities and the (relative) efficiency of their expanses. The variables used in examination of relative efficiency with the DEA CCR-O method. Those variables were supposed to reflect the main areas of municipal activity. To reflect income potential of municipalities the level of own and total revenues p.c. was taken into consideration. Time period covered 2009-2016 years. On a national scale, the percentage of ineffective DMU's in voivodeships fluctuated between 82 and 74%, showing a decreasing trend. It is also reflected in the systematic increase in the average DMU effectiveness in some voivodeships - in particular in those where in the beginning the average efficiency was lower (0.7 to 0.8). It can be concluded that there is a moderate negative correlation between the level of own revenues per capita and the indicators of technical efficiency obtained from the analysis - correlation factors between -0.37 and -0.24 (decreasing tendency). A much stronger relationship occurs between their total revenues per capita and the mentioned indicators - between correlation factors -0.62 and - 0.38 (also decreasing).

Key words
DEA, local government, revenues

JEL classification: C14, H70

1. Introduction

The research on the efficiency of local government units' activity is conducted in many countries and there are various factors which trigger it, whilst, the main objective being the desire to impact the officials and limit their inefficiency (Balaguer-Coll, Prior, Tortosa-Ausina, 2007). The discussion on the subject of the need to measure the efficiency itself reaches back to the 30's; while „in the last 20 years, nearly three dozen articles were published in reputed scientific journals with the purpose of measuring the efficiency of local governments using different methodologies"(da Cruz, Marques, 2014). Literature analysis conducted by da Cruz and Marques up to 2012 indicates that only a small percentage of publications are devoted to measuring of the global efficiency of local governments. As indexed in the Web of Science or Scopus, also in later years the amount of publications analysing this topic has been relatively small. There are practically no articles devoted to the efficiency of Polish municipalities. The issue of efficiency is mainly addressed from the perspective of a certain field (activity of public offices (Czarnecki, Szarota, Wozniak, 2015) (Lizińska et al., 2017); waste management (Przydatek, 2016), cultural institutions management (Gałecka, Smolny, 2017), efficiency of subsidies and grants (Kańduła, 2017; Olejniczak, 2015; Olejniczak, Bednarska-Olejniczak, 2013; Sekula, 2015). Few authors attempt to evaluate global efficiency (Czaplak, 2016; Gendzwill, Swianiewicz, 2016; Swianiewicz, Lukomska, 2016). There are significantly more publications on the matter perceived from a local perspective, however, even here works focusing on global efficiency are rare, despite the fact that the practical efficiency measurement is often said to be one of the most important issues of public finances research (Guziejewska, 2008; Jastrzębska, 2016). One of the first studies of this subject area in Polish scientific literature is the NBP (National Central Bank) study (Karbownik, Kula, 2009), in which three areas of efficiency measurement have been proposed (environment protection, education, administration). The matter related to the ways of measuring expenditure efficiency of municipalities has also been discussed by K. Owsiak (Owsiak, 2014), although the main focus was placed by this author on reviewing the available research tools. Additionally, some studies explored only specific groups of municipalities (Kobiałka, Kubik, 2017; Łękawa 2012) or specific types of municipalities(Sekuła, Julkowski, 2015).

From the point of view of the selected experimental method, the issue of efficiency can be considered in a number of ways. Studies pointed out by da Cruz and Marquez employ both the methods of parametric and nonparametric analysis. In the subsequent years as well, one of the most frequently used methods has been Data Envelopment Analysis (DEA). It is worth highlighting that different varieties of DEA are used depending on the study's objective. Quite frequently in one article the author compares discrepancies between results obtained from many varieties. In publications devoted to global efficiency of Polish municipalities (indexed in WoS) parametric methods prevail (Gendzwill, Swianiewicz, 2016). One of the few works which apply nonparametric methods is the article of Czarnecki, Szrota, and Woźniak mentioned before. Polish authors cited above (from outside WoS or Scopus) also attempted using nonparametric methods in their studies in order to estimate the relative efficiency of local governments' activity, in particular DEA. Nevertheless, the gap in research on the matter of expenditure efficiency using nonparametric methods is still noticeable. Therefore, it is justifiable to carry out research on the existence of a relationship between income potential of municipalities and (relative) efficiency of their activity. One of the reasons behind the above mentioned research are also the doubts concerning the accepted system of funding of local governments in Poland that has been mentioned in literature, in particular, in the area of fiscal transfers (Kańduła, 2017; Poniatowicz, Wyszkowska, 2015; Sekula, 2015).

2. Aim and method

The assessment of efficiency of the public finance sector units can be conducted with the use of either one-dimensional or multidimensional methods. In the case of the undertaken assessment of the local government units' efficiency, comparison of many inputs and outputs of their activity is necessary, which in turn requires the usage of methods allowing the possibility of aggregation of criteria. The essence of the DEA model is, as it has been already mentioned, the possibility of taking into account various inputs and outputs characterizing the activity of one unit (DMU Decision Making Unit) and depiction of their empirical layout, as well as the choice of data envelope applying the best practice frontier. This method thus enables us to find the theoretical frontier of production potential. In general terms, efficiency in DEA model can be defined in the following way (Cooper et al. 2007):

$$Efficiency = \frac{\sum_{r=1}^{s} Weighted\_Output_r}{\sum_{i=1}^{m} Weighted\_Imput_i}$$

where:
j – subsequent DMU
i – subsequent input
r – subsequent output
n – the number of researched objects (j=1,...,n)
m – the number of used input (i=1,...,m)
s – the number of activity output (r=1,...,s)

Charnes, Cooper and Rhodes (Charnes, Cooper, Rhodes, 1978) analysed the issue of comparison of the outputs of different systems. The starting point was defining efficiency as the proportion of the sum of weighted output to the sum of weighted input. This approach does not require any knowledge about the efficiency functions. By using empirical numbers of input and output, one searches for weights maximizing efficiency of an object. This leads to the formulation of a mathematic programming problem, the aim of which is to estimate efficiency of specific objects in regard of the entire group of objects. Effectiveness of a given unit is measured in regard to other objects in the group – therefore to maintain comparability of changes in efficiency in subsequent periods, the stableness of the studied group's structure is important. Basic models of DEA include: CCR which assumes stable output of scale (Charnes, Cooper, Rhodes, 1978), and BCC with variable output of scale (Banker, Charnes, Cooper, 1984). Both models can be either input or output oriented. It is important to note that in Polish conditions, a characteristic feature of local government units is a significantly higher possibility of shaping the output (directions and effects of expenses) than the mere amount of expanses. Thus the output oriented model is the most appropriate one.

In the basic form of DEA CCR model it is assumed that units (DMU) which can be placed on a curve are effective, and their efficiency amounts to $\theta = 1$. DMUs placed beneath the curve of efficiency are ineffective, their level of inefficiency being $1 - \theta$. Efficiency is here understood in the Farrell's sense, so the changes in input/output are proportional. For each object it is determined whether its current technology enables the most beneficial realization of its tasks. The primary issue is to establish the model's orientation and taking or not taking into consideration the scale's effects. The abovementioned assumptions are characteristic for the input oriented model, which means that the object being examined can decrease input while at the same time maintaining the existing output. In the case of local government units, the amount of input is usually determined by law regulations, whereas municipalities can work towards the maximization of output. Thus, with such a DMU orientation, for which

efficiency is greater than one these will be ineffective. It is to be noted that in the DEA model for which the assumption is made of stable benefits of the scale, relative efficiency of a unit is the same in case of input orientation, as it is in case of output orientation (Ćwiąkała-Małys, Nowak, 2009).

The conducted research aimed to verify the hypothesis about the existence of a relationship between income potential of municipalities and the (relative) efficiency of their expanses. Test procedure comprised of: the analysis of scientific literature with the purpose of establishing criteria which could be used as "input" and "output" (taking into account local specificity), isolation from the group of all urban municipalities in Poland of those municipalities, for which data was available for the whole experimentation period (2009-2016), correlation analysis proposed on the basis of the analysed literature on the topic of "output" ("O") – in order to avoid using variables which would be closely correlated, their income (own and general) per capita. Additionally, the Malmquist index for each DMU as well as its average values for the whole collectivity throughout the years have been calculated. The variables used in examination of relative efficiency with the DEA CCR-O method were taken from the Local Databases of CSO (Central Statistical Office) and from the System of Local Government Analyses. Those variables were supposed to reflect the main areas of municipal activity (table 1).

Tab.1:Variables set used in the research

Area	Symbol	Category
Education and upbringing	O1	Children at the age from 3 to 5 years per 1 place in the kindergarten (opposite)
	O2	Gross solarisation coefficient (primary schools)
	O3	Percentage of chartered teachers
Health protection	O4	Medical centres per 10 thousand inhabitants
	O5	Relation between births and deaths within the municipality
Residential economy	O6	Number of persons per chamber (opposite)
Social assistance	O7	Percentage of inhabitants using social environmental assistance (opposite)
Communal economy and environment protection as well as Administration	O8	Number of inhabitants using the water supply network
	O9	Number of inhabitants using sewage network
	O10	Share of terrains covered by local spatial management plans in the general area
	O11	Unemployment coefficient within the territory of the municipality (opposite)
	O12	Number of economic entities per 10 thousand Inhabitants
Culture and protection of national heritage	O13	Library book collections per 1 inhabitant

Source: own elaboration

Due to the lack of available data at the NUTS-5 level regarding the structure of the communication network (the structure of municipal roads in the studied period was no longer reported in the CSO bases) the total expenditure per capita of particular municipalities was adjusted for this expenditure item. Adequate to the partition classification and the share of individual expenditure groups in the municipalities' budgets, 14 variables describing the effects were selected, which enabled the creation of 13 measures. According to the assumptions of the model, all measures meet the assumption of uniform direction of preferences, i.e. the increase of results from the point of view of the objective will be assessed positively, and similar to the increase in output which, while maintaining the stability of results, will be assessed negatively(Guzik, 2009). For this purpose, in the case of 4 variables, their inverses were used in the calculations. Out of 241 municipalities with city status in 2009, 4 municipalities were rejected due to their missing data. In addition, due to the sensitivity of the method of outliers, 45 municipalities were excluded from the group of studied entities for whom the value of at least one of the effects (Ojr) did not meet the quartile test condition (Chromiński , Tkacz, 2010), that is:

$$Qr1-1,5*(Qr3-Qr1) \leq Ojr \leq Qr3+1,5*(Qr3-Qr1)$$

where:
n - number of examined objects (DMU) (j = 1, ..., n)
s - number of activity outputs (r = 1, ..., s)
j – subsequent DMU
r - subsequent output
Ojr - the value of observation for j-th DMU and r-th output
Qr1 - the first quartile for the r-th output
Qr3 - third quartile for the r-th output

3. Results and discussion

The first stage of research using the DEA CCR-O method showed that in the case of the studied municipalities a gradual increase in both the average value and the median relative effectiveness of these DMUs can be observed (Table 2). This means a relative decrease in discrepancies in the efficiency of the researched units.

Tab. 2: Basic descriptive statistics of the DEA CCR-O results in studied municipalities

	2009	2010	2011	2012	2013	2014	2015	2016
Average	0.873	0.839	0.854	0.868	0.884	0.897	0.900	0.919
Median	0.887	0.843	0.868	0.877	0.893	0.914	0.916	0.934
Standard deviation	0.112	0.132	0.126	0.114	0.102	0.098	0.098	0.080
Variance	0.013	0.017	0.016	0.013	0.010	0.010	0.010	0.006
Kurtosis	0.017	0.271	0.228	0.016	1.126	0.164	0.840	1.649
Minimum	0.514	0.339	0.378	0.465	0.440	0.587	0.562	0.559

Source: own elaboration

Tab. 3: Share of inefficient DMUs in the population and average efficiency value among the voivodeships

Voivodeship	Percentage of inefficient DMUs								Average DMU efficiency							
	2009	2010	2011	2012	2013	2014	2015	2016	2009	2010	2011	2012	2013	2014	2015	2016
Dolnośląskie	88%	100%	96%	83%	88%	88%	88%	79%	0.82	0.77	0.82	0.85	0.86	0.89	0.91	0.93
Kujawsko-pomorskie	100%	100%	91%	100%	91%	91%	100%	91%	0.81	0.75	0.78	0.76	0.84	0.83	0.86	0.90
Lubelskie	75%	75%	75%	81%	75%	56%	75%	50%	0.89	0.85	0.85	0.84	0.88	0.91	0.87	0.94
Lubuskie	100%	100%	100%	100%	100%	100%	100%	100%	0.79	0.75	0.74	0.79	0.80	0.85	0.85	0.89
Łódzkie	73%	80%	80%	87%	93%	93%	80%	67%	0.90	0.87	0.85	0.90	0.92	0.92	0.94	0.93
Małopolskie	50%	50%	50%	83%	67%	67%	50%	50%	0.92	0.95	0.91	0.91	0.91	0.91	0.92	0.91
Mazowieckie	94%	88%	94%	88%	88%	82%	71%	100%	0.85	0.83	0.84	0.85	0.88	0.89	0.88	0.87
Opolskie	50%	100%	50%	100%	100%	50%	100%	100%	0.81	0.70	0.87	0.82	0.87	0.90	0.89	0.91
Podkarpackie	67%	75%	75%	75%	83%	67%	75%	75%	0.92	0.87	0.92	0.89	0.89	0.88	0.91	0.93
Podlaskie	70%	90%	60%	50%	50%	60%	60%	50%	0.91	0.88	0.90	0.93	0.93	0.92	0.91	0.96
Pomorskie	80%	87%	87%	87%	80%	80%	73%	80%	0.90	0.85	0.83	0.84	0.87	0.90	0.90	0.90
Śląskie	80%	75%	75%	85%	80%	85%	75%	65%	0.86	0.87	0.88	0.90	0.88	0.90	0.87	0.92
Świętokrzyskie	100%	100%	100%	75%	75%	75%	50%	50%	0.86	0.67	0.81	0.85	0.91	0.93	0.94	0.95
Warmińsko-mazurskie	86%	86%	100%	71%	86%	86%	79%	79%	0.90	0.81	0.85	0.87	0.91	0.90	0.93	0.92
Wielkopolskie	58%	42%	58%	58%	75%	58%	58%	58%	0.93	0.95	0.94	0.92	0.92	0.92	0.94	0.95
Zachodnio-pomorskie	100%	100%	88%	88%	88%	100%	100%	100%	0.88	0.87	0.86	0.89	0.89	0.88	0.89	0.89
Total :	81%	83%	82%	81%	82%	79%	77%	74%	0.87	0.84	0.85	0.87	0.88	0.90	0.90	0.92

Source: own elaboration

Looking at the differences in the effectiveness of municipalities in the regional system, it should be emphasized that there were voivodeships in case of which all surveyed units were ineffective in the selected years (tab. 3), namely- Kujawsko-Pomorskie and Zachodniopomorskie. It should be noted that in certain voivodeships (Opolskie, Lubuskie, Świętokrzyskie), due to the low number of researched DMUs, generalization on the basis of percentage of municipalities should be treated with great caution. On a national scale, the percentage of ineffective DMU's in voivodeships in the analysed period fluctuated between 82 and 74%, showing a decreasing trend. It is also reflected in the systematic increase in the average DMU effectiveness in some voivodeships - in particular in those voivodeships where in the first two years the average efficiency fluctuated within the range between 0.7 and 0.8 (Dolnośląskie, Kuyavian-Pomeranian, and Lubuskie). In the case of voivodeships where the average efficiency at the beginning of the analysed period approached 0.9, one may speak of maintaining the original average despite periodic fluctuations (usually relatively small decreases of the efficiency ratio).

At the same time, it should be pointed out that due to the calculated level of efficiency indicators DMU can be divided into four categories (Table 4). On the basis of ordered values of efficiency indicators, the following groups of municipalities were distinguished ($é$ - the arithmetic mean, and δ_e - standard deviation of the DEA CCR-O efficiency indicator):

▪ group A (high efficiency): $e_j \geq é + \delta_e$,
▪ group B (average efficiency): $é \leq e_j < é + \delta_e$,
▪ group C (low efficiency): $é - \delta_e \leq e_j < é$
▪ group D (very low efficiency): $e_j < é - \delta_e$.

Tab. 4: Division of DMU into groups based on the value of performance indicators

Efficiency groups	2009	2010	2011	2012	2013	2014	2015	2016
A	45	42	43	44	39	44	44	50
B	61	55	60	56	65	62	66	59
C	56	66	57	62	58	56	53	56
D	30	29	32	30	30	30	29	27

Source: own elaboration

As can be seen within the proposed classification method, there are slight differences in the quantity of some DMU groups. In the analysed period the number of high efficient municipalities ranged from 39 to 50, with the lowest number recorded in 2013 and the highest in 2009 and 2016. In turn, in the group of municipalities with very low efficiency, the changes were insignificant (except 2011 and 2016). An analysis of the municipalities' affiliation to particular groups indicates that only 16 DMUs in the period under examination were permanently included in group C or D, and only three were included in group D (Nowy Dwór, Hel, Mikołów). This shows the changes in the activities of some DMUs affecting their relative efficiency. On the other hand, it should be noted that 6 DMUs (Bielsk Podlaski, Siemiatycze, Reda, Wodzisław Śląski, Chodzież, Luboń) were included in the high efficiency group of DMU. At the same time, 31 municipalities were indicated in the analysed period only in the group of municipalities with high or average efficiency.

The next additional stage of the investigation was to determine the Malmquist index for the studied DMUs. The basic data is contained in table 5. As can be seen, the average value of TFP_CH (total factor productivity change) was below 1 in all years and the average values of PE_CH (pure technical efficiency) SE_CH (scale efficiency change) were slightly positive in most periods, while TECH_CH (technological change) indicators were below 1. Detailed analysis of Malmquist indexes for particular units reaches beyond the scope of this publication.

Tab. 5: Malmquist index for annual means (output oriented DEA)

Year	EFF_CH	TECH_CH	PE_CH	SE_CH	TFP_CH	TFP_CH minimum	TFP_CH maximum
2	0.957	0.979	1.000	0.957	0.936	0.416	1.494
3	1.019	0.978	1.001	1.018	0.997	0.546	1.926
4	1.019	0.979	0.999	1.02	0.997	0.642	1.534
5	1.021	0.964	1.001	1.02	0.984	0.712	2.372
6	1.016	0.938	1.001	1.015	0.953	0.731	1.619
7	1.003	0.981	1.000	1.003	0.984	0.517	1.495
8	1.024	0.863	0.999	1.025	0.883	0.604	1.503
mean	1.008	0.954	1.000	1.008	0.961	-	-

Source: authors' own calculation

According to the assumptions of the work the research was carried out to verify the hypothesis that there is a relationship between the income potential of municipalities and the (relative) efficiency of their expenses. The basic research problem is to determine the correlation between the income of particular DMUs and their technical efficiency indicators. In accordance with the results of calculations presented in Table 6, it can be concluded that there is a moderate negative correlation between the level of own revenues per capita and the indicators of technical efficiency obtained from the analysis. A much stronger relationship occurs between their total revenues per capita and the mentioned indicators. In the case of the former, there are fluctuations correlation factors between -0.37 and -0.24 (with a decreasing tendency) while in the case of the latter the values range between -0.62 and - 0.38 (here also a decreasing tendency is present).

Tab. 6: Correlation between technical efficiency indicators from the DEA CCR-O model and particular income aggregates in the studied DMU group

correlations	2009	2010	2011	2012	2013	2014	2015	2016
TR_DEA	-0.48665	-0.62479	-0.51396	-0.50347	-0.37828	-0.51751	-0.48142	-0.39833
OR_DEA	-0.36942	-0.36483	-0.33134	-0.28651	-0.23849	-0.27884	-0.31334	-0.23991

Source: authors' own calculation

The obtained values of correlation indices make the thesis more probable to some extent for the effectiveness of expending funds of financially weaker local governments. Of course, there is no option for uncritically accepting the results obtained primarily due to the arbitrariness and selectivity adopted as comparison criteria of variables and external effects affecting the obtained results. The aspect of DMU's acceptance of a certain level of inefficiency resulting from the specific preferences of the residents of these units is also significant.

Conclusion

In closing, it should be stated that the conducted research has shown the existence of a relationship between the level of income per capita of the studied municipalities and their relative technical efficiency measured by the DEA CCR-O method. However, the obtained results should be treated with great caution due to both the imperfection of the method, the limited scope of the data to be obtained, exogenous factors that may influence the effects of the municipalities' activities and the specific preferences of the residents of particular municipalities. From the point of view of future research the possibility of using other DEA models and changes in their direction should be considered.

Literature

[1] BALAGUER-COLL, M.T., PRIOR, D., TORTOSA-AUSINA, E. (2007). On the determinants of local government performance: A two-stage nonparametric approach. *European Economic Review*, vol. 51, no.2, pp. 425–451. ISSN 0014-2921. DOI: 10.1016/j.euroecorev.2006.01.007.

[2] BANKER, R.D., CHARNES, A., COOPER, W.W. (1984). Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis. *Management Science*, vol. 30, no.9, pp. 1078–1092. ISSN 0025-1909. DOI: 10.1287/mnsc.30.9.1078.

[3] CHARNES, A., COOPER, W.W., RHODES, E. (1978). Measuring the efficiency of decision making units. *European Journal of Operational Research*, vol. 2, no. 6, pp. 429–444. ISSN 0377-2217. DOI: 10.1016/0377-2217(78)90138-8.

[4] CHROMIŃSKI, K. and TKACZ, M. (2010). Comparison of outlier detection methods in biomedical data. *Journal of Medical Informatics and Technologies*, no. 16, pp. 89–94. ISSN 1642-6037.

[5] COOPER, W. W., SEIFORD, L. M., TONE, K., ZHU, J. (2007). Some models and measures for evaluating performances with DEA: past accomplishments and future prospects. *Journal of Productivity Analysis*, vol. 28, no. 3, pp. 151–163. ISSN 0895-562X, 1573-0441. DOI: 10.1007/s11123-007-0056-4.

[6] DA CRUZ, N.F., MARQUES, R.C. (2014). Revisiting the determinants of local government performance. *Omega-International Journal of Management Science*, no. 44, pp. 91–103. ISSN 0305-0483. DOI: 10.1016/j.omega.2013.09.002.

[7] ĆWIĄKAŁA-MAŁYS, A., NOWAK, W. (2009). Sposoby klasyfikacji modeli DEA. *Badania Operacyjne i Decyzje*, , no.3, pp. 5–18. ISSN 1230-1868.

[8] CZAPLAK, J. (2016). Analysis of the effectiveness of public services provision by local governments in the years 2007–2013. *Oeconomia Copernicana*, 7(2), p. 223. ISSN 2353-1827. DOI: 10.12775/OeC.2016.014.

[9] CZARNECKI, P., SZAROTA, R., WOZNIAK, D. (2015). The Study of the Relative Efficiency of Selected Commune Offices Located. In NALEPKA, A., UJWARYGIL, A. (eds.) *Business and Non-Profit Organizations Facing Increased Competition and Growing Customers' Demands, Vol 14*. Nowy Sacz: Wyzsza Szkola Biznesunatl-Louis Univ, pp. 191–205. ISBN 978-83-65196-21-7.

[10] GAŁECKA, M., SMOLNY, K. (2017). Economic Efficiency of Cultural Institutions. In 15th International Conference Hradec Economic Days 2017. University of Hradec Králové.

[11] GENDZWILL, A., SWIANIEWICZ, P. (2016). Does Local Democracy Perform Better in Smaller Jurisdictions? Survey Evidence from Poland. *Lex localis - Journal of Local Self-Government*, vol. 14, no.4, pp. 759–782. ISSN 1581-5374. DOI: 10.4335/14.4.759-782(2016).

[12] GUZIEJEWSKA, B. (2008). The effectivness of local government finance. *Gospodarka Narodowa*, vol. 19, no. 5–6, pp. 71–89. ISSN 0867-0005.

[13] GUZIK, B. (2009). *Podstawowe modele DEA w badaniu efektywności gospodarczej i społecznej*. Poznań: Wydawnictwo Uniwersytetu Ekonomicznego w Poznaniu. ISBN 978-83-7417-368-1.

[14] JASTRZĘBSKA, M. (2016). Uwarunkowania pomiaru efektywności wydatków jednostek samorządu terytorialnego. *Finanse, Rynki Finansowe, Ubezpieczenia*, vol. 6, no. 84, pp. 43–53. ISSN 2450-7741. DOI: 10.18276/frfu.2016.84/1-04.

[15] KAŃDUŁA, S. (2017). The Efficiency of Fiscal Equalization. The Case Study of Municipalities in Poland. *Lex localis - Journal of Local Self-Government*, vol. 15, no. 4, pp. 803–825. ISSN 1581-5374. DOI: 10.4335/15.4.803-825(2017).

[16] KARBOWNIK, B. KULA, G. (2009). *Efektywność sektora publicznego na poziomie samorządu lokalnego*. Warszawa: Narodowy Bank Polski.

[17] KOBIAŁKA, A., KUBIK, R. (2017). Efektywność działalności inwestycyjnej gmin województwa lubelskiego w kontekście rozwoju obszarów wiejskich. *Roczniki Naukowe Stowarzyszenia Ekonomistów Rolnictwa i Agrobiznesu*, no. 1, pp. 80–84. ISSN 1508-3535. DOI: 10.5604/01.3001.0009.8396.

[18] ŁĘKAWA, Z. (2012). Ocena efektywności gmin województwa dolnośląskiego z wykorzystaniem metody DEA. *Annales Universitatis Mariae Curie-Skłodowska. Sectio H. Oeconomia*, vol. 46, no. 4, pp. 515–526. ISSN 0459-9586.

[19] LIZIŃSKA, W., MARKS-BIELSKA, R., BABUCHOWSKA, K., WOJARSKA, M. (2017). Factors contributing to the institutional efficiency of local governments in the administrative area. *Equilibrium*, vol. 12, no. 2, p. 339. ISSN 2353-3293, 1689-765X. DOI: 10.24136/eq.v12i2.18.

[20] OLEJNICZAK, J. (2015). Fiscal efficiency and stability of own revenues in urban local self-governments' budgets before, during and after crisis - example from Lower Silesian voivodeship. In *XVIII. mezinárodní kolokvium o regionálních vědách. Sborník příspěvků*. Brno: Masarykova univerzita, pp. 440–446. DOI: 10.5817/CZ.MUNI.P210-7861-2015-59.

[21] OLEJNICZAK, J., BEDNARSKA-OLEJNICZAK, D. (2013). The intergovernmental equalization system in Poland in view of the development level of rural municipaties in Lower Silesian and Lubuskie Voivodeships. In *The International Conference Hradec Economic Days 2013. Economic Development and Management of Regions. Peer-Reviewed Conference Proceedings, Part III*. Gaudeamus, pp. 288–299. ISBN 978-80-7435-251-5.

[22] OWSIAK, K. (2014). Problem efektywności wydatków jednostek samorządu terytorialnego. *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu*, no. 346, pp. 142-150. ISSN 18993192. DOI: 10.15611/pn.2014.346.14.

[23] PONIATOWICZ, M., WYSZKOWSKA, D. (2015). Dysfunction of Fiscal Equalization Mechanisms in the System of Local Government Finances in Poland. *Lex Localis-Journal of Local Self-Government*, vol. , 13, no.4, pp. 1019–1045. ISSN 1581-5374. DOI: 10.4335/13.3.1019-1045(2015).

[24] PRZYDATEK, G. (2016). A Comparative Analysis of Municipal Waste Management Systems. *Polish Journal of Environmental Studies*, vol. 25, no.5, pp. 2107–2112. ISSN 1230-1485. DOI: 10.15244/pjoes/61823.

[25] SEKULA, A. (2015). General Grants and Development - A Relationship without a Future? The Effects of the Structure of General Grants on the Development of Local Government Units in Poland. *Lex Localis-Journal of Local Self-Government*, 13(4), pp. 915–932. ISSN 1581-5374. DOI: 10.4335/13.3.915-932(2015).

[26] SEKUŁA, A., JULKOWSKI, B. (2015). Pomiar efektywności wydatków budżetowych dużych miast w Polsce. *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu*, no. 404, pp. 265–282. ISSN 1899-3192. DOI: 10.15611/pn.2015.404.18.

[27] SWIANIEWICZ, P., LUKOMSKA, J. (2016) Does Size Matter? The Impact of Territorial Fragmentation/Consolidation. In *Skopje: Geobalcanica Soc*., pp.357-364. ISBN 1857-7636. DOI: 10.18509/GBP.2016.47.