

THE STUDY OF THE RELATIVE EFFICIENCY OF SELECTED COMMUNE OFFICES LOCATED IN NOWY SACZ, LIMANOWA AND GORLICE POVIATS

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Abstract

The main aim of this paper is to analyze the efficiency level of the local administration units supporting the self-government authorities in gminas. The elaboration objects were 28 gminas from the Nowosądecki, Limanowski and Gorlicki poviats (southern Poland). The analysis was carried out for years 2009 and 2010. The authors used the DEA method (CCR model) for calculating relative efficiency of the selected units.

Keywords: *efficiency, DEA, CCR DEA, local administration.*

1. Introduction

Self-governing gminas became commonplace in Polish institutional landscape 25 years ago. During this period, the local government has been the subject to constant evolution, which aims to best meet the needs of mass society. The current crisis of the government (understood as one of the institutional sectors in the economy) is associated in part with the sphere of public finances (Łaski, 2011). This crisis also affects the local government of gminas. During the crisis the question of the effectiveness of the government becomes one of the most important issues of interest.

On the basis of these premises the team of the Regional Science Institute in WSB-NLU in collaboration with the students of Management in Public Administration specialization in the Faculty of Business and Management, took on the challenge to analyze the efficiency of the offices of gminas.

The issue of efficiency, including its measurement, possesses, neither in theory nor in practice, proven and widely used uniform solution. Traditional methods of assessing the efficiency (at least at administration level) are based on a variety of financial indicators. But the studies of the cases where effects

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or inputs necessary to take action are not only form of payment related, constitute a real challenge for economists. In recent years in Poland, there has been a rapid development of analytical techniques to support this kind of analysis in the public sector⁴.

The main objective of this study is to compare the efficiency of self-government offices in gminas which are located in the study area (area districts of Nowy Sacz, Gorlice and Limanowa). Apart from obtaining a picture of the overall effectiveness of the authorities, the results will help to identify areas of offices' activities that can be corrected to achieve higher efficiency. The test method consists of a number of techniques, but the central component is a non-parametric technique derived from linear programming called Data Envelopment Analysis in CCR form (DEA CCR).

The article consists of four parts. The first presents the role of gminas' offices in local self-government administration against the background of financial problems of the local government sector. In the second part, the concept of the relative effectiveness and DEA technique is described. The third part shows the progress and results of the study, and in the fourth part the main conclusions of the study are drawn.

2. The efficiency of commune (gmina) offices' actions in the context of local self-government finances

Public finance situation is best illustrated by public sector debt (Figure 1 and 2). Since the local government reform in 1999, a steady increase in debt which now reaches more than PLN850 million (more than 50% of the annual gross domestic product) has been observed. It should be noted that the obligations of the Treasury (over 90% of the total) hold a dominant position in the structure of debt.

⁴ What, in major part, is an effect of the EU funds and its evaluation, see: <https://www.ewaluacja.gov.pl/Strony/glowna.aspx>.

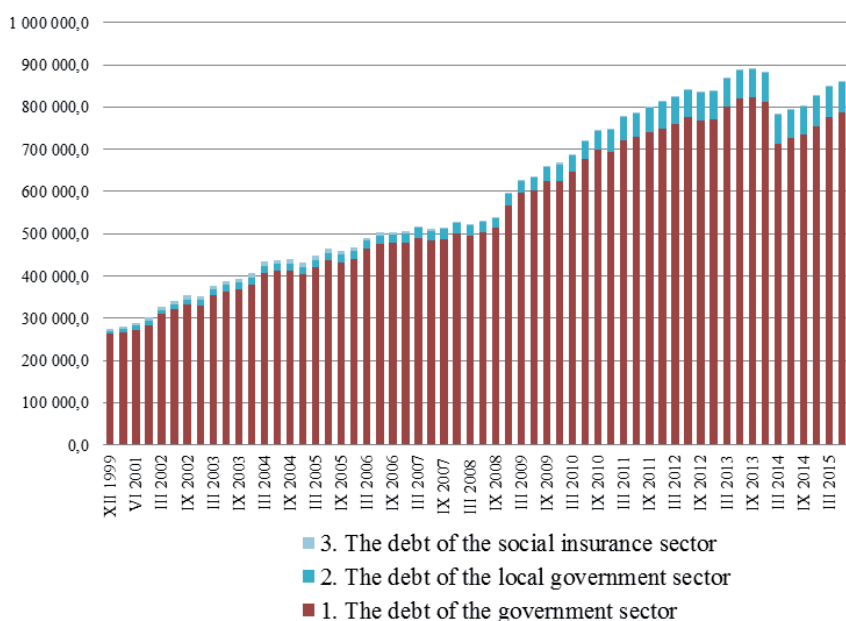


Figure 1. The debt of public finance sector in the years 1999 to 2015 (after the consolidation, nominal values)

Source: Own study based on data from the Ministry of Finance, the database: public finance sector debt, available at: <http://www.finance.mf.gov.pl/web/wp/szeregi-czasowe>, accessed: 20.09.2015.

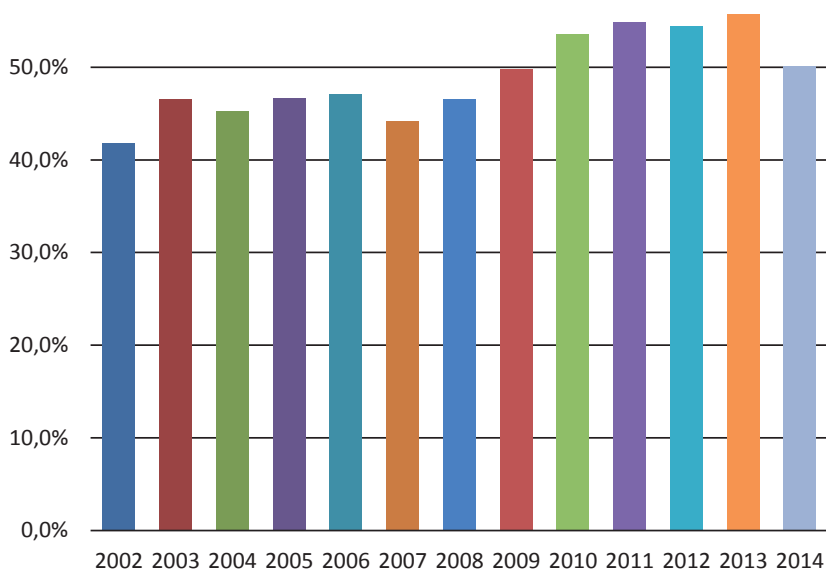


Figure 2. Public finance sector debt in relation to gross domestic product

Source: Own study based on data from the Ministry of Finance, the database: public finance sector debt, available at: <http://www.finance.mf.gov.pl/web/wp/szeregi-czasowe>, accessed: 20.09.2015.

The local government sector debt increased significantly in the previous financial perspective of the European Union and reaches more than PLN70 billion 95% of this debt are the liabilities of local self-governments and their associations. The dynamics of the phenomenon creates a large discussion on the causes and consequences of this state of affairs (see e.g. Korolewska & Marchewka-Bartkowiak, 2011; Heller & Fareltnik, 2013; Satoła, 2012).

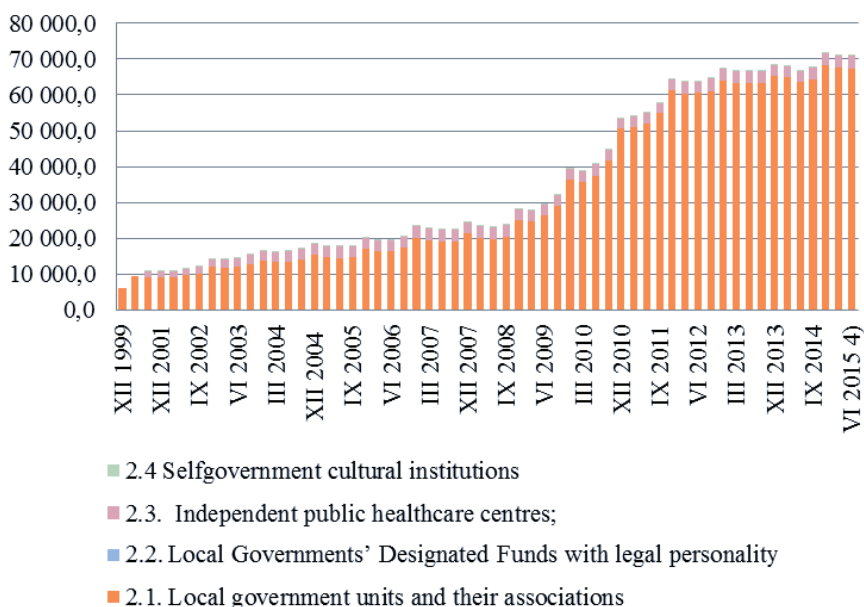


Figure 3. The local government sector debt (nominal value)

Source: Own study based on data from the Ministry of Finance, the database: public finance sector debt, available at: <http://www.finance.mf.gov.pl/web/wp/szeregi-czasowe>, Accessed: 20.09.2015r.

From the perspective of this article, the influence of the situation in this sector on the efficiency of gminas is essential. Theoretical foundations of the activities of gminas and its bodies' evaluation are rooted in praxeology, the general theory of efficient operation. The assessment of actions will be perceived on the ground of praxeology as some practical values of actions ascribed to them in terms of efficiency (Kotarbinski, 2000). The most important features of the operation efficiency are the effectiveness and economy (now often referred to as efficiency). An effective action means such an action undertaken by public authorities, which leads to the intended purpose. Action can be effective or ineffective, which means either counterproductive or indifferent with respect to the purpose. Economy takes the form of either performance or cost savings. The procedure is the more efficient the higher the total output obtained (specifically its value) in relation to the inputs/ expenditures incurred. Saving is understood as a reduction of inputs required to

produce a given amount of output. Both features are gradable, and this means that the operation may be more or less effective and more or less efficient.

The deteriorating financial situation of the local government sector has increased efforts of local authorities at all levels, aimed at increasing efficiency and effectiveness. The subject of this study is the efficiency of offices' activities in gminas. Commune (gmina) offices are auxiliary units of Voits, Mayors or City Presidents. The basis of their functioning are the provisions of the Act on Commune Self-Government, and the organization and scope of the auxiliary unit are determined by the gmina councils in a separate statute that contains, among others (articles 33-35 of Act on Commune Self-Government, consolidated text in OJ 2015 No. 0 pos. 1515):

- the name and area of the auxiliary unit,
- the rules and procedures for the election of the auxiliary unit organs,
- organization and responsibilities of the auxiliary unit,
- the scope of tasks transferred to the unit by the municipality and the manner of their implementation,
- the extent and forms of control and supervision of the gmina authorities over the activities of the auxiliary unit organs.

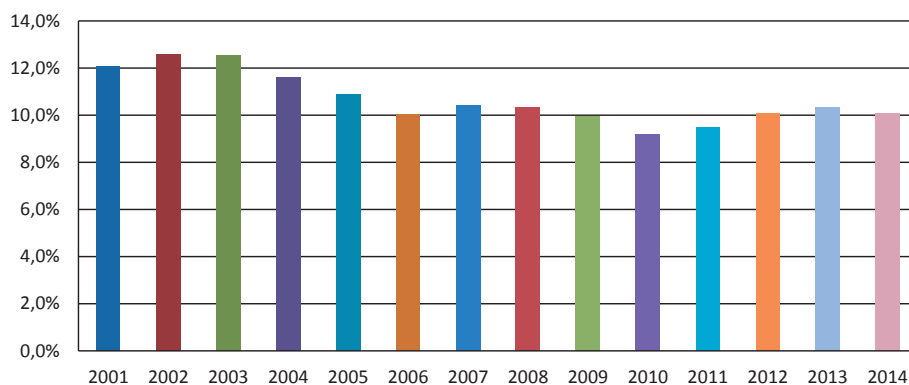


Figure 4. The share of expenditure in section 750 – Public administration in total expenditures of municipalities (excluding cities with poviat status)

Source: own study based on the Local Data Bank, the database is available at <http://stat.gov.pl>, Accessed: 20.09.2015.

It is worth noting that the activities of commune (gmina) offices are of course related to the functioning of the whole community, but the present study attempts to focus on efficiency of gmina offices' operations itself (as of organizational units') and not on the efficiency of the entire gmina. The area of analysis is to focus on activities reflected in section 750 (Public Administration) in accordance with the Regulation of the Minister of Finance form 2nd March 2010 on the detailed classification of incomes, expenses,

revenues and expenditures and the funds coming from foreign sources (text uniform, OJ 2014 pos. 1053). The share of this section in total expenditures of gminas (excluding cities with poviatus status) is currently about 10% (Figure 4).

3. The concept of efficiency and DEA method

The issue of effectiveness, including its measurement has, neither in theory nor in practice, proven and widely used uniform solution. Traditional methods of assessing the effectiveness, various financial indicators, have been enriched with more complex tools which include Data Envelopment Analysis (DEA). In the literature devoted to the study of the effectiveness the parametric and non-parametric approach can be noticed.

Parametric models in econometrics rely on determination of the production function, which defines the relationship between inputs and effects. Nonparametric approach is based on the linear programming known as the DEA method.

The authors of the DEA method (Charnes et al., 1978), often referred to as the CCR model, using the concept of productivity formulated by G. Debreu and MJ Farrell which defines the measure of productivity as the ratio of a single output (effect) and a single input, applied it to the situation in which we have more than one input and more than one output.

DEA therefore focuses on the study of the relationship between the level of multiple inputs and multiple effects. This method allows to determine the production frontier, which includes all of the most effective units in the surveyed population. The DEA method uses the so-called Decision Making Units (DMU) as the objects of analysis. The DEA calculates the efficiency of a DMU relative to the best performing DMU or DMUs (when more than one DMU are the most efficient). Moreover, the DEA assigns an efficiency score of one (100 percent) to the most efficient unit, and the low-performing DMUs efficiency can vary between 0 and 100 percent in comparison to the most efficient DMU(s). For detailed formulas of the DEA calculations see Charnes et al. (1978).

In 1984, Banker proposed the development of the CCR model in such a way that it takes into account the constant economies of scale (CRS DEA) model, assuming variable economies of scale (VRS DEA) (Banker et al., 1984; Charnes et al., 1978). In the literature this model is known as BCC model. This model, however, does not identify economies of scale. Only Fare et al. (1997) modified it by introducing additional assumptions concerning the convexity, which in turn led to a model assuming not grown in economies of scale (NIRS DEA). In the last twenty years, the DEA models have been the subject to many modifications and supplements (e.g. broad discussion on this issue in Guzik, 2009, Cooper et al., 2007).

In order to classify models of the DEA two criteria are used simultaneously: the type of economies of scale and orientation of the model. The first criterion indicates whether expenditures are minimized or results are maximized. The second criterion specifies, however, what kind of assumptions about economies of scale have been adopted in the model (VRS variables, constants CRS, non-growing NIRS). DEA method is well known and often used in different areas and for many applications, e.g. in the analysis of hospitals (Matawie & Assaf, 2010), banks (Brockett et al., 1997), universities (Wolszczak-Derlacz, 2015) or the individual sectors of the national economies in the regions (Czarnecki et al., 2010).

4. The course of study and results

As noted in the introduction, the main aim of the research conducted by the team was to use the DEA method to measure the relative efficiency of commune (gmina) offices in selected poviats of Malopolska Voivodship. It should be emphasized that the study was not about measuring the efficiency of gminas but the offices, treated here as individual decision units. In this study, the term Decision Making Unit (used in the DEA method) we shall mean therefore the commune (gmina) offices in a given calendar year.

The basic assumption underlying the study, was the statement that in the case of gmina offices it is difficult to talk about measuring the absolute efficiency of units, because it is difficult to determine its ideal level. It is therefore preferable in this case to use relative measures.

The main problem the research team faced was to identify the characteristics-variables that would be used to measure the effectiveness of the local government. On one hand, it was obvious to the team that this measurement should not be based solely on the financial dimension of gmina office activities. The effectiveness of the institution is a concept much broader, related to its efficiency, dependent to a large extent on its level of management. And it should be analyzed in many dimensions, including qualitative (Zawicki & Mazur, 2004). In practice, the financial dimension of the commune (gmina) offices' functioning is closely related to the expenditures which are incurred by the local community for its operation. And the results of their work have a much more qualitative dimension, very difficult to express in financial terms.

On the other hand, the purpose of research related to the application of the DEA method for measuring the relative efficiency of the commune (gmina) offices, imposes the need to identify those variables that satisfy the requirements of that method – and so have the characteristics of the variables.

In other words, at this stage of research, the main task of the team was to identify inputs and outputs relevant to the functioning of commune (gmina)

offices. In the initial phase, based on literature studies, a fairly broad set of inputs and outputs was proposed. Subsequently, the proposals were discussed with experts – employees of commune (gmina) offices (10 experts, direct interview), responsible for their management. As a result a set of variables was set, which included:

Inputs:

- the number of people employed under a contract of employment,
- remuneration of employees, resulting from contracts of employment (salaries and their derivatives).
- the number of people employed on the basis of civil law contracts,
- the value of civil-law agreements,
- expenditure on office staff training,
- expenditure on the purchase of fixed assets,
- expenditure on travel, business trips,
- expenditure on the technical infrastructure,
- expenditure on computerization of the office (software, training, etc.).

Outputs:

- the total number of cases processed in the Office (units),
- the average processing time for a case on the basis of the Code of Administrative and the tax code,
- the average processing time for a case based on other provisions (including the Civil Code),
- the number of cases submitted and processed electronically,
- the funds to implement their own tasks derived from external sources (e.g. EU funds),
- the number of projects implemented by the Office during the year, related to the activities of the municipality – own investments and funded from external sources,
- the number of outsourced tasks, carried out by the Office,
- the value of outsourced tasks, carried out by the Authority.

Variables included above, became the basis for constructing the questionnaire addressed to the heads of gminas. The survey covered the gminas of poviats: Gorlicki, Limanowski and Nowosądecki. The survey was conducted in June and July 2011 by the students of postgraduate studies at the Faculty of Business and Management WSB-NLU in Nowy Sącz. The questions in the survey concerned the years 2007-2010.

After the initial analysis of data obtained, the team verified the list of variables presented above and rejected some of them. The reasons for this action were as follows:

- some variables basically did not show any differentiation, in consequence causing no variation in efficiency. This was primarily a variable concerning the time length of proceeding one case by the

office. Almost all offices indicated the number of days resulting from the provisions of law,

- to obtain information about some variables became impossible. For example, the vast majority of offices did not provide information about the number of projects carried out and supervised by the office and the number of tasks assigned and carried out by the office.

Many offices transmitted incomplete information (they mostly confined to the period 2009-2010), which in turn has prevented its application in the case of the DEA method, using predetermined variables. This fact forced the team to reduce the number of offices and years of analysis (DMU), for which efficiency was analyzed. In case of two values used in the analysis the team completed missing data using the method of „hot deck imputation”. As a result, only in case of 28 DMU (offices) out of the 130 DMU which were initially planned to be analyzed, the team had complete data for the years 2009 and 2010, so they were classified for further study.

The final set of variables which meet the conditions of their use in the analysis of DEA (CCR) are as follows:

Inputs:

- the number of people employed under a contract of employment (LZUP),
- remuneration of employees resulting from contracts of employment (salaries and their derivatives) (WL),
- the number of people employed on the basis of civil law contracts (LOUC),
- the value of civil-law agreements (WUCP),
- expenditure on office staff training (WS),
- expenditure on the purchase of fixed assets (WST),
- expenses on travel, business trips (WW),
- expenditure on the technical infrastructure (WII),
- expenditure on computerization of the office (software, training, etc.) – WIU).

Outputs:

- the total number of cases processed in the Office (units) (LSZ),
- the funds to implement their own tasks derived from external sources (SZWZZ),
- the number of outsourced tasks, carried out by the Office (WZL).

Using the data obtained, the analysis of the effectiveness of selected gmina offices using DEA method was carried out. The software used for the calculation was DEA Solver Professional. The basic results of the research are presented in Table 1. The gmina offices which were analyzed are hidden under the codes from G1 to G28.

As can be seen from Table 1, 18 offices proved to be 100% effective, i.e. they lie on the efficiency frontier (boundary). These are the offices with the score 1. In contrast, the efficiency of 10 offices turned out to be worse. The office with the lowest effective use of inputs is G15, its efficiency is more than three times worse than that found in the best municipal offices. In practice, this means that to achieve efficiency comparable to the best authorities, it would have to reduce spending by more than 70%, while maintaining the current results of operation.

Table 1. DEA analysis results for the commune offices

DMU	Score	Position
G1	1	1
G2	1	1
G3	1	1
G4	1	1
G5	1	1
G6	1	1
G7	0,9844368	19
G8	1	1
G9	1	1
G10	1	1
G11	1	1
G12	1	1
G13	0,4514262	24
G14	0,3234666	27
G15	0,2819976	28
G16	1	1
G17	1	1
G18	1	1
G19	1	1
G20	1	1
G21	0,4388171	26
G22	0,6181478	21
G23	0,5154287	23
G24	0,7288626	20
G25	1	1
G26	1	1
G27	0,4421891	25
G28	0,6108083	22

To illustrate more clearly the results and conclusions that we can obtain using the DEA method, the further analysis will focus on one selected DMU – G15. The detailed results of the study for this office are presented below.

Table 2 shows a set of weights for inputs and outputs for commune (gmina) office G15, which helps to identify the factors most important to the efficiency of the unit.

Table 2. A set of weights for inputs and outputs for office G15

DMU	Score	V(1) LZUP	V(2) WL	V(3) LOUCHI	V(4) WUCP	V(5) WS	V(6) WST	V(7) WW	V(8) WH	V(9) WU	U(1) LSZ	U(2) SZWZZ	U(3) WZL
G15	0,2819976	0	0	0	8,36E-06	2,36E-05	0	0	0	0	2,29E-05	1,57E-07	0

According to the data contained in Table 2, in case of the G15 office, the variables that most affect the level of this unit’s efficiency are: WUCP and WS on the inputs side and the LSZ and SZWZZ on the output side. Information contained in Table 2 indicates that relatively small reductions in WUCP and WS factors can have a considerable effect in terms of improving the relative efficiency of the unit. Similarly, any increase in LSZ and SZWZZ could have a considerable effect on improving the relative efficiency of the office. In case of the other inputs and outputs, the effects will be negligible, i.e. for example, reducing the number of employees (LZUP) will have very little impact on improving the efficiency of the unit.

Table 3 presents the weighted results of the DEA for the office G15.

Table3. Weighted DEA analysis results for the office G15

DMU	Score	VX(1) LZUP	VX(2) WL	VX(3) LOUCHI	VX(4) WUCP	VX(5) WS	VX(6) WST	VX(7) WW	VX(8) WH	VX(9) WU	UY(1) LSZ	UY(2) SZWZZ	UY(3) WZL
G15	0,2819976	0	0	0	0,6978766	0,3021234	0	0	0	0	6,88E-02	0,2132029	0

As we can see in Table 3, the quotient of the sum of weighted inputs and a weighted sum of the outputs give the final result (assessment of the effectiveness): 0.281976 for a unit G15.

Table 4 shows a list of benchmarks for the office G15. These are the offices, which are located on the border of efficiency and their use of inputs to which the office expenses of G15 should seek to follow.

Table 4. Set of benchmarks for the office G15

DMU	Score	Position	Referential data (lambda)					
G15	0,2819976	28	G3	3,19E-02	G16	9,30E-02	G18	4,70E-02

As shown in Table 4, the benchmarks for the G15 office are the following offices: G3, G16 and G18. On the basis of a set of inputs and outputs of these three offices, taking into account technological factors (lambda set for each benchmark unit), we can obtain the desired image of the use of inputs and their conversion into effect for office G15. This desired image is called projection.

Table 5 includes changes in the value of individual variables that would allow the office G15 to improve their efficiency to a level comparable with the best offices, according to the above presented technological factors.

Table 5. Projections of costs and effects for the office G15

No.	DMU	Score			
	I/O	Data	Projection	Difference	%
15	G15	0,2819976			
	LZUP	34	8,8300622	-25,169938	-74,03%
	WL	1468107,1	393275,62	-1074831,5	-73,21%
	LOUCI)	13	3,5422527	-9,4577473	-72,75%
	WUCP	83440	23529,878	-59910,122	-71,80%
	WS	12824	3616,3369	-9207,6631	-71,80%
	WST	8012776,9	26962,412	-7985814,5	-99,66%
	WW	39894,12	4372,5277	-35521,592	-89,04%
	WII	13509,63	3369,7351	-10139,895	-75,06%
	WIU	20000,37	3824,8125	-16175,558	-80,88%
	LSZ	3000	3000	0	0,00%
	SZWZZ	1361356,6	1361356,6	0	0,00%
	WZL	373784,66	647048,49	273263,83	73,11%

As can be seen in Table 5, in order to achieve the effectiveness of the best offices, unit G15 would have to reduce significantly the use of inputs. The largest reduction in the spending should concern the office's purchase of fixed assets, which should be reduced by more than 99.5%, and expenses for business trips, which should be reduced by 89%. Other inputs of office G 15 should also be reduced significantly by more than 70%.

The reduction of inputs by G15 alone will not be enough to recognize this entity as effective within the meaning of the DEA analysis. For this purpose, the office should also significantly increase the tasks assigned from the amount of PLN373 784 to over PLN647 thousand. Only completion of the actions described above (including the reduction of inputs while increasing one type of outputs) will allow the office to be recognized as an effective one.

Table 6 summarizes the deviations for the inputs and outputs of office G15 (slacks), i.e. the differences between inputs (effects) optimal and expenditures (effects) proportional.

Table 6. Summary of effects shortcomings and of inputs surpluses for the office G15

DMU	Score	Excess										Shortage		
		LZUP	WL	LOUCI	WUCP	WS	WST	WW	WII	WIU	LSZ	SZWZZ	WZL	
		S-(1)	S-(2)	S-(3)	S-(4)	S-(5)	S-(6)	S-(7)	S-(8)	S-(9)	S+(1)	S+(2)	S+(3)	
G15	0,2819976	0,7578553	20727,026	0,1237158	0	0	2232621,2	6877,5173	439,94782	1815,2434	0	0	273263,83	

As shown in Table 6, in case of WUCP and WS inputs and the effects of LSZ and SZWZZ these slacks are zero, which means that optimal inputs (effects) for these variables coincide with proportional inputs (effects).

5. Conclusion

The DEA technique used in this study is one of the best techniques for measuring the effectiveness of an organization. In addition to the large methodological advancement it offers a multi-dimensional approach for inputs as well as for the effects of individual actions. The presented study is the evidence that the results of the analysis give not only the ranking of units (method requires a comparison to other similar objects), but also suggest courses of action aimed at improvement of functioning of any organization. In times of crisis in public finances sphere, it seems that this technique should be more widely applied to the analysis of the effectiveness of public sector units. It is important to note that the conducted analysis also pointed to possible difficulties and limitations in using this technique to commune offices. The identification of inputs and outputs of commune units proved to be difficult (despite consultations with the experts). This indicates a rather not clearly defined space definition of (mainly functions) of the commune office in the Polish system of local government. It should also be noted that the DEA technique is, although it uses a nonparametric approach, essentially quantitative technique and requires the assembly of large amounts of data. These, unfortunately, are not always available for all of the units and for each period. Despite these drawbacks,

the authors of this research (which can be considered as a pilot one) would like to expand the study population for the municipality of the province of Malopolska and then for the whole Poland in the future.

The team would like to thank the experts, the workers of the analyzed offices and WSB-NLU students for their help in carrying out this study.

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