



## Evaluation of the level of operating surplus in the budgets of land districts in Poland - taking into account the share of central taxes (*PIT - personal income tax and CIT - corporate income tax*)

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**ABSTRACT:** Management of public funds requires the ability to analyse financial phenomena. One of the important financial indicators used to analyse the financial situation of local government units in Poland is budget operating surplus (budget operating result). The aim of the article is to present the results of our own research on the level of budget operating surplus in Poland's land districts, taking into account revenue from PIT and CIT share. The practical aim of the article is to present district authorities with solutions for the use of a linear mixed-effects model to study financial phenomena in land districts in Poland. The choice of this research tool was expedient, because of the interdependence that exists between the observations, measurements of a given variable are repeated annually for individual districts. Fixed effects analysis, provided the coefficients of the model showing how the value of the dependent variable increases or decreases with a unit increase in the explanatory variable. In addition, the random effects statements of the model indicate, in turn, the extent to which the districts differed in the value of the dependent variable.

**KEYWORDS:** operating surplus, local government budget, district, central taxes, linear mixed model

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### I. INTRODUCTION

The local government sub-sector in Poland is an important and at the same time integral element of the public finance sector. Local self-government performs a substantial part of public tasks. By virtue of the basic law, it is endowed with subjectivity, financial independence and also legal independence. The organisation and system of local government in Poland is clearly complex, involving three levels of territorial division [12]. Since 1999, in addition to the municipality, regional communities have been functioning as the basic link of local government in Poland, and there also operates an intermediate level of local government in the number of 314 land districts. The Constitution of the Republic of Poland, in force since 17 October 1997, stipulates in Article 15 that the political system of Poland ensures the decentralisation of public authority [2]. After more than forty years of administrative stagnation the political transformation of local self-government came, thanks to which the decentralisation of structures and public utility tasks began.

Changes in the legal regulations have laid the foundation for re-shaping the structure of the land districts as an entity with the right to decide on the shape of the management of own finances and property [3]. This is an important element of the financial independence of land districts. The district as a unit of local self-government - exercising public authority in order to fulfil its own tasks and tasks commissioned to it in the field of government administration - acts through its bodies [5],[17]. The implementation of public tasks by the district requires the provision of adequate financial resources. Hence, an important factor guaranteeing the ongoing financing of the realised public tasks and services is the financial independence of the districts in the sphere of income. The financial independence of authorities in the sphere of income can be reduced to the powers that these authorities have in terms of conducting fiscal policy in the area in which a given local government unit functions [6], [10]. The concept of budget operating surplus is inextricably linked to the revenue stability of districts. Although Polish financial law does not contain a legal definition of this important financial category, in the practice of local government financial management - operating surplus is a fundamental cognitive indicator. The shape of the operating surplus of the district budget is influenced by current income and current expenditure [4], [2].

The main objective of the article was to present the results of own research aimed at assessing the impact of PIT and CIT taxes share on the level of operating surplus of district budgets in Poland. In the research it was necessary to take into account changes in the number of people living in the territory of individual districts, as well as the number of economic entities conducting business activity in the districts. The analysis was carried out taking into account the one-year index resulting from the provisions of the Public Finance Act of 27 August 2009. The temporal scope of the research covered the years 2001-2019.

## **II. THE IMPORTANCE OF THE BUDGET'S OPERATING SURPLUS IN FINANCIAL MANAGEMENT**

Public finance management requires ongoing analysis of changes in the legal and economic environment. To this end, the use of various financial indicators is important [9]. Their number is impressive. In the practice of local government financial management, an important indicator is the operating surplus, also referred to in the academic literature as the operating budget result. [2]. The determination of this indicator is based on mathematical operations. The way to determine the operating surplus is to confront current income with current expenditure. If the stream of current income is greater than current expenditure then the operating budget result is positive. In the opposite situation, i.e. when current expenditure is higher than the current revenue accumulated in the local government budget, then an operating deficit arises [11],[14]. Such a state of affairs reveals the ability to perform public tasks and is also an important signal for the management that current income exceeds the financial capabilities of the local government unit. In such a situation, the execution of current tasks by the unit takes place in this case at the expense of selling its assets or as a result of incurring new liabilities [17]. From the economic point of view, this type of solution should be assessed negatively, because local government units for the current performance of public tasks are forced to seek additional current income, including the sale - sale of their own assets. Another form of financing current activities is incurring financial liabilities [15]. The latter solution results in additional costs for the local government budget related to servicing the incurred financial liabilities. On the other hand, when an operating surplus is formed, opportunities arise for financing planned and ongoing investments. In addition to the aforementioned advantages of an operating surplus, the second important significance of a positive operating result is the possibility of repaying the debt of the local government budget [13], [1].

From an economic point of view, the operating surplus serves to assess the stability of the financial situation of the local government unit. But it always becomes necessary to recognise the economic content of the formed operating result.

## **III. STATISTICAL METHODS USED IN THE OWN RESEARCH**

A linear mixed effects model was used to examine the relationship between the variables. The reason for using this type of method, due to the interdependence that exists between observations, is that the variable is measured annually repeatedly for each district. Fixed effects analysis, provided the coefficients of the model showing how the value of the dependent variable increases or decreases with a unit increase in the explanatory variable. In turn, the random effects statements of the model indicate the extent to which the districts differed in the value of the dependent variable.

Assessment of the prediction quality of the presented models was performed using cross-validation, which is a variant of the *leave-one-out cross-validation* method. On 314 occasions, according to the number of districts included in the analysis, the data were split into a training (learning) set and, consisting of one district, a test set. Each time, the model was fitted to the training set based on the data from the 314 districts, calculating the mean absolute error (MAE) on the resulting prediction of the outcome for the district data from the test set. The evaluation of the prediction of the obtained models was based on the comparison of the obtained values of the mean absolute errors with the standard deviation of the dependent variable, indicating the number of districts for which they exceeded the value of this deviation, or even half of this value. The MAE values for the test sets were also compared with the mean values of the absolute errors for the training data (for models constructed on these data) in order to check for *underfitting* or *overfitting* of the model, which negatively affect its predictive performance.

The mean absolute error was calculated from the formula:

$$MAE = \frac{\sum_{i=1}^n |y_i - y_i^p|}{n}$$

where:  $n$  is the number of observations per district,  $y_i$  is the actual value of the endogenous variable for  $i$ -th observation for a given district, while  $y_i^p$  is its predicted value based on the model.

All calculations were performed using the R package, version 3.6.0.

#### IV. ANALYSIS OF THE RESULTS AND DISCUSSION

The analysis of the results of the research shows that as the one-year new indicator increased, the level of operating surplus in the district increased: on average, approximately PLN 40 000 per 1 percentage point increase in this parameter, as shown in Tables 1 and 2. The impact of the 'new indicator' was analysed using a model, taking into account population as a fixed factor. The model including population as a fixed effect is described by the formula:

$$\text{Operating result} + \text{One-year new indicator} + \text{Population figure} + (1|\text{District}).$$

**Table 1.** Model explaining the result of the district's operating surplus through the value of the new indicator and the district's population - random effects .

Specification	Position	Variation	Standard deviation
District	(Free parameter)	8,291e + 11	910 537
Residual	-	1,459e + 13	3 819 565

Source: Own calculations based on data from RIO (REGIONAL CHAMBER OF AUDITORS)

**Table 2.** Model explaining the result of the district's operating surplus through the value of the new indicator and the district's population- fixed effects .

Specification	Indicator	2,5%	97,5%	p-value
Free parameter	-216 656 343,804	-722 380 931,996	285 982 269,951	0,379
One-year new indicator	38 198,371	-234 557,140	288 642,95	0,755
Year	107 680,166	-141 730,752	360 161,402	0,379
Population	-11,306	-42,557	19,722	0,464

Source: Own calculations based on data from RIO and GUS (MAIN STATISTICAL OFFICE)

After taking into account the model's estimated coefficients, the following formula was obtained for the level of the districts' current score for EU projects:

$$\text{Operating result} = -216\,656\,343,804 + 38\,198,371 \cdot \text{One-year new indicator} - 11,306 \cdot \text{Population} + 107\,680,166 \cdot \text{Year} + u,$$

where:  $u$  is a random effect assigned separately to the district.

Based on the analysis of the impact of the one-year new indicator on PIT income, it was found that the one-year new indicator was significantly related to the district's PIT income ( $p < 0.001$ ). The analysis clearly shows that the 'new indicator' is statistically significant. The results of the study are presented in Tables 3 and 4.

The model in this case was calculated with the formula:

$$\frac{\text{PIT share income}}{\text{Population}} \sim \text{One-year new indicator} + \text{Year} + (1|\text{District}).$$

**Table 3.** Model explaining the result of the district's operating surplus through the value of the new indicator - random effects .

Specification	Position	Variation	Standard deviation
District	(Free parameter)	1 406	37,5
Residual	-	668,7	25,86

Source: Own calculations based on data from RIO.

**Table 4.** Model explaining the result of the district's operating surplus through the value of the one-year new indicator - fixed effects .

Specification	Indicator	2,5%	97,5%	p-value
Free parameter	-21 275,999	-21 574,216	-21 033,553	< 0,001
One-year new indicator	62,625	50,283	73,717	< 0,001
Year	10,636	10,516	10,785	< 0,001

Source: Own calculations based on data from RIO and GUS.

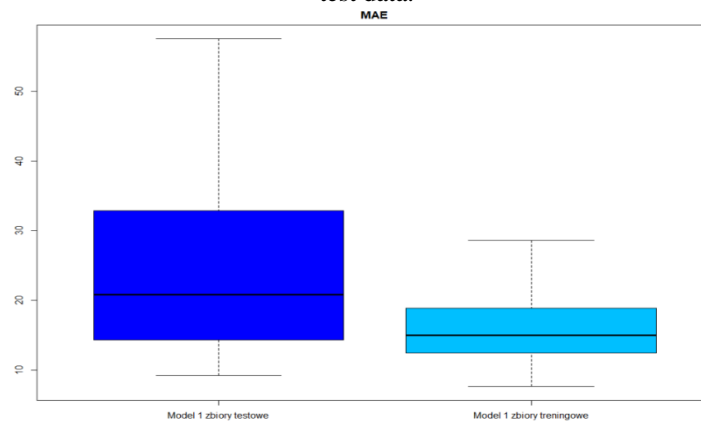
After taking into account the model's estimated coefficients, the following formula was obtained for the per capita PIT share income in the district:

$$\frac{PIT\ share\ income}{Population} = -21\ 275,999 + 62,625 \cdot One - year\ new\ indicator + 10,636 \cdot Year + u,$$

where  $u$  is a random effect assigned separately to the district.

The number of districts where the MAE value exceeded 50% of the standard deviation and the full value of the standard deviation of the dependent variable is 54, while the number of districts where the MAE value exceeded the standard deviation is 13. Based on a comparison of graphs showing the distribution of MAE values obtained by cross-validation on the test and learning sets, the occurrence of mismatch and model overfitting phenomena was excluded for this model (Figure 1).

**Figure 1:** Distribution of mean absolute error values obtained during the validation of the first of the models explaining the PIT share income (due to the value of the new indicator) per district resident for the training and test data.



Model 1 :Test sets

Model 1: Training sets

Source: own elaboration.

In the further part of the research, it was decided to also analyse the impact of the one-year new indicator on the share of income coming from CIT. The model in this case was calculated using the following formula:

$$\frac{CIT\ share\ income}{Population} \sim One - year\ new\ indicator + Year + (1|District).$$

The results obtained from the analysis are shown in Tables 5 and 6.

**Table 5.** Model explaining the result of the district's operating surplus through the value of the new indicator and the district's population - random effects .

Specification	Position	Variation	Standard deviation
District	(Free parameter)	53,21	7,295
Residual	-	26,75	5,172

Source: Own calculations based on data from RIO.

**Table 6.** Model explaining the result of the district's operating surplus through the value of the new indicator and the district's population- fixed effects .

Specification	Indicator	2,5%	97,5%	p-value
Free parameter	-370,107	-434,929	-304,488	< 0,001
New indicator	7,364	4,582	10,131	< 0,001
Year	0,186	0,153	0,218	< 0,001

Source: Own calculations based on data from RIO.

After taking into account the model's estimated coefficients, the following formula was obtained for the per capita income from the district's share of CIT:

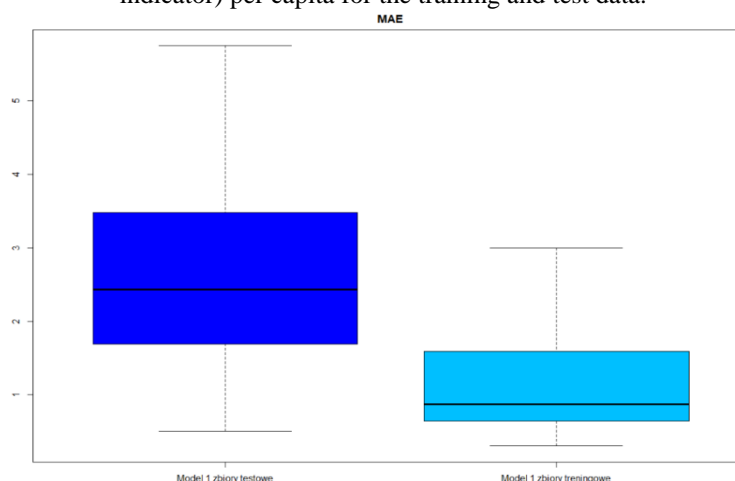
$$\frac{CITshareincome}{Population} = -370,107 + 7,364 \cdot One - yearnewindicator + 0,186 \cdot Year + u,$$

where:  $u$  is a random effect assigned separately to the district.

The relatively low values relating to the number of districts for which the MAE exceeded 50% of the standard deviation of the dependent variable or the full value of the standard deviation of that variable prove the high effectiveness of the model in the context of predicting the value of income from the share of CIT in relation to the number of inhabitants of a given district on the basis of the one-year new indicator. The number of districts where the MAE exceeded 50% of the standard deviation and the full value of standard deviation of the dependent variable is 36, while the number of districts where the MAE exceeded the standard deviation value is 11.

Based on the analysis of the graph showing the error distributions of the validation carried out on the learning and test data, it was concluded that in this case there was no mismatch or overtraining of the model. This is graphically illustrated in Figure 2.

**Figure 2:** Test and training sets - distribution of mean absolute error values obtained during validation of the first of the models explaining the district's income from the share of CIT (due to the value of the one-year new indicator) per capita for the training and test data.



Model 1 :Test sets

Model 1: Training sets

Source: own elaboration.

## V. CONCLUSION

The research proves the significance of the impact of the share of PIT on the shape of the operating surplus of land district budgets in Poland. Districts in which the MAE value was exceeded is 50% value of the standard deviation. The obtained results provide a basis for the statement that along with the increase in the one-year indicator, the level of operating surplus in district budgets also increased on average by 40,000 per 1 percentage point increase in this parameter. The share of CIT to the operating result of the district budgets was also statistically significant. The number of districts in which the value of the MAE exceeded the values of the standard deviation was 36 districts.

## REFERENCES

- [1]. Bról R., *Zarządzanie rozwojem lokalnym- studium przypadków* [Management of local development- a case study] AE, Wrocław, 1998, p. 78-79.
- [2]. Filipiak, B., Dylewski M., Gorzałczyńska -Koczkodaj, M., *Analiza finansowa budżetów jednostek samorządu terytorialnego* [Financial analysis of budgets of local government units], MUNICIPIUM, Warszawa 2011, p. 46-47.
- [3]. Gajl N., *Finanse i gospodarka lokalna na świecie* [Finance and the localeconomy in the world], PWE, Warszawa, 1993, p.18-19.
- [4]. Harańczyk, A., *Samorząd terytorialny. Organizacja i gospodarka* [Localgovernment. Organisation and economy], Wydawnictwo Uniwersytetu Ekonomicznego w Krakowie, Kraków 2010, p. 5-6.
- [5]. Koc, K., *Powiat, Przestrzeń władzy publicznej* [District, Space of public authority], Wydawnictwo Adam Marszałek, Toruń 2013, p.141-142.

- [6]. Kosek -Wojnar, M., Surówka, K., *Podstawy finansów samorządu terytorialnego* [Fundamentals of local government finance], Wydawnictwo Naukowe PWN, Warszawa, p. 24-27.
- [7]. Kornberger -Sokołowska E., Bitner, M., *Prawo finansów samorządowych* [Local government finance law], Wolters Kluwer, Warszawa 2018, p. 78.
- [8]. Kowalczyk, M., *Podstawy analizy ekonomiczno-finansowej w jednostkach samorządu terytorialnego* [Basics of economic and financial analysis in local government units], Difin, Warszawa 2017, p.17.
- [9]. Morozumi A., Veiga F.J., *Public spending and growth: the role of government accountability*, Centre for Finance, Credit and macroeconomics, Working Paper, 14/18, Nottingham 2014., p. 28-30.
- [10]. Patrzałek, L., *Finanse samorządu terytorialnego* [Finance of local government,], Wydawnictwo Uniwersytetu Ekonomicznego we Wrocławiu, Wrocław 2010, p. 35-36.
- [11]. Richter D., *Kommunales Vermögen und seine Verwaltung*, in *Das Recht der Kommunal Finanzen. Abgaben - HaushaltFinanzausgleich*, ed. H.G. Henneke, Munchen 2006., p.47.
- [12]. Sołtyk P., *Influence of Investment Expenditures on the Result of Municipal Budgets in Poland*, *International Journal of Business and Management Invention*, ISSN : 2319-8028, ISSN (Print):2319-801X, 2022, Volume 11 Issue 7 Ser. I p.4-5
- [13]. Walczak, P., *Wozniak, Changes in public finance* [Changes in public finance ], 2019, C.H.BECK, Warszawa 2019, p.
- [14]. Winiarska K., (ed.), *Sprawozdawczość finansowa i budżetowa* [Financial and budget reporting], Wolters Kluwers, Warszawa 2011, p-23-25,
- [15]. Wojciechowski E., (ed.), *Gospodarka samorządu terytorialnego* [Economy of local self-government], Difin, Warszawa 2012, p.89.
- [16]. <https://forsal.pl/gospodarka/finanse-publiczne/artykuly/8478468.nadwyzka-budzetowa-po-maju-wyniosla-121-mln-zl-resort-finansow-podal-najnowsze-dane.html> [Accessed: 20.07.2022].
- [17]. <https://sejm.gov.pl/Sejm7.nsf/BASLEksykon.xsp?id=241D2ACE4FB81B78C1257A610033853E&litera=S> [dostęp: 20.07.2022]