

# The Determinants of Sub-Central Government's Efficiency: The Case of Polish Districts

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Tomasz Skica

Department of Entrepreneurship, University of Information Technology and Management in Rzeszów, Sucharskiego Street 2, 35-225 Rzeszów, Poland;  
e-mail: tskica@wsiz.edu.pl (Corresponding author); ORCID 0000-0002-5620-610X

Lejla Lazović-Pita

Department of Finance, School of Economics and Business, University of Sarajevo, Trg oslobođenja 1, 71000 Sarajevo, Bosnia and Herzegovina; e-mail: lejla.lazovic@efsa.unsa.ba; ORCID 0000-0001-9421-1842

Ademir Abdić

Department of Quantitative Economics, School of Economics and Business, University of Sarajevo, Trg oslobođenja 1, 71000 Sarajevo, Bosnia and Herzegovina;  
e-mail: ademir.abdic@efsa.unsa.ba; ORCID 0000-0002-9635-457X

## Abstract

Academic research indicates that total or current expenditures have been most commonly used in sub-central or local government's efficiency analysis as dependent variables, and a proxy for the cost of service provision. Our research applied in the case of Polish districts for 2019 and 2020 indicates two important results: firstly, regardless of whether total or current expenditures have been used, the determinants indicate the same direction of impact, and, secondly, the COVID-19 pandemic did not change the direction of the impact. The regression results confirm the positive direction that the administrative, educational, protection, and safety variables have on dependent variables.

## Keywords

efficiency, public total and current expenditures, COVID-19, districts

## 1. Introduction

Academic researchers for more than thirty years have been investigating sub-central and/or local government's efficiency by applying several methods, namely composite non-parametric or parametric methods (Data Envelopment Analysis (DEA), Stochastic Frontier Analysis (SFA) or Free Disposal Hull (FDH)). Researchers in local government efficiency analysis (Narbón-Perpiñá & De Witte, 2018a; Narbón-Perpiñá & De Witte, 2018b; Milán-García et al., 2022) have most commonly used total or current local public expenditures (as input or dependent variables), representing a proxy for the cost of service provision. The term 'local' relates to sub-central level of government representing either districts, regions or, most often local self-government, i.e. cities and municipalities.

The aim of this paper is twofold: firstly, we wish to further investigate and contribute towards a hypothesis that regardless of a proxy of sub-central/local government's efficiency (Narbón-Perpiñá & De Witte, 2018a, p. 20; Narbón-Perpiñá & De Witte, 2018b, p. 439) represented through dependent variables – total or current expenditures – the determinants/independent variables indicate the same direction of impact. Secondly, we evaluate the impact that COVID-19 has had on selected sub-central total and current expenditures. Research was implemented in the sample of Polish sub-central levels of government, namely poviats (districts), for the years 2019 and 2020.

As of 1<sup>st</sup> January, 2023, the administrative division of Poland included: 16 voivodeships or regions, 314 poviats or districts, and 66 cities with poviat status, as well as 2,477 local self-governments municipalities or communes, including 302 urban communes, 677 urban-rural communes, and 1498 rural communes (Statistics Poland, 2023). Districts are one of the three levels of the territorial division of Poland. Local government in Poland consists of communes (or municipalities,

which are the lowest unit of territorial division) and self-government voivodeships. Communes are divided into urban, rural, and urban-rural. A special organisational form included in our analysis are cities with *poviat* status, which combine the functions and perform the tasks of both municipalities and districts (Kańduła & Przybylska, 2021).

The scope and direction of expenditure incurred by communes is a function of their statutory tasks (Kańduła, 2015; Kopańska, 2018). The organisation of local government in Poland is based on the principle of subsidiarity. Kańduła and Przybylska (2021) provide detailed information about expenditure assignments between the three levels of government stating the tasks, or expenditure assignments of municipalities as: primary schools, social assistance, water and sewage network, municipal roads, street lighting, parks, public transport, garbage dumps, public libraries, sports fields, and gas and electricity utilities. Tasks of districts are: labour offices, district hospitals, secondary schools, construction supervision, vets, childcare homes, district roads, the consumer advocate, and vehicle registration. Swianiewicz and Łukomska's (2017) prior research confirms that districts conduct a policy of counteracting unemployment and activating the local labour market, and are also responsible for geodesy and cartography. Regions' tasks include: regional rail and buses, regional hospitals, theatres and museums, care of monuments, and distribution of the EU funds. However, in terms of revenue allocation and expenditure assignments between the three levels of government, the system is complex with a distinction which level of government provides what segment of a public good or a service (for example, public health as indicated in Kańduła and Przybylska, 2021).

Kańduła and Przybylska (2021) provide exhaustive information of the impact that the first wave of COVID-19 had on Polish municipal revenues and expenditures with an analysis of the set of financial instruments used by Polish municipalities to overcome the scissors' effect that COVID-19 had on municipal budgets. Similarly, both districts and communes felt the effects of the pandemic with a fall of tax revenues that in 2020 amounted to 2.1 billion PLN whereby cities with district rights lost over 42.0% of this amount. Despite the pandemic, in 2020, compared to 2019, communes recorded an increase in their own revenues. Districts' own-revenues increased to 13.7%<sup>1</sup>, but in the cities with district rights an increase in own-revenues was only 1.8% (Malinowska-Misiąg, 2022). Changes in revenues were accompanied by changes in expenditures. The share of capital expenditures in total expenditures in 2020 amounted to only 16.3%. Their dynamics in cities with district rights accounted for 95.8% of expenditure (Malinowska-Misiąg, 2022). Limiting investments meant that communes ended 2020 with a surplus of 5.7 billion PLN (Gołaszewski, 2021) but obviously at a cost of limited or no capital investment expenditures. Furthermore, 35 cities with district rights, 489 urban, urban-rural, and rural communes, 38 districts, and 3 voivodeships recorded a deficit (Kostyk-Siekierska, 2021).

The justification for taking up this topic in relation to Polish districts lies in relatively limited and only recent academic research (Skica et al., 2019; Wojtowicz & Hodzic, 2021; Lazović-Pita et al., 2022). Districts have been investigated in several studies such as Ludwiczak (2014), referring to districts of eastern Poland, Będzieszak (2012) examining educational expenditure in rural districts, and Kucharski and Lekka-Porębska (2023), verifying the efficiency of the expenditure of district labour offices. The efficiency of communes' expenditure is examined more often in the literature (Olejniczk, 2019). Karbownik & Kula (2009) analysed the municipal expenditures on education, environmental protection, and public administration. Kaczyńska (2017) measured only the efficiency of educational expenditures, while Jakubowski (2007) in this matter focused on gymnasiums. Sekuła and Julkowski (2015) investigated the efficiency of public expenditures in Polish large cities, while Piszczek (2019) focuses only on the city of Kraków. Olejniczak (2015) went a step further by examining the efficiency of expenditures in terms of mechanisms for supplementing communal budget under general subsidies. The above-mentioned studies, on the one hand, indicate constant attempts to examine the efficiency of local public expenditures, but on the other, due to their fragmentary nature and concentration at the municipal level, they differ from the approach proposed in this article. The authors thus wish to contribute to the topic and to complement the identified objective research gap.

<sup>1</sup> Includes the total number of Districts (314).

In this paper, we begin our analysis with the literature review section, followed by the research design and methodology section. The results and discussion of six conducted regressions include a verification of the obtained results by using the average values of both years. We specifically focus our attention on the methodological importance of the obtained results before we conclude.

## 2. Literature review

The theory of fiscal federalism highlights the importance of the efficiency of sub-central governments for both academia and public sector administrations. More than sixty years ago, academics have emphasised the significance of sub-central governments, in particular local self-government in achieving (greater) economic efficiency in the allocation of public resources (Tiebout, 1956; Musgrave, 1959; Oates, 1972). Efficiency as a complex term might be examined as public sector efficiency and calculated as the outcome relative to the resources employed (Alfonso et al., 2005, p. 7) or as cost (in)efficiency which includes technical and allocative (in)efficiency (Radulovic & Dragutinovic, 2015, p. 125). We derive our research interest from the latter, whereby measuring efficiency (technical and allocative) and its determinants may be assessed at all levels of government. Due to vast literature that deals with measures of sub-central efficiency, measuring efficiency has been divided into two broad groups (De Borger & Kerstens, 1996): single local service efficiency measurement (e.g. Worthington & Dollery, 2000, 2001; Bosch et al., 2000; Benito-Lopez, 2011) and the measurement of the local efficiency from a global perspective, using so-called composite approaches to measuring efficiency (Kalb et al., 2011).

Authors such as Radulovic & Dragutinovic (2015) indicate that measuring efficiency at the sub-central level has two general methods – the non-parametric and parametric methods which can then be further classified as deterministic and stochastic. The most common method of measuring efficiency of sub-central governments worldwide has been DEA, closely followed by SFA (Soko & Zorič, 2018; Narbón-Perpiñá et al., 2019; Narbón-Perpiñá et al., 2020; Lazović-Pita et al., 2022). Milán-García and colleagues' (2022) research results indicate that the highest citations on this topic occurred in 2010 in both databases.

Thus, we derive our research interests from the available academic literature. The systematic literature review on the determinants of sub-central government efficiency has been provided in the works of Da Cruz and Marques (2014), and most recently, Narbón-Perpiñá and De Witte (2018b), where summary of the most applied methods, input and output variables, determinants, and obtained results in the country-level studies of local (in)efficiency have been presented. We wish to contribute and assess the use of total versus current expenditures in the case of Polish districts prior and during COVID-19. Out of financial expenditures, financial resources, and non-financial inputs, the most widely used input/dependent variables are financial expenditures due to the data record keeping and data availability. Narbón-Perpiñá and De Witte (2018b) have identified five groups of expenditures: total, current, personnel, capital, and financial, as well as other financial expenditures. In the sample of 121 studies that have used financial expenditures, almost 60% used either total (26 papers) or current (46 papers) expenditures. Similar results can be found in the bibliometric analysis provided by Milán-García et al. (2022), whereby local public expenditures have been a key research term associated with the measurement of local efficiency.

In the context of Poland's sub-central level of governments, the study of the efficiency of public expenditures has also been carried out. Karbownik and Kula (2009) show that the greatest inefficiency in managing public funds is observed in rural communes, while the lowest degree of inefficiency is observed in cities with district rights. The areas of activity of communes with the greatest differences in expenditure efficiency are communal sector and environmental protection. In a sample of districts in eastern Poland, Ludwiczak (2014) shows that local governments with a larger number of inhabitants and located closer to urban centres are more efficient. Sekuła (2012) as well as Sekuła and Julkowski (2015) – examining expenditures on health care, household finances, labour market, education, leisure and recreation, public safety, and natural environment – have come to similar conclusions. The authors show that the efficiency of budget spending is greater in cities with fewer inhabitants and in cities with lower per capita expenditures. The literature shows a strong focus on the efficiency of local government educational expenditures in Poland.

For example, Będzieszak (2012), assessing the efficiency of educational expenditures, proved that the passing rate of the secondary school leaving examination is negatively related to current expenditures on education and upbringing per student. This fact had previously been confirmed by Jakubowski (2007), who shows that the amount of funds allocated for educational tasks does not go hand in hand with students' results.

Patrzałek et al. (2019), referring to the expenditure side of local budgets, assessed it from the perspective of fiscal inequalities that determine both the revenue and expenditure side of LGUs budgets. A slightly different approach to assessing the efficiency of budget expenditures is taken by Piszczek (2019). The author found that the key role of public funds management methods is in increasing the efficiency of budget expenditure. Filipiak (2011), referring to the concept of new public management, and Jastrzębska (2016) – pointing to the advisability of implementing management by objectives and process management in local government units to create the possibility of reliable measurement of the effects of their expenditure – also links the efficiency of public expenditure and management methods.

### 3. Research design and methodology

#### 3.1. Research design and hypotheses

After reviewing the available literature, we wanted to test whether there is a difference in the application of either total or current expenditures as input/dependent variables in measuring sub-central efficiency on a set of sub-central determinants. Hence, our research focuses on testing two hypotheses:

1. Regardless of a proxy of sub-central government's efficiency (Narbón-Perpiñá & De Witte, 2018a, p. 20; Narbón-Perpiñá & De Witte, 2018b, p. 439) represented through total or current expenditures as dependent variables, related set of determinants indicates the same direction of impact;
2. The COVID-19 pandemic did have a significant impact on total and current sub-central expenditures, but it did not change the direction of the impact of the determinants.

We empirically tested our hypotheses in the sample of Polish districts, for 2019 and 2020. Out of total of 314 districts, we had to exclude 12 districts as they appeared to be outliers in our population (Appendix, Table A1). The factors responsible for the deviation of the indicated districts can be grouped into several common sets. Of the 12 outliers, as many as 10 were covered by special economic zones (SEZ), and a technology park operated in the remaining two districts (i.e. Krakowski and Tarnowski). Both the SEZ and the parks create favourable conditions for the location of business, which explains the high saturation rates with business entities. The capitals of the voivodeships are located in the areas of three districts: Wrocławski, Krakowski, and Poznański. In two of the three mentioned districts (i.e. Krakowski and Poznański), the age balance of the society is negative. It is caused by the outflow of young people to voivodeship capital cities (i.e. cities with district rights). The result is an unfavourable age structure in the districts (i.e. a strong percentage of post-working age people). The Warszawski Zachodni, Piaseczyński, Wołomiński, and Pruszkowski districts derive a location rent due to the proximity of the capital of Poland. Good communication conditions are conducive to transport and forwarding companies. Logistic bases and production plants are being built on their territory. The location and infrastructure are also conducive to the interest of foreign investors. Finally, a high saturation with business environment institutions favourable to socioeconomic development are characteristics of the Wejherowski, Piłski, and Poznański districts.

Our research design will include two dimensions of research: we firstly conduct four regression models for two sets of dependent variables (total and current expenditures) for 2019 and 2020, and the same set of independent variables followed by two additional regression models using average values of dependent variables. Particular focus is on the possible impact of the first wave of COVID-19 on selected variables.

### 3.2. Methodology and research variables design

We develop a methodology under the assumption of having the behaviour of each individual district in the same way, meaning having homoscedasticity and no autocorrelation. Therefore, it is possible to apply the OLS model in the following way:

- Total expenditures: 
$$\left[ \begin{aligned} TE_i = \beta_0 + \beta_1 POP_i + \beta_2 NPUP_i + \beta_3 NPS_i + \\ + \beta_4 SSIZE_i + \beta_5 NBE_i + \beta_6 PESAF_i + \varepsilon_i \end{aligned} \right] \quad (1)$$

Or

- Current expenditures: 
$$\left[ \begin{aligned} CE_i = \beta_0 + \beta_1 POP_i + \beta_2 NPUP_i + \beta_3 NPS_i + \\ + \beta_4 SSIZE_i + \beta_5 NBE_i + \beta_6 PESAF_i + \varepsilon_i \end{aligned} \right] \quad (2)$$

where Polish districts are represented by  $i$ ,  $\varepsilon_i$  is the between-districts error term.

The selection of determinants or independent variables was also implemented in line with the available literature together with aforementioned legally-defined districts' expenditure assignments. Narbón-Perpiñá and De Witte (2018a, 2018b), in the set of independent variables/output variables, identify 17 groups applied among a variety of countries, regions, and methods (DEA, SFA, FDH or m-frontier): population or social and demographic determinants, geographical determinants, economic, health, education, communal, political determinants, etc. Hence, representatives of several sets of identified factors have been applied to the Polish districts' case, depending on data availability.

Population and population-related variables living in a local or sub-central community have always been the most important set of administrative or socio-demographic variables (Narbón-Perpiñá & De Witte, 2018a, 2018b). It is the most important determinant of the provision of public goods or services examined in the early works of Tiebout (1956, p. 424). Hence, determinants associated with social and demographic characteristics of the population have continued to be examined in the sub-central efficiency measurements (Pevcin, 2014; Nikolov & Brosio, 2015; Hodžić & Muharemović, 2019). So, most independent variables are directly related to population. Other variables might be associated with educational variables, for example the share of under 15 population, number of pupils together with number of public schools, etc. Within geographical variables, we analysed spatial size of the district. These were followed by a representative of economic determinants, namely total number of registered business entities in a district as well as communal services/expenditures related to public expenses for safety and fire. The list of selected variables corresponds to districts' tasks whereby inclusion of a larger set of variables is restrained by analytical data availability. Also, since more than 20% of our sample relates to cities with district rights, all tested models remain stable even with the inclusion of additional communal variable related to sewage system (the length of active sewage network in km; results available upon request).

It is important to note that all selected groups of variables have a current and capital expense component within themselves. Hence, we examine whether sub-central levels of government are providing only maintenance during the times of crises through current expenditures or are continuing investment activities. All variables examined for the Polish districts from the available literature (Narbón-Perpiñá & De Witte, 2018a, 2018b) are presented in Table 1.

As indicated in Table 1, the study focuses on the impact that population-related variables have on districts' expenditures due to their importance in theory and practice (Narbón-Perpiñá & De Witte, 2018a, 2018b). Some variables might also be classified as educational, economic, or communal (Narbón-Perpiñá & De Witte, 2018a, 2018b). The impact is examined for Polish districts' total expenditures (Models 1,3 and 5 for mean values) and current expenditures (Models 2, 4, and 6 for mean values), respectively. As per available sub-central/local government's efficiency literature, both total and current expenditures are usually represented as cost (efficiency) functions, we would expect that all selected variables have a positive direction of impact on dependent variables. However, the results from the systematic literature review (Narbón-Perpiñá & De Witte, 2018a, 2018b) indicate that results might be ambiguous, since they include local or country specifics.

**Table 1.** An overview of variables used in empirical research

Measure	Abbreviation	Short description
<b>Dependent variable</b>		
Total expenditures	TE19/TE20	Total expenditures (in PLN) 1 Euro = 4.69 PLN (12/2022)
Current expenditures	CE19/CE20	Current expenditures (in PLN)
<b>Independent variables</b>		
Population at post working age	POP	Population at post working age (persons)
Total number of pupils	NPUP	Total number of pupils (post primary, persons)
Total number of public schools	NPS	Total number of public schools (post primary, objects)
Spatial size	SSIZE	Spatial size (in ha)
Total number of business entities	NBE	Total number of business entities (registered)
Public expenses for safety & fire	PESAF	Public expenses for safety and fire (in PLN)

Source: The authors' own elaboration.

All selected independent variables represent Polish districts' expenditure assignments and are related to districts' expenditure responsibilities, focusing primarily on population-related variables. Variables also include educational variables, policy of counteracting unemployment, and activating the local labour market and the corresponding economic variable related to number of registered business entities.

Data was collected from the Local Data Bank (LDB), the Central Statistical Office of Poland, and from the Polish Ministry of Finance. The decision on the selection of variables is a derivative of the regulations in force in Poland, which divide public tasks between various sub-central levels of government, as previously explained in the provision of public goods and services (i.e. municipality, district, and voivodeship). Comprehensive empirical analysis and estimated regression models are performed by using the Stata 13 statistical software.

#### 4. Results and discussion

In the Appendix (Table A2), we provide the results of the descriptive statistics (mean, standard deviations, minimum and maximum values of variables) calculated for the variables used in the research of Polish districts in 2019 and 2020.

Table A2 shows interesting results by confirming heterogeneity among districts. In 2019, the average value of districts' total expenditures (TE) was approx. 90 million PLN whereby TE increased in 2020 in comparison to 2019 by 9.3%. The range of total expenditures in 2019 amounted from 27.5 to 216 million PLN, indicating a vast discrepancy in terms of fiscal position and capacity between Polish districts. The Bieruńsko-Lędziński district has the smallest area (15,815 ha), while the Białostocki district has the largest area (297,644 ha). In the year 2019, the highest population resides in the Nowosądecki district (216,796), while the lowest population resides in the Sejneński district (19,914). The Cieszyński district has the highest revenue (214 million PLN), whereas the Skierniewicki district has the lowest revenue (29 million PLN). The highest total expenditure is in the Cieszyński district (216 million PLN), and the lowest one is in the Skierniewicki district (27.5 million PLN). Some of the differences in the fiscal position and the capacity of districts might be a consequence of different spatial sizes of districts. Similar conclusions can be drawn for districts' average total expenditures in 2020.

The mean value of current expenditures in 2019 amounted to 74.3 million PLN, while the range of districts' current expenditures went from 18.3 to 181 million PLN, again indicating a difference in fiscal position and the capacity of districts. Similarly to TE, current expenditures increased in 2020 in comparison to 2019 by almost 10%. Additionally, the average number of population per district at post working age was 16,163, the average of total number of post primary pupils was 2,206, the average value of total number of public schools was 10, the average value of spatial size was 96,611.7 ha, the average value of total number of business entities was 7,306, and the average

value of public expenses for safety and fire was 5.1 million PLN. In 2019, total districts' revenues on average amounted to 93.3 million PLN whereby in 2020 they increased to an average of 105 million PLN. Districts' own revenues on average amounted to 36.3 million PLN in 2019 and in 2020 they have increased to an average of 40.9 million PLN. Parallel to this process, Polish districts on average recorded an increase in post-working age population, a fall in under 15 population and working population together with a fall in the number of post-primary pupils and schools.

The results in small differences in the size of average values of dependent variables (TE and CE) might indicate little room for capital expenditures during crisis such as COVID-19 (Table A2). Prior to testing impact through regression analysis, we had conducted a correlation analysis whereby the results indicate a statistically significant relationship between the variables (available upon request).

As per equations (1) and (2), we firstly conducted six regression analyses using simple OLS for two dependent variables (TE and CE including mean values) and for the same set of independent variables for 2019 and 2020. The main results of all conducted regressions are presented in Table 2. Special attention has been paid to the impact of COVID-19, whereby COVID-19 had a relatively low impact and economic consequences on demographic and economic factors of districts. TE and CE were stable in both years. Also, all demographic and economic factors data has a similar pattern.

According to the results presented in Table 2, OLS regression models provided very similar results. Appropriate tests have been performed with the aim of comparing the results. The results of the F test, the White test, and the Ramsey RESET test are shown. According to F test, all OLS regression models are statistically significant ( $p < 0.001$ ). Model 1 and Model 3 explained 88.94% and 88.88% of the variance in TE, respectively. Model 2 and Model 4 explained 87.81% and 87.59% of the variance in CE, respectively. Similarly, Models 5 and 6 explained 89.17% and 89.10% of variance, respectively.

The suitability of the model specification is tested using the Ramsey RESET test. The results of these test indicate that the models are well specified ( $p\text{-value} > 0.05$ ). The results of estimates of the variance inflation factor (VIF) indicate that there are no variables that cause a serious problem of multicollinearity ( $VIF < 10$ ). The average VIF value of all explanatory variables for Models 1, 2, 3, and 4 are 3.44, 3.44, 3.63 and 3.63, respectively, and for models 5 and 6 are 3.55.

All explanatory variables are statistically significant at 5% significance levels, except PESAF in models 2, 4, and 6. The results indicate that all variables have a positive impact in all six models. Looking at models with TE, TE (in PLN) will increase by 7877.75 on average if total number of pupils (NPUP) increases by one. Also, TE (in PLN) will increase by 1,372.73 on average if total number of business entities (NBE) increases by one registered entity. Meanwhile, TE (in PLN) will rise by 1,667.13 on average if population at post working age (POP) increases by one person. Similarly, TE will increase by 76.08 PLN if the district spatial size increases by 1 ha and an increase of an average 452,870.6 PLN will be noted if the number of public schools increases by one. Consistent results and conclusions are presented in the case of TE in 2020, as indicated in Model 3 and with mean values of TE in Model 5.

Similar to the results regarding TE, the results for CE presented in models 2, 4, and 6 examine positive impact and statistical significance at either 1% or 5% level. Only the variable PESAF in all three CE models is not statistically significant, which might indicate PESAF's strong capital expenditure component. The results of CE regression models (models 2, 4, and 6) show stronger impact (i.e. greater level of required CE expressed in PLN) that population-related variables have on CE rather than on TE. This finding is in line with the theory of public finances (for example variables POP, NPUP, NPS, NBE). As per our first hypothesis, all independent variables for both 2019 and 2020 have the same direction of impact to districts' TE and CE. Again, all variables have a positive impact on TE and CE.

Similarly, all results and the direction of the impact of variables of interest in Model 5 and Model 6 are consistent with Models 1, 2, 3, and 4, which confirms our second hypothesis.

**Table 2.** The results of all regression models

Model	Model 1 (Dependent variable: TE19)				Model 2 (Dependent variable: CE19)			
	Coeff.	Std. Error	t-statistic	p-value	Coeff.	Std. Error	t-statistic	p-value
POP	1667.13	197.55	8.44	0.000	2137.16	247.56	8.63	0.000
NPUP	7877.75	822.26	9.58	0.000	8282.74	1030.43	8.04	0.000
SSIZE	76.08	14.66	5.19	0.000	148.31	18.37	8.07	0.000
NBE	1372.73	331.44	4.14	0.000	1516.70	415.35	3.65	0.000
NPS	452870.60	225930.80	2.00	0.046	558698	283127	1.97	0.049
PESAF	0.5901	0.2862	2.06	0.040	0.5577	0.3586	1.56	0.121
Constant	5102647	2085485	2.45	0.015	3393261	2613443	1.30	0.195

Obs	302				302			
R-squared	0.8894				0.8781			
RMSE	1.0e+07				1.3e+07			
AIC	10617.82				10754.12			
F(6, 295)	395.51	Prob > F = 0.000			354.10	Prob > F = 0.000		
White test (chi2(27))	54.85	Prob > chi2 = 0.0012			44.05	Prob > chi2 = 0.0204		
Ramsey RESET test F(3, 292)	0.77	Prob > F = 0.5097			0.25	Prob > F = 0.8595		

Model	Model 3 (Dependent variable: TE20)				Model 4 (Dependent variable: CE20)			
	Coeff.	Std. Error	t-statistic	p-value	Coeff.	Std. Error	t-statistic	p-value
POP	1856.29	222.07	8.36	0.000	2365.10	272.24	8.69	0.000
NPUP	8824.77	989.56	8.92	0.000	9477.09	1213.13	7.81	0.000
SSIZE	97.90	16.44	5.96	0.000	178.48	20.15	8.86	0.000
NBE	1320.60	365.93	3.61	0.000	1310.74	448.61	2.92	0.004
NPS	592763.20	274059.9	2.16	0.031	755416.20	335978.3	2.25	0.025
PESAF	0.6901	0.2979	2.32	0.021	0.13058	0.37	0.36	0.721
Constant	3343463	2372784	1.41	0.160	3474705	2908867	1.19	0.233

Obs	302				302			
R-squared	0.8888				0.8759			
RMSE	1.2e+07				1.4e+07			
AIC	10690.54				10813.57			
F (6, 295)	393.02	Prob > F = 0.0000			347.03	Prob > F = 0.0000		
White test (chi2(27))	44.71	Prob > chi2 = 0.0174			52.74	Prob > chi2 = 0.0022		
Ramsey RESET test F(3, 292)	1.55	Prob > F = 0.2020			1.13	Prob > F = 0.3362		



Model	Model 5 (Dependent variable: mean TE)				Model 6 (Dependent variable: mean CE)			
	Variables	Coeff.	Std. Error	t-statistic	p-value	Coeff.	Std. Error	t-statistic
POP	1758.65	207.14	8.49	0.000	2243.87	242.79	9.24	0.000
NPUP	8336.26	897.87	9.28	0.000	8828.36	1052.40	8.39	0.000
SSIZE	86.99	15.35	5.67	0.000	162.91	17.99	9.05	0.000
NBE	1350.07	344.17	3.92	0.000	1420.59	403.40	3.52	0.000
NPS	530865.70	249551.90	2.13	0.034	684788.7	292502.3	2.34	0.020
PESAF	0.6455	0.2917	2.21	0.028	0.3207	0.3419	0.94	0.349
Constant	4190293	2205365	1.90	0.058	3412227	2584930	1.32	0.188

Obs	302			302		
R-squared	0.8917			0.8910		
RMSE	1.1e+07			1.3e+07		
AIC	10647.05			10742.97		
F (6, 295)	405.00	Prob > F = 0.0000		401.99	Prob > F = 0.0000	
White test (chi2(27))	49.74	Prob > chi2 = 0.0049		46.79	Prob > chi2 = 0.0104	
Ramsey RESET test F(3, 291)	1.12	Prob > F = 0.3394		0.24	Prob > F = 0.8700	

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

Source: Own elaboration.

The results of the t-test (Wilcoxon test) indicate that there is a statistically significant difference in TE and CE in 2019 and 2020 (upon request). The results indicate that all identified determinants such as population-related, educational, and protection and safety variables have a positive impact on both the TE and CE of districts measured by their coefficients in the regression models under COVID-19 impact. Hence, empirical findings validate and support the hypothesis that regardless of either total or current expenditures as dependent variables, the determinants indicate the same direction of impact. Additional value and policy implications of the conducted research are reflected in the selection of years and include the impact that the COVID-19 crisis had on sub-central budgets.

Hence, to summarise, our main research findings are as follows:

1. On average, there is an increase in TE and CE during the first wave of COVID-19 in Polish districts.
2. Small differences in average values of dependent variables (TE and CE) might indicate little room for capital expenditures during COVID-19.
3. Results from six conducted regression analyses indicate that all selected variables have a positive impact in all six models.
4. All selected variables (Population at post working age (persons), total number of pupils (post primary, persons), Total number of public schools (post primary, objects), Spatial size (in ha), Total number of business entities (registered), and Public expenses for safety and fire-PESAF)) are statistically significant in all TE models.
5. All selected variables except for PESAF are statistically significant in CE models. Therefore, the PESAF variable might indicate its strong capital expenditure component.
6. The results of CE regression models (models 2, 4, and 6) show stronger impact (i.e. greater level of required CE expressed in PLN) that population-related variables have on CE rather than on TE. This finding is in line with the aforementioned theory of public finances (e.g. variables POP, NPUP, NPS, NBE).

## 5. Conclusions and recommendations

The results of the conducted research in the sample of Polish districts indicate the same direction and a positive impact that selected determinants have on both current and total expenditures. The inclusion of two years in the analysis (i.e. the year of 2019 preceding the pandemic, undisturbed by any COVID-19 *force majeure*, and the 2020 first-wave pandemic year) did not change the results of the estimated models. These findings complement the research of Nielicki (2020), who analysed the impact of the legislation during the COVID-19 pandemic on the finances of local government units in Poland. Polish districts saw an increase in both total and current expenditures during COVID-19 (Nielicki, 2020). The results of the hypothesis verification are, therefore, robust and confirm the positive impact of the independent variables selected for the study on each of the dependent variables separately.

The obtained results suggest that current expenditures constitute the dominant part of the total expenditures of the districts. In 2019, current expenditures accounted for an average of 83.92% of total expenditures, and in 2020 it was already 84.31%, indicating a relatively low share of capital expenditures at the level of districts (Statistics Poland, 2023). The obtained statistics only confirm that current expenditures reflect the basic role of sub-central governments, which is to meet the collective needs of the community by providing services with, unfortunately, little space for capital expenditures. Patrzalek et al. (2019) verify this finding by indicating broadly understood fiscal inequalities in local government, which have an impact on the districts' investment possibilities.

Also, current expenditures are closely related to the implementation of tasks legally imposed on local governments and cannot refrain from implementing them (Skica, 2010). This applies not only to own tasks, but also to assigned tasks. Similarly, and according to the regulations, even in the case of insufficient funds from the central budget allocated to districts for funding their tasks, districts cannot refrain from implementing them. On average, the ratio of districts' own revenues to revenues received from the central budget is 1/3 to 2/3 (Oleszczyk, 2018), but districts still have some spending independence. Patrzalek et al. (2019) state that the allocation of over 75% of districts' budget revenues is decided by the districts' authorities. Paradoxically, despite the relatively large influence on the directions of funds spent (in a task-based manner), their concentration on current expenditures and not the capital ones remains unchanged (Trojak & Szewczyk, 2013).

The main recommendation and validation of our results in the case of Polish districts and cities with district rights verifies the significance of population-related determinants to both total and current expenditures especially in cases of external shocks such as COVID-19. The significance of sub-central governments as the ones closest to their citizens in the adequate provision of public goods and services together with sub-central fiscal autonomy has been examined in public finance theory (Tiebout, 1956; Musgrave, 1959; Oates, 1972). Hence, our research results again highlight that in times of crisis (COVID-19), sub-central governments focus predominantly on financing current expenditures with little room left for capital expenditures. As per ongoing negative demographic trends in Polish districts (falling trend of under 15 and working population and rising trend of post-working population), another recommendation concerns the possibility of further analysis of the aforementioned variables in the context of measuring adequate allocation of total expenditures at sub-central budgets.

Our research limitations relate to the use of only the impact of the first wave of COVID-19 on districts' budgets in 2020 and comparisons to 2019, so longer time frame might provide more insights. More analytical data availability at sub-central level would also provide more accurate results. As we live in times of economic uncertainty, the impact of other determinants might be analysed, such as the Russian-Ukrainian war and the impact it has on the Polish sub-central governments and their budgets, inflationary pressures, etc. Hence, further research might include an examination of the population-related variables together with local expenditure assignments examined in the case of Polish local self-government (municipalities). Further research might also include whether the dependencies identified at a higher level of territorial division are also present at the local level, particularly at the level of Polish municipalities, which have a greater level of fiscal autonomy compared to districts.

## Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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## Appendix A

**Table A1.** Outliers in sample

Teryt	Powiat/District	Outliers variables
0223000	the Wrocławski powiat	NBE
1206000	the Krakowski powiat	NBE, POP, SSIS
1216000	the Tarnowski powiat	SSIS
1418000	the Piaseczyński powiat	NBE, TE19/TE20
1421000	the Pruszkowski powiat	NBE
1422000	the Przasnyski powiat	NBE
1425000	the Radomski powiat	NBE
1432000	the Warszawski Zachodni powiat	NBE
1434000	the Wołomiński powiat	NBE
2215000	the Wejherowski powiat	NBE
3019000	the Piłski powiat	PESAF
3021000	the Poznański powiat	NBE, CE19/CE20, TE19/TE20, SSIS, POP

Source: Own elaboration.

**Table A2.** Descriptive statistics of the sample for 2019 and 2020

<b>Descriptive statistics for 2019</b>				
Variable	Mean	Std. dev.	Min	Max
Capital and financial expenditures	1.57e+07	1.05e+07	698753.5	6.28e+07
Current expenditures (CE)	7.43e+07	3.07e+07	1.83e+07	1.81e+08
Own Revenue	3.63e+07	1.79e+07	7280811	1.07e+08
Own Revenue per capita	469.14	109.27	240.32	1194.01
Population (total)	77794.09	35812.23	19914	216796
Population at post-working age (POP)	16162.69	7419.26	4369	40002
Population at pre-working age – under 15 years	12061.36	6036.05	2680	41031
Population at working age	49570.04	22840.65	12741	141789
Public expenses for safety and fire protection (PESAF)	5097561	2766441	0	1.51e+07
Spatial size (in ha) (SSIZE)	96661.67	44437.4	15815	297644
Total expenditures (TE)	8.99e+07	3.66e+07	2.75e+07	2.16e+08
Total number of business entities (NBE)	7306.35	3941.18	1389	20080
Total number of public post-primary schools (NPS)	9.80	4.57	0	27
Total number of pupils of post-primary public schools (NPUP)	2206.24	1391.1	0	7017
Total revenues	9.33e+07	3.76e+07	2.90e+07	2.14e+08
Total revenues per capita	1247.01	242.68	720.25	2317.68

<b>Descriptive statistics for 2020</b>				
Variable	Mean	Std. dev.	Min	Max
Capital and financial expenditures	1.58e+07	1.12e+07	1451021	6.62e+07
Current expenditures (CE)	8.24e+07	3.45e+07	2.09e+07	1.99e+08
Own Revenue	4.09e+07	1.98e+07	1.03e+07	1.17e+08
Own Revenue per capita	534.07	124.49	304.17	992.76
Population (total)	77548.79	35857.19	19689	217071
Population at post-working age (POP)	16446.75	7540.45	4503	40561
Population at pre-working age – under 15 years	11998.09	6073.11	2603	41083
Population at working age	49103.95	22737.85	12556	141320
Public expenses for safety and fire protection (PESAF)	5992180	3110126	30301.24	1.64e+07
Spatial size (in ha) (SSIZE)	96661.67	44437.4	15815	297644
Total expenditures (TE)	9.83e+07	4.01e+07	2.89e+07	2.29e+08
Total number of business entities (NBE)	7557.61	4089.22	1489	20649
Total number of public post-primary schools (NPS)	9.49	4.46	0	26
Total number of pupils of post-primary public schools (NPUP)	2191.56	1373.01	0	6996
Total revenues	1.05e+08	4.22e+07	3.10e+07	2.46e+08
Total revenues per capita	1410.87	284.82	745.69	2365.11

Source: Own elaboration.