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## FINANCIAL SITUATION OF CITIES IN THE LODZ VOIVODESHIP IN THE ERA OF THE COVID-19 PANDEMIC – TRENDS OF CHANGE AND IMPACT ON INDEBTEDNESS<sup>1</sup>

### Summary

*Purpose* – The aim of this article is to identify and assess the change in the structure and direction of spending of the financial resources of the cities of Lodz Voivodeship in connection with the measures taken during the COVID-19 pandemic and their impact on the level of debt.

*Research method* – The study uses data obtained from two sources: a questionnaire interview conducted in the target group of towns in Lodz voivodeship and the repository of the Local Data Bank CSO.

*Results* – The research shows that the different cities have different profiles of the activities undertaken during the COVID-19 pandemic and how they were financed. The majority of cities financed these activities through targeted grants or from their own budget reserves, which implied no reduction in expenditure. A smaller number of cities financed these activities from other sources, which had the effect of reducing current and investment expenditure. Cities' debt was increasing, but not as a direct result of the pandemic.

*Originality/value/implications/recommendations* – On the basis of the data obtained, the authors distinguished three different profiles of actions taken to prevent the negative effects of the COVID-19 pandemic and ways of financing the resulting expenditure for

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cities in the Lodz Voivodeship. The need for further analysis in the context of new challenges: migration crisis, climate crisis, energy crisis was indicated.

**Keywords:** COVID-19 pandemic, urban finances, income, expenditure, urban debt, anti-COVID programmes

**JEL classification:** H4, H7, H8

## 1. Introduction

The old Chinese proverb ‘May you live in interesting times’ has taken on particular significance in the early 2020s. The new Covid-19 virus, diagnosed in China at the end of 2019, has triggered a global health crisis. The impact of its presence has been felt in all areas of life: health, social and economic. The authorities of the various countries were faced with the need to make rapid and complex decisions, including the most difficult one related to the lockdown, which changed the picture of how the state, local governments, entrepreneurs and citizens had been working.

Polish local governments have long struggled with financial problems, which were reflected in the state of their budgets. The year 2020 was a special one as two fundamental changes collided. The first was the coronavirus pandemic, which forced local authorities to make a series of increased expenditures in areas such as health care, education or local entrepreneurship. The second is the impact of the changes in the tax system, which has led to a reduction in the tax revenue base of local authorities.

The aim of this article is to identify and assess the changes in the expenditure of cities in the Lodz Voivodeship in relation to the measures taken during the COVID-19 pandemic and their impact on debt levels.

It has been hypothesised that the actions taken by municipalities in response to the declared pandemic state will be individual (determined by the needs of the local community and the organisational and financial framework of the municipality), while, on the other hand, patterns of behaviour will emerge that are common to a group of municipalities and at the same time different from the behaviour of other entities. We also expect that the change in the level of indebtedness will be determined by the change in the level of expenditure, as well as the features of the policy implemented to combat the negative effects of the COVID-19 pandemic.

The research questions were: (1) what the effect of the measures taken by the municipalities to prevent the negative effects of the COVID-19 pandemic was on the structure and direction of financial expenditure, and (2) what the effect of the change in this expenditure was on the change in the debt level of the municipalities studied.

The paper is based on literature studies, legislation introduced in 2020 in relation to the COVID-19 epidemic, data and information from a questionnaire survey of the target group of cities in the Lodz Voivodeship and the Central Statistical Office – Local Data Bank repository.

## 2. Literature review

### 2.1. COVID-19 pandemic in Poland

SARS-CoV-2, COVID-19, coronavirus, pandemic are terms that dominated the global public sphere in 2020. The first mentions of a new, previously unknown virus causing severe pneumonia appeared in late 2019 in China. Information and images from the Chinese city of Wuhan, which was the cradle of the virus, quickly circulated around the world. At the time, the health threat was limited to the Chinese territory only and no one imagined that 2020 would bring a rapid global spread of the virus.

The exponential increase in cases led the Chinese authorities to notify the World Health Organization (WHO) on 3 January 2020 of a disease causing severe pneumonia of unknown etymology [Mitchell et al., 2020]. In the early months of the new year, the first cases of coronavirus were reported in many countries on all continents [Chlipała, Żbikowska, 2022, p. 2]. The dynamics and scale of the disease's spread led the WHO to declare COVID-19 a pandemic on 11 March that year [www 1]. The global public space has been dominated by the pandemic and the methods to combat its health, social and economic consequences [Kowalski, 2021, p. 14]. The first case of coronavirus was reported in Poland on 4 March 2020. In response to the increasing number of cases, the governments of individual countries, including Poland, took unprecedented steps "locking citizens at home" in order to interrupt transmission of the virus. Mass events were cancelled, e-learning was introduced, catering, transport, and large-scale commercial activities were closed. Border controls were reinstated [Siel-ska, 2020, pp. 67–68]. In Poland, the first wave of the pandemic was relatively mild but by the end of August the number of infections had already increased,

and the autumn and winter months were the worst. Lack of vaccine and drugs meant that patients were treated symptomatically, increasing the number of cases and deaths. It is estimated that more than 1,800 citizens died in Poland during the first five months of the pandemic, more than 90% of whom were elderly. During the second wave of the pandemic, more than 1.4 million cases were detected, of which 35 000 died. Similar figures were recorded in the third wave, indicating that the pandemic is not slowing down. By the end of December 2021, more than 4 million people with positive coronavirus tests had been reported in Poland, and more than 97 000 infected people had died [Kaczorowska, Słonec, 2022, p. 119]. The year 2021 proved to be the most dramatic in terms of deaths, this is when more than 68,500 deaths were reported, with more than 30% occurring in November and December [Wójtowicz, 2022]. It is emphasised that the incidence and death figures are underestimated and are in fact much higher [Ćwiek, 2022]. The outbreak status of COVID-19 lasted until 15 May 2022. From 16 May 2022 to 30 June 2023, an epidemic emergency was in force in the country. It was lifted on 1 July 2023 [Rozporządzenie MZ, 2023]. Earlier on 5 May 2023, WHO declared the end of the COVID-19 pandemic [www 2]. A total of 6,518,546 people have fallen ill in Poland since the outbreak of the pandemic, including 190,693 reinfected. 119,637 have died as a result of the disease [Raport zakażeń..., 2023].

## 2.2. Local government units in the COVID-19 pandemic

The outbreak of the COVID-19 pandemic in 2020 significantly altered the course of macroeconomic conditions in Poland, including a slowdown in economic activity, a worsening of the labour market situation and a change in the behaviour of households, businesses and, as a result, the situation of public finances, including those of local governments.

Some local government units entered 2020 with a difficult financial situation. The debt of all units in 2019 amounted to PLN 82,036.0 million, an increase of 7.8% compared to the previous year (PLN 76,115.8 million in 2018) [www 3]. Municipalities, cities with county rights and counties recorded a significant increase in debt compared to 2018. Provinces practically maintained their 2018 debt levels. The highest increase in debt (by 10.5%) and the highest amount of debt (45.2% of the total debt of territorial self-government units) occurred in cities with county rights. The indebtedness of municipalities accounted for 39.5% of the total, that of counties and provinces respectively: 8.0% and 7.3% [www 4].

The economic and financial potential of local government units varies. It depends on the level at which a given unit operates, its size, natural resources, investments made and the state of municipal infrastructure, the number and nature of economic entities operating and the amount of taxes they pay. Hence, the level of debt and the financial situation of individual units was not uniform. It resulted from the previously introduced changes in the tax system. These reduced the share of local governments in personal income tax (PIT) without adequate compensation from the state. The systemic changes included a reduction in the PIT rate from 18% to 17% and the introduction of zero PIT for those under 26 years of age, an increase in employees' deductible costs, an increase in the minimum wage for employees, the increase in costs associated with local government financing of the education system (increase in teachers' salaries) without a corresponding increase in the amount of the education subsidy [Klimek, 2022, p. 94]. Not surprisingly, many local government officials and experts alarmed that the changes introduced would negatively affect the budgetary situation of many units [Kostyk-Siekierska, 2021, p. 33]. Research conducted in the first wave of the pandemic confirmed local authorities' belief that the pandemic year would worsen their financial situation. It was forecast that in the short to medium term there would be a widening gap between revenue and expenditure. It was assumed that tax revenues from PIT and CIT would fall by around PLN 8–9 billion and current expenditure would increase by PLN 3–4 billion [Czudec, 2021, p. 8].

At the onset of the pandemic, an analysis was undertaken of the impact of the pandemic and the consequences of the declared lockdown on local government budgets [Swianiewicz, Łukomska, 2020; Budner-Iwanicka, Legutko, 2021; Kańduła, Przybylska, 2021; Kostyk-Siekierska, 2021; Franek, 2022; Nelicki, 2021; Klimek, 2022]. Contrary to earlier predictions, the situation of local governments was not as catastrophic as suggested in the early days of the pandemic. In 2020, local government budgets closed with a surplus of PLN 5.6 billion, compared to PLN 17.4 billion a year later. Total revenues of local self-government units in 2020 increased by PLN 10,587.9 billion (9.5%) compared to the previous year, while total expenditures increased by PLN 19.0 billion (7.7%) [Kostyk-Siekierska, 2021, p. 34; [www 5](#)]. The reported results were a reaction to the funds received from the Government Fund for Local Investment. A total of PLN 10.3 billion was allocated to municipalities and counties for investments serving local communities, including: modernisation and renovation of schools, kindergartens, investments in water supply and sewage systems, construction of crèches, roads [Nelicki, 2020, pp. 2–3; Czudec, 2021, p. 9; Łubina, 2021,

p. 107]. The unused funds in 2020 were carried over to the following year, resulting in a budget surplus in the following year as well. In turn, the Government's Strategic Investment Programme, which provided non-refundable funding for local investment, was launched in 2021. Research by Swianiewicz and Łukomska's team [Swianiewicz, Łukomska, 2020, pp. 2–6] showed that the financial situation of individual local governments varied depending on which group the unit belonged to. Provincial and county governments did not experience a drastic financial weakening due to the high share of funds transferred from the state budget (subsidies and grants). Municipalities, including cities with district rights, where the majority of public investments are made and the majority of services important for the daily life of the inhabitants are provided, reacted more sensitively. In Q1 2020, the team attributed the reasons for the stagnation in this group of local governments to a change in tax legislation, while in Q2 it was a consequence of the pandemonium.

It is noteworthy that the situation of Polish TSUs did not differ from that of local governments in the European Union (EU), which is confirmed by the research of S. Franek [Franek, 2022, pp. 60–65]. It was found that in the vast majority of EU countries, the impact of the pandemic on the reduction in tax revenues was small and temporary, and in those countries where the decrease in tax revenues was significant, there was no significant decrease in total revenues as a consequence of government transfers. On the expenditure side, no significant increase in total expenditure was observed, while there was a change in allocation. While in the pre-pandemic years the expenditure structure was relatively constant, with rather small changes in the share of local government expenditure by function, there was a shift in local government spending priorities after the outbreak of the pandemic. The largest decreases occurred in areas requiring significant investment and subsidies, namely: recreation, culture, housing and utilities. Spending increased in areas such as health, economy, social welfare units and the local community.

The impact of the COVID-19 pandemic on local finances was addressed by Ahrens and Ferry, Allain-Dupre, Chatry, Kornprobst and Michalum. The first authors drew attention to the expectations of entrepreneurs, who expected local authorities to assist them with ad hoc assistance in the form of small tax exemptions [Ahrens, Ferry, 2020]. It has been pointed out that the impact of the crisis on finance depends on various factors including the degree of decentralisation [Allain-Dupre, Chatry, Kornprobst, Michalum, 2020], the structure of incomes and their sensitivity to economic fluctuations [Chernick, Copeland and Reschovsky, 2021]. In turn, Klimovský, Bouckaert, Nemeč search has shown that the

COVID crisis strongly affects the finances of small municipalities, large cities, municipalities responsible for public transport and tourist attractions [Klimovský, Bouckaert, Nemeč, 2021; Ogden, Phillips, 2020].

In Poland, local authority support for health care was complementary, due to the fact that this is a government level task. Nevertheless, local authorities were very active in funding and supporting health workers during the first weeks of the pandemic. Provincial self-governments earmarked funds for the purchase of medical equipment and supplies (medical and diagnostic equipment), especially intensive care equipment, ventilators, ultrasound machines, ECG machines, CT scanners, defibrillators and other equipment for intensive care units [www 6]. Some local authorities also decided to purchase ambulances adapted to transport people infected with coronavirus. The second line of support was the provision and funding of personal protective equipment for medical staff through the purchase of masks, protective suits, shields, goggles, protective visors, gloves, etc.). A large pool of funding was used to purchase diagnostic tests for medical personnel [Klimek, 2020, pp. 43–46].

The second area of support for local authorities during the epidemic was support for entrepreneurs. As almost the entire burden of assistance was borne by the state, local authorities used their own fiscal instruments. It was decided to introduce reductions or exemptions from local taxes (e.g. on real estate, on means of transport); reductions, exemptions or deferrals of rent payments for the rental of municipal premises or economic counselling [Klimek, 2020, pp. 43–46].

The third area requiring support from local government units was social welfare homes and other 24-hour care institutions. The institutions received personal protective equipment for staff (masks, aprons) and disinfection equipment. For children in foster care, local governments financed the purchase of equipment needed for distance learning (e.g. laptops), personal protective equipment and equipment for quarantine or isolation areas [Klimek, 2020, pp. 43–46].

A number of measures were also taken for the residents of the communities. In the first days, disinfectants were provided in public places, protective masks were delivered to residents' boxes. Measures were taken to provide distance learning equipment for both students and teachers (purchase of licences for MS TEAMS, Skype, laptops, camcorders, etc.). Special helplines have been set up for isolated people (sick, lonely, disabled) who have to stay at home.

The actions and initiatives launched were dictated on the one hand by the unprecedented pandemic situation and on the other hand by the extended bond of the local community and the responsibility for its functioning in new, un-

familiar conditions. This picture of the financial situation of local governments during the COVID-19 pandemic thus presented was also largely due to the legal and organisational solutions introduced by the government administration in the early days.

The first government actions concerned changes in legislation, adoption and implementation of the so-called anti-crisis shields [Ustawa z 2 marca 2020, Ustawa 31 marca 2020, Ustawa z 19 czerwca 2020]. It should be clarified here that some of the adopted regulations were not directly aimed at local governments, and some covered them on an analogous basis to other entities. The first regulations (Shield 1.0), introduced by the Act of 2 March, 2020. [Ustawa z 2 marca 2020] did not directly affect local government finances. They were related to the suspension of stationary school classes, the restriction of passengers on local transport or public facilities. In connection with the indicated restrictions, an indirect impact on local finances resulting from the operation of economic entities could be observed, expressed in terms of a reduction in tax revenues [Łubina, 2021, p. 103].

The second category is the provisions imposing obligations on local governments and their organisational units to deal with the pandemic. The financial impact of these provisions was difficult to capture due to the lack of appropriate COVID-19 pandemic-related subdivisions in the budget classification, as requested by local government representatives.

The third category was provisions addressed directly to territorial self-government units [Ustawa z 19 czerwca 2020] which had an impact on their finances, hence referred to as the 'self-government shield'. They concerned: facilitating the incurrence of liabilities; the possibility of earlier transfer of general subvention to self-governments; relaxing the requirement of at least balanced current result in the budget of territorial self-governments; reducing the rigours related to the application of the individual debt ratio; increasing the possibility of using targeted subsidies from the state budget; creating the Government Fund for Local Investment [Nelicki, 2020, pp. 2–3; Czudec, 2021, p. 9; Łubina, 2021, p. 107].

The legislation gave municipalities the right to increase the amount of exemptions and reductions in taxes and fees. For example, they were allowed to use revenue from alcohol licence fees to finance measures to counteract the pandemic and its effects. Another subgroup were provisions allowing deferment of perpetual lease and conversion fees and increasing revenue from the administration of Treasury property from 25% to 50%.

### 3. Materials and Methods

Answering the research questions required an in-depth look at the value and structure of cities' expenditures and the change in their debt levels during the COVID-19 pandemic. The analysis used data and information from two sources: (1) a survey of local government units and (2) public statistics.

The survey was conducted between May and July 2022 among 46 cities in Lodz Voivodeship, the seats of urban-rural municipalities, municipalities, or cities with district rights<sup>2</sup>. The questionnaire consisted of 41 questions covering issues related to municipal budgets, the value of debt, changes in revenue and spending due to the COVID-19 pandemic, or actions taken by municipalities to counteract its harmful effects.

Respondents were asked which specific anti-covid activities had been spent on and in which departments. This made it possible to diagnose in which areas city authorities were most frequently involved during the first phases of the health crisis.

For reasons of the limited size of the article, the authors do not present the distribution of expenses incurred in the areas of education, health care and business support, which were incurred in the cities and shown in the survey questionnaire.

Information was obtained from the Local Data Bank on the value and structure of income and expenditure of municipalities during the study period, the size of the resident population and the CPI (Consumer Price Index), used to realise variables expressed in monetary terms.

The research problem covers two issues: (1) the change in the structure and direction of municipal expenditures due to the introduction of the anti-COVID-19 measures and (2) the identification of the impact these changes have had on the change in debt. For this reason, the study distinguishes between 2018–2019 (pre-pandemic years) and 2020–2021 (pandemic period).

The factors identified as relevant to the problem under consideration include:

- X1: the difference between the average debt value (per capita) in both periods,

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<sup>2</sup> The urban-rural municipality of Bolimów was excluded from the study. The municipality of Bolimów obtained urban rights as of 1.01.2022, so it did not meet the criterion of a city during the period covered by the study (2018–2021) (RM Regulation 2021). Lututów and Piątek, on the other hand, were included in the set of cities included in the study: both towns obtained city status as of 1.01.2020 (RM Regulation 2019).

- X2: the difference between the average total expenditure (per capita) in both periods,
- X3: the difference between the average share of current expenditure in total expenditure in both periods,
- X4: number of actions taken by municipalities to prevent the harmful effects of the COVID-19 pandemic (from none up to 10),
- X5: the cancellation of budgeted current spending due to the need to take measures to prevent the harmful effects of the COVID-19 pandemic (bivariate, 0 or 1),
- X6: the cancellation of budgeted investment expenditures due to the need to take measures to prevent the harmful effects of the COVID-19 pandemic (0 or 1),
- X7: Source of funding for expenditure to prevent the harmful effects of the COVID-19 pandemic (four variants: reduction in expenditure, own budget reserves, targeted grants from the appropriated funds and other sources).

The distributions of variables X1–X7 are present in Table 1 and Table 2.

TABLE 1  
Variables X1–X4 – descriptive statistics (all observations)

Statistics*	Variable			
	X1	X2	X3	X4
N	43.0	43.0	43.0	43.0
Min	-384.21	-1541.76	-9%	0.00
Max	1986.33	3824.54	25%	10.00
M	327.69	1298.94	3%	8.16
Me	251.98	1304.09	3%	9.00
SD	514.95	708.36	6%	1.80
K	1.63	8.57	4.00	-0.41
S	1.15	-0.47	1.22	-0.77

\*N – number of observations, Min – the lowest value, Max – the highest value, M – mean (arithmetic), Me – median, SD – standard deviation, K – kurtosis, S – skewness

Source: authors' own elaboration.

TABLE 2

Variables X5–X7 – frequencies (all observations)

Variable	Answer	N*	%**
X5	yes	6	14.0%
	no	37	86.0%
	total	43	100.0%
X6	yes	4	9.3%
	no	39	90.7%
	total	43	100.0%
X7 – reduction in expenditure	yes	12	26.1%
	no	31	67.4%
	total	43	100.0%
X7 – budget reserves	yes	36	78.3%
	no	7	15.2%
	total	43	100.0%
X7 – targeted grants	yes	21	48.8%
	no	22	51.2%
	total	43	100.0%
X7 – other sources	yes	8	17.4%
	no	35	76.1%
	total	43	100.0%

\*N – number of observations,

\*\*% – percent of (valid) observations

Source: authors' own elaboration.

The study was conducted in two stages. The first stage of the analysis was aimed at determining municipal spending patterns. For this purpose, the actions taken by the municipalities (variables  $X_4$ – $X_7$ ) in conjunction with the change in expenditure structure ( $X_3$ )<sup>3</sup>. Then, a model explaining debt variability ( $X_1$ ) was built. The model was developed based on two explanatory variables: the change in expenditure ( $X_2$ ) and the municipality's spending pattern.

<sup>3</sup> Based on the change in the share of one of the two categories of municipal expenditure, i.e. current expenditure.

Considering the variables' different measurement scales, the first stage of the analysis was conducted using the Two-Step Cluster Analysis. This method makes it possible to divide observations from the analysed set into groups consisting of municipalities with similar expenditure characteristics. The Two-step Cluster Analysis allows the grouping of observations characterised by variables expressed on mixed measurement scales, both quantitative and qualitative [Chiu et al., 2001, p. 263]. This method is suitable for analysing large datasets [ibid., p. 267]. Nevertheless, the computational algorithm ensures its scalability for different sizes of datasets [Aswandi, Kholibrina, 2020, p. 8; Michailidou et al., 2009, p. 166]. Its areas of practical application include healthcare [Rundle-Thiele et al., 2015], market analysis [Johnson et al., 2011], climate [Michailidou et al., 2009] or those devoted to the functioning of localities [Supandi et al., 2020]. The essence of the method is a two-step classification process. In the first step of the analysis, the algorithm creates pre-clusters, significantly reducing the number of objects during the main clustering process [Chiu et al., 2001, pp. 265–267; Michailidou et al., 2009]. The authors of the method point out that its application requires the normality of the distribution of quantitative variables and the polynomial distribution and independence of qualitative variables<sup>4</sup> [Chiu et al., 2001, p. 267]. However, the robustness of the method to failures of these assumptions is emphasised [Chan, 2005, p. 159; IBM, 2021]. The classification assessment can be done with the Silhouette coefficient. This measure reaches values between -1 and 1 [Rousseeuw, 1987, p. 56], where below 0.2 indicates poor, between 0.2 to 0.5 – acceptable, and above 0.5 – good classification quality [Supandi et al., 2020, p. 16].

We used a linear regression model in the second stage of our analysis. In simple terms, the regression model explains the influence of an explanatory variable or sets of such variables on a dependent one. One of the most popular model parameter estimation methods is the Classical Least Squares Method. Constructing a linear regression model requires the quantitative dependent variable and the predictor(s) to be quantitative or bivariate [Bedyńska, Ksiązek, 2012, p. 58; Miller, Erickson, 1974]. For an estimated model to be considered correct and valid, the following assumptions must be met: regarding the predictor and explanatory variables: both are normally distributed (1) and linearly dependent (2), the explanatory variables are not correlated (3) and regarding the residuals: constant variance (4), normal distribution (5) and no autocorrelation is required (6) [Bedyńska, Ksiązek, 2012, pp. 58–59]. An appropriate sample size is also essential [Bedyńska, Ksiązek, 2012, p. 58; Maxwell Scott, 2000, p. 454].

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<sup>4</sup> The authors of the method compared the speed of the Two-step Cluster Analysis algorithms and the k-means method for sets of 50,000 to 5 million observations [Chiu et al., 2001, p. 267].

### 3. Results

The survey was conducted on the population of local government units – urban-rural municipalities, municipal municipalities and cities with district rights in the Lodz Voivodeship. The data shows that 43 out of 46 respondents provided comprehensive answers, while 3 answered only a few questions<sup>5</sup>.

Both methods used in the study require the variables to be normally distributed. The analysis of the distribution of variables  $X_1$ ,  $X_2$  and  $X_3$  indicates the problem of outliers ( $X_1$ :  $K = 1.63$ ;  $X_2$ :  $K = 8.57$ ;  $X_3$ :  $K = 4.00$ ). Closer examination revealed that the reason lies in the values that characterise Poddebice<sup>6</sup>, Lodz<sup>7</sup>, Rzgów<sup>8</sup> and Kamiensk<sup>9</sup> – removing these observations from the analysed set allowed for the convergence of the distributions of variables  $X_1$ – $X_4$  to normal (Table 3).

TABLE 3  
Variables X1–X4 – descriptive statistics (outliers excluded)

Statistics*	Variable			
	X1	X2	X3	X4
N	39	39	39	39
Min	-384.21	499.67	-9%	4.0
Max	1363.97	1998.88	14%	10.0
M	258.83	1285.21	0.8%	8.21
Me	230.81	1303.48	0.3%	9.00
SD	419.67	402.3	0.5%	1.82
K	0.15	-0.71	0.02	-0.28
S	0.64	0.07	-0.10	-0.87

\*N – number of observations, Min – the lowest value, Max – the highest value, M – mean (arithmetic), Me – median, SD – standard deviation, K – kurtosis, S – skewness

Source: authors' own elaboration.

<sup>5</sup> Ozorkow, Uniejow (urban-rural municipalities) and Sieradz (urban municipality).

<sup>6</sup> Own value for  $X_1$  = PLN 1986.33.

<sup>7</sup> Own value for  $X_1$  = PLN 1465.58.

<sup>8</sup> Own value for  $X_2$  = PLN 3824.54.

<sup>9</sup> Own value for  $X_3$  = 25.5%.

Before proceeding with the Two-step Cluster Analysis, an independence test was performed for variables  $X_5$ ,  $X_6$  and  $X_7$ . The values of the V-Cramér coefficient are presented in Table 4.

TABLE 4  
Variables X5–X7 – assessment of interdependence of variables (Cramér's V)

Variable	$X_6$	$X_7$ – reduction in expenditures	$X_7$ – budget reserves	$X_7$ – targeted grants	$X_7$ – other sources
$X_5$	0.465	0.612	0.049	0.047	0.620
$X_6$	–	0.247	0.123	0.074	0.617
$X_7$ – reduction in expenditure	–	–	0.207	0.106	0.449
$X_7$ – budget reserves	–	–	–	0.175	0.014
$X_7$ – earmarked grants	–	–	–	–	0.165

Source: authors' own elaboration.

At least moderate relationship is visible between variable  $X_5$  (the cancellation of budgeted current spending) and the variables:  $X_7$  – other sources ( $V = 0.620$ ),  $X_7$  – expenditure reduction ( $V = 0.612$ ) and  $X_2$  the cancellation of budgeted investment expenditure ( $V = 0.465$ ). Similar conclusions can be drawn for the relation between variable  $X_7$  – other sources and  $X_7$  – expenditure reduction ( $V = 0.449$ ) as well as variable  $X_6$  – cancellation of budgeted investment expenditure ( $V = 0.617$ ). All play a crucial role in the municipalities' strategies during the COVID-19 pandemic. Thus, given the robustness of the Two-stage Cluster Analysis to violation of the assumptions, the decision was to include them in the analysed dataset. For the remaining pairs of variables, the degree of interdependence is low ( $0.1 < V < 0.2$ ) or very low ( $V < 0.1$ ).

As a result of the Two-stage Cluster Analysis, the dataset was divided into three groups: cluster 1 (8 municipalities), cluster 2 (14 municipalities) and cluster 3 (17 municipalities). The Silhouette coefficient value was 0.4, which means that the result of the classification process can be considered correct or desirable. Among the variables included in the grouping procedure, the key turned out to be two sources of financing expenditure on activities related to the prevention of the negative effects of COVID-19: other sources (validity 1.00) and targeted subsidies

(validity 0.88), as well as the resignation of current expenses by municipalities (validity 0.67) (Table 5). The source of financing was slightly less important for the assignment of communes to clusters – resignation from total expenditure (importance 0.43) and resignation from investment expenditure (importance 0.38). The variable source of financing – budget reserves, the number of activities undertaken in connection with COVID-19 and the difference in the share of current expenses in total expenses differentiated the surveyed communes the least (importance: 0.16, 0.09 and 0.01, respectively).

TABLE 5

Result of the Two-stage Cluster Analysis procedure with characteristics of the groups

Variable	Validity	Variant	1 n* = 8	2 n = 14	3 n = 17
X7 – other sources	1.00	Yes	87.5%	0.0%	0.0%
		No	12.5%	100.0%	100.0%
X7 – targeted grants	0.88	Yes	25.0%	0.0%	94.1%
		No	75.0%	100.0%	5.9%
X5	0.67	Yes	62.5%	0.0%	0.0%
		No	37.5%	100.0%	100.0%
X7 – reduction in expenditure	0.43	Yes	75.0%	0.0%	29.4%
		No	25.0%	100.0%	70.6%
X6	0.38	Yes	37.5%	0.0%	0.0%
		No	62.5%	100.0%	100.0%
X7 – budget reserves	0.16	Yes	87.5%	100.0%	70.6%
		No	12.5%	0.0%	29.4%
X4	0.09	Mean	8.39	8.79	7.56
X3	0.01	Mean	2 pp**	2 pp	3pp

\*n – number the cluster, \*\*pp – percentage points

Source: authors' own elaboration.

Three groups of municipalities are characterised by different profiles of activities undertaken during the COVID-19 pandemic and the financing methods. They can be described as follows:

1. Cluster 1 – includes 8 municipalities that intensively used other sources to finance their expenses (87.5% of respondents classified in this group). Unlike the representatives of the other clusters, these municipalities cut current spending (62.5%) and investment expenses (37.5%) and used targeted grants to a limited extent (25.0%). During the pandemic, they increased the share of current spending in total expenses by an average of 2.0 percentage points. The average number of actions these municipalities took regarding the COVID-19 pandemic was 8.38.
2. Cluster 2 – includes 14 communes that financed the discussed activities exclusively from their own budget reserves (100.0% of respondents classified in this group). These municipalities did not introduce any restrictions on current spending (100.0%) or investment expenditure (100.0%). Respondents classified to the second cluster declared that they had implemented an average of 8.79 anti-COVID activities (the highest value among all three). The change in the share of current spending in total expenses was the same as in the case of municipalities from cluster 1, which means 2 percentage points on average.
3. Cluster 3 – includes 17 municipalities that largely financed their activities with targeted grants (94.1% of communes in this group) and did not introduce any restrictions on current spending (100.0%) or investment expenditure (100.0%). Compared to the other groups, they relatively rarely used budget reserves (70.6%, compared to 87.5% in cluster 1 and 100.0% in cluster 2). The average number of actions taken to prevent the negative effects of COVID-19 was the lowest among the analysed groups – 7.65. The share of current spending in total expenses was the highest, reaching an average of 3.0 percentage points.

As a result of the classification, three strategies for the functioning of selected municipalities in the Lodz Voivodeship during the pandemic were identified. The first one is limiting expenses (mainly current) and using sources of financing other than budget reserves or targeted subsidies. A different strategy was adopted by the municipalities classified in cluster 2. These entities financed the expenses resulting from the necessity of preventing the harmful effects of COVID-19 from budget reserves and, at the same time, did not introduce restrictions on current spending or investment expenses. The third strategy considers the frequent use of targeted subsidies as a source of covering expenses caused by COVID-19, with relatively limited use of budget reserves and no restrictions on current spending or investment expenses.

We used the results obtained during the classification procedure as an independent variable in the model explaining the variance in the variability of the debt level of municipalities during the COVID-19 pandemic (2020–2021) compared to the previous period (2018–2019). We chose cluster 3 as a reference value for the strategies adopted by municipalities, considering the group's dominant size and the profile's balanced characteristics. The second dependent variable in the model is the change in the average value of total expenses incurred by municipalities in analogous periods, i.e. during the pandemic compared to the preceding period. The assumption regarding the linear relationship between the variables was verified using Pearson's linear correlation coefficient ( $r_{xy}^{10} = 0.4$ ).

The change in the value of debt during the COVID-19 pandemic (2020–2021) compared to the previous period (2018–2019) was estimated using the linear regression model. In the first step, we estimated a base model with one independent variable – the change in the average value of total expenses during the COVID-19 pandemic (Table 6).

TABLE 6

The base linear regression model

Variable	Estimate	SE	$\beta$	95 CI		$p$
				LL	UL	
constant	-280.245	211.400	-	-708.581	148.091	0.193
$X_2$	0.419	0.157	0.402	0.101	0.738	0.011

SE – Standard Error,  $\beta$  – beta coefficient, CI – Confidence Interval, LL – Lower Limit, UL – Upper Limit,  $p$  – probability (t-Test)

Source: authors' own elaboration.

The obtained model has the form of (1)

$$\hat{Y} = -280.245 + 0.419 X_2, \quad (1)$$

where:

$\hat{Y}$  – change in the average value of debt (per capita);

$X_2$  – change in average total expenditure (per capita).

<sup>10</sup>  $r_{xy}$  – the Pearson linear correlation coefficient.

The obtained estimate indicates that, on average, an increase in total expenses (per capita) by PLN 1,000.00 during the COVID-19 pandemic, compared to the preceding period, resulted in an increase in debt (per capita) by PLN 138.76. The explanatory variable is related to the change in debt in a statistically significant way ( $p = 0.011^{11}$ ). This model is characterised by a low degree of fit to the empirical data – the coefficient of determination indicates that the model explains only 14% of the variance in the change in debt (adjusted  $R^2 = 0.139^{12}$ ). It should be noted that a low value of this coefficient is acceptable when a model is used only to describe the relationships between variables [Aczel, Sounderpandian, 2008, p. 441] and at least one regression coefficient is statistically significant [Ozili, 2023, p. 7]. The base model meets these criteria. The residuals also meet the requirements of the method (normality of distribution:  $SW^{13} = 0.968$ ,  $p = 0.337$  and the lack of autocorrelation:  $DW^{14} = 1.716$ ).

Including variables representing clusters 1 ( $X_8$ ) and 2 ( $X_9$ ) in the model<sup>15</sup> results in the new equation (2)

$$\hat{Y} = -352.048 + 0.422X_2 + 167.422X_8 + 95.873X_9 \quad (2)$$

where:

$\hat{Y}$  – change in the average value of debt (per capita);

$X_2$  – change in average total expenditure (per capita);

$X_8$  – municipality's membership of cluster 1;

$X_9$  – municipality's membership of cluster 2.

The model with additional independent variables allows for estimating the change in the value of debt, considering the municipalities' affiliation to one of the three groups obtained in the clustering procedure. The model described by equation (1) explains the case of group 3 – the reference group. For the municipalities classified into cluster 1, the value of the change in debt during the COVID-19 pandemic compared to the preceding period will be equal to PLN 237.38 per capita for each PLN 1,000.00 increase in total expenses. For the communes belonging to cluster 2, this value will be equal to PLN 165.79. It can be said that the increase in total expenses determined the highest increase in debt among municipalities implementing the strategy of using other sources of financing expenses

<sup>11</sup> Probability in the regression coefficient significance test.

<sup>12</sup>  $R^2$  – the coefficient of determination.

<sup>13</sup> Shapiro-Wolf statistics.

<sup>14</sup> Durbin-Watson statistics.

<sup>15</sup> Cluster 3 is the reference for clusters 1 and 2.

while limiting expenses (mainly current spending) and implementing relatively many activities to combat the pandemic's harmful effects. On the other hand, the lowest increase in debt was observed in the municipalities that financed preventive activities exclusively from budget reserves, and the number of these activities was the highest among the groups established in the study. Between these two extreme groups, municipalities are implementing a strategy of supporting the financing of their activities from targeted subsidies.

With regard to model (2), it should be noted that it is of lower quality than model (1). Although the method's assumptions regarding the normality of distribution ( $SW = 0.981$ ;  $p = 0.749$ ) are met, the degree to which the model in question explains the variance of the dependent variable (changes in debt) is lower than in the model (1). (Table 7). The value of the adjusted coefficient of determination is 12% (adjusted  $R^2 = 0.117$ ), compared to 16% in the model (2). Also, the parameter estimates for two new variables –  $X_8$  and  $X_9$  – are relatively high ( $X_8$ :  $SE = 169.430$ ;  $X_9$ :  $SE = 144.461$ ). These variables are also not statistically significantly related to the change in the debt level ( $X_8$ :  $p = 0.988$ ;  $X_9$ :  $p = 0.664$ ). This results in a limited possibility of using model (2) to estimate changes in debt or explain the causes of its variability. The hypotheses regarding the factors shaping the change in the level of municipal debt should be reformulated, at least in terms of the municipality's expenditure strategy.

TABLE 7

Linear Regression Model (4)

Variable	Estimate	SE	$\beta$	95 CI		$p$
				LL	UL	
constant	-352.048	211.400	-	-	-	0.145
X2	0.422	0.163	0.404	0.092	0.752	0.014
X8*	167.422	169.430	0.163	-176.539	511.382	0.988
X9**	95.873	144.461	0.111	-197.398	389.145	0.664

SE – Standard Error,  $\beta$  – beta coefficient, CI – Confidence Interval, LL – Lower Limit, UL – Upper Limit,  $p$  – probability (t-Test)

\* 0 = no, 1 = yes, \*\*0 = no, 1 = yes

Source: authors' own elaboration.

#### 4. Conclusion

The COVID-19 pandemic has changed the way we perceive reality. It highlighted many imperfections in the functioning of the economy as a whole and its individual areas, including health care. Counteracting the multi-faceted consequences required the involvement of the state and local governments as entities responsible for implementing public tasks.

Local government authorities at all levels have been actively involved in all areas of anti-COVID assistance: health, economic and social. However, there is a variation in the scope and degree of their implementation. It resulted from the financial capabilities of individual local government units. This was primarily dictated by the revenues obtained, which, in the case of tax revenues from PIT, were limited mainly after the changes introduced in 2019. This translated into the structure of expenses incurred.

The research indicates that individual cities have different profiles of actions taken to prevent the negative effects of the COVID-19 pandemic and the methods of financing them. Most cities financed the activities in question from targeted subsidies obtained from the state budget or from their own budget reserves, which meant there was no need to reduce expenses. A smaller number of municipalities financed COVID-19 activities from other sources, which resulted in reduced current and investment expenses. Observations show that the debt of the cities is increasing, but it is not a direct result of the pandemic.

However, it should be noted that at the current stage, it is impossible to fully determine the pandemic's impact on the functioning of local government and what its further consequences will be in the future because the external conditions in which local governments operate are changing dynamically. During the pandemic, war broke out in Ukraine, and further crises emerged: energy, climate and ecology. They do not remain indifferent to the functioning of local authorities and the state of budgets of communes, counties and voivodeships and will constitute a premise for further research.

The Chinese proverb "May you live in interesting times", quoted in the introduction, seems to be a curse of the modern world.

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