IMPACT OF FISCAL AND NON-FISCAL FACTORS ON THE MUNICIPAL DEBT: THE CASE OF WIELKOPOLSKA REGION IN POLAND

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Purpose: The aim of the paper is to examine indebtedness factors in the field of the structure of own revenues and expenditure as well as spatial relationships on the example of municipalities of the Wielkopolska Region in Poland.

Design/methodology/approach: The subject literature was studied to present miscellaneous predictors of the indebtedness of the local governments. Then, using the fiscal, socio-economic, and political variables for 222 municipalities from Wielkopolska Region in Poland, panel data models with fixed effects were estimated for the period 2010-2021, and the spatial autocorrelation statistics.

Findings: There is a direct relationship between the share of PIT and CIT in own revenues and the indebtedness of the municipalities. Furthermore, the decrease of the unemployment and the growth of the business density contribute to the decrease in the debt to revenues ratio. In addition, the increase of the indebtedness resulted from an increase of the investment activity, the share of spendings on wages as well as the expenditures on education. The use of EU funds also stimulates the indebtedness of the municipalities. Moreover, in 2018-2021 the territorial proximity affected the weak, positive correlation of the debt to revenues ratio between the municipalities.

Research limitations/implications: The research presents the predictive power of the applied variables, which contributes to the identification of the role of the predictor in the creation of debt.

Practical implications: The research study is aimed at the estimation of the models, which could be applied to predict the level of the indebtedness in the municipalities.

Social implications: The research contributes to the higher recognition of the relationships between the changing fiscal, economic and political circumstances on the indebtedness of the municipality, e.g., in the process of creating local strategies.

Originality/value: The study examines the indebtedness factors concerning the composition of the own revenues and expenditures, as well as the socio-economic issues and spatial relationships, considering the predictive power of each factor.

Keywords: municipality, debt, predictors, panel models, spatial autocorrelation statistics.

Category of the paper: Research Paper.

JEL Classification: E62, H72, H74.

1. Introduction

Predictors of the indebtedness of the local governments are key factors determining the fiscal situation of the local public finance. The theorists indicate both negative and positive aspects of incurring the debt. This is one of the sources of financing the capital spendings of the units in the process of the local development. Thus, the creation of new investments might increase the possibility of generating revenues in the future in the form of the local taxes and fees, as well as contribute to the satisfaction of residents or raising the standard of living (Owsiak, 2022, p. 110). Funding investment activity through debt also ensures intergenerational equity in the case of insufficient level of revenues. In turn, for the case of the operational debt there is no reasonable moral justification for increasing its level (Drew, 2020, p. 153). Thus, the use of debt for financing current tasks shows a structural maladjustment of the system of the financial receipts for local authorities. Low-restrictive budget policy (high debt ratio) (Owsiak, 2022, pp. 128-130), in contrast, is associated with higher future debt repayments. Simultaneously, a higher share of these outflows in relation to total spendings increases the probability of the fiscal distress (Gregori, Marattin, 2019, p. 1271). Hence, the indebtedness of the municipalities determines this distress (Galiński, 2022, pp. 102-105; Galiński, 2021, pp. 411-425) as well as a financial sustainability, perceived as the ability to meet service and financial commitments and to apply and maintain current policies without increasing level of the borrowing (Frintrup, Hilgers, 2023, p. 4).

In the subject literature, there are various studies on the determinants of the municipal debt. However, some of them show different outcomes. In many cases, this results from the applied set of variables, which should be adjusted to the regulations in the state and the practical frameworks of the functioning of the local government in the country. Numerous studies put pressure on the influence of changes in the level of revenues, expenditures, population on the indebtedness, analysing often aggregate data (Serbes et al., 2022, p. 145; Alińska et al., 2021, p. 121; Ehalaiye et al., 2017, p. 519; Wichowska, 2019, p. 124), and do not assess the impact of the budget composition, socio-economic structure, or potential spatial relationships amongst municipalities. Furthermore, the local units, which are functioning in the close proximity, may interact with each other due to the common characteristics.

Therefore, the aim of the paper is to examine indebtedness factors in the field of the structure of own revenues and expenditure as well as spatial relationships on the example of municipalities of the Wielkopolska Region in Poland. In addition, the research study is aimed at the estimation of the models, which could be applied to predict the level of the indebtedness as well as ordering the examined predictors according to their predictive power. This, in turn, may contribute to the higher recognition of the relationships between the changing fiscal, economic and political circumstances on the debt of the municipality, e.g., in the process of creating local strategies.

To attain the aim of this research study, the following hypotheses were formulated, i.e.:

- Hypothesis 1 (H1): There is an inverse relationship between the indebtedness of local government and the share of PIT and CIT inflows in own revenues, where the share of PIT has the higher predictive power.
- Hypothesis 2 (H2): There is a direct relationship between the indebtedness of municipality and the share of expenditures on wages in the total, which has the high predictive power.
- Hypothesis 3 (H3): The growing investment activity and the engagement in spendings on education results in a growth in the debt to revenues ratio of municipalities.
- Hypothesis 4 (H4): There is a direct relationship between the indebtedness of local government and the share of pre-working age population, since this population determines the expenditures on education.
- Hypothesis 5 (H5): The unemployment ratio and the business density have respectively positive and negative relationships with the debt to revenues ratio of the municipality.
- Hypothesis 6 (H6): Spatial proximity between local governments influences their indebtedness.

The novelty of this study is the examination of indebtedness factors concerning the composition of the own revenues and expenditures, as well as the socio-economic issues and spatial relationships, considering the predictive power of each factor. The applied research procedure contributed to showing the importance of the indebtedness predictors in the municipalities. The paper studies 222 municipalities from Wielkopolska Region in Poland, taking into account their certain relationships and similarity, e.g., access to funds from the European Union (EU) under the regional operational programme, functioning under the common regional development strategy of the voivodship prepared by its board, or similar environmental and geographical circumstances.

2. Literature review

The subject literature distinguishes certain reasons for the increase of the local government debt, which results primarily from the imbalance in the budget. Simultaneously, this imbalance may arise from internal (depending on the activities of local units and their financial condition) and external (the micro and macro circumstances). Thus, it concerns the specificity of revenues and expenditures. The revenue factors include the method of planning and collecting certain funds, their types, efficiency, and stability against the background of financial autonomy and independence. In turn, expenditure factors are analysed in the context of the scope of the tasks, the way they are planned and performed, their structure, taking into account the division into current (operating) and capital (investment) expenditures. Therefore, the local debt is perceived

as external resource of financing the budget deficit and financial shortages. Poniatowicz (2018, pp. 201-203) indicates issues, which lead to the borrowing for the local government activity, i.e.:

- the long-term budget deficit;
- the extensive public spending, e.g., due to the economic crisis;
- a faulty structure of public expenditures, especially due to dominance of the rigid expenditures. It is worth adding that budget rigidities stem from institutional arrangements which limit the budgetary authorities' ability to adjust the composition and the size of the budget in the short run (IMF, 2006, p. 28). In addition, the spending rigidity includes those categories which address rights and guarantees established by various types of regulations (Cetrángolo et al., 2010, p. 19). Therefore, the rigidity of some social expenditures (especially concerning education and health care) results from its legal stiffening, aimed at establishing certain guarantees to deliver this type of public goods appropriately (MF, 2015, p. 4);
- an implemented economic policy assuming conscious maintenance of the budget deficit and public debt as intervention instruments.

Furthermore, arguments for the need to incurring the debt are also highlighted, i.e. (Poniatowicz 2018, p. 203):

- an inadequate level of own revenues, especially in relation to the scope of the obligatory tasks, and thus limited fiscal capacity, identified as the ability to raise revenues from the own sources to finance required expenditures (Malinowska-Misiąg, 2020, p. 113). However, it may appear a situation, in which the municipalities financing most of their activities from intergovernmental funds present a lower level of indebtedness (Ramírez Camberos, Poom Medina, 2013, p. 88). On the other hand, in larger municipalities with the higher share of own resources in comparison to both medium-sized and small units, per capita debt can be higher. Therefore, the indebtedness might be driven by the composition of the own revenues (Horvat et al., 2020, p. 1089);
- the principle of intergenerational equality, which envisages the shifting part of the costs of the infrastructure investments, which were previously financed with the generated debt, to future generations due to the long-term use of these assets. It is also about the even distribution of fiscal burdens over time, i.e., within the functioning of individual generations (Gelfand, 1979, p. 550);
- the high cost and time-consuming infrastructural investments;
- an instability of investment expenditures;
- an access to non-refundable grants, which require own contribution, often in the form of the additional debt. Therefore, the debt is perceived as an instrument increasing the absorption capacity of the EU funds.

Analysing the relationships between the indebtedness and the revenues it is crucial to examine the revenues' structure, especially in the field of own revenues. Białek-Jaworska (2022, p. 970) found positive relationships between both tax visibility and the property tax burden variables with a local government's short-term and long-term debt. This, in turn, determines the expansion of the indebtedness. Moreover, unit's overall revenue diversification does not allow to collect enough funds to fulfil the needs of the local society, and only tax revenue diversification enables to decrease the short-term debts. It is worth adding that the revenue diversification is a strategy of effective fiscal management, aimed at a decrease of the instability of the overall tax revenues and can contribute to a more favourable business climate or soothe taxpayer discontent (Białek-Jaworska, 2022, p. 935). In the public sector the growth of the real interest rate on the debt may force the government to increase tax revenues to service the liabilities (Montiel, 2005, p. 271). Therefore, the composition of own revenues and the tax autonomy can stimulate the borrowing policy. In addition, the structure of own revenues reflects the circumstances of the local economy, i.e., the urbanization, situation on the labour market, households' incomes, the entrepreneurship, or the industrialization. Thus, a development of the municipality is affected by a high level of own revenues, revenues derived from sharing taxes, i.e., Personal Income Tax (PIT), and Corporate Income Tax (CIT), and the indebtedness (Standar, Kozera, 2019, p. 18). These shared taxes show higher procyclical magnitude of responses in comparison to local taxes, especially property taxes (Dynnikova et al., 2021, pp. 18-30). PIT and CIT, as shared taxes, are also affected by the regulatory changes, implemented by the central authorities.

The debt burden is also determined by the growth in fixed expenditures, especially the extensive level of the expenses for salaries. Their value in relation to other budget categories, e.g., total expenditure or current revenues, provides information on the budget rigidity (Scartascini, Stein, 2009, p. 14). Hence, their drop indicates the larger flexibility of the budget and the ability to adjust to unexpected events, economic downturn, or less pressure to generate new short-term liabilities. The concentration of expenses in the relatively rigid category means that local units may have difficulties to balance the budgets in the contexts of sudden changes in the structure and size of revenues (INC Rating, 2018). Muñoz and Olaberria (2019, p. 30) add that budget rigidities constrain the ability of the authorities to modify and adjust the size and structure of the public budget, especially in the short term. The wages, in contrast, are components of the fixed costs (OSC, 2015, p. 2) and their high share in operating expenditures may increase the pressure on debt growth due to insufficient fiscal capacity.

On the other hand, municipal indebtedness is stimulated by certain economic factors (Galiński, 2015, pp. 379-380), e.g., the unemployment, the entrepreneurship and the inflows of the businesses, and the demographic predictors, e.g., the level and the structure of the population. These aspects affect both the revenue and the expenditure sides of the local budget. However, in many cases the empirical calculations in the studies show different results. Feld et al. (2011, pp. 60-61) estimated that the unemployment rate has not a statistically

significant effect on per taxpayer public debt, whilst Veiga and Veiga (2014, pp. 31-32) revealed the significant direct relationship between the unemployment and the real gross debt to the three-year moving average of total effective revenues. Wassmer and Fisher (2012, p. 61) indicated that public school enrollment significantly influenced outstanding state and local government debt. Regressions of Bellot et al. (2017, p. 59) show, in contrast, that the share of the population over 65 years old may reveal disparate signs of the coefficients in the econometric models on the local indebtedness factors for different countries, indicating direct or inverse relationships between the studied variables. According to the findings of Wichowska (2019, p. 126) the proportion of the post-working age population in total population was significantly and positively correlated with per capita short-term debt in the studied units, while the number of businesses per inhabitants was not included in the final model with significant variables. Valkama and Oulasvirta (2021, p. 447), analysing the Finnish municipalities, showed that these units run into debt while the share of 65 and over population increased substantially. This could be examined in the context of urbanization. This results from the facts that the scale of local government debt is significantly driven by urban expansion (Yan et al., 2021, p. 1) and upfront capital expenditures required for many types of municipal systems (Kirkpatrick, 2016, p. 49).

The level and structure of local entrepreneurship, in turn, were the key factors influencing the revenue autonomy of the analysed municipalities by Wichowska and Wierzejski (2019, pp. 80-83). It results from the fact, indicated by these authors, that local entrepreneurs generate a substantial portion of a municipality's own-source revenues. In addition, these entrepreneurs are responsible for the part of income generated by CIT. Thus, the scholars claim that the insufficient amount of non-repayable financing and the restricted financial autonomy of municipalities to be among the reasons behind growing indebtedness (Kozera, Standar, 2020, p. 18). Klapper et al. (2010, pp. 130-136) presented that business density (the number of registered businesses as a percentage of the active population) is significantly related to indicators of economic development and growth in the country.

In the subject literature, political factors are also included in the studies as debt determinants. This results from the concept of the Political Budget Cycle (PBC), which refers to increases in government spendings or in the deficit, in an election year or preelection years. This is motivated by the incumbent's desire for reelection (Bonfatti, Forni, 2019, p. 327). The PBC also suggests that there is a debt expansion immediately before elections by the ruling party in an intent to promote its re-election (Benito et al., 2021, p. 2). Cuadrado-Ballesteros et al. (2013, p. 701) highlight that public debt has been used strategically by politicians to manipulate voter's preferences and to affect the voting results. Geys (2007, p. 247) revealed that in Flemish municipalities in an election year there was a strong increase in a debt growth between one- and two-party governments, whereas the additional increase was much more modest in coalitions consisting of three or more parties. Bohn and Veiga (2019, p. 448) argue that high-debt governments often face recessions, which force them to manipulate fiscal policy

more when elections are approaching. Therefore, fiscal rules have been found to reduce public debt (Gootjes et al., 2021, p. 3). However, Delgado-Téllez and Pérez (2020, p. 233-239) indicated that political variables and fiscal rules strength do not seem to have a noteworthy effect on the debt of the analysed units. The theorists also suggest that political ideology may affect indebtedness because left-wing authorities prefer larger public spendings covered by the borrowing in comparison to right-wing governments (Seitz, 2000, p. 184). In the group of the political factors coincidence of the political party between the local executive and the central government and the political fragmentation are also studied (Basílio, Borralho, 2021, pp. 7-8). Basílio and Borralho (2021, p. 16) found that less debt is present in municipalities which are ruled by a partisan of the same political orientation as the authorities at the central level. Moreover, in-between the elections, the probability of deficit is lower than in election year (Działo et al., 2019, p. 1046)

In the subject literature, in the estimations miscellaneous local (sub-national) debt predictors are considered within certain categories, which in most of the cases are adjusted to the fiscal regulations (e.g., revenue composition) in the country, i.e.:

1) financial and institutional (Ehalaiye et al., 2017, p. 519),
2) fiscal and financial, socioeconomic and political variables (Balaguer-Coll et al., 2016, pp. 516-519),
3) institutional, political, and ideological, fiscal, economic and financial forces (Ribeiro, Jorge, 2014, p. 70),
4) political, demographic, size, budgetary and economic indicators (Bellot et al., 2017, pp. 55-57),
5) financial, political, and socio-economic variables (Veiga, Veiga, 2014, pp. 11-12, 31),
6) budgetary variables in the field of revenues and expenditures (Alińska et al., 2021, pp. 118-119),
7) fiscal and financial conditions of units, economic and geographical position, social factors (Medvednikova, 2022, p. 538),
8) fiscal situation, political factors, indicators of inter-municipal cooperation (Pérez-López et al., 2014, pp. 197-201),
9) fiscal, institutional, political, external crisis appearance (del Castillo et al., 2022, pp. 8-9).

Thus, the predictors of the municipal indebtedness in specific countries are usually discussed under two broad categories, i.e.: financial (such as capital expenditure, taxation/revenue issues) and socioeconomic/political determinants (such as population/size, government fragmentation, debt regulations) (Ehalaiye et al., 2017, p. 515). Macroeconomic policy measures are also included. Nevertheless, the mentioned studies do not examine the spatial associations between local public units in the field of their indebtedness. However, certain relations may appear due to similar policy and structure in the field of revenues or expenditures because of common task performing, similar demographic structure

or economic conditions as well as an impact of the regional development strategy. It might be also driven by the access to non-refundable funds for programs and projects, where the own contribution is required, e.g., in a form of debt, within the existing system of their absorption in the region (voivodeship in Poland) and its specificity for this region. At the basis of the analysis of possible spatial associations is the First Law of Geography, developed by W. Tobler, which indicates that everything is related to everything else, but near things are more related than distant things. In turn, the Second Law of Geography states that the phenomenon external to area of interest determines what goes in the inside (Ghemawat, 2017, p. 3). Thus, it is worth analysing possible similarities on the debt to revenues ratio between the neighbouring local governments.

3. Data and Methodology

To examine the debt predictors of municipalities the paper studies 222 local units (N = 222) from the Wielkopolska Region in Poland in the years 2010-2021 (T = 12). The panel does not include four cities with the county rights (ccr) from this region since they are characterized by additional sources of revenues and tasks. The article uses the available data provided by the Central Statistical Office (CSO) in Poland as part of the Local Data Bank as well as the Ministry of Finance (MF) in Poland as a part of a database containing the debt level of the municipalities.

Due to the aim of the article and the longitudinal data, panel models were applied. These models have greater capacity for capturing the complexity of unit behaviour in comparison to a single cross-section or time series regressions and can control the impact of omitted or unobserved variables (Hsiao, 2007, p. 3-4). The simplest estimator for this data is the pooled OLS (Ordinary Least Square) model, in which all units, i.e., municipalities are assumed to be homogeneous (Das, 2019, p. 501). However, this is unlikely to be adequate, but it does provide a baseline for comparison with other types of the regressions, i.e., fixed effects models and random effects models (Cottrell, Lucchetti, 2022, p. 204). The pooled OLS model may be written as (1):

$$y_{it} = x_{it}\beta + u_{it}, \tag{1}$$

where:

y_{it} is the dependent variable for the cross-sectional unit i, i.e., municipality of the Wielkopolska Region, Poland in the period t,

x_{it} is a $1 \times k$ vector of independent variables for municipality i in the period t,

β is a $k \times 1$ vector of the parameters to be estimated on explanatory variables,

u_{it} is an error term specific to municipality i in period t.

The application of the type of the final longitudinal model resulted from the calculation of the Wald test (the F statistic), the Breusch-Pagan test (the χ^2 statistic) as well as the Hausman test (the χ^2 statistic) (Greene, 2003, pp. 283-301). In this paper the regressions with fixed effects were applied, in which u_{it} is decomposed into a unit-specific and time-invariant constant coefficient, α_i, and an observation specific error, ε_{it}. This model is as follows (2):

$$y_{it} = x_{it}\beta + \alpha_i + \varepsilon_{it}. \tag{2}$$

As consequence of a failure to meet assumptions of the distribution of residuals (the presence of the heteroscedasticity, verified by the Modified Wald test - χ^2 statistic, and the autocorrelation checked through the Breusch-Godfrey test for serial correlation - χ^2 statistic, as well as cross-sectional dependence, verified by the Pesaran test), the clustered standard errors were applied (Hoechle, 2007, p. 285; Janda, Zhang, 2022, p. 203). During the model estimation, the Variance Inflation Factor (VIF) was also calculated to control the potential problem of the multicollinearity (Bandyopadhyay, 2022, p. 200) with a rule of thumb indicated in Pesaran (2015, p. 70). For the final models there are presented goodness of fit measures: within R^2, LSDV R^2 and Akaike Information Criterion (AIC), as measures of a predictive power (Lewis-Beck et al., 2004, p. 983; Maindonald, Braun, 2010, p. 187), as well as the Root Mean Square Error (RMSE).

In the regressions the debt to revenues ratio, % (Debt Ratio) of the municipalities was applied as the dependent variable in the models.

Taking into consideration the aim of the paper and the literature review, to identify the factors affecting the dependent variable, a certain set of independent variables is investigated, i.e.:

A. in the group of fiscal factors:

1) Investment expenditures in total expenditures, % (InvestExp) – this variable shows the significance of the capital spendings and the engagement in restructuring of the local economy.

2) Expenditures on Wages in Total Operating (Current) Expenditures, % (WagExOp) – this variable presents the share of the wages in the sphere of the current activity as fixed costs, which are not flexible in the short term.

3) Expenditures on Education in Total Expenditures, % (EduExp) – this ratio shows the significance of the most important task in the municipalities. In addition, expenditures on the education are spent under the strict regulations and affect rigidity of the budget. In Poland in the municipalities, the expenditures on education (section 801 in the budget) out of all budget categories (functions) have the highest share in the total spendings, e.g., 31% in 2017 (Statistics Poland, 2018, p. 89).

4) Personal Income Tax Revenues in Own Revenues, % (PITinOR) – this variable indicates the importance of the PIT in own revenues.

5) Corporate Income Tax Revenues in Own Revenues, % (CITinOR) – this variable shows the importance of the CIT in the own revenue.

6) Tax on Real Estate in Own Revenues, % (TREinOR) – this variable indicates the importance of the tax on real estate in own revenues and thus the circumstances of the local economy and the scope the fiscal autonomy.

7) Capital Revenues in Total Revenues, % (CapRev) – this ratio shows the significance of the grants and funds for investments, the inflows of the sale of assets and from the transformation of the right of perpetual usufruct into the right of ownership.

8) Revenues financing and co-financing the EU programs and projects *per capita* (EUfunds) – this ratio presents the engagement in the EU programs and projects to restructure local economy. Medve-Bálint and Bohle (2016, p. 22) found a direct relationship between local debt and EU funds in two very different territorial-administrative settings, i.e., in Poland and in Hungary.

B. in the group of socio-economic factors:

1) Business Density (BusinDen), as a number of companies per inhabitant (00s) in mobile age (18-44) population – this predictor represents the level of the entrepreneurship and its intensification. This also refers to the possibility of collecting the shared taxes in the area.

2) Unemployment Ratio, % (UnempRatio), as the number of the unemployed to the working-age population, which is an unemployment measure (Garloff, Carsten, Schanne, 2013, p. 399) – this ratio shows the conditions on the labour market and the loss of the capability to generate revenues from PIT.

3) Pre-Working Age (0-17) Population in Total Population, % (Pre-WorkAge) – this predictor determines the necessity of the service delivery in the field of the education.

4) Aging Index, as the Post-Working Age Population to the Pre-Working Age Population, % (AgingIndex) – this variable represents generation relationship of the number of persons 65 years old and more, per 100 persons 0-14 years.

5) Urban Population in Total Population, % (UrbanPop) – this variable identifies the specificity of the municipality, i.e., the level of the urbanization, which influences the revenue composition and the scope of the tasks.

C. Political factor:

1) Distance to Elections (DistElect) – this variable takes the value of 1 in the electoral year while in other years, it would take the level according to the formula: 1÷the number of years left until the forthcoming election. Thus, if there are four years between elections, the variable would take 0.25, 0.5, 0.75, and 1 – election year. This kind of variable was applied by Delgado-Téllez and Pérez (2020, pp. 224-225, 245), who based their study on the approach of Franzese (2000, pp. 61-83). In Poland, in the analysed period, local elections were held in 2010, 2014 and 2018.

Firstly, the single-factor models (with fixed effects because of the final model types) for each variable were calculated to show whether the single predictors are statistically significant, and to reveal the direction of the relationship as well as to check and control potential reverses of the coefficient sign in the final model with the set of statistically significant variables. In this way the confounding (perceived as a mixing of effects) was limited, which can make the exposure appear stronger, weaker, or opposite to the outcome than it truly appears (Howards, 2018, p. 395). In addition, the levels of the AIC and 'Within R^2' of these single-factor models contributed to the recognition of the importance of each predictor on the indebtedness.

The three models were then estimated, containing only statistically significant predictors. In the process of calculating the first two regressions the procedure was aimed at achieving the high 'Within R^2', applying the sets of fiscal and socio-economic variables. The third model, in turn, contains chosen variables concerning revenue and the political factor. It is worth highlighting that some researchers suggest not to include an excessive number of independent variables and consequently to focus only on the most relevant predictors (Benito, Bastida, 2004, 503), especially in terms of the study objectives.

Furthermore, to disclose the spatial relationships, and to identify the presence of spatial structure (Zhao et al., 2018, p. 33), between the municipalities in the field of the level of their debt ratio, the Moran's Index (I) is calculated, for every year between 2010 and 2021. The formula of this ratio is expressed as follows (3) (Kopczewska, 2021, pp. 188-189):

$$I = \frac{n \sum_{i=1}^{n} \sum_{j=1}^{n} w_{ij}(x_i - \bar{x})(x_j - \bar{x})}{\sum_{i=1}^{n} \sum_{j=1}^{n} w_{ij} \sum_{i=1}^{n} (x_i - \bar{x})^2}, \tag{3}$$

where:

x_i is the observation in the municipality i,

$\bar{x}$ is the average of all the units studied,

n is the number of units

w_{ij} is part of the spatial matrix W.

The spatial weights matrix is standardised by rows up to 1, i.e., the row-standardise spatial weights matrix. Simultaneously, the queen's case contiguity weight matrix with order 1 was employed (Chi, Zhu, 2021, p. 29).

The Moran's I index is interpreted based on the expected value calculated under the null hypothesis of no spatial autocorrelation, i.e., spatial randomness, and is statistically evaluated using a p-value (certain number of permutations is used here, i.e., 999 in this research study) and a z-score (Grekousis, 2020, pp. 211, 225). Since its values can be bounded to the range from -1.0 to +1.0, when the weights are row standardized, it is often interpreted as the correlation coefficient, testing its significance (p-value below 0.05 in this research study). This correlation occurs between the value of the variable in the analysed area (municipality in this paper) and the values of this variable in the neighbouring units. The positive or negative Moran's I value implies the existence of positive or negative spatial autocorrelation over the

study area respectively, whereas the value 0 implies spatial randomness (Zhou et al., 2020, p. 112). In practice, its score higher than 0.3 or lower than -0.3 is an indication of relatively strong autocorrelation (Grekousis, 2020, p. 215).

In addition, using the local indicators of spatial autocorrelation – LISA (Kopczewska, 2021, p. 199), which decompose the global statistics of spatial association (Zhou et al., 2020, p. 112), certain types of spatial relations were studied. There were depicted on the LISA cluster map, i.e.: (a) 'High-High' (units with high values of the debt ratio surrounded by neighbours of similar high values of this indicator) – known as 'hot spots', (b) 'Low-Low' (units with low values of the debt ratio surrounded by neighbours of similar low values of this indicator) – known as 'cold spots', (c) 'Low-High' (units with low values of the debt ratio surrounded by the units with high values of this indicator) - spatial outlier/unstable spatial pattern, (d) 'High-Low' (units with high values of the debt ratio surrounded by the units with low values of this indicator) - spatial outliers/unstable spatial pattern, and (e) 'Not Significant' (areas that are not significant in the context of the analysed spatial relations, at significance level of 0.05) (Wang, 2011, p. 183; Zhou et al., 2020, p. 112). This spatial structure is also visualized by means of Moran's *I* scatterplot which presents the relationships, i.e.: 'High-High' (I quadrant), 'Low-Low' (III quadrant), 'High-Low' (IV quadrant), and 'Low-High' (II quadrant). The slope of a regression line on this scatterplot fitted to the points in the scatterplot gives global Moran's Index (Lloyd, 2010, p. 90).

4. Results and Discussion

In Poland, the revenues of municipalities consist of (a) own revenues, (b) general subvention, involving educational part, equalization part, balancing part, (c) and grants. These units have a tax authority within local taxes, the most important of which is a tax on real estate. Municipalities also receive revenues from the participation in shared taxes, i.e., in PIT and CIT, where PIT is the most important source of the tax revenues. As consequence, the own revenues to the total were: in all municipalities 44.62% in 2010 and 42.35% in 2021, in municipalities of the Wielkopolska Region/Voivodeship (WR) 49.62% in 2010 and 44.71% in 2021. In turn, in 2021 the expenditures mainly cover tasks in the field of education (29.5% in Poland; 31.0% in municipalities of WR), family (26.0% in Poland; 28.2% in municipalities of WR), municipal economy and environment protection (9.9% in Poland; 7.7% in municipalities of WR), public administration (8.2% in Poland; 7.9% in municipalities of WR), transport and communication (7.5% in Poland; 8.0% in municipalities of WR).
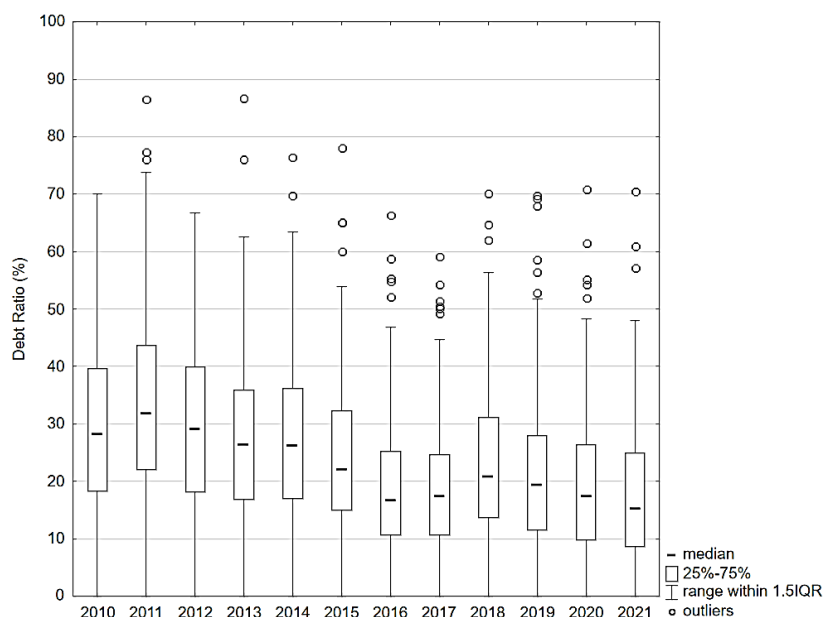
Note. Calculation of the range within 1.5IQR assumes that, using the values of quartiles (Q), the lower limit is: $Q_1 - 1.5IQR$, and upper limit: $Q_3 + 1.5IQR$.

Figure 1. The level of median, interquartile range (IQR) and outliers (outside the range within 1.5IQR) of the debt to revenues ratio in the municipalities of the Wielkopolska Region between 2010 and 2021.

Source: author's own study.

As far as the municipalities of the Wielkopolska Region are concerned, they differ in terms of their financial situation and the socio-economic conditions (Table 1). In 2010 and 2021 there were substantial differences in their indebtedness, investment activity, revenue and expenditure compositions, absorption of EU funds as well as the situation on the labour market, entrepreneurship, the demographic structure, and urbanization. However, between 2010 and 2021 it was seen a drop in median of the debt to revenues ratio (Debt Ratio), whereas some units were still characterized as outliers having a large level of this ratio in comparison to the others (Figure 1).

Table 1.
Descriptive statistics for the analysed municipalities in 2010-2021

Variable	Mean	Std. dev.	Min	Max
Debt Ratio	24.00	14.42	0.00	86.76
InvestExp	15.85	8.15	0.55	53.58
WagExOp	35.36	5.77	16.77	50.59
EduExp	35.17	6.59	13.81	57.92
PITinOR	34.99	8.67	4.58	73.47
CITinOR	1.49	1.78	-5.22	16.38
TREinOR	27.23	8.13	7.40	63.33
CapRev	6.43	5.25	0.00	39.59
EUfunds	139.66	203.94	0.00	2,332.44
BusinDen	22.63	7.37	8.44	73.43
UnempRatio	4.82	2.81	0.64	14.64
Pre-WorkAge	20.66	1.75	13.94	27.90
UrbanPop	25.36	31.01	0.00	100
AgingIndex	99.50	22.65	45.04	206.15

Source: author's own study.

The results of the single-factor models indicate that in the group of the examined fiscal factors the highest predictive power on the municipal indebtedness has the share of the wages to current expenditures ('Within R^2' is 0.1777) and then the share of investment spendings in the total ('Within R^2' is 0.1239). In turn, within the analysed revenue predictors the highest predictive power has the share of PIT in own revenues ('Within R^2' is 0.0898). Moreover, the higher the share of the expenditures on education, the higher Debt Ratio. This extends the statement, that in Poland a decrease in the proportion of general subsidies in the budgets of municipalities, and a surge of expenditures on education forced these units to allocate more funds on education from locally generated revenues (Wichowska, 2022, p. 141). The growth of these expenditures led to the additional borrowing.

Table 2.
Indebtedness predictors in the single-factor models with fixed-effects in municipalities of Wielkopolska Region in 2010-2021, ordered by the level of the AIC in the groups

Model (factor)	Coefficient	Intercept	Within R^2	LSDV R^2	AIC
Models for the group of fiscal factors					
WagExOp	0.8525*** (0.0761)	-6.1355** (2.6901)	0.1777	0.6424	19,485
InvestExp	0.4730*** (0.0324)	16.5062*** (0.5135)	0.1239	0.6190	19,654
PITinOR	-0.5912*** (0.0619)	44.6919*** (2.1650)	0.0898	0.6042	19,755
EduExp	0.3122*** (0.0698)	13.0230*** (2.4546)	0.0311	0.5786	19,922
TREinOR	0.3021*** (0.1001)	15.7757*** (2.7270)	0.0163	0.5722	19,962
CITinOR	-1.1873*** (0.2673)	25.7728 (0.3982)	0.0155	0.5719	19,964
CapRev	0.2288*** (0.0491)	22.5334*** (0.3154)	0.0134	0.5710	19,970
EUfunds	0.0053*** (0.0015)	23.2692*** (0.2092)	0.0107	0.5698	19,977
Models for the group of socio-economic factors					
AgingIndex	-0.3408*** (0.0297)	57.9107*** (2.9551)	0.1798	0.6433	19,478
UnempRatio	1.8357*** (0.1653)	15.1478*** (0.7975)	0.1684	0.6383	19,515
BusinDen	-1.2566*** (0.1140)	52.4357*** (2.5785)	0.1548	0.6324	19,558
Pre-WorkAge	3.4281*** (0.5240)	-46.8214*** (10.8269)	0.0618	0.5920	19,836
UrbanPop	0.1441 (0.1325)	20.3494*** (3.3609)	0.0015	0.5658	20,002
Model for the political factor					
DistElect	1.2497*** (0.4329)	23.2541 (0.2597)	0.0014	0.5657	20,002

Note. (1) ***, ** and * denotes statistical significance at 1%, 5% and 10% levels respectively, (2) clustered standard errors in parentheses (…), (3) estimated single-factor models with random effects revealed the same signs of the parameters on explanatory variables; in addition, the variable 'UrbanPop' was statistically significant in the model with random effects.

Source: author's own study.

Although the influence of the factor: *per capita* revenues from EU funds is statistically significant on the Debt Ratio in the municipalities, its predictive power is relatively low ('Within R^2' is 0.0107) in comparison to other ratios. As far as the single-factor models for socio-economic factors are concerned, the highest predictive power has 'AgingIndex' ('Within R^2' is 0.1798), whereas 'Within R^2' for the single-model with Unemployment Ratio is 0.1684. In addition, there is the high predictive power of the number of companies per inhabitant in mobile age ('BusinDen'), i.e., 'Within R^2' is 0.1548 (Table 2). The outcome of the single-factor model for the political factor shows that the forthcoming elections put pressure on the growth of the Debt Ratio in the analysed public units. To sum up, the indebtedness is affected by the structure of the spendings, i.e., the higher share of investment activity or the share of rigid expenditures the higher the Debt Ratio. On the other hand, the municipalities, in which the share of PIT and CIT in the own revenues is higher, reduce their indebtedness. This is in line with the local economic condition since lower unemployment and higher entrepreneurship affect a decrease of the borrowing needs. The high share of the pre-working age population in comparison to post-working age population determined the higher indebtedness. This affected the greater spendings on education, which are less flexible due to the strict regulations.

Table 3.
Indebtedness predictors on municipalities of Wielkopolska Region in 2010-2021 – estimation results of the panel models with fixed effects

Factor	Coefficient	Clustered standard errors	*p*-value	95% conf. interval		VIF
				Lower bound	Upper bound	
Model 1						
InvestExp	0.3589	0.0365	<0.001	0.2870	0.4308	1.0684
WagExOp	0.5050	0.0903	<0.001	0.3270	0.6830	2.2302
CITinOR	-0.4788	0.1941	0.014	-0.8614	-0.0962	1.0281
AgingIndex	-0.1360	0.0354	<0.001	-0.2058	-0.0662	2.3087
UrbanPop	0.2612	0.1072	0.016	0.0499	0.4724	1.0057
Intecept	8.0865	6.9958	0.249	-5.7004	21.8735	-
Model 2						
InvestExp	0.3694	0.0366	<0.001	0.2972	0.4415	1.0568
WagExOp	0.4122	0.1015	<0.001	0.2121	0.6123	3.4997
CITinOR	-0.4838	0.1907	0.012	-0.8596	-0.1079	1.0380
UnempRatio	0.6657	0.2140	0.002	0.2439	1.0875	3.0301
BusinDen	-0.2145	0.1201	0.076	-0.4512	0.0223	2.5478
UrbanPop	0.2657	0.1138	0.020	0.0415	0.4899	1.0068
Intercept	-0.7999	3.9798	0.894	-12.6591	11.0593	-
Model 3						
CITinOR	-1.1675	0.2604	<0.001	-1.6807	-0.6543	1.0005
EUfunds	0.0056	0.0015	<0.001	0.0026	0.0086	1.0241
DistElect	1.7319	0.4471	<0.001	0.8508	2.6129	1.0244
Intercept	23.9214	0.5723	<0.001	22.7934	25.0493	-

Cont. table 3.

Goodness of fit measures								
Model 1			Model 2			Model 3		
Within R^2 = 0.2799	AIC = 19,139	LSDV R^2 = 0.6869	Within R^2 = 0.2791	AIC = 19,144	LSDV R^2 = 0.6865	Within R^2 = 0.0286	AIC = 19,933	LSDV R^2 = 0.5776
RMSE = 8.0780			RMSE = 8.0840			RMSE = 9.3791		

Source: author's own study.

Using the described scientific procedure and the set of the indebtedness predictors and debt to revenues ratio (%) as the dependent variable (Table 1), three regressions were estimated (Table 3). The results of the Wald test, the Breusch-Pagan test and the Hausman test (Table 4) indicated to apply models with fixed effects, whereas the outcomes of the Modified Wald test, Breusch-Godfrey test and Pesaran test resulted in the application of clustered standard errors (Table 4). In each model the indebtedness predictors are statistically significant (Table 3), and their coefficients' signs comply with the outcomes in the single-factor models (Table 2). These models show that both fiscal and socio-economic factors should be combined to explain the changes in municipal debt (Table 3). According to the 'Model 1' a 1 percentage point (pp) increase of the share of the capital expenditures in the total ('InvestExp') affected the growth of the Debt Ratio by 0.3589 pp, *ceteris paribus* (Table 3). In turn, a 1 pp increase of the share of wages in current expenditures ('WagExOp') influenced an increase of the Debt Ratio by 0.5050 pp, *ceteris paribus*. Similar relationships were confirmed by the 'Model 2'. In addition, 'Model 1' shows that predictors: 'CITinOR' and 'AgingIndex' have inverse relationships with Debt Ratio. Furthermore, according to 'Model 2', a 1 pp increase of the Unemployment Ratio affected a growth of the Debt Ratio by 0.6657 pp. An increase of the indebtedness was also positively affected by the share of Urban Population ('UrbanPop'). On the other hand, the higher the number of companies per inhabitant in mobile age ('BusinDen') the lower the Debt Ratio (Model 2). In turn, a lower 'Within R^2' of 'Model 2' indicates that an exclusion of certain indebtedness predictors concerning expenditures, demographic structure, or the local economic conditions, influenced the decrease of the predictive power of the empirical model, i.e., 'Within R^2' of 'Model 3' is 0.0286 in comparison to 0.2799 in 'Model 1' or 0.2791 in 'Model 2'. However, 'Model 3' shows that forthcoming elections put pressure on the growth of Debt Ratio in the municipalities (Table 3).

Table 4.
Diagnostic tests for estimated models

| Diagnostic Test	Model 1		Model 2		Model 3	
	Statistics	*p*-value	Statistics	*p*-value	Statistics	*p*-value
Wald test	19.24	<0.001	19.83	<0.001	14.59	<0.001
Breusch-Pagan test	5,079.20	<0.001	5,036.02	<0.001	3,863.51	<0.001
Hausman test	25.66	<0.001	56.71	<0.001	28.87	<0.001
Modified Wald test	25,623.27	<0.001	22,249.90	<0.001	91,450.07	<0.001
Breusch-Godfrey test	985.72	<0.001	999.70	<0.001	997.67	<0.001
Pesaran test	16.46	<0.001	14.45	<0.001	123.86	<0.001

Source: author's own study.

The results of the 'Within R^2' for 'Model 1' and 'Model 2' imply that almost 28% of the variation in the applied dependent variables within the municipalities are captured by these models. The levels of LSDV R^2s show that these models explain 68.69 ('Model 1') or 68.65 ('Model 2') of the variation of the Debt Ratio in the analysed units, taking into account the fixed effects.

Table 5.
Moran's Index and the spatial relations for the debt ratios in the municipalities in 2010-2021

| Year	2010	2011	2012	2013	2014	2015
Moran *I*	0.0277	0.0584	0.0235	0.0319	0.0386	0.0236
p-value	0.2260	0.0760	0.2660	0.1830	0.1690	0.2690
Spatial relations - no. of the municipalities						
High-High	2	3	2	3	2	3
Low-Low	10	8	3	3	4	7
Low-High	6	8	7	7	6	8
High-Low	3	6	4	7	3	4
Not Signif.	201	197	206	202	207	200
Year	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Moran *I*	0.0182	0.0460	0.1098	0.1192	0.1157	0.1175
p-value	0.2980	0.1290	0.0130	0.0050	0.0060	0.0050
Spatial relations - no. of the municipalities						
High-High	3	5	14	10	12	13
Low-Low	10	11	7	12	11	11
Low-High	7	8	7	5	10	7
High-Low	2	3	2	1	2	5
Not Signif.	200	195	192	194	187	186

Source: author's own study.
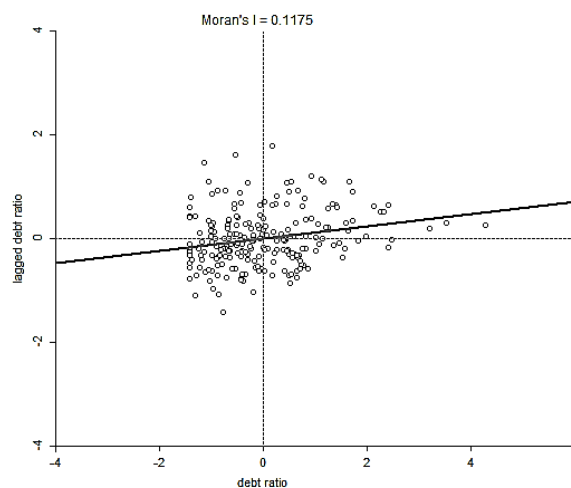
Figure 2. Moran's *I* scatterplot for the debt ratio in 2021 of the municipalities.
Source: author's own study.

Analysing the spatial correlation of the Debt Ratios of the municipalities in 2010-2021, this was not significant between 2010 and 2017 (Table 5). In turn, in 2018-2021 the estimation of the Moran's *I* disclosed a very weak, positive, and a significant association (*p*-value below 0.05, Table 5). In 2021, this statistic was 0.1175 (Figure 2). Hence, after 2017 neighbours are the units with similar values of the Debt Ratio. According to the analysis of local indicators of

spatial autocorrelation for the Debt Ratio, after 2017 in the range from 10 to 14 a high indebtedness of the municipality affected a high Debt Ratio in the neighbouring unit (Table 5). On the other side, after 2017 in the range from 7 to 12 localities a low value of Debt Ratio affected the low value of this indicator in the neighbours. In the above cases/municipalities the local authorities somewhat imitated the policy regarding the size of the indebtedness, adopting specific patterns of behaviour in the process of incurring debt in neighbouring units. Therefore, among significant cases there were mainly both 'hot spots' and 'cold spots'. In 2021, five municipalities created a 'High-High' cluster near the largest metropolitan city (Poznan) in this region, and two 'hot spots' were localized in the centre of the Wielkopolska Region, between three cities with county rights (Figure 3). In addition, in some significant cases, e.g., in 2021 in 7 'Low-High' and 5 'High-Low', there were different Debt Ratios and relations among the neighbouring locations. In these units there were a disparate approach to the indebtedness policy. Hence, there is relatively low level of spatial outliers in the field of the Debt Ratio. However, in most of the units, the analysed spatial relations were insignificant (Table 5).
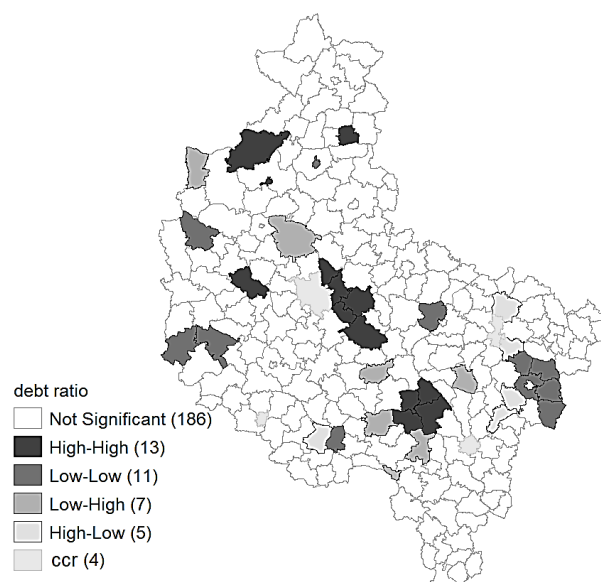
Note. Number of the units in the parentheses; ccr - cities with county rights.

Figure 3. LISA cluster map for the debt to revenues ratio (debt ratio) of the municipalities in 2021.

Source: author's own study.

It is worth emphasizing that in 2018 among the analysed municipalities the median increased and the 'range within 1.5IQR' extended (Figure 1). In this year there were introduced the changes in the individual debt limit calculation and a principle of the balanced budget. Furthermore, in the budget resolution for 2018, for the first time a new chapter was used concerning the providing to pupils the free access to textbooks, educational and exercise materials (Statistics Poland, 2019, pp. 20-22). In addition, the new educational regulations increased the school period, from the beginning of the September 2017, in the primary schools from six to eight years (Statistics Poland, 2018, p. 23). This reform concerned the functioning

of the analysed municipalities as the lead authorities of the primary schools. Simultaneously, the estimated regression showed that an increase of the share of the spendings on education in the total resulted in an increase of the Debt Ratio (Table 2).

5. Conclusions

The indebtedness of municipalities is driven by a certain set of fiscal, socio-economic, and political factors. Thus, it is affected by the budget structure in the field of revenues and expenditures. Demography and the intensification of economic activity combined with the situation on the labour market also play a significant role in the debt creation. The indebtedness of municipalities is also determined by the spatial structure in the region. Their proximity to each other may contribute to adopting the specific pattern on the debt policy.

According to the findings there is a direct relationship between the share of PIT and CIT in own revenues and the indebtedness of the municipalities. This refers to the outcomes that a fall of unemployment ratio and the growth of the business density contributed to the decrease of the Debt Ratio in the analysed local public units. Thus, both the hypothesis 1 (H1) and the hypothesis 5 (H5) were positively verified. This impact of the unemployment ratio was also revealed by Veiga and Veiga (2014, pp. 18, 31), in contrast to Feld et al. (2011, pp. 60-61), who did not show significant impact of this ratio on the debt. However, the direct influence of the unemployment ratio on the indebtedness results from the fact the unemployment may increase the deficit in both the short and long run (Cifuentes-Faura et al., 2022, p. 1). Simultaneously, the share of PIT to own revenues has the highest predictive power in comparison to other analysed factors in the field of budget own revenues. Analysing the expenditure side of the budget it is seen that an increase of the investment activity, the share of spendings on wages as well as expenditures on education affected the growth of the Debt Ratio in the municipalities. In addition, the share of the expenditures on wages had the highest predictive power in explaining the level of the Debt Ratio in the units. Hence, both the hypothesis 2 (H2) and the hypothesis 3 (H3) were positively verified. These types of spendings influence the rigidity of the expenditures composition and the possibility to adjust the budget to the changing economic circumstances. Therefore, additional delegation of tasks in the field of education, without securing funds from the central budget, may result in a growth of the debt. The investment activity was also driven by the access to non-refundable EU funds, the absorption of which was conductive to an increase in the debt ratio. It was also noticed by Medve-Bálint and Bohle (2016, p. 22). In addition, there is a direct relationship between the indebtedness of local government and the share of pre-working age population, which is in line with the findings of Wassmer and Fisher (2012). This population influences the expenditures on education, often capital spendings, which are determined by central regulation and make the

expenditures structure more rigid. Hence, the hypothesis 4 (H4) was positively verified. An involvement of the pre-working age population in the Aging Index results in a high predictive power of the ratio of the post-working age population to the pre-working age population. It is worth noting that the election cycle also determined the Debt Ratio, however, it was not a decisive factor, what was also disclosed by Delgado-Téllez & Pérez (2020, pp. 233-239).

As far as the spatial structure is concerned there are significant spatial relationships, which influence Debt Ratios in the municipalities. However, in the analysed period they turned out to be significant since 2018. In this year there were implemented crucial changes in the educational system. Consequently, in 2018-2021 the territorial proximity affected the weak, positive correlation of the Debt Ratio between the municipalities, which led to the positive verification of the hypothesis 6 (H6). Thus, an increase in the Debt Ratio in the unit may influence such increases in the neighbouring entities. These ties may result from similar revenue structure, combined with the demographic composition, which imposes the obligation to deliver certain social services due to the devolution of public tasks between the central and the local government. Furthermore, the cluster of high indebted municipalities was localized in the neighbourhood of the metropolitan city. In turn, the regressions disclosed the direct relationship between ratio of the urban population and the indebtedness. Hence, urbanization processes affected the borrowing policy in the municipalities.

References

1. Alińska, A., Kosztowniak, A., Wajda, M. (2021). Liabilities of Local Government Units in Poland: Identification and Analysis of Diversification Factors. *European Research Studies Journal, XXIV(2B)*, 113-134. DOI: 10.35808/ersj/2206.
2. *Analiza elastyczności wydatków budżetowych w Polsce. Podsumowanie wyników współpracy z OECD* (2015). Warszawa: Ministerstwo Finansów (MF). Retrieved from: https://mf-arch2.mf.gov.pl/c/document_library/get_file?uuid=ea70eede-e83a-4d44-b1ae-3ef1133dc03a&groupId=764034, 21.03.2023.
3. Balaguer-Coll, M.T., Prior, D., Tortosa-Ausina, E. (2016). On the Determinants of Local Government Debt: Does One Size Fit All? *International Public Management Journal, 19(4)*, 513-542. https://doi.org/10.1080/10967494.2015.1104403.
4. Bandyopadhyay, A. (2022). *Basic Statistics for Risk Management in Banks and Financial Institutions.* Oxford: Oxford University Press.
5. Basílio, M., Borralho, C. (2021), Political Factors and Municipalities Debt: An empirical assessment in Portugal, *RIC - Revista de Informação Contábil, 15*, 1-21. https://doi.org/10.34629/ufpe-iscal/1982-3967.2021.v15.e-021006.

6. Bellot, N.J.M., Selvab, L.M., Menéndez, L.G. (2017). Determinants of sub-central European government debt. *The Spanish Review of Financial Economics, 15(2),* 52-62. https://doi.org/10.1016/j.srfe.2017.04.001.

7. Benito, B., Bastida, F. (2004). The Determinants of the Municipal Debt Policy in Spain. *Journal of Public Budgeting, Accounting & Financial Management, 16(4)*, 492-525.

8. Benito, B., Guillamón, M.-D., Ríos, A.-M. (2021). Political Budget Cycles in Public Revenues: Evidence from Fines. *SAGE Open October-December*, 1-13, https://doi.org/10.1177/21582440211059169.

9. Białek-Jaworska, A. (2022). Revenue diversification and municipally owned companies' role in shaping the debt of municipalities. *Annals of Public and Cooperative Economics, 93(4)*, 931-975. https://doi.org/10.1111/apce.12358.

10. Bohn, F., Veiga, F.J. (2019). Elections, recession expectations and excessive debt: an unholy trinity. *Public Choice, 180,* 429-449, https://doi.org/10.1007/s11127-019-00647-x.

11. Bonfatti, A., Forni, L. (2019). Fiscal rules to tame the political budget cycle: Evidence from Italian municipalities. *European Journal of Political Economy, 60*, https://doi.org/10.1016/j.ejpoleco.2019.06.001.

12. Cetrángolo, O., Jiménez, J.P., del Castillo, R.R. (2010). *Rigidities and fiscal space in Latin America: a comparative case study.* Santiago: United Nations, 1-33.

13. Checkoway, H., Pearce, N., Kriebel, D. (2004). *Research Methods in Occupational Epidemiology*. New York: Oxford University Press.

14. Chi, G., Zhu, J. (2021). *Spatial Regression Models for the Social Sciences*. Thousand Oaks: Sage Publications.

15. Cifuentes-Faura, J., Simionescu, M., Gavurova, B. (2022). Determinants of local government deficit: evidence from Spanish municipalities. *Heliyon, 8(12)*, pp. 1-11. https://doi.org/10.1016/j.heliyon.2022.e12393.

16. Cottrell, A., Lucchetti, R. (2022), *Gretl User's Guide. Gnu Regression. Econometrics and Time-series Library.* Retrieved from: https://gretl.sourceforge.net/gretl-help/gretl-guide.pdf, 28.11.2022.

17. Cuadrado-Ballesteros, B., García-Sánchez, I.-M., Prado-Lorenzo, J.-M. (2013). Determinants of functional decentralization and their relation to debt: empirical evidence based on the analysis of Spanish municipalities. *International Review of Administrative Sciences, 79(4)*, 701-723. https://doi.org/10.1177/0020852313501246.

18. Das, P. (2019). *Econometrics in Theory and Practice. Analysis of Cross Section, Time Series and Panel Data with Stata 15.1*. Singapore: Springer.

19. del Castillo, E., Cabral, R., Saucedo, E. (2022). The Sustainability of Mexican Municipal Public Debt. *Sustainability, 14*. https://doi.org/10.3390/su14116558.

20. Delgado-Téllez, M., Pérez, J.J. (2020). Institutional and Economic Determinants of Regional Public Debt in Spain. *Public Finance Review, 48(2)*, 212-249. https://doi.org/10.1177/1091142120901672.

21. Drew, J. (2020). *Reforming Local Government. Consolidation, Cooperation, or Re-creation?* Singapore: Springer.

22. Dynnikova, O., Kyobe, A., Slavov, S. (2021). Regional Disparities and Fiscal Federalism in Russia. *IMF Working Papers, 144*, 1-42. https://doi.org/10.5089/9781513573649.001.

23. Działo, J., Guziejewska, B., Majdzińska, A., Żółtaszek, A. (2019). Determinants of Local Government Deficit and Debt: Evidence from Polish Municipalities. *Lex Localis - Journal of Local Self-Government, 17(4)*, 1033-1056, https://doi.org/10.4335/17.4.1033-1056(2019).

24. Ehalaiye, D., Botica-Redmayne, N., Laswad, F. (2017). Financial determinants of local government debt in New Zealand. *Pacific Accounting Review, 29(4)*, 512-533. https://doi.org/10.1108/PAR-11-2016-0104.

25. Feld, L.P., Kirchgässner, G., Schaltegger, C.A. (2011). Municipal debt in Switzerland: new empirical results. *Public Choice, 149(1/2)*, 49-64. https://doi.org/10.1007/s11127-011-9828-5.

26. Fiscal Stress Close-Up Indicator Report Albany, Office of the New York State Comptroller (OSC) (2015). New York. Retrieved from: https://www.osc.state.ny.us/files/local-government/fiscal-monitoring/pdf/ArchivedCloseUpReports-June2015.pdf, 25.04.2023.

27. Franzese, R.J. Jr. (2000). Electoral and Partisan Manipulation of Public Debt in Developed Democracies, 1956-90. In: R.R. Strauch, J., von Hagen (eds.), *Institutions, Politics and Fiscal* Policy (pp. 61-83). New York: Springer.

28. Frintrup, M., Hilgers, D. (2023). Drivers and risk factors of German local financial sustainability focusing on adjusted income. *International Review of Administrative Sciences,* 1-19, https://doi.org/10.1177/00208523221143289.

29. Galiński, P. (2015). Determinants of debt limits in local governments: case of Poland. *Procedia - Social and Behavioral Sciences, 213*, 376-382. https://doi.org/10.1016/j.sbspro.2015.11.554.

30. Galiński, P. (2021). *Zagrożenie fiskalne jednostek samorządu terytorialnego. Uwarunkowania, pomiar, ograniczanie*. Gdańsk: Wydawnictwo Uniwersytetu Gdańskiego.

31. Galiński, P. (2022). Importance of the Size of Local Government in Avoiding the Fiscal Distress – Empirical Evidence on Communes in Poland. *Annales Universitatis Mariae Curie-Skłodowska, sectio H – Oeconomia, 56(5)*. 101-113. http://dx.doi.org/10.17951/h.2022.56.5.101-113.

32. Garloff, A., Carsten, P., Schanne, N. (2013). Do small labor market entry cohorts reduce unemployment? *Demographic Research, 29*, 379-406, https://doi.org/10.4054/DemRes.2013.29.15.

33. Gelfand, M.D. (1979). Seeking Local Government Financial Integrity Through Debt Ceilings, Tax Limitations, and Expenditure Limits: The New York City Fiscal Crisis, the Taxpayers' Revolt, and Beyond. *Minnesota Law Review, 63*, 545-608.

34. Geys, B. (2007). Government Weakness and Electoral Cycles in Local Public Debt: Evidence from Flemish Municipalities. *Local Government Studies, 33(2)*, 237-251.

35. Ghemawat, P. (2017). *The Laws of Globalization and Business Applications*. Cambridge: Cambridge University Press.

36. Gootjes, B., de Haan, J., Jong-A-Pin, R. (2021). Do fiscal rules constrain political budget cycles? *Public Choice, 188*, 1-30. https://doi.org/10.1007/s11127-020-00797-3.

37. Greene, W.H. (2003). *Econometric Analysis.* New Jersey: Pearson Education.

38. Gregori, W.D., Marattin, L. (2019). Determinants of fiscal distress in Italian municipalities. *Empirical Economics, 56,* 1269-1281, https://doi.org/10.1007/s00181-017-1386-3.

39. Grekousis, G., (2020). *Spatial Analysis Methods and Practice: Describe – Explore – Explain through GIS*. Cambridge: Cambridge University Press.

40. Hoechle, D. (2007). Robust Standard Errors for Panel Regressions with Cross-Sectional Dependence. *The Stata Journal, 7(3)*, 281-312. https://doi.org/10.1177/1536867X 0700700301.

41. Horvat, T., Vidmar, M., Justinek, G., Bobek, V. (2020), Legislative, Organisational, and Economic Factors of Debt Level of Municipalities in Slovenia. *Lex Localis - Journal of Local Self-Government, 18(4),* 1065-1091. https://doi.org/10.4335/18.3.1067-1093(2020).

42. Howards, P.P. (2018). An overview of confounding. Part 1: the concept and how to address it. *Acta Obstetricia et Gynecologica Scandinavica, 97(4)*, 394-399. https://doi.org/10.1111/ aogs.13295.

43. Hsiao, C. (2007). Panel data analysis-advantages and challenges. *Test, 16*, 1-22. http://dx.doi.org/10.1007/s11749-007-0046-x.

44. Janda, K., Zhang, B. (2022). *Green Bond Pricing and Its Determinant: Evidence from Chinese Secondary Market*, 191-212. In: D. Procházka (ed.), *Regulation of Finance and Accounting. 21st and 22nd Virtual Annual Conference on Finance and Accounting (ACFA2020-21), Prague, Czech Republic*. Cham: Springer.

45. Kirkpatrick, L.O. (2016). The New Urban Fiscal Crisis: Finance, Democracy, and Municipal Debt. *Politics & Society, 44(1)*, 45-80. https://doi.org/10.1177/00323292156174.

46. Klapper, L., Amit, R., Guillén, M.F. (2010). Entrepreneurship and Firm Formation across Countries. In: J. Lerner, A. Schoar (eds), *International Differences in Entrepreneurship, National Bureau of Economic* Research (pp. 129-158). Chicago: University of Chicago Press.

47. Kopczewska, K. (2021). *Applied Spatial Statistics and Econometrics. Data Analysis in R.* New York: Routledge.

48. Lewis-Beck, M.S., Bryman, A., Liao, T.F. (2004). *The SAGE Encyclopedia of Social Science Research Methods, Vol. 1*. Thousand Oaks: SAGE Publications.

49. Lloyd, C. (2010). *Local Models for Spatial Analysis*. Boca Raton: CRC Press.

50. Maindonald, J., Braun, W.J. (2010). *Data Analysis and Graphics Using R: An Example.*

51. Malinowska-Misiąg, E. (2020). Diverse aspects of local fiscal capacity – case study of Poland. *The Scientific Journal European Policies, Finance and Marketing, 23(72)*, 113-122. https://doi.org/10.22630/PEFIM.2020.23.72.9.

52. Medve-Bálint, G., Bohle, D. (2016). Local Government Debt and EU Funds in the Eastern Member States: The Cases of Hungary and Poland. *MAXCAP Working Paper Series, 33*, 1-29.

53. Medvednikova, D.M. (2022). Differentiation Factors of the Debt Situation in Russian Urban Okrugs with over 100000 Residents in 2015-2020. *Regional Research of Russia, 12(4)*, 531-543. https://doi.org/10.1134/S2079970522700186.

54. Montiel, P.J. (2005). Public Debt Management and Macroeconomic Stability: An Overview. *The World Bank Research Observer, 20(2)*, 259-281.

55. Muñoz, E., Olaberria E. (2019). Are Budget Rigidities a Source of Fiscal Distress and a Constraint for Fiscal Consolidation? *World Bank Policy Research Working Papers, 8957*, 1-87.

56. Owsiak, K. (2022). Local Debt and the Development of Municipal Infrastructure. The Case of Małopolska. *Annales Universitatis Mariae Curie-Skłodowska, sectio H – Oeconomia, 56(4)*, 107-133, http://dx.doi.org/10.17951/h.2022.56.4.107-133.

57. Pérez-López, G., Plata-Díaz, A.M., Zafra-Gómez, J.L., López-Hernández, A.M. (2014). Operaciones fuera de presupuesto (off budget), factores políticos y deuda municipal: Un estudio empírico aplicando una metodología de datos de panel. *Gestión y política pública, 23(1)*, 185-218.

58. Pesaran, M.H. (2015). *Time Series and Panel Data Econometrics*. Oxford: Oxford University Press.

59. Poniatowicz, M. (2018). *Koncepcja federalizmu fiskalnego w systemie finansów samorządu terytorialnego*. Warszawa: CeDeWu.

60. Ramírez Camberos, J.J., Poom Medina, J. (2013). Factores políticos e institucionales asociados a la deuda municipal en el noroeste de México: 1989-2007. *Andamios, 10(21)*, 61-93.

61. *Regional Economic Outlook, November 2006, Western Hemisphere* (2006). Washington, DC: International Monetary Fund (IMF), 1-47. https://doi.org/10.5089/9781589065949.086.

62. Ribeiro, N.A., Jorge, S.M.F. (2014). Determinantes do endividamento da administração local: estudo exploratório nos municípios do norte de Portugal. *INNOVAR - Journal of Administrative and* Social Sciences, *24*, 61-78.

63. Scartascini, C., Stein, S. (2009). A New Framework. In: M. Hallerberg, C. Scartascini, S. Stein (eds.), *Who Decides the Budget? A Political Economy Analysis of the Budget Process in Latin America* (pp. 1-22). Cambridge: Inter-American Development Bank, David Rockefeller Center for Latin American Studies Harvard University.

64. Seitz, H. (2000). Fiscal Policy, Deficits and Politics of Subnational Governments: The Case of the German Laender. *Public Choice, 102(3/4)*, 183-218.

65. Serbes, H., Aydemir, M., Çetinkaya, Ö., Arl, N.B. (2022). Analysis of Variables Affecting Municipal Borrowing with Quantile Regression in Turkey. *Ege Academic Review, 22(2)*, 139-154. DOI: 10.21121/eab.857078.

66. Standar, A., Kozera, A. (2019). The Role of Local Finance in Overcoming Socioeconomic Inequalities in Polish Rural Areas. *Sustainability, 11(20),* 1-28. https://doi.org/10.3390/su11205848.

67. Standar, A., Kozera, A. (2020). Identifying the Financial Risk Factors of Excessive Indebtedness of Rural Communes in Poland. *Sustainability. 12(3)*, 1-25. https://doi.org/10.3390/su12030794.

68. Statistics Poland (2018). *Financial economy of local government units 2017*. Warsaw: Statistics Poland.

69. Statistics Poland (2019). *Financial economy of local government units 2018*. Warsaw: Statistics Poland.

70. Valkama, P., Oulasvirta, L. (2021). How Finland copes with an ageing population: adjusting structures and equalising the financial capabilities of local governments. *Local Government Studies, 47(3)*, 429-452, https://doi.org/10.1080/03003930.2021.1877664.

71. Veiga, L.G., Veiga, F.J. (2014). Determinants of Portuguese local governments' indebtedness. *NIPE-Universidade do Minho Working Paper Series, 16*, 1-33.

72. Wang, J. (2011). *The Health Impacts of Brownfields in Charlotte, NC: A Spatial Approach.* In: J.A. Maantay, S. McLafferty (eds.), *Geospatial Analysis of Environmental Health* (pp. 171-190). London: Springer.

73. Wassmer, R.W., Fisher, R.C. (2012). Debt Burdens of California's State and Local Governments. *California Journal of Politics and Policy, 4(2)*. 49-76. http://dx.doi.org/10.5070/P2ZW2F.

74. Wichowska, A. (2019). Determinants of Debt in Rural Municipalities on the Example of the Warmińsko-Mazurskie Voivodeship. *Acta Scientiarum Polonorum. Oeconomia, 18(4)*, 121-130, https://doi.org/10.22630/ASPE.2019.18.4.52.

75. Wichowska, A. (2022). Government transfers in the budgets of Polish municipalities and their determinants. *Rozwój Regionalny i Polityka Regionalna, 59*, 133-148. https://doi.org/10.14746/rrpr.2022.59.09.

76. Wichowska, A., Wierzejski, T. (2019). Revenue autonomy and entrepreneurship in the municipalities of the Warmian-Masurian voivodeship. *Olsztyn Economic Journal, 14(1)*, 75-86. https://doi.org/10.31648/oej.3647.

77. Yan, Y., Liu, H., Wang, N., Yao, S. (2021). How Does Low-Density Urbanization Reduce the Financial Sustainability of Chinese Cities? A Debt Perspective. *Land, 10(9)*, 1-18. https://doi.org/10.3390/land10090981.

78. Zhao, J., Wang, Y., Shi, W. (2018). Using Local Moran's I Statistics to Estimate Spatial Autocorrelation of Urban Economic Growth in Shandong Province, China. In: H. Yuan, J. Geng, C. Liu, F. Bian, T. Surapunt (eds.), *Geo-Spatial Knowledge and Intelligence* (pp. 32-39). *5th International Conference, GSKI 2017, Chiang Mai, Thailand, December 8-10, 2017.* Revised Selected Papers, Part I. Cham: Springer.

79. Zhou, T., Niu, A., Huang, Z., Ma, J., Xu, S. (2020). Spatial Relationship between Natural Wetlands Changes and Associated Influencing Factors in Mainland China. In: F.J.M. Carrascosa (ed.), *Geo-Informatics in Resource Management* (pp. 109-121). Basel: MDPI.