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DETERMINANTS OF THE OWN INCOME OF MUNICIPALITIES IN THE LUBUSKIE PROVINCE IN THE LIGHT OF THE RESULTS OF ECONOMETRIC MODELING

DETERMINANTY DOCHODÓW WŁASNYCH GMIN WOJEWÓDZTWA LUBUSKIEGO W ŚWIETLE WYNIKÓW MODELOWANIA EKONOMETRYCZNEGO

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Abstract: The local development of municipalities is a process taking place in a specific place and time. One of the most important measures of this process is the own income of municipalities, proceeding from the sources within the territory of a given local government. Their level depends to a large extent on internal determinants related to the nature of local economic activity. However, the impact of external and spatial determinants has to be taken into account as well. This paper reviews the literature dealing with determinants influencing the own income of municipalities and presents the results of an empirical case study of the Lubuskie Province. For the purpose of the study spatial econometric methods were used. On the basis of the data for 1999-2020, panel models of the own income of municipalities in the analysed region with spatial autoregression of the explained variable (SAR) and spatial autocorrelation of the random component (SE) were estimated. Both models were compared with the classical model estimated by the least squares method. The results of the research indicate the existence of a number of correlations between the own income of municipalities in the region, the examined explanatory variables and the spatial factor.
Keywords: own income of municipalities, spatial econometrics, panel data, Lubuskie Province

Streszczenie: Rozwój lokalny gmin jest procesem odbywającym się w określonym miejscu i czasie. Jednym z ważniejszych jego mierników są dochody własne gmin, pochodzące ze źródeł znajdujących się na terenie danego samorządu. Ich poziom jest uwarunkowany w dużej mierze przez determinanty wewnętrzne związane z charakterem lokalnej działalności gospodarczej. Pomijać nie można też wpływu na nie determinant zewnętrznych i przestrzennych. W artykule dokonano przeglądu literatury na temat determinant wpływających na dochody własne gmin oraz przedstawiono na przykładzie województwa lubuskiego wyniki badań empirycznych w tym zakresie. Na potrzeby badań zastosowano metody ekonometrii przestrzennej. Na podstawie danych z lat 1999-2020 oszacowano modele panelowe dochodów własnych gmin badanego województwa z autoregresją przestrzenną zmiennej objaśnianej (SAR) oraz autokorelacją przestrzenną składnika losowego (SE). Oba modele porównano z modelem klasycznym estymowanym metodą najmniejszych kwadratów. Wyniki badań wskazują na występowanie szeregu zależności dochodów własnych gmin regionu względem rozpatrywanych zmiennych objaśniających oraz czynnika przestrzennego.
Słowa kluczowe: dochody własne gmin, ekonometria przestrzenna, dane panelowe, województwo lubuskie

Introduction

An intrinsic feature of economic development is its variability in time and space. This concept is generally defined as all the changes that both society and economy undergo (Parysek, 2018, p. 39). When considering economic development in spatial terms, the concepts of regional and local development come into play. Local development, which is the subject of this article, is understood as the entirety of permanent, favourable changes taking place on a given territory, driven, in particular, by local natural and material resources and features of local communities that are conducive to development, as a result of which the needs of the inhabitants can be satisfied in a more comprehensive way and their welfare increased (Bagdziński, 1994, p. 17).

When conducting empirical research on local development, two issues are of key importance: measurement of its level and explanation of its mechanisms (Wojewódzka, 2009). A certain difficulty in this respect can be the lack of availability of statistical data at the level of municipalities regarding such indicators of economic development as: gross domestic product or gross value added in industry, services and agriculture. Hence, the literature on the subject often assumes own income per capita as an important measure of local development that covers to a reliable extent a wide spectrum of phenomena characterising the economic situation of a given municipality (Hryniewicz, 2017, p. 10).

The purpose of this paper is to conduct econometric modelling of the correlation between the own income of municipalities in the Lubuskie Province and the determinants affecting it based on spatial and temporal data for the period 1999-2020. For the purpose of the research, econometric models of the own income of municipalities were estimated using the method of least squares (OLS) and methods for panel data with spatial autoregression of the explained variable (SAR) and spatial autocorrelation of the random component (SE). The analysed data included data from the Local Data Bank of the Central Statistical Office (2021), as well as published and unpublished data from the Statistical Office in Zielona Góra (2000-2003; 2004-2019; 2020-2021).

Literature review

Economic development of municipalities is shaped by a number of factors, which are referred to as the determinants of local development (Szaja, 2009). In the context of research on local development, the amount of *own income per capita of municipalities* is an important indicator (Hryniewicz, 2017). It is pointed out that the greater the scale of economic processes taking place on the territory of the municipality, the higher, as a rule, the level of its own income. Pursuant to the Act on income of local government units, this comprises revenues from: agricultural, forest and motor vehicle taxes, real estate tax charged to businesses, rents for business premises, share in personal income (PIT) and corporate income taxes (CIT), revenues from municipal assets, market, advertising and spa fees and other revenues due (Journal of Laws 2003, No. 203, item 1966). Given the above, selected factors of local development can also be considered by analysing their impact on the own income of municipalities.

Based on the literature on the subject, the determinants of the own income of municipalities can be classified according to various criteria (Warczak, 2015). Considering the source of their origin, they can be divided into internal (endogenous) and external (exogenous) determinants. Taking into account their impact as the main criterion, they can also be divided into positive determinants, which promote the growth of municipalities' income, and negative determinants, which hinder it (Szaja, 2009). As regards the possibility of their measurement, determinants can be classified into quantitative (measurable) and qualitative (non-measurable) (Grzebyk, 2017).

Internal determinants of municipalities' own income are related to the economic potential of their territory, the natural resources they possess and the environmental and spatial conditions (Warczak, 2015). The local economic potential is defined by the major employers in a given municipality and the structure of production in its area (Brzozowska et al., 2018), including large industrial plants (e.g. industrial processing, electronics, timber industry, logistics centres) and natural resources exploitation (mining and quarrying industry) (Kachniarz, 2011). The potential in question is also determined by the strength of the local small and medium-sized enterprises (Warczak, 2015).

Internal determinants of municipalities' own income also include the demographic structure, the level of wealth of the population and the scale and structure of unemployment (Brozowska et al., 2018). They play an important role as, in addition to the economic base, they directly affect the tax resources that local authorities can use. Financial factors should also be taken into account, including the financial policy of municipalities, the tax and fee rates applied, tax incentives, the level of debt and the efficiency of the tax collection system.

Some authors also regard the state of road, energy, telecommunications, gas, water and sewage infrastructure as key internal determinants (Warczak, 2015). Local infrastructure provides the resources and services necessary for production and service companies to conduct their business activity (Myna, 2012). In this context, municipal investment expenditure incurred by local government units contributes to the improvement of the state and advancement of technical infrastructure. Developed municipal infrastructure is, in turn, a factor that attracts businesses and people to a given area, increasing as a result the own income of municipalities.

The category of internal determinants also includes municipal assets and advantages resulting from favourable location (Szaja, 2009). Being part of an agglomeration complex plays a crucial role in this respect (Kachniarz, 2011), as does location at the state border, by the sea or in the mountains, since the tourism sector, accommodation and catering services, as well as cross-border trade contribute to an increase of the own income of municipalities (Mync, Szul, 1999).

On the other hand, the own income of municipalities is also affected by external determinants resulting from their relations with the regional, national and international environment (Warczak, 2015). One should mention here cyclical fluctuations in the economy, especially changes in such macroeconomic parameters as the level of inflation, interest rates or exchange rates. This category of determinants also includes economic zones created as part of government programmes or economic initiatives undertaken by municipalities financed from national and European Union funds.

Attention should also be drawn to negative determinants, either of an internal or external nature. These are understood as various obstacles limiting or preventing municipalities from increasing the own income (Bagdziński, 1994). The most important internal obstacles include: economic weakness of the local system, low entrepreneurship of the inhabitants, high unemployment, high concentration of declining industries in a given area, poorly developed agriculture, weakness of local authorities, insufficiently developed technical and economic infrastructure, and the shortage of capital for local businesses. Obstacles of an external nature are mainly those related to the economic situation of the state and appropriation by it of local income.

Materials and methods

To examine in quantitative terms the correlations occurring in local development processes, it is possible to use methods typical of the discipline referred to as spatial econometrics. By analysing the correlations, based on data in the form of spatial-temporal series, it allows to construct spatial panel models (Suchecki, 2012; Salima et al., 2018).

The implementation of spatial panel models for the analysis of various correlations related to own income of municipalities requires taking into account the following issues:

- the literature on the subject lacks theoretical econometric models describing the correlations of this kind at the level of municipalities, as is the case, for example, GDP models used for provinces (Tokarski et al., 1999),
- due to the nature of the data, an important issue is the choice between different spatial models that include spatial correlations in their structure, as well as their inclusion in the spatial weights matrix (Kopczewska, 2020),
- the need to maintain confidentiality of statistical data may cause gaps in public data sets for particular periods and municipalities or even complete lack of data for some variables not published at this administrative level (Śleszyński, 2017).

The basic versions of spatial panel econometric models are models with spatial autoregression of the explained variable (SAR) and with spatial autocorrelation of the random component (SE). The *Spatial Autoregressive Model* (SAR) can be presented as (Suchecki, 2012, p. 94):

$$y_{it} = \beta_0 + \mathbf{x}_{it}^T\boldsymbol{\beta} + \rho(\mathbf{Wy})_{it} + u_{it}, \quad (1)$$

where: y_{it} – value of the explained variable of the *i*-th municipality in the *t* period, $\mathbf{x}_{\mathrm{it}}$ –vector of values of explanatory variables of the *i*-th municipality in the *t* period, $\boldsymbol{\beta}$ – vector of parameters by the explanatory variables, $\mathbf{Wy}_{it}$ – spatial image of the explained variable of the *i*-th municipality in the *t* period, ρ – spatial autoregression parameter, u_{it} – random error.

The spatial interactions between municipalities in the model are represented by a spatial weights matrix (Zeliaś, 1991). In the simplest case, the matrix $\mathbf{W}$ is a binary matrix. Elements w_{ij} at the intersection of the *i*-th row and *j*-th column are equal to one when *i*-th and *j*-th objects are adjacent to each other and zero otherwise. In the case of a row-standardised matrix, one obtains $\mathrm{w}_{ij} = 1/n$ for each of the n neighbours of a given object, resulting for each row in $\sum_j w_{ij} = 1$. Other varieties of the weight matrices used include: *k*-nearest neighbours matrix, neighbours within *d*-kilometre radius, inverse distance (Kopczewska, 2020).

The second type of spatial panel model is the SE model (*Spatial Error Model*). It treats spatial correlations as a linear pattern of spatial autocorrelation of a random component:

$$y_{it} = \beta_0 + \mathbf{x}_{it}^T\boldsymbol{\beta} + u_{it}, \quad u_{it} = \lambda(\mathbf{Wu})_{it} + \varepsilon_{it}, \quad (2)$$

where: λ – spatial autocorrelation parameter of the random component, ε_{it} – random error.

There are also other versions of spatial panel models known as SAR-FEM, SAR-REM and SE-FEM and SE-REM (Suchecki, 2102). Apart from spatial effects, they take into account also individual effects specific for particular objects.

These can be introduced as fixed effects or as random effects, which are part of the random component.

The SAR-FEM model (*Spatial Autoregressive Fixed Effects Model*) takes the form:

$$y_{it} = \alpha_i + \mathbf{x}_{it}^T\boldsymbol{\beta} + \rho(\mathbf{Wy})_{it} + u_{it}, \quad (3)$$

where: α_i – fixed effects for individual municipalities.

The SAR-REM (*Spatial Autoregressive Random Effects Model*) model takes the form:

$$y_{it} = \beta_0 + \mathbf{x}_{it}^T\boldsymbol{\beta} + \rho(\mathbf{Wy})_{it} + v_{it},\ v_{it} = \alpha_i + u_{it}, \quad (4)$$

where: α_i – unobservable random effects for municipalities.

The SE-FEM (*Spatial Error Fixed Effects Model*) model takes the form:

$$y_{it} = \alpha_i + \mathbf{x}_{it}^T\boldsymbol{\beta} + u_{it}, \quad u_{it} = \lambda(\mathbf{Wu})_{it} + \varepsilon_{it}. \quad (5)$$

The SE-REM (*Spatial Error Random Effects Model*) model takes the form:

$$y_{it} = \beta_0 + \mathbf{x}_{it}^T\boldsymbol{\beta} + v_{it},\ v_{it} = \alpha_i + u_{it}, \quad u_{it} = \lambda(\mathbf{Wu})_{it} + \varepsilon_{it}. \quad (6)$$

The selection of the model from the above-mentioned options is made by verifying the validity of the inclusion of the selected effects using appropriate statistical tests (Salima et al., 2018). These include ordinary and robust Lagrange Multiplier (*LM*) tests, conditional and marginal tests for random effects models, Likelihood ratio test (*LR*) for fixed effects and Hausman test helpful when choosing between fixed and random effects. The goodness-of-fit measure of these models used are the *pseudo-r*^{2} coefficient and the log likelihood ratio value (*logLik*).

However, regardless of the adopted form of the spatial panel model, the possibility of making estimations depends on the availability of statistical data. In the case of incomplete data, imputation methods can be used to supplement it (Kwiatkowski, 2004). For data in the form of spatial-temporal (panel) series, the recommended imputation method is the *cold-deck* method. It consists in the use of data from previous iterations of the same survey. By means of an analogy to the time series analysis, missing data for a selected object may also be supplemented with the arithmetic mean of observations in neighbouring survey periods.

Changes in own income of municipalities in the Lubuskie Province in 1999-2020

The Lubuskie Province is situated by the western border of Poland and has several border crossings with Germany. The region is one of the smallest in the country, both in terms of size and population. As at 2020, the province covered an area of 13,988 km^2 and had a population of 1,007,145 (GUS, 2021). The GDP generated by the province amounts to 49,131 million PLN, which makes up 2.14% of the country's total GDP[1]. 352 544 people in total are employed in the Lubuskie Province. Sectors that are the most important for the labour market include: industry (25.49%), trade and repair of motor vehicles (15.45%), agriculture, forestry, hunting and fishing (10.48%), transport and warehousing (8.19%), education (7.72%). The province has two capital cities of Zielona Góra (the seat of the province's legislative assembly) and Gorzów Wielkopolski (the seat of the provincial governor). The region is divided into 82 municipalities, including: 9 urban, 33 urban-rural and 40 rural municipalities[2].

Municipalities with the lowest and the highest level of own income per capita at the beginning and at the end of the examined period are listed in Table 1[3]. Based on the data for 2020, the richest municipality in the region in terms of own income per capita was Bobrowice (rural municipality), where that amount reached 4,229.96 PLN in that year. The factor that has the largest impact on its financial situation are shares in revenues from corporate taxes. The largest taxpayer in the municipality is the Hydroelectric power plant Dychów, which is part of the PGE concern (Koleśnik, 2017). The level of own income per capita exceeded PLN 4,000 also for the next three municipalities in the ranking: Świdnica (rural municipality, 4,155.81 PLN), Zbąszynek (urban-rural municipality, 4,130.47 PLN) and Łęknica (urban municipality, 4,019.35 PLN). The group of the richest municipalities in the region in 2020 also included its capital cities. Own income per capita

[1] Most recent available data for 2019 (cf. GUS, 2021).
[2] In the years 1999 and 2014 the province had 83 municipalities, since 2015 it has 82. The change in the number of municipalities in the province resulted from the absorption by the city of Zielona Góra of the adjacent rural municipality of the same name in 2015.
[3] Own income of municipalities was expressed in fixed prices as of 2020. They were indexed with the general GDP price index for Poland in individual years of the examined period.

for Zielona Góra in the year in question amounted to 3,587.87 PLN (6th place), while for Gorzów Wielkopolski – to 3,262.92 PLN (10th place). The poorest municipality in the region was the rural municipality of Bytnica, where the level of own income amounted to PLN 1,570.32 per capita.

Changes in own income per capita of the municipalities in the province in the period 1999-2020 are presented in Figure 1.

Table 1. Municipalities with the highest and the lowest own income per capita (fixed prices) in the Lubuskie Province in the years 1999 and 2020

Year	No.	Highest income	PLN	No.	Lowest income	PLN
1999	1.	Łęknica	6,325.21	81.	Otyń	593.43
	2.	Lubniewice	2,790.27	82.	Trzebiechów	539.26
	3.	Słubice	1,867.57	83.	Bytom Odrzański	534.61
2020	1.	Bobrowice	4,229.96	73.	Strzelce Krajeńskie	1,883.40
	2.	Świdnica	4,155.81	74.	Bytom Odrzański	1,856.62
	3.	Zbąszynek	4,130.47	75.	Stare Kurowo	1,845.55
	4.	Łęknica	4,019.35	76.	Dąbie	1,842.48
	5.	Kostrzyn nad Odrą	3,684.07	77.	Brzeźnica	1,834.10
	6.	Zielona Góra	3,587.87	78.	Kożuchów	1,797.64
	7.	Słubice	3,527.26	79.	Siedlisko	1,751.82
	8.	Pszczew	3,458.49	80.	Wschowa	1,718.04
	9.	Ośno Lubuskie	3,401.03	81.	Małomice	1,575.44
	10.	Gorzów Wielkopolski	3,262.92	82.	Bytnica	1,570.32

Source: own elaboration based on GUS, 2021.

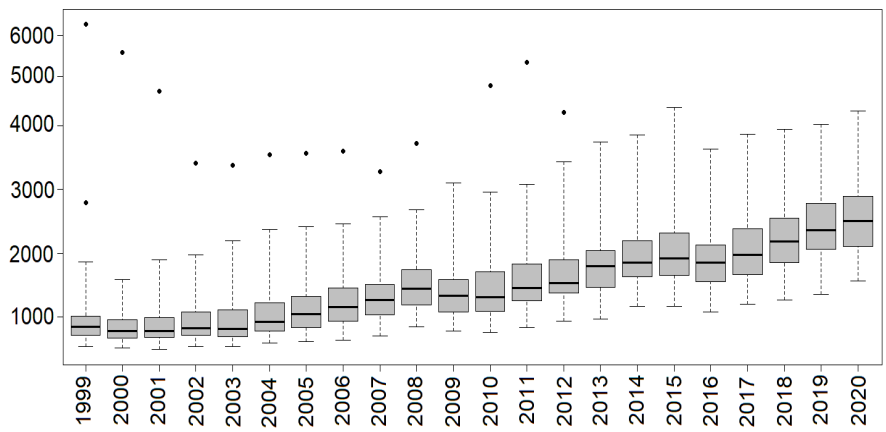

Figure 1. Own income per capita in the municipalities of the Lubuskie Province in PLN (fixed prices) in 1999-2020
Source: own elaboration.

What can be observed for the period in question is an upward trend in own income per capita of municipalities. What should also be pointed out is an unusually high level of the index in selected municipalities in some years, which is a result of the impact of various factors and circumstances. For example, the municipality of Lubniewice reported a particularly high share of income from the sale of land and real estate in 1999 (ZMiG Lubniewice, 2001). Another example is the municipality of Łęknica, where a significant share of income in the period 1999-2008 was from rent and lease. This was due to the functioning of one of the largest markets in Poland located close to the German border (Markowska, 2016). In turn, in the case of the municipality of Lubrza, a significant percentage share of its own income in the period 2010-2012 were funds for financing investments obtained from other sources. This was due to the project implemented at the time,

consisting in the construction of a sewage and water supply system in the northern part of the municipality (bip.lubrza.pl, 2011).

Correlation analysis was used to establish the determinants of own income of the examined municipalities in 1999-2020. The selection of potential explanatory variables was based on the review of the literature on the subject (cf. Sztando, 2008). The gaps in the collected data were filled in using the last available value of a given variable for a given municipality[4]. The results of the analysis are presented in Table 2.

Table 2. Correlation coefficients of own income per capita of municipalities in the Lubuskie Province in relation to selected variables for the period 1999-2020

Variable	*r*	*p-value*
Number of business entities in REGON per 1000 inhabitants	0.576**	<0.0001
Unemployment rate (in %) of working age population	-0.652**	<0.0001
Cumulated investment expenditures per capita of municipalities for 5 years (in PLN)	0.690**	<0.0001
Number of persons employed in the industry sector in entities employing more than 9 persons per 1000 inhabitants	0.218**	<0.0001
Migration balance per 1000 inhabitants	0.011	0.6550
Number of dwellings completed per 1000 inhabitants	0.343**	<0.0001
Number of tourists using the accommodation base in collective accommodation facilities per 1000 inhabitants	0.200**	<0.0001
Number of observations: $n = 1820$; 1999-2014: 83 municipalities; 2015-2020: 82 municipalities		

Source: own calculations. *Note: * values significant at 0.10 level, ** significant at 0.05 level.*

The results indicate that most of the analysed variables, with the exception of the migration balance, are in significant – at the level of 0.05 – correlation with own income per capita of municipalities[5]. The strongest correlation with the examined category was found for the cumulative investment expenditures per capita of municipalities for the period of 5 years. The value of the correlation coefficient in this case was 0.690, and the correlation itself was positive.

Estimation of panel spatial models of own income of municipalities in the province

The level of the own income of municipalities in the Lubuskie Province is influenced by various determinants, illustrating the diversity of their local economies (Kachniarz, 2011). A determinant that should also be taken into account in the spatial-temporal analysis are spatial connections between municipalities (Suchecki, 2012). In light of the above, spatial panel models were used to estimate models of own income of municipalities in the region.

The model of own income per capita of municipalities, estimated on the basis of data for 1999-2020, in its basic version takes the following form[6]:

$$\begin{aligned} INCOME_{it} = \beta_0 + \beta_1 \sum_{t-4}^{t} INVEST_{it} \\ + \beta_2 ENTIT_{it} + \beta_3 UNEMP_{it} \\ + \beta_4 INDUST_{it} + \beta_5 FLATS_{it} \\ + \beta_6 TOURIST_{it} \\ + \beta_7 URBAN_i + \beta_8 BORDER_i \\ + \beta_9 TIME + \varepsilon_{it}, \end{aligned} \quad (7)$$

where: $\sum_{t-4}^{t} INVEST_{it}$ – cumulated investment outlays per capita for the period of 5 years in PLN, $ENTIT_{it}$ – number of business entities in REGON per 1000

[4] Missing data for the migration balance in municipalities amounted to 4.55% of the total data for this variable. For the number of tourists using the accommodation base it was 12.20%, while for the number of people working in industry in the municipalities it was 13.02% (cf. GUS, 2021).

[5] The *p-value* is the actual probability, obtained on the basis of the sample, of making an error consisting in the rejection of the hypothesis of non-significance of the correlation coefficient, in case it were true. In practice, a parameter can be considered as significant if the *p-value* does not exceed 0.05. Values below 0.10 indicate a result that is significant at the level of statistical tendency (Wasilewska, 2015, p. 320).

[6] A linear function was used, since due to the presence of zero values for selected variables (TOURIST, INDUST FLATS) in the case of some municipalities their logarithmisation is not possible. This makes it impossible to use a power or logarithmic function.

inhabitants, $UNEMP_{it}$ – unemployment rate in %, $INDUST_{it}$ - number of people employed in industry per 1000 inhabitants, $FLATS_{it}$ - number of dwellings completed per 1000 inhabitants, $TOURIST_{it}$ - number of tourists per 1000 inhabitants, $URBAN_i$ – zero-one variable for urban municipalities, $BORDER_i$ – zero-one variable for border municipalities, $TIME$ – time variable, ε_{it} – random component.

Panel models with spatial autoregression of the explained variable (SAR) and spatial autocorrelation of the random component (SE) were estimated with the maximum likelihood method. For comparison, the model was also estimated using the least squares method (OLS). Spatial relationships between municipalities were determined on the basis of a neighbourhood matrix standardised by rows to one. Estimation results are presented in Table 4[7].

The applicability of spatial panel models SAR and SE in the analysis of the phenomenon was examined using LM Lagrange tests. The results of the statistical tests are presented in Table 5.

Table 4. Estimated spatial panel models of own income per capita of municipalities in the Lubuskie Province for 1999-2020

Explanatory variable	Model OLS	Model SAR	Model SE
const.	185.664** 0.0039	21.557 0.7329	195.839** 0.0053
∑INVEST	0.155** <0.0001	0.152** <0.0001	0.157** <0.0001
ENTIT	6.410** <0.0001	6.214** <0.0001	5.863** <0.0001
UNEMP	-16.264** <0.0001	-13.116** <0.0001	-15.583** <0.0001
INDUST	0.751** 0.0001	0.795** <0.0001	0.813** <0.0001
FLATS	8.362* 0.0844	8.384* 0.0782	11.949** 0.0152
TOURIST	0.028** <0.0001	0.027** <0.0001	0.026** 0.0001
URBAN	212.898** <0.0001	246.590** <0.0001	230.697** <0.0001
BORDER	143.060** <0.0001	132.884** <0.0001	148.386** <0.0001
TIME	43.233** <0.0001	30.730** <0.0001	43.881** <0.0001
ρ	X	0.192** <0.0001	X
λ	X	X	0.216** <0.0001
r^2	0.7421	0.7347	0.7418
$logLik$	-13251.95	-13232.80	-13232.76
n	1804	1804	1804

Note: *p-values* are given under the parameter evaluations*;* ρ - coefficient of spatial autoregression of the explained variable; λ - coefficient of spatial autocorrelation of the residuals; r^2 – pseudo-coefficient of determination; $logLik$ – likelihood ratio logarithm; * values significant at the level of 0.10; **values significant at the level of 0.05.

Source: own calculations.

[7] Calculations were performed in the SPLM package in the R Cran software (Millo, Piras, 2018). The neighbourhood matrix, unified for the whole period 1999-2020, was determined on the basis of the administrative division of the region in force since 2015. Data for the municipality of Zielona Góra for the period 1999-2014 was recalculated taking into account the former urban and rural municipalities that were combined to form it.

Table 5. LM tests of Lagrange multiplier of spatial panel models

Test	LM_{lag}	LM_{err}	LMR_{lag}	LMR_{err}
LM value	34.00**	37.22**	1.62	4.84**
p-value	<0.0001	<0.0001	0.2026	0.0278

Note: LM_{lag} – test for the model with spatial autoregression of the explained variable; LM_{err} – test for the model with spatial autocorrelation of the random component; LMR_{lag} and LMR_{err} – robustness tests for both models.

Source: own calculations.

Significant results of ordinary $LM_{lag} = 34.00$ and LM_{err} =37.22 tests indicate that for the given data structure both spatial models SAR and SE are more appropriate than the classical OLS model (Table 5). For both spatial models the values of the likelihood ratio logarithm are also higher than for the OLS model. A significant result of the robustness test LMR_{err} =4.84 and a non-significant one $LMR_{lag} = 1.62$ suggest, in turn, that out of the two the model with the spatial autocorrelation of the random component is better for the analysis of the phenomenon under consideration.

The estimates of SE model parameters inform how many units the level of own income per capita of municipalities changes when the level of a given explanatory variable increases by one unit (Table 4). This means that an increase in investment expenditures incurred by municipalities during the period of 5 years by 1 PLN per capita translated into an increase in their own income per year by 0.16 PLN per capita. An increase in the number of business entities in REGON by 1 per 1000 inhabitants resulted in an increase of this value by 5.86 PLN. A positive impact on the own income of municipalities was also found for such variables as: the number of persons employed in industry, the number of dwellings completed and the number of tourists per 1000 inhabitants. An increase in the number of people working in industry by one person per 1000 inhabitants resulted in an increase in own income per capita by 0.81 PLN. Each new dwelling completed in the municipality per 1000 inhabitants translated into an increase in this value by PLN 11.95, while each additional tourist who visited the municipality per one 1000 inhabitants increased it by PLN 0.03. The unemployment rate has a negative impact on the own income of municipalities. An increase in the value of that parameter by 1 p.p. resulted in a decrease in the own income of a given municipality by PLN 15.58 per capita. The estimates also indicate that in the case of urban municipalities (Gorzów Wielkopolski, Zielona Góra, Kostrzyn nad Odrą, Gubin, Nowa Sól, Gozdnica, Żagań, Łęknica, Żary) the level of own income per person is higher than for urban-rural and rural municipalities by an average of PLN 230.70. In turn, in the case of municipalities located near the border (Słubice, Górzyca, Cybinka, Gubin (urban), Gubin (rural), Brody, Trzebiel, Łęknica, Przewóz, Kostrzyn nad Odrą), compared to other municipalities, the level of own income per capita is on average higher by 148.39 PLN. What should also be noted for the period in question is a general upward trend in own income of municipalities in the region, which increased on average by 43.88 PLN per capita YoY.

All of the correlations in the SE model, including the assessment of the coefficient of random component spatial autocorrelation, are statistically significant at the level of 0.05. The value of the coefficient λ in this model is 0.216. It indicates that the level of the random component of own income of municipalities per capita increases by the above-mentioned amount when the mean error resulting from neighbourhood location increases by 1 PLN. To compare, the value of the coefficient of spatial autoregression ρ in the SAR model is 0.192. Based on the *pseudo-r*^{2} indicator, it can be concluded that the model in question explains in 74.18% the structure of own income per capita of the examined municipalities in the analysed period[8].

Conclusions

In conclusion, it can be said that the own income per capita of municipalities is influenced by a number of determinants, the most important of which is the scale of economic processes taking place in a given area. The results of econometric modelling of own income of municipalities in the Lubuskie Province in 1999-2020 indicate that the determinants which significantly affect this value

[8] Estimation attempts were also made for models SE-REM, SAR-REM, SE-FEM and SAR-FEM. However, no satisfactory results were obtained for any of these. The parameters at some of the explanatory variables of own income of municipalities in these models indicated a different direction of impact than expected or were statistically insignificant. The last two models were estimated without qualitative zero-one variables.

include: the number of business entities, the number of employees in industry, the number of dwellings completed, the number of tourists visiting the municipality, the level of unemployment and the scale of investment outlays. In the econometric models obtained, a significant correlation was also found for such factors as the location of the municipality at the border, its urban/rural nature, as well as the general trend reflecting the ongoing changes in the region's economy. The estimated SE and SAR spatial panel models also indicate spatial autocorrelation of own income of municipalities in the region. It may result from small distances between municipalities, especially from the proximity of their labour and sales markets.

Some recommendations for the local economic policy makers that could be proposed based on the obtained research results include the development and incentives for various types of entrepreneurial activity (e.g. industry, tourism, construction, services), as well as counteracting unemployment, since these determinants subsequently translate into higher level of own income of municipalities. An appropriate investment policy and a skilful use of the advantages resulting from the location and neighbourhood of surrounding municipalities may also play a key role in this regard. An issue that also needs attention is ensuring wider availability of relevant statistical data at the administrative level of municipalities, since it significantly facilitates conducting econometric analyses for these units of local government.

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