THE DEVELOPMENT LEVEL OF RURAL MUNICIPALITIES IN LOWER SILESIAN VOIVODESHIP IN VIEW OF THEIR INCOME STRUCTURE

Jarosław Olejniczak, PhD

Department of Finance

Wrocław University of Economics, Poland

Aim of presented research:

To determine the relation between:
1) the income structure of rural municipalities
2) and the levels of their social and economic development specified by means of the Hellwig's taxonomic method of development pattern.

Method

- analysis of the relevant literature, to identify a set of variables to describe **local** level of development
- analysis and choice of the variables from the years 2006 and 2010 and that were accessible in the Local Data Bank of the CSO;
- on its basis, a set of the 14 variables was identified
- analysis and identification of the variables (among the available ones) which are not quasi-constants;
- elimination of the remaining variables that are characterised by a high degree of correlation;
- standardisation of the features of the variables;

Method (continued)

- determination and classification of development measures for individual municipalities in compliance with the Hellwig's method (taxonomic development measure).

- division of the municipalities into those of high, medium and low development level .

The next stage of the study involved the analysis of the income structure in the individual municipalities, including the division into own income, subsidies and subventions.

As a consequence, the results achieved allowed to determine whether there is a correlation between the indices of the rural municipality development level and particular income sources in both examined periods.

A set of the following variables was identified:

1. the proportion of councillors with a university degree,
2. birth rate,
3. migration balance in relation to the number of inhabitants of a given municipality,
4. general housing stock of the municipality in relation to the number of its inhabitants,
5. the number of housing benefits paid in the municipality in relation to the number of the inhabitants,
6. the proportion of sewage treatment plants users,(removed from matrix)
7. the proportion of water supply system users,
8. the proportion of sewerage system users,
9. primary school computerisation index,
10. lower-secondary school computerisation index, t
11. he share of the registered unemployed in the number of the working-age population,
12. population index per one library,
13. entities registered in the National Official Business Register REGON per 10 thousand people,
14. own income per capita.

How to .... it was calculated?

Variability index V_j was computed for the selected variables with the critical value of the coefficient $V^* \leq 0.1$. The absolute values of the indices for all features exceeded the above level and hence were all subject to further analysis.

$$V_j = \frac{S_j}{\bar{x}_j} \quad (1)$$

where:

V_j - variation coefficient for j-variable

S_j - standard deviation for j-variable, computed according to (2):

$$S_j = \sqrt{n^{-1} \sum_{i=1}^{n} (x_{ij} - \bar{x}_j)^2} \quad (2)$$

$\bar{x}_j$ - arithmetic mean for j-variable

Subsequently, Pearson correlation coefficient matrix was built (3).

$$r_{xy} = \frac{\sum_{i=1}^{n}(x_j - \bar{x})(y_j - \bar{y})}{\sqrt{\sum_{i=1}^{n}(x_j - \bar{x})^2 \sum_{i=1}^{n}(y_j - \bar{y})^2}} \qquad (3)$$

where: r_{xy} – Pearson's correlation coefficient, X, Y – measurable statistical features, $\bar{x}$, $\bar{y}$ – arithmetic mean, features X and Y, respectively.

It was assumed that the features which show high correlation, whose correlation coefficient satisfies the condition $| r_{xy} | \geq r^*$ in relation to the critical value $r^* = | 0.75 |$ would not be allowed for in the further study. Therefore, the variable of sewage treatment plants users was excluded. Thus, matrix X was obtained, with successive lines corresponding to particular local government units and columns – to the values of the individual features for the following entities.

$$X = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1m} \\ x_{21} & x_{22} & \cdots & x_{2m} \\ \cdots & \cdots & \cdots & \cdots \\ x_{n1} & x_{n2} & \cdots & x_{nm} \end{bmatrix} \qquad (4)$$

where x_{ij} – stands for the value of j-feature for i-object ($i = 1, 2, ..., n; j = 1, 2, ..., m$). In order to unify the variables, the features were standardised by the formula:

$$z_{ij} = \frac{(x_{ij} - \bar{x}_j)}{S_j} \qquad (5)$$

thus obtaining a matrix of standardised values, where z_{ij} stands for the value of j-feature for i-object ($i = 1, 2, ..., n; j = 1, 2, ..., m$).

$$Z = \begin{bmatrix} z_{11} & z_{12} & \cdots & z_{1m} \\ z_{21} & z_{22} & \cdots & z_{2m} \\ \cdots & \cdots & \cdots & \cdots \\ z_{n1} & z_{n2} & \cdots & z_{nm} \end{bmatrix} \qquad (6)$$

Based on the above data, **development pattern with standardised coordinates** was determined in accordance with the Hellwig's taxonomic method of development pattern, including the division into stimulants and destimulants. Primary school computerisation indices, the share of the registered unemployed in the working-age population number, and population index per one library were regarded as destimulants. Subsequently, the development measure for each municipality was computed by the formula:

$$d_i = 1 - \frac{D_{i0}}{D_0} \qquad (7)$$

where:

$$D_{i0} = \sqrt{\sum_{i=1}^{m}(z_{ij} - z_0)^2} \qquad (8) \text{ (deviation from the standard)}$$

$$D_0 = \overline{D}_0 + 2S_0 \qquad (9)$$

$$\overline{D}_0 = n^{-1}\sum_{i-1}^{n} D_{i0} \qquad (10)$$

$$S_0 = \sqrt{n^{-1}\sum_{i=1}^{n}(D_{i0} - \overline{D}_0)^2} \qquad (11)$$

By the means synthetic indicators in the years 2006 and 2010 for each of the rural municipalities in Lower Silesian Voivodeship were determined. Afterward, the municipalities were divided into three groups:

1. The municipalities of a high development level **(type A)** included the entities with the **development index higher than the mean plus the standard deviation**.

2. The municipalities of a medium development level (type B) included the entities with the index falling within the range of +/- standard deviation from the mean.

3. The last group comprised the municipalities of a low development level (type C), where the index achieved was lower than the mean minus the standard deviation.

Table 1 Number of municipalities in the individual categories in the years 2006, 2010

	high development level type A municipalities		medium development level type B municipalities		low development level type C municipalities	
year	'06	'10	'06	'10	'06	'10
number of municipalities	9	15	57	52	12	11

Source: Own work based on the results of the study and LDB CSO data

Table 2 Income structure of category A municipalities as well as the relation of income per capita and own income per capita to the average values in 2006 (%)

	Own income share in the income	Subsidy share in the income	Subvention share in the income	Income per capita to the average	Own income per capita to the average
CZERNICA	69.91	10.25	19.82	127.01	169.23
DŁUGOŁĘKA	66.34	10.77	22.88	108.57	137.28
GŁOGÓW	59.00	20.71	20.27	98.87	111.16
JERZMANOWA	79.27	9.66	11.06	201.64	304.60
KOBIERZYCE	77.89	6.89	15.21	153.33	227.60
KUNICE	60.53	21.74	17.72	122.62	141.45
LUBIN	85.93	7.70	6.35	182.46	298.80
PODGÓRZYN	51.42	24.62	23.94	90.83	89.01
RUDNA	77.70	8.04	14.24	184.35	273.00
Average	**52.47**	**19.49**	**28.02**		

Source: Own work based on the results of the study and LDB CSO data

Table 3 Income structure of category C municipalities as well as the relation of income per capita and own income per capita to the average values in 2006 (%)

	Own income share in the income	Subsidy share in the income	Subvention share in the income	Income per capita to the average	Own income per capita to the average
CIEPŁOWODY	33.28	23.00	43.72	82.72	52.47
CIESZKÓW	27.39	28.38	44.22	91.44	47.73
DOMANIÓW	33.82	21.93	44.25	74.49	48.01
KONDRATOWICE	39.38	31.21	29.41	76.22	57.20
MARCINOWICE	37.87	23.30	38.83	93.60	67.54
NIECHLÓW	31.69	28.39	39.92	88.03	53.16
PRZEWORNO	27.96	25.94	46.10	82.93	44.19
SIEKIERCZYN	45.07	21.42	33.51	90.55	77.77
STARA KAMIENICA	35.71	28.42	35.87	83.65	56.92
WĄDROŻE WIELKIE	36.46	27.32	36.22	84.81	58.92
WIŃSKO	29.84	25.31	44.85	79.31	45.10
ZAGRODNO	33.23	25.95	40.82	75.10	47.55
Average	**52.48**	**19.50**	**28.03**		

Source: Own work based on the results of the study and LDB CSO data

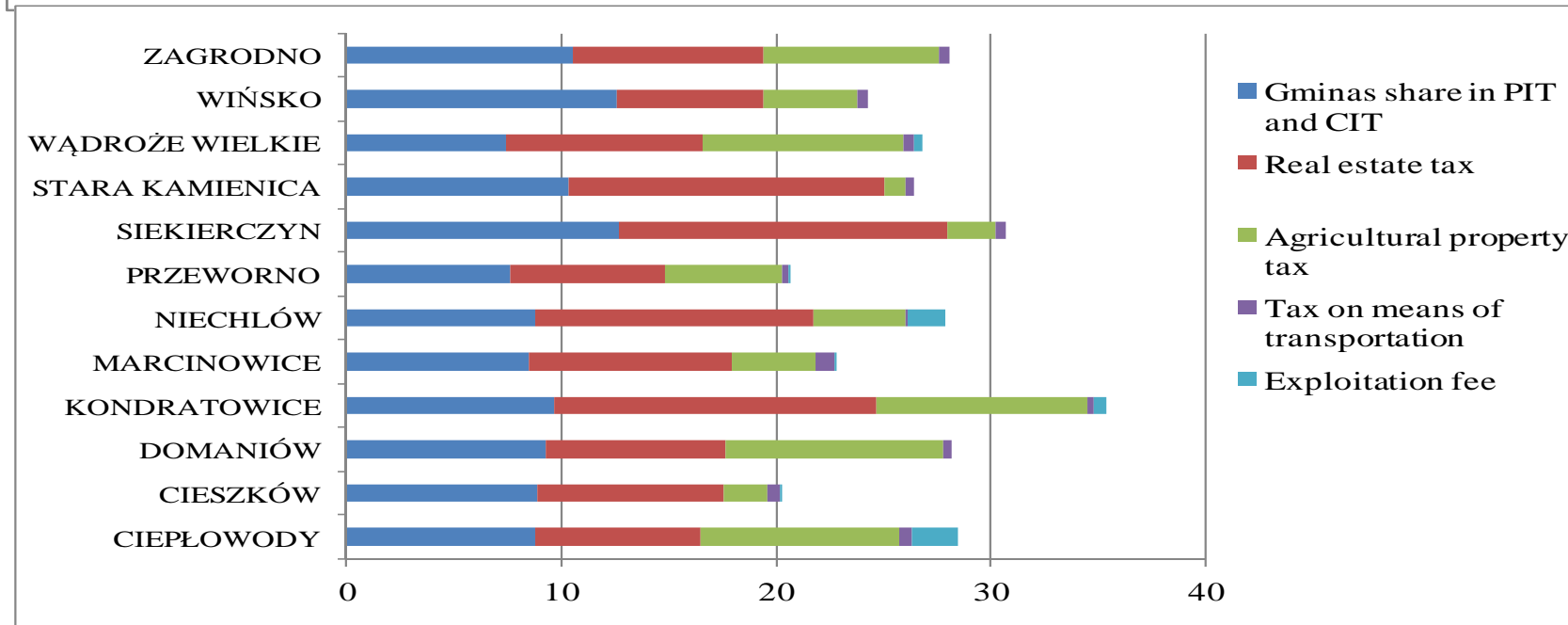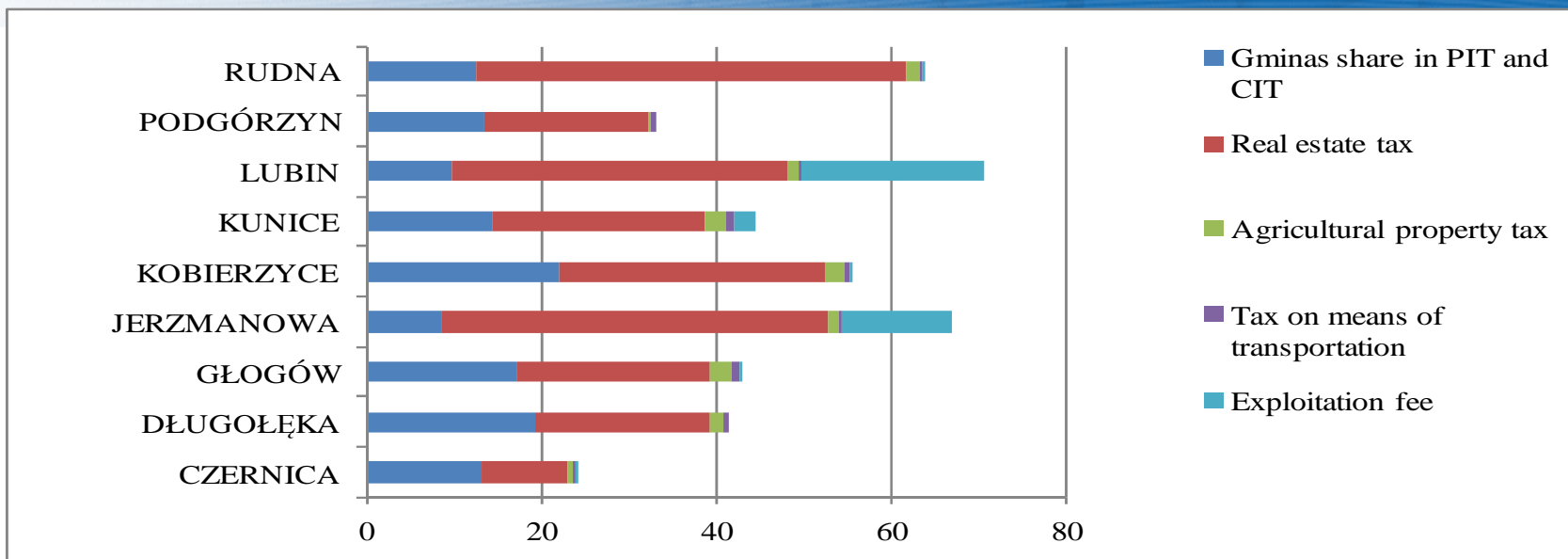**Main own revenues of A and C type gminas in 2006 year**

Table 3 Income structure of category A municipalities as well as the relation of income per capita and own income per capita to the average values in 2010 (%)

	Own income share in the income	Subsidy share in the income	Subvention share in the income	Income per capita to the average	Own income per capita to the average
CZERNICA	59.44	17.17	23.38	92.79	111.59
DŁUGOŁĘKA	61.11	18.91	19.97	115.41	142.70
GŁOGÓW	58.01	23.15	18.82	101.97	119.68
JERZMANOWA	78.20	9.76	12.03	175.83	278.19
KOBIERZYCE	83.56	6.16	10.27	181.29	306.47
KROTOSZYCE	57.90	18.08	24.00	98.65	115.57
KUNICE	63.79	13.72	22.47	95.08	122.72
LUBIN	73.70	18.24	8.05	108.30	161.47
MŚCIWOJÓW	49.41	25.84	24.73	104.20	104.18
PODGÓRZYN	51.61	26.49	21.89	85.04	88.80
RADWANICE	31.66	50.08	18.24	158.15	101.33
ŚWIDNICA	37.06	36.77	26.16	110.51	82.86
ZGORZELEC	46.22	38.71	15.05	125.56	117.41
ZŁOTORYJA	42.66	32.13	25.19	98.45	84.98
ŻÓRAWINA	54.95	21.22	23.82	77.41	86.07
Average	**49.43**	**24.50**	**26.06**		

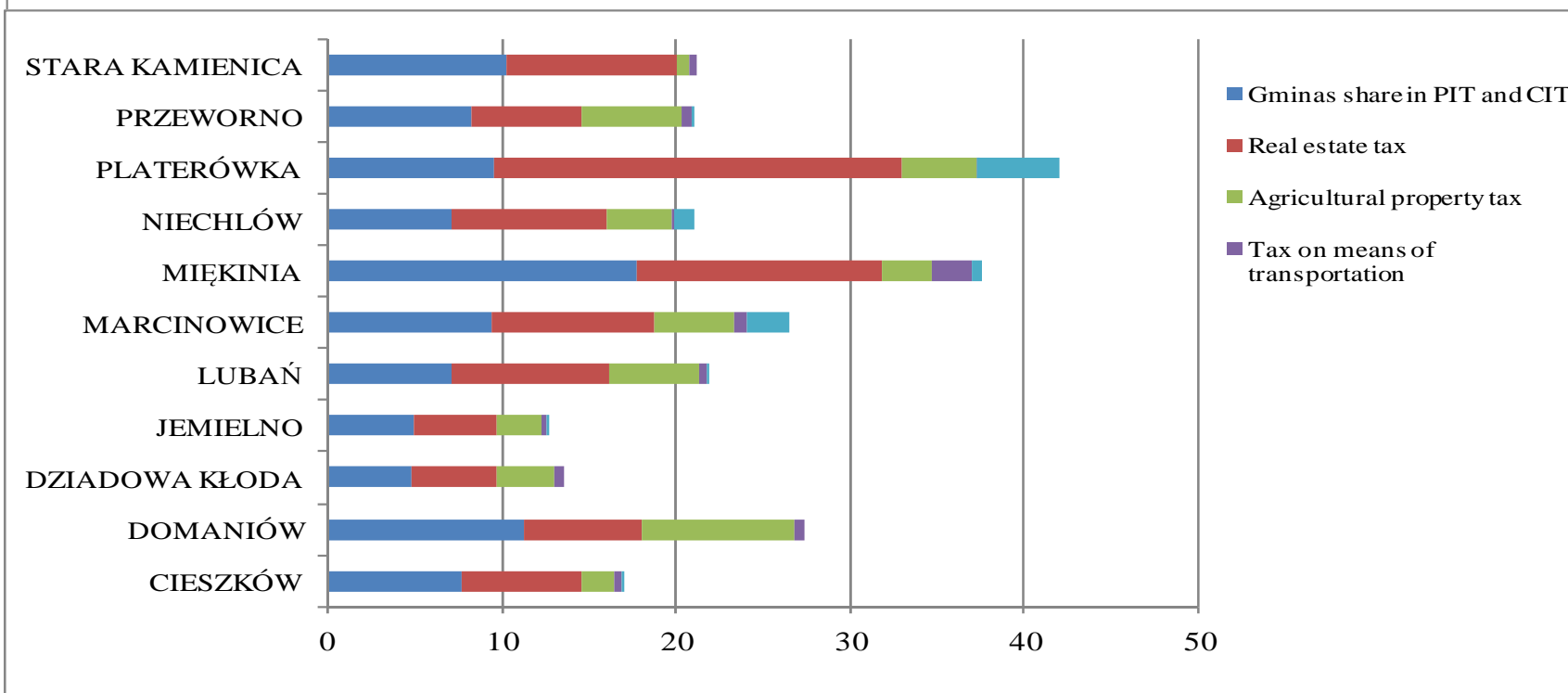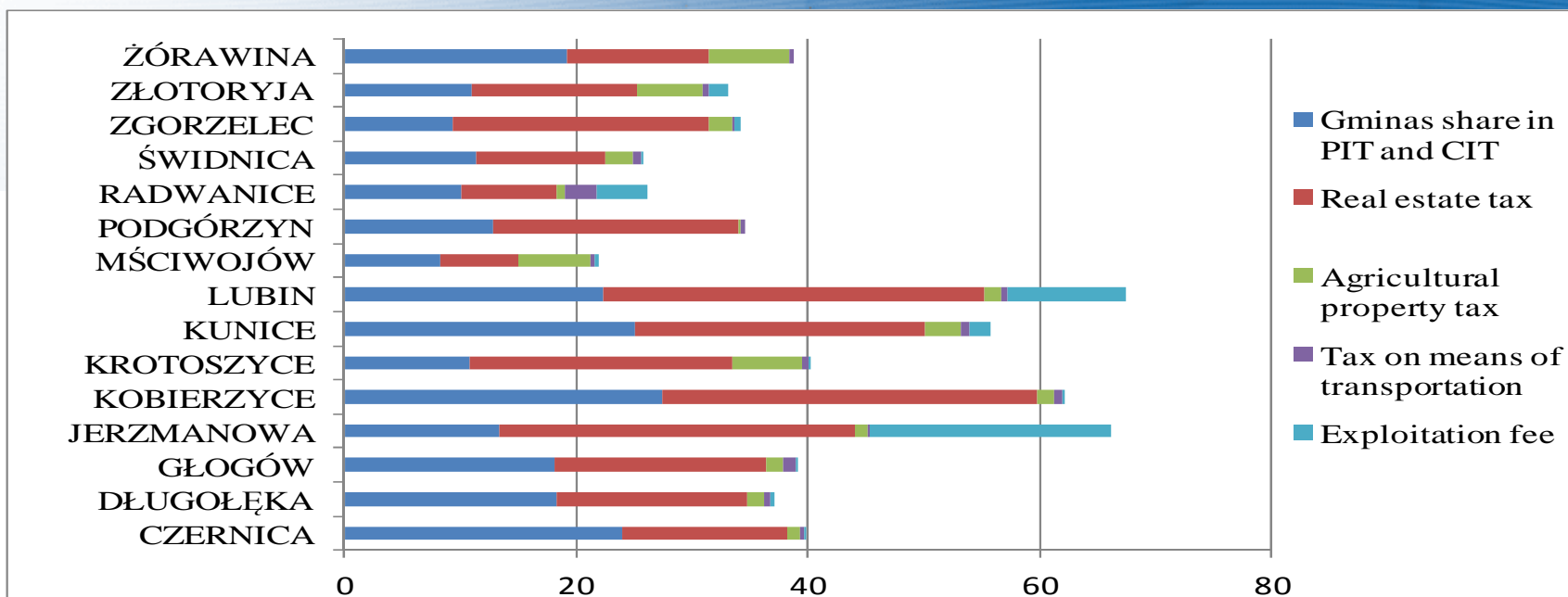Source: Own work based on the results of the study and LDB CSO data

Table 5 Income structure of category C municipalities as well as the relation of income per capita and own income per capita to the average values in 2010 (%)

	Own income share in the income	Subsidy share in the income	Subvention share in the income	Income per capita to the average	Own income per capita to the average
CIESZKÓW	27.75	28.11	44.12	91.15	51.18
DOMANIÓW	37.45	20.23	42.30	74.29	56.29
DZIADOWA KŁODA	22.05	32.59	45.35	101.65	45.36
JEMIELNO	25.34	38.73	35.91	113.61	58.25
LUBAŃ	37.05	30.71	32.22	98.25	73.65
MARCINOWICE	37.54	25.47	36.98	91.22	69.28
MIĘKINIA	55.96	22.90	21.12	99.27	112.40
NIECHLÓW	26.25	35.20	38.53	92.90	49.34
PLATERÓWKA	48.97	28.65	22.36	85.40	84.62
PRZEWORNO	31.00	27.73	41.26	86.78	54.44
STARA KAMIENICA	29.44	35.38	35.17	100.73	60.00
Average	**49.43**	**24.51**	**26.06**		

Source: Own work based on the results of the study and LDB CSO data

Main own revenues of A and C type gminas in 2010 year

Top chart — legend:
- Gminas share in PIT and CIT
- Real estate tax
- Agricultural property tax
- Tax on means of transportation
- Exploitation fee

Top chart categories: ŻÓRAWINA, ZŁOTORYJA, ZGORZELEC, ŚWIDNICA, RADWANICE, PODGÓRZYN, MŚCIWOJÓW, LUBIN, KUNICE, KROTOSZYCE, KOBIERZYCE, JERZMANOWA, GŁOGÓW, DŁUGOŁĘKA, CZERNICA

Bottom chart — legend:
- Gminas share in PIT and CIT
- Real estate tax
- Agricultural property tax
- Tax on means of transportation

Bottom chart categories: STARA KAMIENICA, PRZEWORNO, PLATERÓWKA, NIECHLÓW, MIĘKINIA, MARCINOWICE, LUBAŃ, JEMIELNO, DZIADOWA KŁODA, DOMANIÓW, CIESZKÓW

The conducted analysis **of income** in the distinguished groups of municipalities of high and low relative development level **points to the existence of significant differences** among these groups in terms of their size and structure.

Based on the collected data, it can be concluded:
- that the **amount of own income per capita** can be a factor determining the development level,
- the study did not demonstrate any considerable differences in the **general income per capita** between the groups A and C, particularly in 2010,
- that differences between rural municipalities are becoming less prominent,

It should be emphasised that:

- differences between rural municipalities in levels of development are becoming less prominent;
- the improvement in community infrastructure of the rural municipalities is caused also by investment processes, partly financed from external subsidies;
- from among a varied structure of income sources, rural municipalities largely profit from the PIT and CIT share, real property tax, agricultural tax and property income.
- the municipalities of a high development level are characterised by marginalising the agricultural tax income in favour of other sources.

Thank You for attention.

Jarosław Olejniczak, PhD
Wroclaw University of Economics
jaroslaw.olejniczak@ue.wroc.pl