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Article

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Contemporary Economics

Provided in Cooperation with:

University of Finance and Management, Warsaw

Suggested Citation: Grdić, Zvonimira Šverko; Gregorić, Maja; Nižić, Marinela Krstinić (2019) : Local authority tax policy in Poland: Evidence from the Union of Polish metropolises, Contemporary Economics, ISSN 2300-8814, University of Finance and Management in Warsaw, Faculty of Management and Finance, Warsaw, Vol. 13, Iss. 1, pp. 49-62, https://doi.org/10.5709/ce.1897-9254.298

This Version is available at: https://hdl.handle.net/10419/297468

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Local Authority Tax Policy in Poland. Evidence from the Union of Polish Metropolises

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Primary submission: 11.05.2017 | Final acceptance: 19.12.2017

ABSTRACT

Local taxes and the related taxing power are significant determinants of public authority decentralization. Local taxes should primarily serve as an effective source of self-government revenues. Therefore, it is extremely important to identify and comprehend the motives and behaviors of selfgovernment authorities with regard to local taxes. This work focuses on real property tax, the most efficient of all local taxes. Importantly, in Poland, the system of real property taxation is based on the area of the given property and not on its value. The present work is based on two sources: official data derived from budget reports and reports from town council meetings during which tax resolutions were made. The spatial scope of the analysis covers 12 largest Polish cities - members of the Union of Polish Metropolises (UMP). The article is aimed at the comprehension of ways in which town self-governments make use of opportunities created by the current legal framework in Poland. Therefore, through the use of the correlation testing methods (Pearson's correlation (r) and Spearman's correlation) the article attempts to determine the impact of a reduction in rates on the volume of budget revenues and to explain the statistical diversification of real property tax rates. It presents econometric models illustrating the financial effects of town tax authority on real property taxes. The results of the empirical study reveal diversity in the tax policies of large cities. The observed differences can to some extent be explained by the size and wealth of a city. Furthermore, the results confirm that tax policy influences city income but that consequences of the policies change significantly over time.

KEY WORDS: local authority tax policy, taxing power decentralization, self-government own revenues, local taxes, real property tax

JEL Classification: E62, H71, H72, R51

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Introduction

This article focuses on the examination and assessment of the local tax policy pursued in Poland from 2007-2014 by towns of the Union of Polish Metropolises (UMP) in

Correspondence concerning this article should be addressed to: **Paweł Felis**, Szkoła Główna Handlowa w Warszawie, ul. Madalińskiego 6/8, Warszawa 02-554, Poland. E-mail: pfelis@sgh.waw.pl the area of real property tax. However, as it is explained later in the article that due to the adopted methods and due to the availability of empirical data, it was necessary to confine this study to the period of 2009-2013.

Of the instruments of local tax policy, the most frequently used are reductions in tax rates, and they are what the present research focuses on. The article attempts to verify two research hypotheses:

- town tax policy affects the volume of local revenues, but its effects in the same period and following periods are decisively different.
- town tax policy is strongly diversified depending on the social and economic characteristics of entities and on their affluence and size.

The verification of these hypotheses was based on an analysis of statistical material. Data from a report on the implementation of budget revenue plans of local selfgovernment entities served as an indispensable source of information (report Rb-27s). As another source of data, we used information on 12 cities – the UMP members, i.e., Białystok, Bydgoszcz, Gdańsk, Katowice, Cracow, Lublin, Łódź, Poznań, Rzeszów, Szczecin, Warsaw and Wrocław. This study makes use of, for example, the content of resolutions on property tax rates and data on the populations of these cities, on the number of dwellings and on the usable square footage of housing properties. Town affluence and size are explanatory factors of the diversification of a local tax policy.

For this study several research methods were used: descriptive statistical methods (structure and dynamics indicators) and methods for testing correlations (Pearson's correlation (denoted as r) and Spearman's correlation (denoted as ρ)).

Before we test factors affecting the diversification of tax policy in Polish towns, some methodological assumptions must be made. When we take into account data on the 12 largest cities for 2010-2014, in our overall approach to the data (12 towns x 5 years), we obtain a data series length of 60. When testing hypothesis H_a: r = 0 against alternative hypothesis H₁: $r \neq 0$ for data of this length we obtain for significance a $\alpha = 0.05$ limit on correlation value $r^* = 0.2542$, for which it is possible to reject the hypothesis on its insignificance. Each smaller (with regard to the absolute value) correlation value should be regarded as insignificant so that the correlation is equal to 0. Further, when testing hypothesis H₀: r = 0 against alternative hypothesis H₁: r > 0(or H₁: r < 0) with significance $\alpha = 0.05$, we obtain the limit value of insignificant correlation $r^* = 0.2144$ for positive correlations (or $r^* = -0.2144$, for negative correlations). When data series of length 12 (the number of towns) are to be used, for significance $\alpha = 0.05$ we respectively have $r^* = 0.5760$ and $r^* = 0.4973$ for positive correlations (or $r^* = -0.4973$ for negative correlations). For more significant correlations, it is necessary to test the longest possible data series, and merging data for several years does not change conspicuous tendencies - if any - and rather makes them "convex," indicating where correlations occur. The same considerations apply to the value of Spearman's correlation (ρ) and in the determination of the limit on correlation value ρ^* , from which correlations significantly different from O begin.

Part of the article makes use of Pearson's correlation (r) to measure the strength of linear relationships. Numerical data with an approximately normal distribution are used (see Figure 1 - Normality graphs based on two variables).

The following section presents models that combine a positive revenue growth tendency for the following year (variable PD_{next}) with the growth in the share of tax rate reduction effects in real property tax revenue (variable PU), the share of tax rate reduction in real property revenue (variable VU) and tendencies toward revenue growth in the current year (variable PD).

The final section of the article first specifies dichotomous variables (0/1) U and D, and then these are converted on account of data for two consecutive years to a nominal scale 0/1/2/3 (4 possible values). These data should be used with rank-based correlations such as Spearman's correlation (ρ), and this is what was done. How carefully the aforementioned variables U/D on the nominal scale were created is described in a section devoted to tax policy and to its impact on revenue growth tendencies.

Literature review

Local taxes, in compliance with the theory of public finance and normative standards, should be an essential source of self-government budget financing.

Theories arguing for the decentralization of the decision making process and for strong structures of local self-government due to heightened efficiency, responsibility, managerial skills and decision making autonomy include: principles of decentralization (Oates, 1969), the principle of adequacy (Tiebout, 1956) and principles of regulation based on the "theory of public choice" (Stigler, 1957).

The content of Article 9 of the European Charter of Local Self-Government indicates the right of local self-governments to possess their own sufficient financial resources adjusted to the scope of tasks and



Figure 1. Variable normality graphs: real property tax of one person and real property tax paid by physical persons per person.

for at least part of these resources to come from local charges and taxes whose volumes may be determined by them within the scope defined under law (Council of Europe, 1985).

A considerable proportion of income independence and the rights of each self-government to develop its own tax policy principles may affect growth in terms of responsibility for the financial conditions of its selfgovernment community.

However, the problem of taxing power decentralization is very complex. On one hand, thanks to their own taxes self-government authorities may affect the development of these sources of revenue and shape their volume. On the other hand, there is a risk of insufficiency in revenues from local taxes when the whole system of self-government income is based on them with simultaneous dynamic growth in self-government tasks and spending (Guziejewska, 2007). In addition, one cannot ignore the effects of transferring taxing power to local authorities (vertical imbalance and horizontal imbalance), which is emphasized in the theory of fiscal federalism. Among the latter there are two forms of external horizontal fiscal factors: tax export and tax competition (Herber, 1979).

The literature indicates certain theoretical concepts explaining the diversification of local authorities' tax policies. These include tax competition, which describes a situation in which tax policy in a commune is changed as a response to the policy pursued in neighboring communes or in communes perceived as major "competitors" (Tiebout, 1956; Goodspeed 1998); the average elector according to which local politicians fighting for electors' votes try to adjust their decisions to people's opinions (Downs, 1957); the "taxes and political cycle" emphasizing the obvious fact that electoral decisions depend strongly on perceptions of the economic situation at hand (Nordhaus, 1975; Mouritzen, 1989); and a tax policy diversification party and environmental model. Of these concepts, the one most frequently tested in the European empirical research is the concept of local tax competition as a determinant of potential impacts on the mobility of business entities. A complex review of the research results of this area may be found in, for example, work conducted by Blöchliger and Pinero

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Campos (2011) and Blöchliger (2013). However, it appears that in the practices of European countries, local tax competition is of a limited dimension and primarily because the scope of local taxes and freedom in imposing them in Europe is relatively limited. Only a few countries such as England, Denmark, Finland, Norway, Sweden and Switzerland use financial systems in which taxes determined by local self-governments dominate budget revenues (Łukomska & Świaniewicz, 2015). In other countries, the dominant role is played by all kinds of transfers (subsidies and subventions) and by incomes constituting shares in state taxes (primarily income taxes). The group of countries with an unsatisfactory share of autonomous tax revenues in budget revenues includes Poland.

Scope of property tax authority of Poland communes

Several types of local taxes may be identified in the budgets of Polish commune self-governments; however, not all of them use the same scope of taxing power granted to communes (Felis, 2014). The first group (active taxing power) includes taxes for of which communes may shape certain elements of their construction (real property tax, agricultural tax, forestry tax and tax on means of transport). The second (passive taxing power) includes taxes that constitute, as a whole, the revenue of communes, but there is no local taxing power in relation to these (tax on civil law transactions, tax on inheritance and donations, tax cards, and shares in income taxes: personal income tax (PIT) and corporate income tax (CIT). The major sources of commune tax revenues are shares in PIT and property tax.

Shares in PIT, both in budget classification and in statistical reporting, are considered to be communes' revenues. However, there may be doubts regarding such perceptions of their own revenues. Communes have essentially no taxing power over this tax, and all that they can do is achieve revenues from this tax when taxpayers declare this commune as a place of residence or business activity.

The most important local tax of commune jurisdiction is the real property tax. This tax is a classical wealth tax imposed by self-government authorities on the basis of the Act on Taxes and Local Charges (2018). In the majority of EU countries cadastral systems of real property taxation dominate based on the capital or rental value of a given property. Poland uses an area system for property taxation, as the taxation base (except for buildings) is the area shown in the register of land and buildings. Immovable property is "estimated" for the purpose of taxation in square meters and hectares and not in money. The adoption of this form of taxation causes Polish communes to obtain insufficient incomes. Many negative effects in the field of real property result from the rights of commune self-government to shape the construction of real property taxes. Taxing power is considerably limited and boils down to the determination of tax rates within statutory borders and the introduction of different exemptions from those defined by acts of law. Thus, communes are not absolutely free in imposing the value of tax rates. Tax policies run by communes have not been explored at length by scientists and self-government researchers thus far. A study conducted by J. Łukomska and P. Swianiewicz deserves attention. It attempts to specify the motives and behaviors of self-government authorities with regard to local taxes (Łukomska & Swianiewicz, 2015). A monograph by P. Felis is also worth mentioning, as it presents the system of property taxation as a significant component of the system of local revenues in an area of which a selfgovernment policy may be pursued (Felis, 2015).

Characteristics of UMP towns with a special focus on the tax revenues and local tax policies of these entities

Despite the indicated limitations, the tax policy of Polish self-governments is significant and affects the state of financial state of every commune. For example, in 2013, on account of the property tax, the twelve large towns we examine here obtained nearly 4 billion zlotys, i.e., slightly over 21% of all revenues of communes on this account.

The data presented in Table 1 indicate that in all towns the share of property tax revenues of own revenues increased. The strongest growth is observed in Warsaw, but in the capital city of Warsaw tax revenues on average amounted to slightly over 15% of budget revenues. Steady growth in the significance of property tax primarily results from unfavorable growth rates playing a crucial role as a source of revenue for local self-governments in Poland, i.e., revenues from income taxes. Revenues from property taxes are characterized by much lower sensitivity to cyclical fluctuations in

-			Dynamics of change						
Iown	2007	2008	2009	2010	2011	2012	2013	2014	(2007=100)
Białystok	23.54	24.38	27.18	27.66	28.14	27.98	27.47	25.54	108.50
Bydgoszcz	25.46	24.50	27.54	30.71	31.09	30.45	30.87	28.28	111.08
Gdańsk	24.87	25.13	27.84	30.15	31.19	34.31	31.14	30.96	124.49
Katowice	22.75	23.33	25.55	27.51	25.52	27.36	27.46	26.45	116.26
Cracow	21.57	21.40	22.51	22.61	23.23	24.92	25.51	25.49	118.17
Lublin	23.81	21.25	26.55	26.36	24.92	26.08	26.94	27.23	114.36
Łódź	24.58	24.39	25.91	27.26	28.10	29.31	29.81	29.24	118.96
Poznań	20.19	20.43	21.48	23.41	24.44	25.14	25.90	25.88	128.18
Rzeszów	25.27	25.46	26.45	29.43	28.94	29.06	28.27	27.03	106.96
Szczecin	23.52	23.36	23.84	26.06	27.85	28.63	27.89	26.81	113.99
Warsaw	12.19	12.52	14.05	15.88	16.43	17.71	17.12	16.21	132.98
Wrocław	21.00	20.10	21.84	24.31	23.68	25.83	24.84	22.95	109.29

Table 1. Percentage share of property revenues of UMP towns of their own budget revenues (%)

Source: author's own material based on the Report Rb-27s data.

the economy than those resulting from income taxes. The area construction of the tax base is not unimportant here either. It seems, however, that the rise in the share of revenues achieved by towns from property taxes resulted from fiscally motivated authorities of the examined towns, reflecting considering for budget revenues. Thus, the largest towns, which are discussed below, pursued fiscally oriented policymaking resolutions on tax rates at maximum or slightly lower rates.

The assessment of the significance of property taxes in the system of UMP towns' revenues also involves accounting for data on their incomes per inhabitant. The volume of total own budget revenues per inhabitant is an indicator affluence as presented in Table 2. The cited data indicate that the regional distribution of property tax revenues to a large extent overlaps with the indicator of affluence.

It is worth reviewing the following comparison (Table 3), which shows the significance of the pursued tax policies on property by means of tax rates in relation to decisions made on all local taxes over which entities of a commune self-government play a clearly defined role in statutory taxing power. The presented comparison indicates that in the decisive majority of the towns (11) the share of revenue losses due to a decline in the reduction of property maximum rates of revenue loss on account of taxing power instruments in all local taxes decreased. It may be assumed that towns exhibited higher levels of efficiency in the application of tax policy instruments and primarily for taxes on means of transport, for which the tax base is undoubtedly more mobile than that of case taxes on immobile property, which we focus on here. For less than half of the examined towns tax policy instruments with the strongest effects (for a given year's lower budget income) spurred reductions in rates of real property tax. The research indicates that most UMP towns demonstrate a tendency toward restrictive tax policies on property tax.

Our analysis of the data on property taxes for business activity-related land and buildings and on residential buildings imposed in the examined towns indicates that the reduction in upper rates has been pursued cautiously (Table 4). Maximum rates were applied in towns such as Gdańsk, Poznań and Warsaw

Table 2. UMP town affluence

T	Town b	oudget rev	venues per	capita (in	zlotys)	Real property tax revenues per capita (in zlotys)				
IOWN	2010	2011	2012	2013	2014	2010	2011	2012	2013	2014
Białystok	1351.73	1437.18	1 501.01	1649.48	1838.90	373.94	404.40	419.95	453.10	469.73
Bydgoszcz	1569.53	1618.09	1665.79	1791.48	1975.93	481.97	503.02	507.23	553.01	558.80
Gdańsk	1984.75	2112.64	2176.15	2357.82	2677.10	598.46	658.97	746.61	734.17	828.83
Katowice	2174.82	2306.72	2287.14	2494.37	2678.89	598.30	588.57	625.84	685.08	708.65
Cracow	1921.26	2030.01	2059.06	2176.79	2357.95	434.40	471.60	513.10	555.24	600.96
Lublin	1440.81	1615.16	1706.54	1818.94	1896.58	379.73	402.52	445.01	490.02	516.38
Łódź	1527.12	1669.47	1749.01	1825.80	1902.38	416.28	469.18	512.71	544.34	556.31
Poznań	2291.86	2348.61	2403.39	2485.24	2632.97	536.46	574.11	604.17	643.75	681.29
Rzeszów	1529.72	1699.21	1760.51	1928.64	2110.45	450.17	491.77	511.69	545.21	570.42
Szczecin	1631.06	1705.74	1738.37	1896.36	2028.89	425.09	475.08	497.70	528.85	543.88
Warsaw	3326.04	3332.28	3311.38	3662.38	4018.69	528.33	547.40	586.38	626.98	651.40
Wrocław	1933.91	2047.96	2121.86	2326.14	2648.18	470.19	484.89	547.99	577.85	607.72

Source: author's own material based on Report Rb-27s data.

Table 3. The significance of UMP town tax policy for property tax in relation to local policies on all local taxes with active taxing power (%)

Taum		Years									
Iown	2007	2008	2009	2010	2011	2012	2013	2014			
Białystok	63.62	50.22	43.31	40.18	30.60	30.04	24.53	32.11			
Bydgoszcz	100.00	81.87	75.90	35.89	62.75	61.78	57.71	62.13			
Gdańsk	58.94	52.78	43.37	38.16	30.45	3.38	3.66	3.84			
Katowice	61.71	60.08	64.26	64.03	75.47	64.11	63.65	61.21			
Cracow	67.36	64.07	72.78	78.22	85.16	76.78	64.23	34.11			
Lublin	70.21	60.88	68.47	73.70	67.78	63.94	52.26	50.35			
Łódź	75.68	66.25	68.29	69.34	71.10	0.00	0.00	46.04			
Poznań	26.85	22.06	24.45	11.18	1.81	0.00	0.00	0.00			
Rzeszów	62.05	53.72	53.33	62.65	64.81	64.84	66.45	68.07			
Szczecin	61.73	55.97	40.22	64.66	48.11	32.89	21.05	4.23			
Warsaw	98.11	52.90	40.19	10.62	14.58	15.45	14.33	14.15			
Wrocław	86.42	86.50	87.69	78.59	79.68	0.00	0.00	35.36			

Source: author's own material based on Report Rb-27s data.

T	Land used for business activity				Reside	Residential buildings or their parts				Buildings used for business activity					
IOWN	2010	2011	2012	2013	2014	2010	2011	2012	2013	2014	2010	2011	2012	2013	2014
Białystok	94.81	97.50	98.81	95.45	94.38	96.92	97.01	100.00	100.00	98.65	98.15	98.10	97.99	97.98	97.09
Bydgoszcz	100.00	96.25	95.24	95.45	94.38	100.00	97.01	92.86	93.15	91.89	98.00	95.49	96.17	96.89	96.01
Gdańsk	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Katowice	94.81	93.75	90.48	89.77	89.89	93.85	94.03	91.43	90.41	90.54	98.54	98.53	95.99	95.97	95.96
Cracow	87.01	83.75	90.48	95.45	100.00	86.15	83.58	88.57	95.89	100.00	90.93	88.60	93.98	96.98	100.00
Lublin	92.21	92.50	92.86	95.45	95.51	92.31	92.54	92.86	95.89	95.95	90.25	90.50	91.16	95.09	95.53
Łódź	100.00	100.00	100.00	100.00	98.88	100.00	100.00	100.00	100.00	98.65	93.76	93.73	100.00	100.00	99.09
Poznań	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Rzeszów	97.40	96.25	95.24	95.45	96.63	84.62	83.58	81.43	82.19	82.43	100.00	100.00	99.86	99.87	100.00
Szczecin	100.00	98.75	97.62	100.00	100.00	95.38	95.52	95.71	91.78	94.59	98.39	98.34	98.31	100.00	100.00
Warsaw	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Wrocław	93.51	95.00	100.00	100.00	98.88	83.08	85.07	100.00	100.00	98.65	97.71	99.95	100.00	100.00	99.09

Table 4. Share of current property tax rates of UMP towns of a maximum rate (%).

Source: author's own material based on acts on taxes and local charges and UMP town council resolutions (Public Information Bulletin).

T		Years									
Iown	2007	2008	2009	2010	2011	2012	2013	2014			
Białystok	9.71	5.68	4.28	3.70	2.42	2.31	1.66	2.43			
Bydgoszcz	12.89	7.87	6.13	1.06	3.20	3.39	2.82	3.64			
Gdańsk	2.65	2.24	1.85	1.29	0.79	0.06	0.06	0.04			
Katowice	3.87	3.79	3.58	3.28	5.48	5.53	5.44	5.53			
Cracow	4.90	4.41	7.65	10.75	15.21	7.86	3.95	1.07			
Lublin	6.53	5.57	5.42	8.02	7.58	6.82	3.69	3.42			
Łódź	4.93	3.51	4.07	3.90	3.75	0.00	0.00	0.85			
Poznań	0.06	0.06	0.06	0.06	0.05	0.00	0.00	0.00			
Rzeszów	3.70	3.66	3.76	4.52	5.14	6.83	7.18	7.46			
Szczecin	3.27	2.21	1.83	1.81	1.81	2.00	1.16	0.19			
Warsaw	3.35	1.53	0.87	0.13	0.15	0.16	0.16	0.15			
Wrocław	9.29	11.66	12.52	5.56	6.12	0.00	0.00	0.75			

Table 5. Share of effects of reductions in upper property tax rates on revenues from this tax for UMP towns (%)

Source: author's own material based on Report Rb-27s data.

I.

and to most forms of real property in Łódź. Only a few towns show a clear downward tendency for all forms of real property in relation to upper amount rates. It is generally typical of large towns to apply maximum or nearly maximum tax rates to real property. Hence, property tax rates were similar in every town. However, empirical data do not confirm that the affluence of a local entity explicitly explains the diversification of tax policies. It is possible to point to very affluent towns (Warsaw, Gdańsk, and Poznań), which unwillingly make use of tax policy instruments but also to less affluent towns, which due to insufficient budget funds also raised rates (Białystok or Lublin). Of the entities with fiscally oriented active tax policies there are affluent towns, which could theoretically afford to reduce rates, as they possess sufficient budget funds to accomplish tasks, and less affluent towns, which cannot afford to set low rates due to budget difficulties.

Thus, there are no doubts that large towns experience minor financial effects due to the reduction of upper property taxes not only in terms of absolute amounts of lost revenues but also as illustrated in Table 5 in relation to property revenues. Only Katowice and Rzeszów noted a certain rise in this relation, which could have resulted from an attempt to attract a tax base through local tax competition. For the majority of remaining towns, the indicator of losses in achievable property tax revenues considerably declined, oscillating at roughly zero. Due to the aforementioned approval of maximum property tax rate levels by some towns, the trace relation presented in the table may be surprising. It results from the fact that Table 4 is confined to property tax rates most frequently used in practice. In Article 5 of the Act on taxes and local charges the legislator also envisages rates for other land categories (e.g., land under lakes and reservoirs and remaining land) and buildings (e.g., buildings occupied for business activities in qualified seed material turnover or for providing health services). It is the decisions of town councils on this property that caused small percentage loss indicators to appear.

Diversification of local tax policy in UMP cities

Factors that explain the diversification of the towns' tax policies include town size (calculated as population size and the square footage of dwellings) and town affluence (calculated as town budget revenues, property revenues and revenues from property taxes paid by physical persons per capita). Thus, the correlation of the following variables was tested: L (population), PM (area of dwellings), LM (number of dwellings), D (budget revenue per capita), DPN (revenues from real property tax per capita) and DPNFIZ (revenues from property tax from physical persons per capita) with SPG rates (rates for business activity-related land), SBM (rates for residential buildings), SBG (rates for buildings for business activity), SOSPN (effects of a reduction in property tax rates in relation to revenues realized from this tax), SOSPNFIZ (effects of a reduction in real property tax rates from physical persons in relation to revenues realized from this tax) and SOSPL (effects of a reduction in tax rates for all local taxes in relation to all realized budget revenues), and the correlations presented in Table 6 were obtained.

The calculations included in Table 6 indicate that large towns are more inclined to leave upper tax rates unchanged (positive correlations in columns SPG and SBM), which certainly translates into less financial loss (negative correlations in columns SOSPN, SOSPNFIZ and SOSPL). A conclusion to be drawn here that smaller towns are more flexible in pursuing their tax policies. The lack of a significant correlation observed between L, LM and SBG is in a sense understandable. In this case, the number of enterprises should be a more adequate variable. Regarding population size, we do not have access to data in terms of them doing business on their own. The diversification of tax policies may also be linked to town affluence. The results of our analysis reveal a correlation to decisions made on tax rates. Parameter DPN proved to be most useful here. We may assume then that more affluent communes (calculated as property tax revenues per capita) more seldom decide to reduce property tax upper rates. Lower losses in revenues come as a consequence of such activities.

It is also worth checking how the explanatory factors described above correlate with the indicator measuring the significance of property tax as a source of town revenues, i.e., *UDPN* (the share of real property revenue of towns' own revenues) and *UDPNFIZ* (the share of revenue from property taxes paid by physical persons of towns' own revenues). The obtained correlations are presented in Table 7. The correlation here is very strong, especially with regard to town size. The

Correlations	SPG	SBM	SBG	SOSPN	SOSPNFIZ	SOSPL	
L	0.2933	0.3775	0.1775	- 0.2914	- 0.3099	- 0.5266	
PM	0.3108	0.3691	0.2264	- 0.3161	- 0.3198	- 0.5434	
LM	0.2997	0.3798	0.1946	- 0.3028	- 0.3187	- 0.5306	
D	0.2397	0.2951	0.3761	- 0.3467	- 0.3043	- 0.5030	
DPN	0.2519	0.2662	0.4615	- 0.4034	- 0.3182	- 0.4390	
DPNFIZ	0.1959	0.2334	0.1552	- 0.2627	- 0.2676	- 0.1017	

Table 6. Correlation between the size and affluence of towns and their property policies

Source: author's own material based on Report Rb-27s data.

Table 7. Correlations between the size and affluence of towns and their revenue structures

Correlations	UDPN	UDPNFIZ
L	- 0.8006	- 0.5479
РМ	- 0.8238	- 0.5790
LM	- 0.7983	- 0.5391
D	- 0.7105	- 0.7504
DPN	0.0549	- 0.4839
DPNFIZ	0.2043	0.6365

Source: author's own material based on Report Rb-27s data.

Table 8. Correlations between the size and affluence of towns

Correlations	D	DPN	DPNFIZ
L	0.7750	0.1645	- 0.1378
РМ	0.8081	0.1910	- 0.1400
LM	0.7892	0.1816	- 0.1137
D	1.000	0.6395	- 0.0389
DPN	0.6395	1.0000	0.1596
DPNFIZ	- 0.0389	0.1596	1.0000

Source: author's own material based on Report Rb-27s data.

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negative correlation between town size and share of paid property tax of town revenues does not come as a surprise. This means that for larger towns, property tax revenues constitute a smaller proportion than they do in the remaining towns because for large towns shares of state taxes (PIT or CIT) are of the greatest fiscal significance. The second variable partly confirms this observation. The more affluent the town, the lesser the significance of property tax revenues to the overall revenue structure. Correlation UDPNFIZ-DPNFIZ proved to be unexpectedly large and positive where simply larger payments of property tax made by physical persons result in a larger percentage share of these payments in revenues (understood as a proportion of all revenues). This may appear contrary to a statement expressed in the following section that tax policy addressed to physical persons has no relation to a rise in these revenues. However, as it can be observed, these two factors are not mutually related.

It is interesting to complete these analyses by testing correlations between variables of town size and affluence (Table 8). As assumed, a strong positive correlation was obtained for variable D (town budget revenues per capita). Larger towns obtain revenues more effectively, which may be attributed less to their higher efficiency and more to higher revenues from income taxes (PIT and CIT) and remaining local taxes due to their larger populations and business entities. For the collection of property tax itself this correlation is not observed (the correlation is statistically insignificant). A strong correlation for parameters D with DPN is also worth noting, from which the lack of a significant correlation between D and DPNFIZ could indicate that average levels of payment of property tax in relation to all revenues depends primarily on the property tax paid by legal persons. This conclusion does not come as a surprise, as in the area of property tax the largest revenues come from legal persons, i.e., tax on undeveloped and business activity-related developed land.

Impact of property tax reductions on the volume of UMP towns' budget revenues

Let us first examine models indicating what and to which extent revenue growth tendencies are affected in the following year. The 2009-2013 data are included in one-time sectional data sequence. A possible impact of PU on PD was analyzed for the current year and for the following year in relation to growth in the share of effects of property tax rate reduction in town revenues (variable PU expressed in percentages) and to growth in the variable showing relative growth in property tax revenues relative to the previous year with inflation taken into account (variable PD expressed in percentages). The share of the effect in property tax rate reduction in revenue from this tax (variable VD expressed in percentages) was also taken into account. Table 9 explicitly indicates that variable PU is correlated negatively with variable PD for the given year, which was to be expected, as a higher degree of tax authority had to give rise to a decrease in revenue growth. However, if the effect of variable PU for a given year on variable PD in the following year is considered, a positive correlation is observed, which may indicate an effective tax policy. A very strong positive correlation between VD and PD is also observed (this is a natural consequence of a well-known observation indicating that towns that can afford local tax rate reductions may generate subsequent revenue growth more easily). There are also strongly negative correlations between VD and PDnext and between PD and PD_{next}, which indicates that revenue growth is self-limited, as strong growth in revenues in one-year results in the opposite tendency in the following year.

To more explicitly measure the impact of towns' decisions on tax rates with regard to growth in property tax revenues for exogenous variables PU and PD for a definite year and with variable PD_{next} for the following year as an endogenous variable, a model was constructed as follows:

 $PD_{next} = 1.46\% + 0.3586^*PU - 0.5702^*PD$

confirming how *PU* and *PD* affect PD_{next} as shown in Table 9.

Another model accounts for the role of variable VU:

 $PD_{next} = 0.14\% + 0.3456^*VU - 0.6155^*PD$

The obtained model indicates that towns with a larger share of upper tax rate reduction in relation to revenues more easily generate positive property tax revenues. The impact of variable PD is quite similar to that of the previous model – a positive tendency for

Correlations	VU	PU	VD	PD	PD _{next}
VU	1.0000	0.2832	- 0.2571	- 0.0056	0.2365
PU	0.2832	1.0000	- 0.5093	- 0.2939	0.3512
VD	- 0.2571	- 0.5093	1.0000	0.7497	- 0.8243
PD	- 0.0056	- 0.2939	0.7497	1.0000	- 0.6009
PD _{next}	0.2365	0.3512	- 0.8243	- 0.6009	1.0000

Table 9. Correlation table – interdependences of variables PU, PD, VU, VD and PD_{next}

Source: author's own material based on Report Rb-27s data.

obtaining revenues in the current year has a self-limiting effect on revenue growth tendencies of the following year. Both models are coincident: the indication of the Pearson correlation coefficient (growth/decline) is identical to the regression coefficient indication.

To recapitulate, the Pearson correlation coefficient indicates that the share of tax revenue of all town revenues has a positive impact on property tax revenue growth. However, it was not possible to build a model showing this sort of impact with a possible share of other exogenous variables. The authors examined this issue and came to the conclusion that variables used in other sections of the article, i.e., those describing the population, tax rate volume, the level of housing stock utilization, property tax burdens per capita, etc., cannot be included in models describing a potential impact on property tax growth.

Additionally, to analyze the model on the impact of upper tax rate reduction on budget revenues, the authors examined whether at the 2-year scale the tax preference model shifts to a model of property tax revenue growth.

To determine whether there is a perceptible impact of upper tax rates reductions on the upward tendencies of realized revenues in subsequent years, Spearman's correlation was calculated and a chi-square test of independence (Pearson's independence test) was conducted. For years R = 2007...2014, a percentage share was set for effects of tax rate reduction in realized property tax revenues, and it was found that when this share declined (U = 0) or rose (U = 1). For R = 2009...2013, values U_{R-1} and U_R were found. Next, while considering inflation we determined how in percentages "realized revenues" rose or declined. When the percentage of upward/downward tendencies of "realized incomes" was found numerically it was possible to find whether these values declined over time (D = 0) or rose (D = 1). As indicated above, for 2009-2013 values D_R and D_{R+1} were found.

The aforementioned question on the correlation of the impact of upper tax rate reductions on upward tendencies of realized revenue changes to a question on the impact of variables U_{R-1} and U_R on variables D_R and D_{R+l} . Possible values of variables U_{R-l} and U_R were written down as follows: U = 0(00), U = 1(01), U = 2(10),U = 3(11). This was also done for the values of variables D_{R} and D_{R+1} , ascribing this pair of variables one of values D = 0, 1, 2, 3. For each year R = 2009...2013, Spearman's correlation coefficient ρ was first calculated to find the form and strength of the impact of variable U on variable D or the lack of such a significant impact. The applied number of years (from 2009) was "forced" by the need for the calculation of $D_{\rm p}$ – it would be impossible to calculate D_{2008} for example because this would require, among other things, an awareness of an increase in revenues realized in 2007 in relation to 2006 (accounting for inflation in 2007), and the data have a lower time limit of 2007. Further, the upper limit of 2013 results from the need to calculate $D_{p_{11}}$, as it should be borne in mind that the applied data period ends in 2014.

To determine if the obtained Spearman's correlation coefficient ρ is statistically significant, if it is $\neq 0$ (or > 0 or < 0), the zero hypothesis should test $\rho = 0$ against al-

0.0664, $\rho = 0.1963$	$1.0664, \rho = 0.1963$											
U\D	0	1	2	3	Sum							
0	3	1	0	0	4							
1	8	8	0	4	20							
2	11	1	6	3	21							
3	6	0	3	6	15							
Sum	28	10	9	13	60							

Table 10. Correlation table – impact of the tax policies of 12 towns on tendencies toward the realization of revenues, p = 0.0664, $\rho = 0.1963$

Source: author's own material based on Report Rb-27s data.

ternative hypothesis H₁: $\rho \neq 0$ (or H₁: $\rho > 0$ or H₁: $\rho < 0$). To test these hypotheses, we use a classical statistical test:

$$U = \frac{\rho}{\sqrt{1 - \rho^2}} \sqrt{n - 2}$$

with distribution t_{n-2} (Student's t-distribution of n-2degrees of freedom), where n is the sample size. We note that the correlation coefficient calculated below ρ = 0.1963 is "slightly" significant statistically and that the probability of rejecting H₀ (assuming that H₀ is true) is equal to p = 0.0664 when the alternative hypothesis is H₁: $\rho > 0$ (the alternative hypothesis H₁: ρ < 0 is not used, as the value of the above test U is positive). This is not a "strong" correlation, but it may be concluded that a positive Spearman's correlation coefficient ρ calculated from Table 10 is statistically significant. However, for conformation it is necessary to identify other explanations of such a correlation by for instance conducting Pearson's test of independence. Making use of the notation (U, D) described above, we obtained the following table of size (Table 10).

To complete the analysis, Pearson's test of independence is used, and we obtain an analogous or even "stronger" result. The value of the test:

$$U = \sum \frac{(O-E)^2}{E}$$

(with distribution χ^2 of 9 degrees of freedom) amounts to **u** = **22.33**. The probability of rejecting the hypothesis on insignificance (of the impact of tax policy on incomes realized) is *p* = 0.00789 (e.g., for α = 0.05 the critical value of the test is 16.919 and for $\alpha = 0.01$ the critical value is 21.666); thus, there is a statistically significant correlation between lines (tax policy) and columns (tendencies of revenue realization) of the table. Thus, our application of the chi-square test of independence allowed for the confirmation of initial conclusions drawn from the calculation of Spearman's correlation on the existence of dependence between the pursuit of tax policy through the reduction of upper property tax rates and the upward tendencies of realized revenues from this tax. The independence test does not describe the nature of this correlation, however. Therefore, we make use of Spearman's correlation (ρ) , which presents a positive correlation, showing that larger reductions in future upper property tax rates have positive effects on property tax revenues.

The following section presents correlation tables for property tax paid legal persons (Table 11) and property tax paid by physical persons (Table 12).

Spearman's correlation (ρ) is large enough to assume that with a test significance of roughly 0.1, there is a positive correlation. When Pearson's test of independence is used in a confirming analysis of the same data, we obtain a test value of u = 21.98. The probability of rejecting the hypothesis on insignificance (the impact of tax policy on realized revenue tendencies) is p = 0.00895. We confirm this correlation. The test values show that the correlation for real property tax revenues obtained by towns from legal persons is slightly lower than that for property tax overall. However, it may be assumed that tax policies pursued by town au-

U\D	0	1	2	3	Sum
0	3	1	0	0	4
1	9	8	2	2	21
2	13	0	6	3	22
3	6	0	2	5	13
Sum	31	9	10	10	60

Table 11. Correlation table – impact of the tax policies of 12 towns on tendencies for the realisation of revenues from legal persons, p = 0.1013, $\rho = 0.1688$

Source: author's own material based on Report Rb-27s data.

Table 12. Correlation table – impact of the tax policies of 12 towns on tendencies for the realisation of revenues from physical persons, p = 0.2844, $\rho = 0.0750$

U\D	0	1	2	3	Sum
0	8	1	1	2	12
1	7	4	1	4	16
2	12	6	5	0	23
3	4	0	3	2	9
Sum	31	11	10	8	60

Source: author's own material based on Report Rb-27s data.

thorities with regard to business entities spur positive tendencies for such revenue growth.

On the other hand, tax policy on physical persons has no major significance. The data presented in Table 12 indicate that a significant correlation cannot be observed. It is as if it were equal to 0 (zero). Correlation insignificance can also be found when applying Pearson's independence test. This test gives a value of "only" u = 12.99. The probability of rejecting the hypothesis on insignificance (of the impact of tax policy on realized revenue tendencies) amounts to p = 0.16327, confirming the lack of a significant correlation between variables U and D.

Conclusions

Our analysis conducted on 12 UMP cities indicates that local entities are not very active with regard to

local taxes. The majority of large towns apply a strict tax policy on real property taxes, imposing high rates on business-related and housing property. The applied explanatory factors (town size and affluence) subject to analysis proved useful, partially explaining the diversification of tax policy. Town size appeared to be an independent variable best explaining the diversification of property tax rates but only for noncommercial property. Town affluence is a variable with a slightly weaker correlation. However, importantly, a minor role of revenues from mobile property taxes in UMP town budgets was confirmed when testing total own revenues, property taxes and property taxes paid by physical persons. Some attention was also paid to the fact that the tested variables (town size and affluence) are, to a certain degree, correlated with one another.

The research undertaken in the course of writing this article allowed for the positive verification of two hypotheses.

First, the tax policies of 12 large cities in Poland pursued primarily through the reduction in upper real property tax rates affected the volume of their own revenues. Resulting effects have however varied across different periods. When tax rates were reduced, tax revenues usually declined. However, in the later periods an upward tendency for property tax-realized revenues was observed from the correlation tables created.

Second, town tax policy is diversified. The applied factors explaining tax policy diversification proved statistically significant, though their explanatory strength varies. The best explanatory factor is the size of the local entity. UMP towns imposing high property tax rates have applied a restrictive tax policy. Thus, local politicians determining tax policies in large towns seem to be driven by a fiscal objective. Town affluence is the second applied variable whose explanatory strength was not found to be fully satisfactory. This allowed however for the confirmation of a minor role of taxes on property owned by other entities in the budgets of more affluent towns, which may indirectly affect the diversification of tax policy.

To more precisely depict the effectiveness of tax policy, the authors also built simple econometric models describing the impact of certain variables (e.g., a percentage share of tax preferences reflected in upper tax rates reductions in revenues from property tax or the percentage share of this share) on property tax revenue growth.

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