

Neighbour effect: applicability of tax mimicking concept to setting tariffs for water provision in Poland

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Abstract

In our paper, tariff mimicking is interpreted as a specific type of yardstick competition. Local authorities compete for political capital and, in order to maintain (or increase) it, they compare their voter-sensitive policies with the policies of other local governments. The phenomenon of mimicking is related to the subject of inter-jurisdictional interactions. We try to identify the phenomenon of mimicking in local fees for water provision in Poland in the period 2013–2017. Our empirical strategy is based on two methods: spatial lag regression and a quasi-experimental design using a difference-in-differences method. In the latter method, we first identify local governments that have considerably increased their tariffs for water. Next, we compare whether their immediate neighbouring municipalities are more likely to follow the change than a ‘control group’ of similar, more distant, local governments. The results of our study confirm the existence of geographical interactions in the tariff policies of Polish local governments. Furthermore the results of our regression models confirm that ‘mimicking interactions’ are stronger in the case of tariffs for water provision than for local tax policies.

Keywords: Inter-jurisdictional interactions; Local government; Poland; Tariff mimicking; Tax competition; Water prices

Highlights

- We argue that in Central and Eastern European countries (including Poland), the phenomenon of yardstick competition is more likely to be identified in policies related to tariffs for local public services than in local tax policies.
- So far there have been no studies on water tariff mimicking in Central and Eastern European countries and the objective of our manuscript is to fill this gap.
- For the first time we try to apply quasi-experimental design to the test of tariff mimicking among local governments in water provision.
- We try to compare the results of using different statistical methods to identification of spatial interactions of local public policies.

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- Using econometric methods we identified the mimicking phenomenon between Polish municipalities in relation to charges for water.
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Introduction – conceptual framework

In this article, we apply the tax competition theory and the related concept of tax mimicking to the analysis of policies related to tariffs for local public services, namely water provision.

Our main research question is whether we can identify the phenomenon of mimicking in relation to policies of tariffs for local public services. We expect to find that the concept is more relevant in relation to tariffs than to local taxes. Our test is based on the case of Poland, but we argue that it may be applicable more widely to other countries in Central and Eastern Europe (CEE), or – more generally – to countries in which local government taxing powers are relatively limited.

Tariff mimicking is defined in this article as a situation in which a local tariff in a given jurisdiction is set under strong influence of, or is changed as a reaction to, the level of tariffs applied in another local jurisdiction. Tariff mimicking is not necessarily related to geographical neighbourhood only. For example, there may be situations in which a regional city analyses its policies on tariffs by comparing them with other (distant) cities of a similar size and function, rather than with the immediate neighbours. However, we argue that in most smaller local governments, it is justified to narrow down the concept to focus on spatial proximity.

Conceptually this article borrows from the concept of tax competition. There are two different potential forms of tax competition:

1. Competition for a mobile tax base, in which a local government tries to attract the movement of capital, companies or residents to the given jurisdiction. This leads to the growth of the local tax base, and in the ideal scenario, also to the resultant growth of budget revenues;
2. Maintenance or increase of political capital – tax rates are adjusted in the considered jurisdiction, taking into account the tax rates of the neighbouring municipalities (or the other group with which citizens and politicians are likely to compare) in order to satisfy local voters and to secure political support in local elections. Unpopular decisions (such as increasing local tax rates or increasing tariffs for local public services) are more likely to be made if they do not result in fees (or tax rates) higher than those in the local governments with which they are being compared. This relates not to ‘classic’ competition for the tax base, but to the concept known in economics as ‘yardstick competition’.

The situation of ‘yardstick competition’ is sometimes referred to as ‘tax mimicking’ – the situation in which governments replicate policies observed in other governments. The concept of competition or mimicking is generally discussed in relation to tax policies. The phenomenon of tax mimicking has been identified, for example, in Finland (Moisio, 2010), Belgium (Gérard *et al.*, 2009), the Netherlands (Allers & Elhorst, 2005), Switzerland (Dafflon & Rossi, 2004), France (Reulier & Rocaboy, 2009; Ndiaye, 2018), Germany (Kalb *et al.*, 2012; Holzmann & von Schwerin, 2015), Denmark (Kleven *et al.*, 2014), Spain (Solé-Ollé, 2003), the Czech Republic (Sedmíhradská & Bakoš, 2016) and Poland (Swianiewicz & Łukomska, 2016; Małkowska *et al.*, 2018), although Buglione & Mare (2010) find little evidence of tax competition among sub-national jurisdictions in Italy and Lytikäinen (2012) proves that there is no strategic interaction in property tax rates among neighbouring municipalities in Finland.

Delgado *et al.* (2018) note the growing popularity of studies of strategic fiscal interactions among jurisdictions within the local public finance literature in the last decades. They argue that most of them are related to searching for mimicking patterns among governments and most of them are based on the yardstick competition hypothesis instead of tax competition (Delgado *et al.*, 2018). The consequences of mimicking phenomenon, in terms of policy choices and efficiency, have been broadly studied and largely acknowledged in the fiscal federalism literature. Therefore, research on mimicking is devoted not only to taxes but also to other policies of local governments – for example, Michigan’s cities spending patterns (Sapotichne *et al.*, 2019), the spending decisions of Portuguese local governments (Costa *et al.*, 2015), the expenditures on rescue services by Swedish municipalities (Hanes, 2002), decisions made by French municipalities on cooperation in the provision of local public goods (Di Porto *et al.*, 2017), and the debt decisions of Polish municipalities (Kopańska & Kopyt, 2018).

Studies identifying spatial interactions between local governments related to tariffs for local services are very rare. This article attempts to contribute to filling this gap. Klien (2015) identifies mimicking for water prices in Austrian municipalities using a panel data set covering 2000–2009. Results of his tests indicate that neighbouring municipalities influence the scale of the political budget cycle, which points towards yardstick competition as the most likely source of mimicking in tariffs for water provision. In a similar study conducted by Lundin (2017) water price mimicking has been identified in Swedish municipalities. Both studies use different variants of spatial lag (SL) method. The latter of two studies estimated also additional models to control spatial correlation among time-varying omitted variables (spatial mixed model and the spatial Durbin model). They include an extensive list of control variables related to cost factors (e.g. the number of single-family houses and apartment buildings, the average wage for a public servant, investments), which is not common in other studies of this subject. Söderberg & Tanaka (2012) study price setting in the Swedish district heating sector using cross-sectional data from 2007 and they identify price mimicking between privately and publicly owned neighbour utilities. The authors demonstrate that spatial price correlation increases when privately owned utilities are exposed to strong threat by customer complaints.

Since we were not able to find any research confirming tariff mimicking phenomenon in the CEE countries, we decided to carry out a test for Poland, which might be considered representative for the region.

Following the above arguments our **first hypothesis states that the water price setting of neighbouring jurisdictions has an effect on the pricing decisions of Polish local governments (H1)**. H1 is verified by using a combination of two econometric methods (inspired by Baskaran’s study from 2014): spatial lag regression and quasi-experimental design (our main empirical challenge). As a supplementary, background material, we also refer to the results of interviews conducted in 2017–2018 in 41 local governments in which we investigated the motives behind policies on tariffs for local public services¹.

In their analysis of typical local government responses to fiscal stress, Wolman & Davis (1980) argue that an increase in fees and tariffs for local services is politically easier than a change in local taxes. This observation has been empirically confirmed by some European studies (for example, Borge, 2000 in Norway; Dafflon, 2015 in Switzerland). At first glance, this may be against our claim – if an increase in tariffs is easier from raising local taxes than mimicking being the result of ‘yardstick competition’ should concern first of all the rates of local taxes, which are more politically sensitive issues. However,

¹ N = 60. In most municipalities, two interviews were conducted: one with the town mayor and one with the head of the company providing water services. Investigated local governments were located in three different Polish regions.

we should take into account the strictly limited discretion of local tax policies in Poland (and more generally in the whole region of CEE) and limited yields collected from local taxes. This may lead local politicians to focus more on tariffs for services, where the discretion is often much higher. At the same time, the logic related to political sensitivity for a median voter, presented by Wolman and Davis, does not need to be confirmed in our countries. For the average household, the financial burden of tariffs for services is much higher than the local tax yield. A recent report shows that for the average Polish household, spending on water and sewage is 24 times higher – and in case of waste collection, the fee is 9 times higher – than the tax paid on residential properties² ([Wydatki mieszkańców na usługi komunalne, 2018](#)). Clearly, this fact inflates the political sensitivity of changes in tariff levels.

The phenomenon of tax mimicking among Polish local governments was identified in previous research ([Swianiewicz & Łukomska, 2016](#); [Małkowska et al., 2018](#)). Given that our H1 can be confirmed, and based on the arguments described above, **we assume in our second hypothesis that the phenomenon of mimicking in Poland is stronger for water tariffs than for local taxes (H2)**. H2 is conditioned by the positive verification of the first one and its test is based on spatial lag regression.

The facts quoted in the previous paragraph partially explain why we have decided to concentrate on water charges – their absolute volume is more than double waste collection fees, and a similar proportion also applies to comparisons with other tariffs. What might be other factors deciding which of the tariffs are more prone to be subject of tariff mimicking? Borrowing from earlier studies of tax competition ([Blöchliger & Pinero-Camos, 2011](#); [Blöchliger, 2014](#)), as well as more general considerations based on fiscal federalism ([King, 1984](#)), the following characteristics which make tariff mimicking more likely to happen can be identified:

1. **Popularity of consumption.** If influencing the behaviour of voters (building or maintaining political capital) is at the core of the concept, we should expect that local governments would be willing to mimic the tariffs of services which are important for most of the voters, not those which are consumed by a small proportion of their electorate. Following this criterion, we should indeed expect a high likelihood of tax mimicking in the case of water provision, which – in Poland at least – is provided to nearly all households.
2. **Visibility of the tariff.** In the case of water, visibility is considerable, but lower than some other services (such as tickets for local public transport). Several consumers pay for water via standing orders (or direct debits), having no occasion to carefully study the details of each payment. Moreover, in several multi-flat buildings, the cost of water is combined into one bill with other payments related to heating, hot water and rent, which makes the clear recognition of individual elements much more difficult.
3. **Distinction between services for which local governments have full discretion to decide on tariffs and those for which setting tariffs is restricted by law and/or has a more technocratic character.** Mimicking is possible only if local governments have considerable discretion to decide upon tariffs. In relation to water provision in Poland, this issue is discussed in the methodological section of this article.
4. **Size of local governments.** The phenomenon of tax mimicking is more likely in small jurisdictions and in rural settings than in larger cities³. This is related both to physical access to information and to rural versus urban lifestyles, which influence the density of contacts with consumers in neighbouring jurisdictions.

² Property tax is the most important local tax in Poland, but over 85% of its yield is collected from properties used for commercial purposes.

³ This assumption is in opposition to some earlier studies suggesting a higher level of tax competition among larger jurisdictions (see [Walasik 2014](#) in his purely theoretical discussion of local government policies, and [Kanbur and Keen 1993](#) in their model constructed for competition among national states), but they concentrated on classic tax competition for mobile capital. We argue that the logic for the ‘yardstick competition’ is different in this respect.

Summing up, we concentrate on water provision, since it is a service which:

- is commonly provided, available in all local governments,
- is vital for every household, so its political sensitivity is high,
- the financial burden for households is considerable (usually higher than for local taxes) and has been growing on average over recent decades,
- in spite of legal provisions providing a methodology for setting a tariff (see the next section), local governments have considerable discretion⁴ over decision making on the actual tariff level.

Institutional framework – Polish sub-national government system

The present system of subnational governments was formed by the two major decentralization reforms. First, in 1990 the Local Government Act introduced a democratically elected local government at the municipal (*gmina*) level. Second, the 1998 reform created the upper tiers of elected authorities. Because of these processes, there are currently three tiers of sub-national governments: almost 2,500 *gminy* (municipalities), 314 *powiats* (counties) plus 66 cities of county status (performing both tasks allocated to the municipal and county level of governments), and 16 *województwa* (regions). There is no hierarchical relationship between the three sub-national levels.

The municipal level is by far the strongest tier of sub-national governments in Poland. That relative strength is visible in functional and financial dimensions. Municipalities (including cities of county status) spend about three quarters of all sub-national budgets and are responsible for a broad set of functions including water and sewage systems. Municipalities – in contrast to counties and regions – also have a limited power of taxation, collecting over 20% of their budget from locally controlled taxes (the remaining parts of the budget come from shares in revenues from national taxes, as well as general purpose and earmarked grants). According to a recent comparative study of local autonomy index, Polish municipalities are among the most autonomous local governments in Europe, after Switzerland, Scandinavian countries and Germany (Ladner *et al.*, 2019). The mean population size of Polish municipalities is close to 15,500 (median about 7,500), but over 20% of jurisdictions have fewer than 5,000 residents, and the smallest has just 1,300.

Municipal autonomy in Poland also includes considerable discretion in decision-making concerning tariffs for major local public services, such as fares for local public transport, rents in communal housing, solid waste collection and water provision. Water supply services can be provided in Poland in various forms but the vast majority of providers (more than 90%) are either municipally owned companies or local budgetary units.

The setting of tariffs for water in Poland is quite complex. From a purely formal perspective, the impact of local government is minimal. The tariff is proposed by the unit that provides the service and is based on quite precise rules describing various elements of costs of the service provision, stipulated by the 2001 Law on Water Provision and the 2006 By-law on Tariffs for Water and Sewage Services⁵. The formula prescribed by the legal regulations imposes taking into account costs of the

⁴ Or at least they did until 2018, when a new law introduced a national regulator (*Wody Polskie*) who took over supervision and part of the decision making on the level of tariffs.

⁵ The basic element of the tariff (which is taken into account by our study) is set per cubic metre. In some municipalities, the tariff is different for various users (higher for businesses, for instance), but having in mind the purpose of the study, we concentrate entirely on tariffs for households.

current operation of the service, depreciation of assets, taxes and other duties to be paid by the service provider, debt repayment (capital and interest) as well as profit of the company providing water.

The role of the council is simply to check the calculation and approve (or reject) the tariff⁶. Moreover, in some cases, even rejection by the council may only delay the introduction of the tariff by a couple of months, after which it is enforced even without the consent of local government. At first glance, it looks like there is no space for politics in the whole process of tariff setting. However, practice often deviates from this formal picture. First and foremost, in many cases water in Poland is provided by different forms of in-house modes of service delivery where the role of the mayor in determining the price of water is very important. Second, even if the water provider is a company owned by the municipality, rules concerning the calculation of costs include elements which may be part of political negotiations (for example, company profit, property tax, and sometimes the depreciation of fixed assets). Third, if local government is a shareholder of the company (in practice it is frequently the only shareholder), the city mayor has significant power of informal influence over the behaviour of the company submitting the tariff proposal. This claim was confirmed by the results of our field research mentioned in the Introduction. Of our respondents, 53% did not agree with the statement: ‘the setting of the tariff for water is strictly regulated by the law, and decision-making has a purely technical nature, leaving no discretion for local government to influence the eventual level of the tariff.’

The tariffs for water provision to individual households vary widely across Polish municipalities. In 2018, the highest price for the provision of a cubic metre of water was 57.3 PLN (ca. 13 EUR), whereas the lowest price was 1.3 PLN (0.3 EUR)⁷. The coefficient of variation in tariffs for water is relatively high in Poland, amounting to about 40% (the standard deviation is about 1.5 PLN).

Studying tariff mimicking – empirical strategy

Data and methods

In our study, we want to test our tariff mimicking hypothesis in the case of tariffs for water provision to individual households. We argue that in Poland (as well as in other countries of CEE), the mimicking of tariffs for local public services may be more visible than for local taxes.

The databases used in the study have different scopes depending on the stage of analysis. The first step of the empirical test is based on the cross-sectional data relating to prices for water from the year 2016, collected for each municipality in three of the 16 regions of Poland: Opolskie, Podkarpackie and Podlaskie. Altogether, data was collected for 344 municipalities. The second stage of the analysis (quasi-experimental design) concentrates on a selected smaller group of 63 municipalities (located in the above-mentioned regions) and it is based on panel data relating to tariff changes during the period 2013–2017. The main sources of information were the websites of individual local governments (or the websites of water companies). The selection of regions is based on two criteria. First, we chose regions which are located in different parts of Poland (south-east, north-east and south-west), with different historical and cultural backgrounds, so our choice is not biased towards one particular environment. Second, we picked regions which are predominantly rural, since taking into account

⁶ In 2018 this function was taken over by the national regulator, Polish Waters (*Wody Polskie*), so the role of local government decreased substantially. However, the data we analyse in this article relate to the situation before 2018.

⁷ Data based on information from the national regulator (*Wody Polskie*).

the results of previous studies on local tax policies mimicking in Poland (Swianiewicz & Łukomska, 2016) we expected that the mimicking phenomenon would be more visible in small, rural municipalities. We concentrate on the tariffs imposed on individual households, which we expect to be more prone to following the logic of the political budget cycle than tariffs for businesses (Swianiewicz *et al.*, 2019).

Verifying our H2 we test tax mimicking among Polish local governments, focusing on the property tax rates on residential buildings. Previous research has shown that the mimicking phenomenon is most visible in relation to property taxes (Swianiewicz & Łukomska, 2016; Małkowska *et al.*, 2018), which is related to the higher share of property tax in local budget revenues compared to other local taxes. The choice of residential buildings instead of buildings used for business purposes can be justified by the fact that residents constitute a larger group of voters than entrepreneurs which is important in the context of competition for political capital. We use data from annual municipal council resolutions publicized on the official web pages of municipalities. We found it impossible to collect such information covering a longer period and for the wider group of local governments, which is why we decided to use cross-sectional data from only one year (2016), collected for each municipality in three above-mentioned Polish regions.

Methodologically, the issue of testing to what extent the rates in an analysed municipality are dependent on the level of rates in neighbouring local governments is complex. The level of tariffs depends on several other characteristics of the local environment, such as population size, the wealth of the local community, and also on physical characteristics of environment which determine cost of the service. In some cases, these other explanatory variables are related to features connected to the location of the local jurisdiction. In particular, this concerns the distance from major agglomerations. Factors affecting costs may be important for setting the water prices, e.g. differences in altitude above sea level. In municipalities with high values of altimetric variation, we can expect higher costs of water provision. Consequently, our tests include the following set of control variables: population size, affluence of the local budget, distance to the centre of large agglomeration and altimetric variation. Table 1 shows description and descriptive statistics for each variable.

A wide range of methods are used to study the phenomenon of tax mimicking. The frequently used methodology is to estimate reaction functions using the SL framework (Anselin, 1988). According to Baskaran (2014), the main methodological difficulty when estimating interactions among local governments in local taxation within the SL framework is that tax rates in other jurisdictions are by construction an endogenous variable. In this way, he claims that the application of the method which is the most popular in the literature on the identification of tax mimicking (traditional spatial lag regressions that rely on variation in neighbours' demographic and political characteristics) might be problematic. One of the problems with that method is that most tests do not include control variables which would allow to distinguish between actual mimicking and other factors explaining similarity of tax rates (or tariffs) among neighbouring jurisdictions.

Methodology for verification of H1

Considering that mainstream empirical tax mimicking literature relies primarily on the SL framework, we decided to investigate the relationship through the spatial lag regression model⁸. In the model,

⁸ The early version of this analysis (limited to OLS regression model, with no additional steps in empirical strategy which are explained further in the text) was presented at Geobalcanica Conference in Ohrid in 2018 (Swianiewicz & Łukomska, 2018).

Table 1. Description and descriptive statistics of the variables.

Variable	Description and source	Mean	SD	Min	Max	N
Tariff for water	Price per cubic metre of drinkable water for households (in PLN); own desk research	3.38	1.03	1.84	8.69	344
Property tax rates	Rates on residential buildings (in PLN per square metre) own desk research	0.62	0.14	0.01	0.77	344
Population size	Total population of the municipality at the end of the year; Main Statistical Office	12,452	21,742	1,567	296,628	344
Affluence of the local budget	Local budget revenues (excluding received special purpose grants) (in PLN per capita); Ministry of Finance	2,683.56	492.44	2,038.58	5,952.26	344
Distance to agglomeration	Distance to the nearest city with more than 300,000 inhabitants (in km); own calculations	152	55	40	303	344
Altimetric variation	Difference between maximum and minimum height above sea level (in metres). Own analysis of data from ASTER ^a and PCGCD ^b	208	122	40	902	344

^aAdvanced Spaceborne Thermal Emission and Reflection Radiometer.

^bThe Polish Centre for Geodetic and Cartographic Documentation.

correlation with neighbouring tariffs will be controlled by the distance from agglomerations, the affluence of local communities, population size and altimetric variation. The other variable which has typically been used to control the studied impact in earlier, similar studies is related to the party colour of the sub-national government (for example, [Delgado *et al.*, 2018](#); [Ndiaye, 2018](#)). However, in the Polish context this factor is almost irrelevant due to the extremely limited importance of party politics in local government. Well over half of Polish mayors (and even more in the small municipal jurisdictions which are the focus of this study) are independent ([Gendźwiłł & Żółtak, 2014](#); [Egner *et al.*, 2018](#)).

The model estimated is as follows:

$$\tau_{i,t} = \delta \sum w_{i,j} \tau_{j,t} + \beta x_{i,t} + \varepsilon_{i,t} \quad (1)$$

where $\sum w_{i,j} \tau_{j,t}$ is the weighted average of the neighbours' tax rates and $w_{i,j}$ is the weight of municipality j 's tax rate in the weighted average. A significant coefficient estimate for δ is interpreted as evidence for strategic interactions. We use distance-based weights. All municipalities j receive weights according to the distance of their centroids to the centroid of municipality i : if the centroid of a municipality j is within 20 km of the centroid of municipality i , municipality j receives a weight based on its actual distance; if the centroid is beyond 20 km, municipality j receives a weight of zero in the weighted average for municipality i .

To cope with the problem of skewness of distributions, the dependent and the explanatory variables were transformed into natural logarithms in tested model related to Equation (1).

However, we consider that regression analysis does not give us reliable results, since we are not able to include in the model all potentially significant intervening variables, nor take into account their collinearities with the main explanatory factor, which is geographical proximity ('neighbour effect'). We suggest a somewhat different approach. Adapting the argument developed by [Jordahl & Liang \(2010\)](#), who studied the

common pool effect in local government amalgamations, if we know all the variables which are important for the values of our dependent variable, we can simply include all relevant variables as covariates of the regression model. It is likely, however, that unobservable variables will influence the similarity of tariffs among neighbouring municipalities. Following the solution applied by Jordahl and Liang, and similarly to the earlier efforts of Baskaran (2014), in response to these weaknesses, in the second step we apply a quasi-experimental design, which is considered a more advanced tool to test causal relationships.

Our empirical strategy builds also upon empirical arguments of Baskaran (2014) who argues that quasi-experimental design might be a more certain method to determine the extent to which local governments react to signals from their neighbours (see also Lyytikäinen, 2012; Isen, 2014). Baskaran (2014) used the two most popular methods simultaneously: the spatial lag technique and *difference-in-differences* (DiD) design. Using the former, he finds an effect comparable to previous studies: evidence of tax competition between sub-national jurisdictions in Germany. However, using the DiD method, he finds no significant effect. Therefore, he argues that spatial lag models with instruments that are traditionally used in the tax mimicking literature overestimate the significance of local tax mimicking. Instead, he suggests developing a quasi-experimental approach which would allow the identification of the tax mimicking phenomenon with a much greater degree of certainty and allow reliance on credibly exogenous variation in the tax rates of other jurisdictions which is necessary to identify interactions between local governments.

The construction of our experiment allows the observation of the impact of an independent variable (geographical proximity) on a dependent variable (rates of tariffs for water), which can be extracted from the impact of other intervening variables. The design consists of the following steps:

1. A group of 7 municipalities was identified in which there was the largest change in tariffs for water between 2014 and 2015. The selection of the year 2014 is related to the political cycle. 2014 was the year of local elections, and as we know from other studies (see Swianiewicz *et al.*, 2019), the likelihood of an increase in the tariff is highest in the year after an election (between 2014 and 2015 in our case). The selection of this year gives us access to information on at least a short trend (2013–2014) before the ‘reform’ (change of the tariff) and the trend after the reform (2015–2017).
2. In identifying our case studies, we concentrate on small, rural municipalities. Policies of large and mid-size cities are also influenced by comparisons with other local governments, but in this case, they usually compare themselves not with immediate neighbours but with similar (in terms of size and function) cities in the same region or even nation-wide. This claim was confirmed by the results of the survey described above in the Introduction. Comparing with neighbouring municipalities was found to be an important or very important factor which had an impact on the setting of tariffs for water in 69% of rural local governments, but only in 22% of urban municipalities. Under such circumstances, the study of larger cities would require the difficult identification of the group with which these cities compare themselves. This identification would need to be performed for each city separately. Moreover, the reference group often changes over time, which would make our analysis of the role of mimicking even more complicated. Instead, we concentrate on smaller municipalities, for which the reference group is usually concentrated in the immediate neighbouring local governments. In this way, we investigate the phenomenon of mimicking, which has a clear geographical pattern of comparing with (and often following the behaviour of) the immediate neighbours.
3. For each of the selected 7 municipalities, we identify two groups of local governments:
 - a. the **first group**, called the ‘treatment group’, consists of local governments which are immediate neighbours of (sharing a border with) our selected municipality⁹. The N of the treatment group is 31,

⁹ The logic of the test might be distorted if some of the neighbouring municipalities are served by the same provider of water. Therefore we have thoroughly checked all selected cases and we have not found a situation in which the same unit provides

- b. the **second group** (called the ‘control group’¹⁰) consists of local governments which are NOT neighbours of our selected municipality, but which are located in the same region and which are the most similar to our ‘treatment group’. The identification of the untreated group is performed using the *synthetic control* method¹¹ (Abadie *et al.*, 2015) and the criteria of similarity include: population size, affluence (measured by budget tax revenues per capita), altimetric variation (an important factor which has an impact on the costs of water provision) and the level of tariff for water at the beginning of the research period. For each treated municipality, the method creates one ‘synthetic control’ unit, which is an abstract construct composed of a weighted average of all potential comparison units that best resemble the characteristics of the treated unit before the reform. Eventually, in our analysis of the ‘untreated’, we take into account (for each ‘treated unit’) the three concrete municipalities that have the highest weightings in the construction of the ‘synthetic control’. This selection was further verified via the robustness test¹².

In analysing the small group of non-randomly selected municipalities (which increased the tariffs), we attempt to follow the quasi-experimental logic and create a carefully selected untreated group. The untreated group should resemble the group of treated municipalities – for that reason, we match each treated municipality with the three municipalities that were most similar in the pre-treatment period (before 2014). The donor (selection) pool for each treated municipality in Opolskie region is 88 municipalities; in Podkarpackie region, it is 163 municipalities, and in Podlaskie region, 123.

We determine the similarity using the variables described in item 3b above. The results of the matching procedure are reported in Table 2, which presents the main descriptive statistics of the variables describing the treated and untreated group. Finally, the control group consists of 32 municipalities (10 in Opolskie, 12 in Podkarpackie and 10 in Podlaskie regions), as many of the municipalities were selected to serve as a control unit for more than one treated municipality. Table 2 demonstrates the similarity of the two groups in the pre-treatment period.

4. In the next step, we compare trends of changes in tariffs for water provision in the treated and the control group using the DiD approach.

The idea is to compare developments in tariffs for water in the group of municipalities that had the strongest exposure to the tariff increases in the selected 7 municipalities – the neighbouring municipalities (treated group) – with developments in similar municipalities that were exposed to a lesser extent – the municipalities which are not located in the neighbourhood of the selected 7 municipalities (untreated group). If there are spatial interactions resulting from geographical neighbourhood, tariffs for water in the treated municipalities should diverge, over time, from those in the untreated municipalities.

water to several municipalities being under scrutiny. As in the case of the party colour of local governments, which we mentioned earlier in this section, organizational-legal form of service provision should not be important in the context of the impact on water prices. Other unobserved structural characteristics that might affect water tariffs are cost factors that are established by law such as profit or debt repayment. Unfortunately, due to the fact that in most Polish local governments, water is supplied by municipal companies that do not make their financial data available to the public free of charge, access to this information is limited.

¹⁰ Baskaran (2014) uses the terms ‘treated’ and ‘untreated’ instead of terms of ‘treatment’ and ‘control’ groups. In this article, we use these terms interchangeably.

¹¹ We use this method only to determine the control group, our main method at this stage of the analysis is DiD.

¹² The robustness test included an identical procedure of tracing tariff mimicking, but with a different size of the untreated group (4 instead of 3 ‘most similar’ municipalities for each of the local governments in the treated group). Due to a lack of space, we do not provide the full results of the robustness tests, but in general the test yielded almost identical results, confirming the correctness of the main conclusions.

Table 2. Comparison of the ‘treated’ and the ‘untreated’ group of municipalities.

	Average values in the pre-treatment period (2013, 2014)	
	Treated	Untreated
Population (2013)	10,703	6,672
Affluence of the local budget (2013, in PLN per capita)	2,495	2,707
Altimetric variation (2013, in metres)	220	211
Tariff per cubic metre of drinkable water for households (2013, in PLN)	3.13	3.21
Tariff per cubic metre of drinkable water for households (2014, in PLN)	3.20	3.26
N	31	32

This dataset allows us to conduct the empirical analysis with using DiD strategy, which under counterfactual assumptions of quasi-experimental design allows the estimation of the treatment effects in non-experimental conditions.

We used DiD method to check the extent to which the change in tariffs in subsequent years differed between the treated and the untreated group. This estimation used a **standard fixed effects regression model**:

$$Y_{ij} = \eta_i + \delta_j + \alpha T_i + \varepsilon_{ij} \quad (2)$$

where

Y_{ij} is the value of the tariff for water provision for the i -th municipality in year j ,

η_i is the municipality fixed effect to control for any time-invariant characteristics,

δ_j is the period fixed time effect, α is the treatment effect (the interaction between the indicator of being in the treated group and the dummy indicator of time T), and

ε_{ij} is an error term.

Standard errors are clustered at the level of the municipality and they are robust to heteroscedasticity. In order to positively verify our H1 (the ‘neighbour effect’), we expect to find that:

- The change in the tariff is often followed by a similar change in neighbouring local governments (treated group);
- This change in the treated group is significantly different from the trend in the untreated group (without meeting this criterion, we might confuse a change in the treated group resulting from mimicking with a more general trend of changes in tariffs, observable in the whole population of the local government, which results from other factors, such as cost increases, and so on).

Methodology for verification of H2

OLS regression method has previously been applied to the study of tax mimicking in Poland (Swianiewicz & Łukomska, 2016), therefore we decided to use the results of that earlier study to estimate whether the phenomenon of mimicking is indeed stronger in the case of setting tariffs for public services than in the case of local tax policies. However, the study from 2016 was conducted for different regions, so we cannot be sure that the results are fully comparable.

This part of the analysis is performed using spatial lag regression, which – due to limited data availability is computed for 2016 year only. To make the results of analysis of tax mimicking and fee mimicking fully

comparable, we perform the test for tax mimicking on the same group of municipalities as in the case of fee mimicking. Testing tax mimicking using the same quasi-experimental design, which we use for tariff mimicking would be a more certain method, however it would require collection of additional data which goes beyond our capacity at the moment, taking into account that the main focus of our study is the system of tariffs for water, and data on tax mimicking are analysed as comparative background only.

Results

Regression model – the first step in the identification of water tariff mimicking

As mentioned earlier in this article, the results of the survey with the mayors and heads of municipal water companies at least partially confirm our H1. The question remains of the extent to which these subjective declarations are confirmed by actual data on adopted tariffs. The first general answer is provided by the correlation between the tariff in a given municipality and the level of tariffs among their neighbours. The normalised Moran's I coefficient is 7.08 and it is statistically significant at 0.001 level. This suggests that tariff mimicking is occurring.

However, as discussed in the methodological section of the paper, a similarity to tariffs in a neighbouring municipality could potentially be unrelated to tariff mimicking, perhaps originating from the similarity of the social, economic and biophysical environment. If the similarity of tariffs in neighbouring municipalities is caused more by the similar conditions than purely by the 'neighbouring factor', then the variation can be explained better by factors such as the affluence of the local community or the distance from large urban agglomerations. However, if the impact of the neighbourhood remains significant after including the other controlling variables in the model, this could mean that tariff mimicking plays a role in explaining the variation of policies concerning the local tariffs for services. Therefore, we have added control variables to our model, which should help us to avoid biased conclusions. The results of the estimating Equation (1) of spatial lag regression is presented in [Table 3](#). The spatial autoregressive coefficients (ρ) are positive and highly significant ($p < 0.01$) which indicates the spatial dependence in the water price among neighbouring municipalities. According to the results, a PLN 1.00 increase in the average water price by a municipality's geographic neighbours generates a PLN 0.46 increase in that municipality's price for water provision. Among covariates, the most statistically significant are those related to cost factors: population and altimetric variation.

Results of the quasi-experimental design – the second step in the identification of water tariff mimicking

As described in the methodological section, an additional test is arranged through quasi-experimental design in which we investigate the reaction of neighbouring municipalities (compared with the control group) to a sudden increase in the tariff in the given local government.

As demonstrated in [Table 4](#), our first results confirm the phenomenon of tariff mimicking in the case of water provision in small, rural local governments which often follow the policies of their neighbours. In the case of the increase of the tariff in one municipality, the policy is often followed in subsequent years (or even in the same year) by its neighbours, and the effect clearly differs from the behaviour of more distant, similar local governments. The fact that the effect is often observed in the same year may suggest that this is not always a case of an ex-post reaction to a change in a neighbouring community,

Table 3. Results of spatial lag regression analysis on interactions among Polish local governments in three regions for water provision tariffs.

Dependent variable	Ln Tariffs for water provision (households)
Spatial effect Rho	0.465*** (0.057)
Ln Affluence of local community	−0.030 (0.021)
Ln Population size	0.213*** (0.040)
Ln Distance to agglomeration	0.049 (0.043)
Ln Altimetric variation	0.286*** (0.076)
Constant	−0.555*** (0.107)
Log likelihood	115.61
Number of observations	344

Note: Regression coefficients are quoted, standard errors are in parentheses. Cross-sectional estimates using data from 2016. All variables have been logged. Weights for all surrounding municipalities according to distance from municipality *i*'s centroid (municipalities with a distance of more than 20 km receive a weight of 0). Significance level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

but that neighbouring local governments consult and agree on the same (or similar) change of the tariff before the decision is made. This may be done in order to minimize a negative popular reaction to the increase and to strengthen the ‘objective character’ of the change which is a result of independent cost factors (which is why it has to be implemented at more or less the same time in other municipalities with which voters may compare). The potential existence of such ‘collusion’ does not contradict the mimicking hypothesis, since it would still be a form of shaping tariff policy under the influence of the behaviour of neighbouring local governments. As the DiD results of estimating Equation (3) in Table 4¹³ suggest, the difference between the treated and untreated group becomes statistically significant during the following two years, although the impact is much stronger in the first year following the change in our municipality. This means that the process of ‘monopolistic collusion’ is relatively rare.

However, as shown both graphically in Figure 1, and in Table 4, the effect is not long-lasting. The estimates provided in Table 4 suggest that relative to the municipalities from the untreated group, the predicted change in the water price is 0.13 PLN greater in the treated municipalities between 2014 and 2016. Two years after the change of the tariff, the difference between the treated and untreated group clearly weakens although it remains statistically significant (at 0.10 confidence level). In other words: if neighbouring municipalities follow the change introduced in the studied local government, they usually do it almost at once, over the next year. In the following year, the difference between the treated and untreated group decreases, perhaps due to other factors influencing the modification of the tariff, or the proliferation of the change to more distant areas (‘second wave of mimicking’).

Regression model – comparing property tax versus water tariff mimicking

In order to compare the relevance of inter-jurisdictional interactions to tax rate policies and policies related to tariffs for water provision we use spatial lag regression. The significance of the identified tariff

¹³ In Table 4 we show estimations conducted for three separate spans of the post-reform period (2014–2015, 2014–2016, 2014–2017). The table only reports the estimated values of the coefficient of interest, i.e. parameter of the treatment effect – αT from the equation (2).

Table 4. Results of difference-in-differences analysis ($N = 126$, significance of the models: 0000).

		Parameter of the treatment effect	Robust standard error	Z	Significance (p)	95% confidence intervals	
Year of the 'reform'	2014–2015	0.0598	0.0406	1.4728	0.1408	–0.0198	0.1394
One year after the 'reform'	2014–2016	0.1311	0.0448	2.9235	0.0035	0.0432	0.2189
Two years after the 'reform'	2014–2017	0.1109	0.0582	1.9063	0.0566	–0.0031	0.2250

Note: All estimations include year and municipality fixed effects. Standard errors are clustered at the level of the municipality and they are robust to heteroscedasticity.

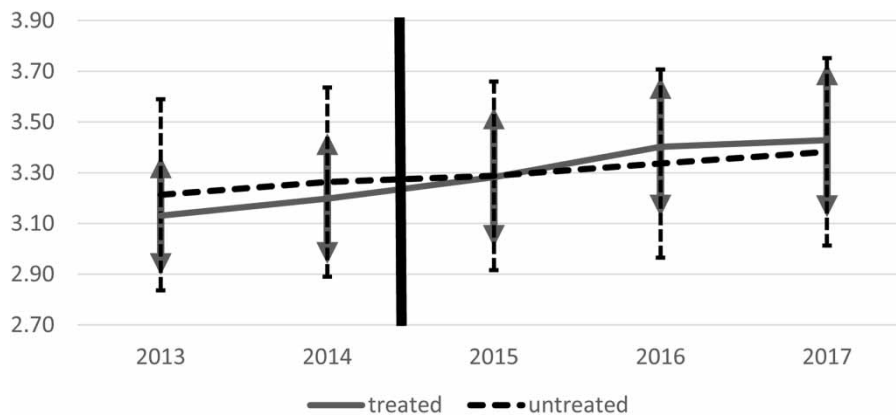


Fig. 1. Mean price for water provision in 'treated' and 'untreated' groups (2013–2017, in PLN for 1 cubic meter, $N = 63$). Note: The year of the 'reform' is marked with black vertical line. The figure shows 90% confidence intervals (for treated group ended with arrows).

mimicking, is indistinctly stronger than in the case of the tax mimicking: spatial autoregressive coefficients (ρ) are positive and highly significant ($p < .01$) in both tested models¹⁴ but the amount of spatial effects is slightly lower in case of tax mimicking stands at about PLN 0.42 (Table 5). In the light of the obtained results we can confirm that in the case of water provision in Poland, the effect of 'tariff mimicking' is probably slightly stronger than 'local tax mimicking' (or 'yardstick' local tax competition).

Conclusions

Our study is part of the literature on searching for mimicking patterns among local governments that has been increasingly presented in recent decades. In contrast to most of the earlier empirical studies, we focus our attention on tariffs for local public services (water provision) rather than on local tax policies. We concentrate on small, rural, local governments where the immediate geographical neighbours are the

¹⁴ In addition, we also counted the I Moran's statistics. For both dependent variables, they are statistically significant at a similar level ($p = 0.000$). Their values are also almost identical.

Table 5. Results of spatial lag regression analysis comparing interactions among Polish local governments in three regions for property tax rates and water provision tariffs (2016).

Dependent variable	Ln Tariffs for water provision (households)	Ln Property tax rates on residential buildings
Spatial effect Rho	0.465*** (0.057)	0.423*** (0.057)
Ln Affluence of local community	−0.030 (0.021)	−0.145 (0.122)
Ln Population size	0.213*** (0.040)	0.656*** (0.228)
Ln Distance to agglomeration	0.049 (0.043)	−0.044 (0.226)
Altimetric variation	0.286*** (0.076)	
Constant	−0.555*** (0.107)	−1.948*** (0.340)
Log likelihood	115.61	−479.52
Number of observations	344	344

Note: Regression coefficients are quoted, standard errors are in parentheses. Cross-sectional estimates using data from 2016. All variables have been logged. Weights for all surrounding municipalities according to distance from municipality *i*'s centroid (municipalities with a distance of more than 20 km receive a weight of 0). Significance level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

most obvious points of reference for voters and politicians comparing tariffs in their municipality with those applied by other local governments. The empirical test was conducted for water services in three Polish regions.

Similar to Baskaran's (2014) study in Germany, we apply two different statistical methods for testing our H1: a spatial lag regression model and a quasi-experimental design using the DiD and synthetic control (only on the stage of the control group identification) methods. Also similar to Baskaran, we find stronger evidence of the phenomenon in the regression model. However, contrary to the study conducted in Germany, the effect of mimicking remains significant in the DiD analysis, even if its significance clearly falls in comparison with the results obtained through the first method. A change in tariff in a given municipality is often followed by a change in the immediate neighbouring municipality, and their reaction clearly deviates from the control group based on non-adjacent municipalities (confirmation of our H1). The resulting (mimicking) effect is usually visible in the year following the change in the tariff in the local government in question, although there are also cases when it happens in the same year (which raises the question of a priori 'collusion' of neighbouring local governments on the regulation of tariffs). The mimicking effect remains statistically significant for one year only, perhaps due to further geographical proliferation of the tariff increase, or other factors beyond the control of our model. In summary, our study confirms the existence of the (statistically significant) geographical interactions of tariff policies of local governments in the form of tariff mimicking, although the effect does not seem to be very strong.

In our study, we argue that in Poland (and perhaps also in other countries of CEE) the mimicking effect might be more visible in policies concerning tariffs than in the case of local taxes. The results of our regression models confirm our second hypothesis that 'mimicking interactions' are stronger in the case of tariffs for water provision than for local tax policies. We suggest that this pattern, which differs from patterns previously identified in some other countries, is related to the limited tax autonomy of local governments and the low importance of local tax burdens for households in Poland. However, the difference in the strength of mimicking in both analysed cases is not very strong. It may be explained perhaps by the relatively technocratic process of water tariff setting in Poland, where political considerations play only a limited role. We may expect the difference would be higher in the case of tariffs for

some of the other services, such as local public transport or waste collection, but confirmation of that expectation would require a separate study.

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Data availability statement

All relevant data are included in the paper or its Supplementary Information.

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