

# Infrastructure Expenditures versus Local Budget Resistance of Communes under the Risk of Urban Sprawl

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## Abstract

*The subject of the study is to identify the impact on communes budgets in Poland of one of the major costs of urban sprawl (i.e., excessive expenditure on infrastructure). The study takes two objectives: first, whether excessive infrastructure costs in Polish communes are common; second, what the mechanism is determining an excessive budgetary burden on communes through infrastructure expenditures. The objectives were made using taxonomic methods in relation to the 222 communes in Poland 2007–2014. Among the most important conclusions from the study is the fact, that excessive infrastructure expenditures are observed in Poland, but they are not a common phenomenon. The mechanism of an excessive budgetary burden of these expenses is determined by the weakness of the financial policy of the communes in terms of their own revenue and low level of economic development.*

**Keywords:** urban sprawl, infrastructure, communes' budgets expenditures, excessive budgetary burden

**JEL:** H720, R510, R580

## Introduction

The phenomenon of urban sprawl, which is defined as chaotic and scattered spillage of buildings within areas of the communes surrounding the city, is considered negative due to the costs which it may generate. This conviction about the phenomenon stems from studies conducted mainly outside Polish borders. The phenomenon is also perceived in Polish government documents, which underline the lack of widely conducted research on sprawl consequences. Both in foreign and Polish publications, the most frequently invoked costs of urban sprawl are excessive budgetary expenditures incurred by local units due to infrastructure expenditure. These costs derive mostly from expenditures on roads and water and sewerage networks.

Taking into account the need to develop research on the consequences of urban sprawl but also to verify the Polish conditions of foreign conclusions, the subject of the study is to recognize the impact of infrastructure expenditures on budgets of communes threatened by the phenomenon of urban sprawl. The article hypothesis is therefore that in the Polish communes that are under the risk of urban sprawl, infrastructure expenditures cause an excessive burden on the budget. Thus, the article adopted two goals. First, is to recognize among the Polish communes affected by urban sprawl a common phenomenon; is the excessive budgetary burden due to infrastructure expenditures? The second goal is the recognition of the mechanism which is decisive about the excessive budgetary burden due to infrastructure expenditures. At the same time, it was assumed that an excessive budgetary burden is such a one that substantially determines the budget structure and the financial consequences of the commune. The realization of the set of objectives and assumptions was made using quantitative methods in relation to the rural and rural-urban communes included in the Functional Urban Areas in Poland.

## 1 Current State of Knowledge

The mechanism determining infrastructure investments in Polish communes is both economic and political. On the one hand, in the literature the relationship between infrastructure and socio-economic development has been sufficiently proven (Ahlfeldt and Wendland 2011; Gibbons et al. 2012, 33–35; Kłos 2012; Stawasz 2005, 9; Venables 2007) for relationships of both static (infrastructure state vs. economic development level) and dynamic natures (infrastructure investments vs. dynamics of economic development). Common knowledge about the correlation between infrastructure and economic development can therefore justify making investments in infrastructure. However, in the theory of economic growth, there is still the issue of explaining the interdependence between infrastructure and the economy (Kudłacz 2015, 21). The discussion concerns the strength and causality of this relationship, ie: infrastructure determines the economic development or economic development determines the status and improvement of infrastructural development? On the other hand, the fact that the development of infrastructure is associated with socio-economic development often becomes an instrument of political games. As indicated by Kudłacz (2015, 30), a local authority, as an entity that is responsible for infrastructure, is under public pressure to improve its existing state. Social pressure stems from a desire to meet the needs of local communities and this common knowledge about the correlation of infrastructure and economic development. The local authority is therefore aware that the achievements in this area can be used to measure its performance. Positive achievements are an argument for re-electing the current local government; lack of accomplishments is an argument for the opposition to change the local government. Thus concluding, the efforts of local authorities towards the dynamics of economic development and maintaining themselves in power results in wide infrastructure investments. At the same time, an important feature of investment in infrastructure is capital intensity, which results in financial burdens of the commune budgets. These burdens are beyond communes' capabilities (Klimczuk 2010, 74). The budgetary burden's significant negative consequence comes not only from the excessive budgetary expenditures but also from the so-called "crowding out effect." This effect refers to a significant reduction of financing tasks that are not infrastructural, which are important for social and economic development (Ratajczak 2000, 89).

As indicated above, the mechanism of making infrastructure investments is well perceived in areas affected by suburbanization — both in Poland and abroad. Frequently, in fact, the domestic and foreign literature attributed the cost of suburbanization with an excessive burden of communes' budgets due to expenditure on infrastructure like roads, sewerage, and telecommunication. American experience shows that the existing and originally sufficient infrastructure may be inefficient due to the increase in the number of inhabitants. The progress of the process of suburbanization may increase the costs of operation and maintenance of infrastructure: roads, water and sewage networks. These costs may be higher in the suburbs than in areas with high density of homes — mainly because of the greater distance between buildings and their smaller cubic volume. At the same time in the suburbs with an increase in population, it can be expected that the growing political pressure on local authorities in the area of infrastructure development is noted (Bhatta 2010; Brueckner 2000; Burchell et al. 2002; Heimlich and Anderson 2001).<sup>1</sup> However, in relation to the Polish conditions, one case seen in the *Koncepcja Przestrzennego Zagospodarowania Kraju 2030*, which is a national spatial development strategy, indicates that in Poland there are no accounts of suburbanization, and the potential negative effects are adapted from the American experience. On this basis, the document formulated a request for excessive financial burdens for the communes' budgets. As a majority of foreign authors and partial Polish research noted in this document found, it is estimated that the external costs associated with sprawl of cities in Poland are 30% higher than the costs of urban sprawl in Western Europe. In the Polish case, this may lead to a rise in the deficit and the collapse of public finance and the communes' financial system

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1. See also: Understanding Smart Growth Savings. What We Know about Public Infrastructure and Service Cost Savings, and How They are Misrepresented By Critics. Report by Todd Alexander Litman, Victoria Transport Policy Institute, 3 December 2004, [@:] <http://citeseerx.ist.psu.edu/viewdoc/download;jsessionid=E983CCCE7BC3AA D9CDF7E152ABDF5E77?doi=10.1.1.124.3119&rep=rep1&type=pdf>.

will not be able to finance the quantitative requirements for infrastructure (*Koncepcja przestrzennej...* 2012, 161–162). Excessive costs of infrastructure and their negative impact on the financial condition of communes in Poland (affected by urban sprawl) are also among the leading conclusions of such studies as: *Raport o ekonomicznych stratach i społecznych kosztach niekontrolowanej urbanizacji w Polsce* (year 2015), *Przestrzeń Życia Polaków* (year 2015), *Informacji Ministerstwa Infrastruktury i Budownictwa na posiedzenie Komisji Samorządu Terytorialnego i Polityki Regionalnej* (year 2016).

## 2 Methodology

The study assumed that communes of the Functional Urban Areas (FUA) are affected by the processes of chaotic urbanization. Although this analysis does not include the direct study of the morphology of the spatial structure, it is carried out in relation to the FUA delimited for the purposes of the government document NSDC 2030. This delimitation includes selected morphological indicators (population density in areas excluding forests and bodies of water, dwellings commissioned for use), and functional aspects (registered residence, commutes to employment in the FUA core). For the analysis in the article it is therefore rural and urban-rural communes taken from Delimitation of the Functional Urban Areas Around Poland's Voivodship Capital Cities, delimited by Śleszyński (2013) for the purpose of NSDC 2030. The analysis omitted cities in this delimitation. Therefore, the study includes 222 territorial units, including 148 rural and 74 urban-rural communes (fig. 1). The analysis of selected communes of the FUA will be conducted on the basis of budget indicators relating to revenues and expenditures for the years 2007–2014. The necessary data was obtained from the Local Data Bank CSO. Selected analysis indicators of revenues and expenditures attempt to assess the excessive financial burden for communes' budgets due to infrastructure expenditures. In this light, indicators of analysis (features) are described in table 1.

Each municipality is represented by a set of these five characteristics, which was calculated as the arithmetic average of the period 2007–2014. In this manner, a set of diagnostic variables was made. Diagnostic variables have been analyzed by the correlation analysis—none of the variables did not show a high correlation. Further analysis was carried out using the Hellwig development

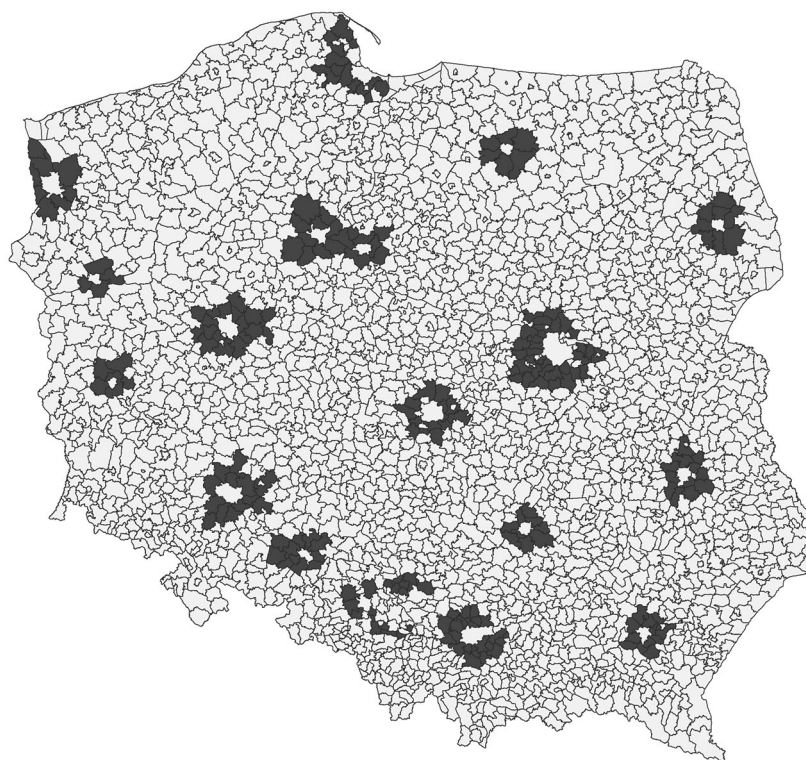


Fig. 1. Study area

**Tab. 1.** The set of diagnostic variables in the study on the communes' budget burden due to infrastructure expenditure

Diagnostic variable	Description
The share of capital expenditure on infrastructure in the total expenditure	Capital expenditure on infrastructure include: (1) public roads: communes', county's and national's; (2) cleaning of villages; (3) the maintenance of the green areas; (4) lighting of streets, squares and roads; (5) the protection of air; (6) the sewage system and water protection; (7) waste management. Capital expenditures are investments and other development activities—e.g. the establishment by the commune authorities of the company that builds and manages and a certain type of infrastructure.
The weight of income tax by infrastructure expenditures	This variable presents the ability of communes to be financed from own taxes, expenses related to the construction and maintenance of infrastructure. The variable shows what part levied by the commune's taxes are able to finance the development and maintenance of the infrastructure. The taxes included the following: agriculture, real estate, on means of transport, corporate income taxes (CIT) and personal income taxes (PIT).
The share of income tax in own revenues	This variable exposes the core of revenues of communes (i.e., taxes). Increasing the number of residents of the community in general will lead to increasing the own revenues, but only the indicator of own revenues may be characterized by external interference. The Bill on Revenues of Local Government Units indexes other components of own revenues, including income from penalties and fines defined in separate regulations - especially transportation ticketing. Thus, income tax in the analysis are the collection of the taxes which are strongly correlated with the number of residents and businesses in the communes.
The share of own revenues in total revenues	Own revenues represent a set of local taxes, fees and capital revenues. In the context of suburbanisation processes—i.e., mainly migration, own revenues may increase especially by: (1) increased income tax (e.g., PIT, CIT, the means of transport, real estate), but also (2) income from fees (stamps, fairs, local, operational, from the ownership of dogs); (3) revenues generated by municipal budgetary units due to the increased number of customers; (4) revenue from assets of the communes, fines and penalties.
The weight of own revenues by debt service	Investing activities related to securing the conditions for the functioning of the entities in the communes requires incurring liabilities. Indicator reflects that the commune is able to earn for liabilities, which it drew.

pattern method (i.e., from taxonomic methods) (Hellwig 1968). This method has the aim to calculate, for each commune, one synthetic indicator determining a budget burden by a set of diagnostic variables. The method gives an answer to the question of how the commune budget is developed for resistance to excessive infrastructure expenditures. In practice, the method consisted in determining the aggregate measure calculated as a synthetic indicator of the taxonomic distance of the commune from a theoretical development pattern. The development pattern method helped organize a collection of communes, each of which has been described by a collection of the five diagnostic variables, those of a stimulant or destimulant. The algorithm also included the standardization of diagnostic variables through their standardization, taking into account the arithmetic average and standard deviation. It therefore set a matrix of standardized characteristics, which then determined the pattern of development and synthetic indicators for each of the communes. The development pattern is a hypothetical commune with the best observed values of variables; while the synthetic measure is the distance from the commune pattern. The more the variables are similar to the pattern; the level of development budget is higher, and the more remote—the level of development is lower. The next step in the analysis was the classification of communes by level, which has been developed using synthetic measures and their arithmetic average and standard deviation. On this basis, three groups of communes have been set each with a certain level of budget development at an angle of resistance to excessive infrastructure revenues (tab. 2).

**Tab. 2.** Distance measures from pattern

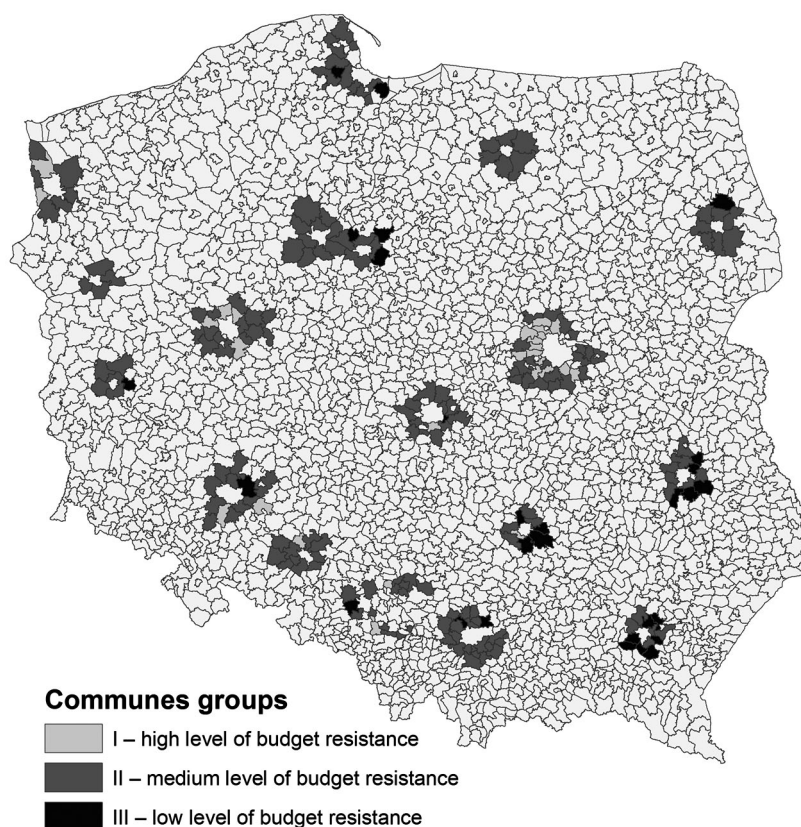
Communes group	Distance from pattern	Value of $d_i$
I—high level of budget resistance	$d_i > \bar{d}_i + s_{di}$	(0,32; 1)
II—medium level of budget resistance	$\bar{d}_i - s_{di} < d_i \leq \bar{d}_i + s_{di}$	(0,16; 0,32)
III—low level of budget resistance	$d_i \leq \bar{d}_i - s_{di}$	(0,00; 0,16)

$d_i$ —synthetic measure value;  $\bar{d}_i$ —arithmetic average of  $d_i$ ;  $s_{di}$ —standard deviation of  $d_i$ .

Note: [In the journal European practice of number notation is followed—for example, 36 333,33 (European style) = 36 333.33 (Canadian style) = 36,333.33 (US and British style).—Ed.]

### 3 Results and Discussion

Figure 2 shows the calculated synthetic measures divided in three groups of communes with budgets of a certain resistance to excessive infrastructure expenditures. Communes with the best situation in terms of budgetary burden arising from infrastructure spending are located in areas of Warszawa, and further: Poznań, Katowice. It should be added that the FUA: Warszawa, Poznań and Katowice are among the most developed in terms of socio-economic development in Poland (Brańka 2016). But the group of communes with underdeveloped budgets are from areas of Rzeszów, Lublin, Kielce and Toruń, which according to Brańka are among the lowest economically and socially developed in Poland. Another observation is that the number of communes in groups I and II is the same (each 12,6% of all analyzed communes). In light of the calculations, it cannot therefore be indicated that infrastructure expenditures generally cause an excessive burden on the budgets of communes. Yes, infrastructure expenditure can charge excessively local budgets but for communes underdeveloped socially and economically. Given the evidence the level of socio-economic development can still be assumed that the commune's budget will not be strong enough to meet the infrastructural expenditures. In this light, further analysis will refer to the recognition of the mechanism decisive about the excessive budgetary burden due to infrastructure expenditures.

**Fig. 2.** Synthetic measure

**Tab. 3.** Values of the budget indicators in selected communes of FUA

Voivodship Capital Citi (FUA core)	Commune	Type	The share of capital expenditure on infrastruc- ture in total expenditure	The weight of inco- me tax by infrastruc- ture expenditures	The share of inco- income tax in own revenues	The share of own revenues in total revenues	The weight of own revenues by debt service
Group I – high level							
Katowice	Ornotowice	R	0,11	0,36	0,69	0,74	0,00
Katowice	Orzesze	R	0,06	0,31	0,82	0,65	0,01
Katowice	Świerklaniec	R	0,02	0,33	0,83	0,62	0,01
Kielce	Sitkówka-Nowiny	R	0,08	0,25	0,77	0,71	0,01
Łódź	Rzgów	UR	0,14	0,53	0,67	0,75	0,00
Opole	Dobrzeń Wielki	R	0,16	0,52	0,82	0,72	0,01
Poznań	Czerwonak	R	0,09	0,43	0,67	0,74	0,01
Poznań	Kórnik	UR	0,10	0,60	0,61	0,77	0,02
Poznań	Suchy Las	R	0,12	0,43	0,67	0,84	0,02
Poznań	Tarnowo Podgórne	R	0,16	0,57	0,66	0,81	0,01
Szczecin	Końbaskowo	R	0,09	0,42	0,38	1,06	0,00
Szczecin	Police	UR	0,08	0,45	0,67	0,70	0,01
Warszawa	Błonie	UR	0,14	0,34	0,87	0,71	0,01
Warszawa	Czosiów	R	0,09	0,33	0,77	0,66	0,02
Warszawa	Izabelin	R	0,14	0,42	0,84	0,76	0,01
Warszawa	Jabłonna	R	0,10	0,43	0,78	0,71	0,01
Warszawa	Karczew	UR	0,06	0,28	0,80	0,68	0,02
Warszawa	Konstancin-Jeziorna	UR	0,16	0,41	0,81	0,84	0,01
Warszawa	Lesznowola	R	0,09	0,34	0,74	0,78	0,02
Warszawa	Łomianki	UR	0,16	0,51	0,85	0,81	0,02
Warszawa	Michałowice	R	0,16	0,41	0,78	0,78	0,02
Warszawa	Nadarzyn	R	0,15	0,34	0,81	0,80	0,03
Warszawa	Nieporęt	R	0,11	0,36	0,80	0,71	0,01
Warszawa	Ożarów Mazowiecki	UR	0,17	0,59	0,75	0,82	0,02
Warszawa	Stare Babice	R	0,10	0,48	0,68	0,80	0,02
Warszawa	Wieliszew	R	0,14	0,43	0,80	0,69	0,01
Wrocław	Jelcz-Jaskowice	UR	0,10	0,35	0,80	0,65	0,01
Wrocław	Kobierzyce	R	0,20	0,49	0,74	0,83	0,00
Arithmetic average:			0,12	0,42	0,75	0,75	0,01

Group III – low level

Białystok	Czarna Białostocka	UR	0,13	0,82	0,63	0,39	0,04
Gdańsk	Cedry Wielkie	R	0,13	0,82	0,60	0,41	0,02
Gdańsk	Przodkowo	R	0,06	0,79	0,59	0,35	0,04
Katowice	Sośnicowice	UR	0,06	0,39	0,78	0,52	0,51
Kielce	Daleszyce	UR	0,04	0,65	0,64	0,32	0,05
Kielce	Górno	R	0,05	0,67	0,77	0,21	0,09
Kielce	Miedziana Góra	R	0,16	1,08	0,77	0,33	0,04
Kielce	Morawica	R	0,21	0,93	0,66	0,47	0,01
Kraków	Kocmyrzów-Luborzyca	R	0,16	0,86	0,79	0,39	0,01
Kraków	Wielka Wieś	R	0,29	1,15	0,65	0,69	0,01
Lublin	Jabłonna	R	0,10	0,87	0,75	0,26	0,01
Lublin	Piaski	UR	0,11	0,88	0,82	0,31	0,04
Lublin	Spiczyn	R	0,02	0,54	0,75	0,24	0,01
Lublin	Strzyżewice	R	0,15	0,88	0,78	0,31	0,05
Lublin	Wólka	R	0,17	1,01	0,58	0,48	0,03
Łódź	Andrespol	R	0,20	0,93	0,57	0,54	0,01
Rzeszów	Błazowa	UR	0,07	0,96	0,62	0,22	0,06
Rzeszów	Boguchwała	UR	0,17	0,96	0,62	0,46	0,03
Rzeszów	Chmielnik	R	0,08	1,04	0,60	0,29	0,04
Rzeszów	Czarna	R	0,10	1,05	0,49	0,33	0,03
Rzeszów	Czudec	R	0,07	1,00	0,68	0,22	0,06
Rzeszów	Lubenia	R	0,15	1,74	0,61	0,25	0,01
Rzeszów	Trzebownisko	R	0,14	1,12	0,54	0,43	0,01
Toruń	Kowalewo Pomorskie	UR	0,09	0,79	0,59	0,35	0,01
Toruń	Lubianka	R	0,12	1,16	0,48	0,39	0,06
Toruń	Obrowo	R	0,05	0,58	0,48	0,39	0,05
Wrocław	Długofęka	R	0,30	0,95	0,72	0,66	0,01
Zielona Góra	Zabór	R	0,12	1,01	0,49	0,50	0,01
Arithmetic average:			0,13	0,91	0,64	0,38	0,05

Source: Own calculations based on data published by Central Statistical Office of Poland in 2016

R—rural commune; UR—urban-rural commune

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Evaluation of the strength of the communes' budget, which is the mechanism of the excessive budgetary burden due to infrastructure expenditures, will be carried out by comparing the ratios of communes from groups I and III. These groups represent the high and low levels of development of communes' budgets for resistance to excessive expenditures in infrastructure. Table 3 is a detailed presentation of the variables (budgets indicators) of those communes that belong to the groups of high and low level of development of the budget (the resistance of the budget). It should be emphasized that in table 3 the characteristics are shown before standardization, which directly reflect the value of the indicator.

Results of analyses will be presented by comparison of the arithmetic average of the diagnostic indicators between groups I and III. The results of the study show:

- The share of capital expenditure on infrastructure in the total expenditure—the difference between groups I and III is minimal, because the group I is 0,12 while the third is 0,13. This result provides an interesting conclusion that communes with budgets which are not resistant to infrastructure expenditures spend an average amount of the budget similar to communes with resistant budgets.
- The weight of income tax by infrastructure expenditures—communes with developed budgets are characterized by less than twice the value of this index, than communes with budgets underdeveloped, from 0,42 to 0,91. This result shows the weakness of the communes of group III (low level of development). Thus, it shows the lack of resistance on infrastructure expenditure of communes in the analyzed indicator associated with the fact that communes spend almost all of their taxes on construction and maintenance of infrastructure.
- The share of income tax in own revenues—in the group of communes with a high level of budget development tax revenues are an average of 75% of own revenues, and in communes with a low level of 64% of own revenues. It thus appears that communes with developed budgets are characterized by a higher share of income tax in their own revenues—so the tax base of these communes is stronger. Thus, this result justifies, to a certain degree, the higher resistance of the budget described in the previous indicator.
- The share of own revenues in total revenues—communes with developed budgets are characterized by a close to twice higher value of this indicator than communes with underdeveloped budgets, from 0,75 to 0,38. This result shows the weakness of the communes of group III (low level of development) in terms of financial independence. The essential parts of the total revenues of the underdeveloped budgetary communes are the governmental grants and subvention passed on the tasks assigned to these communes. This result extends the findings regarding the mechanism of lack of resistance on infrastructure expenditure—i.e., lack of resistance is associated with a weak financial policy of the municipality in terms of own revenues, which in addition to taxes also includes income from local fees (fiscal, trade fair, local, operational, on possession of dogs); income received by communes' budgetary units; income from the assets of the community, fines and penalties.
- The weight of own revenues by debt service—it can be assumed that it is a summary of these indicators and the consequence of a low resistance to the infrastructure burden. In the group of communes with low development, expenditures pay off debts incurred from its own revenues are five times higher than for communes with a group of highly developed budgets. Thus, communes with low resistance have problems in the independent earning to pay off the liability.

## Conclusion

Based on the study results it can be concluded that in the Polish communes infrastructure expenditure generally does not cause an excessive budgetary burden, but burdens are still observable. Infrastructure expenditure can be excessive to budgets but for communes underdeveloped socially and economically. The conclusions of the study also indicate that communes underdeveloped economically spend on average a closer part of the budget on the infrastructure growth than a highly developed community. This forces weak communes to incur financial obligations and results in excessive budgetary burdens. An excessive burden for these entities can be described as



a mechanism of debts not accompanied by the financial potential of the communes' budget for its repayment. The lack of budgetary potential refers in this case to the weakness of the local financial policy—especially in terms of own revenues. This includes taxes, but also the revenues from local fees, income received by communes' budgetary units, income from assets of the community, fines and penalties. Excessive burden on budgets for infrastructure expenditure includes—apart from financing development—the need to incur the costs of maintaining current and new infrastructure. Such expenditure is an additional strain on the ability of communes' budgets. The calculations indicate that the manifestation of the lack of budgetary resistance is also that communes with low resistance are forced to spend almost all of the collected taxes on infrastructure, which may result in the intensification of the crowding out effect, which means resignation by communes from the implementation of important development activities that have a non-infrastructure character.

The empirical considerations provide enrichment to the theoretical achievements in Poland in the area of the explanation of the implications for local budgets with the intensification of the phenomenon of urban sprawl. The study confirms assumptions formulated in Poland about the possibility of excessive financial burden on the budgets of communes due to the growth of municipal infrastructure, which leads to the accumulation of the deficit and the possibility of the collapse of commune finance. However, this risk is not common and relates primarily to urban areas of the so-called Polish Eastern Wall, which are considered areas with a lower level of economic development.

The conducted analysis allows to formulate a conclusion which is addressed especially to the communes with urban sprawl. Thus, favoring the phenomenon of urban sprawl in the hope that the influx of new residents and businesses will increase tax revenues, which will be a panacea for the financial situation of the commune, is deceptive. For urban sprawl, a commune should be prepared in budget and in terms of a stable and income diversified financial policy. To protect the realization of commune tasks—both in infrastructure, as well as others important for the socio-economic development—local authorities should think creatively about the financing of tasks using the alternative sources of financing (Rynio 2013), and the broader policy of raising own revenues. But above all they must lead a local spatial policy focused on increasing the number of users of the current infrastructure, but not a need to build a new infrastructure for migrants.

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