Local Development as a Function of Budgetary Policy and Entrepreneurship

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1 Introduction

Local development is a topic very often analyzed in the literature. There were several research attempts regarding the problem of measuring the territorial units development (including [1–8]).

Pomianek [9] points out the difficulties with local development measuring caused by the lack of statistical data collected at the commune level, allowing to calculate indicators describing the level of economic development as Gross Domestic Product (GDP) per capita or Human Development Index (HDI).

Most of the research concentrates on building multidimensional indicators presenting the level of development instead of explaining the factors responsible for its level (see i.a.: [10–16]). For this reason the knowledge on factors determining the development level of local government units, remains unchanged (see i.a.: [17–19]).

Parallely in the literature there is a lack of studies aimed at measuring and explaining the level of local development in other way than using synthetic development indexes. Usually research concentrates on building the development

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classification, and does not undertake the issue of development variables. Due to this fact, the matter of variables explaining the development level is still not fully recognized. There are some works that focus on the alternatives in development measuring (see: [20–22]), nevertheless the dominating approaches are the traditional ways of expressing development at the lowest level of government.

There is a lot of criticism of the measures in the form of multidimensional synthetic development indexes (i.a. [23, 24]). They are based on the subjective weights assigned to variables, some of them focus separately on the social and economic development, and some merge all the aspects together in sustainable development indicators [25, 26]. Moreover, the construction of a multidimensional indicator of development limits the possibilities of development level estimations, because very often all explanatory variables are included into the indicator. Finally, due to the lack of the data available at the lowest level of government (i.e. communes), development indicators usually concentrate on the upper level (i.e. poviats) of territorial units [27]. All of the difficulties limit the possibility for comparisons of the local development. For these reasons attempts of other development measures creation seem to be very important and valuable.

2 Local Development Determinants: Literature Review

Local development is a very complex phenomenon widely analyzed and defined by many researchers. Many studies derived that it is conditioned by range of economic, social and other factors.

Sekuła [28] identified two groups of local development definitions. In the first of them, the local community and its needs were considered the center of gravity, while in the second—changes occurring within the local system.

The theory of the learning region emphasizes the importance of social values as a leading development factor that encourages economic initiatives. These values are the climate of trust and cooperation, the traditions of entrepreneurship, the presence of demanding and rich consumer market, the availability of office and industrial base, large and varied in terms of qualifications and requirements, labor resources (both poorly educated and highly qualified). The condition for creating an environment conducive to entrepreneurship is the development of networks of cooperating institutions: public, economic, service, financial, social and scientific for the exchange of ideas, creation of trust and economic cooperation. This enables the emergence of innovative phenomena and new forms of entrepreneurship. Proponents of this theory recommend an active attitude of public authorities with a precise strategy to stimulate entrepreneurship. This concept emphasizes the extraordinary importance of personal contacts between cooperating parties, even informal contacts of managers [29].

Nowińska [30] links local development with the area of a commune subordinate to self-government authority. Local authorities, institutions, organizations and individuals are involved in the use of local opportunities and resources and conduct

activities in various fields for the benefit of communities forming the local community. Similarly, Parysek [31, 32] emphasizes that local development is the result of cooperation between local communities (i.e. residing in a local territorial unit), local self-government and other organizations and institutions, mainly non-profit. Myna [33] divides the initiators of local development into five groups: local authorities, ecological lobbies, socio-cultural association, entrepreneurs and local communities. These groups cooperate with each other, mobilizing the energy of the entire local environment and lead to the achievement of local development goals.

Finally, Bagdziński [34], Grzebyk [35], as well as Pomianek [9], classify local development factors into three groups. The first one consists of political factors (the regime, competence and power of authority at various levels, way of governing, government-community relations and the degree of public acceptance of power). The next is related with social factors (needs and values, aspirations, interpersonal relations, attitude to reforms, innovation and technical progress, private entrepreneurship and the attitude of local authorities to entrepreneurship). The last one is connected with economic-environmental-spatial factors (natural resources, environmental values, human resources and their qualifications, economic potential, including technical and economic and social infrastructure as well as investment potential).

Based on the key findings from the literature review, we have found two alternative indicators as measures of local development. The first one describes intensive local development. It concentrates on communes' own revenue. This variable is used in various configurations for development measuring. Czyszkiewicz [17], as well as Grzebyk and Stec [36], use the share of own revenue in total revenue as a measure of economic development and wealth of the population. Stawicki [37], uses the dynamics of own revenues as a measure of local development. Madras and Mitura [38], use the share of own revenues in total revenue as a measure of endogenous economic potential. Stanny and Strzelczyk [39] apply the per capita income ratio to measure the possibility of generating own financial inflows by communes.

The second measure focuses on the total revenue of local governments to reflect local development, that describes both intensive and extensive development (see: i.a. [40], as well as [41]). The revenue consists of three components: own revenue, general subsidies and grants (see: [42, 43]). The sum divided by the number of inhabitants could be used as a measure of overall development resulting from the submission of both funds received from the central budget and the efficiency of own sources of budgetary inflows. Based on the comparison of both measures we decided to use the total revenue of local governments as the measure of total (intensive and extensive) local development.

In the article the variables explaining the development of communes were classified into two groups. The first was budgetary policy analyzed through the prism of expenditures' structure (see: [42]). The second was entrepreneurship [44]. The literature review proves that there are no optimal, imperfection-free measures describing local development. Similar difficulties accompany the selection of development measures at the countries' and regions' levels. The presented

research approach is a starting point for further in-depth studies aimed at perfecting the methodology of local development measurement.

3 Data and Methods

The analysis was based on the datasets of local government units in Poland. The communes were divided into three categories: urban, urban-rural, and rural. The time interval adopted for the study covered the years 2008–2016. The data were obtained from Statistics Poland, Local Data Bank (LDB) and Ministry of Finance. The explained variable was local development, defined as the total revenue of commune per capita (in PLN), as a measure of intensive and extensive local development.

Explanatory variables were: budgetary policy and entrepreneurship. To describe budgetary policy of communes, we used the following variables:

1. share of investment expenditure in total expenditure (%),
2. expenditures on agriculture and hunting per capita (in PLN),
3. expenditures on transport and communications per capita (in PLN),
4. expenditures on tourism per capita (in PLN),
5. expenditures on dwelling economy per capita (in PLN),
6. expenditures on public administration per capita (in PLN),
7. expenditures on public safety and fire protection per capita (in PLN),
8. expenditures on servicing public debt per capita (in PLN),
9. expenditures on education per capita (in PLN),
10. expenditures on health care per capita (in PLN),
11. expenditures on social assistance per capita (in PLN),
12. expenditures on municipal economy and environmental protection per capita (in PLN),
13. expenditures on culture and national heritage per capita (in PLN),
14. expenditures on physical education per capita (in PLN).

In the description of entrepreneurship level, we used one variable:

1. the number of newly registered economic entities per 10,000 people at working age.

Due to missing data for other potential indicators measuring the entrepreneurship, we excluded them from the study. Attribute selection method gives the subset of attributes that have predictive ability to the considered variable (here total revenue per capita). The attributes, which were not selected we considered redundant to the others. In this work we used method CfsSubsetEval [45], with search method Best-First. This method prefer such subset of attributes, which are strongly correlated with given class. On the other hand these attributes cannot be highly correlated among themselves. The merit M_s of feature subset S contains k features.

$$M_s = \frac{k\overline{r_{cf}}}{\sqrt{k + k(k-1)\overline{r_{ff}}}} \tag{1}$$

where:
$\overline{r_{cf}}$—mean feature-class correlation,
$\overline{r_{ff}}$—mean feature-feature correlation.

Clustering method groups the instances into mostly uniform groups called clusters. The values of respectively attributes have some similar properties. The k-means method [46] is performed in the following steps:

1. Initialization: choose k clusters' means $m_1^{(1)},\ldots, m_k^{(1)}$ as randomly chosen observations. Repeat 2–3 while assignment of observation doesn't change.
2. Assignment step t: assign each observation x_p to such cluster S_i, which mean has the smallest distance to this observation:

$$S_i^{(t)} = \left\{ x_p : \left\| x_p - m_i^{(t)} \right\| < \left\| x_p - m_j^{(t)} \right\| \ \forall_j 1 \le j \le k \right\} \tag{2}$$

3. Update Step—Calculate the mean of new cluster.

$$m_i^{(t+1)} = \frac{1}{\left| S_i^{(t)} \right|_{x_j}} \sum_{S_i^{(t)}} x_j \tag{3}$$

In this algorithm we used Manhattan distance:

$$\|x - y\| = \sum\nolimits_i |x_i - y_i| \tag{4}$$

In feature selection analysis we did not consider total expenditure per capita, which could not be taken as a reason of revue. We took into account the components of expenditures, they should not be measured by simple correlation. Correlation was used for feature selection, but for such selected features we analyzed the clusters and we did not provide exact analysis of correlation.

We will show also, that in out research the correlation coefficients are not strong. However we will be able to find some characteristics using cluster analysis.

4 Research Results

The analysis of the data was performed in two steps. The first was attribute selection, and the second clustering. For attribute selection we used CfsSubsetEval [45], with search method Best-First. These algorithms were performed separately on each type

Table 1 Selection of attributes in each commune type to predict total revenue per capita

Attribute	Type of commune		
	Urban	Rural	Urban-rural
Newly registered economic entities per 10,000 population	+	+	
Share of investment expenditure in total expenditure	+	+	+
Expenditure on tourism per capita		+	+
Expenditure on transportation and communication per capita	+		
Expenditure on public administration per capita	+		
Expenditure on public safety and fire protection per capita	+		+
Expenditure on servicing debt per capita	+	+	+
Expenditure on education per capita		+	+
Expenditure on health care per capita	+	+	+
Expenditure on physical education per capita		+	

Source: Own study

of commune. The results are shown in Table 1. For better visualization we removed also the communes with total revenue per capita significantly higher than the others' communes. Thus the communes: Kleszczów, Rewal, Krynica Morska, Rząśnia were clustered together according to the higher total revenue per capita.

We use k-means with Hamming Distance. This method was applied for each type of communes separately. Clusters have different sizes. For example in case of urban communes we have clusters with 52 elements as well as 6 elements (together 300 communes). For rural communes the clusters are higher by average, since we analyzed around 1600 communes. The number of clusters (10) was chosen that is big enough to cover different subsets of data. This number in our opinion is optimal to perceive visually different subsets. Data, which we used don't need normalization or discretization. Clustering algorithm works for any floating point vectors as points of data, so we didn't apply any additional techniques.

The graphs below do not illustrate all the relationships between local development and explanatory variables. Although the attribute selection showed that they should be included in clustering, the obtained results did not explain the relationship between the explanatory variables and the explained variable (local development).

For urban communes we can observe (Fig. 1) that total revenue per capita and newly registered entities per 10,000 people are not strongly related, although we expect that with growing number of newly registered entities increases the communes' revenue per capita. We can observe, that only cluster 9 describe communes with higher (>150) number of newly registered entities, with also higher (>6500 PLN) revenue per capita. Cluster 4 in major number of cases shows moderate (120–200 PLN) number of newly registered entities, with revenue per capita ranging from 4800 to 5800 PLN. Very dense area on the Fig. 1 represents the lower or moderate range of 80–170 of newly registered entities, and lower level of revenue per capita in the range from 3100 to 4200 PLN (e.g. cluster number 3).

At this point we can discuss the correlation coefficients between total revenue per capita and newly registered economic entities per 10,000 population. Presented

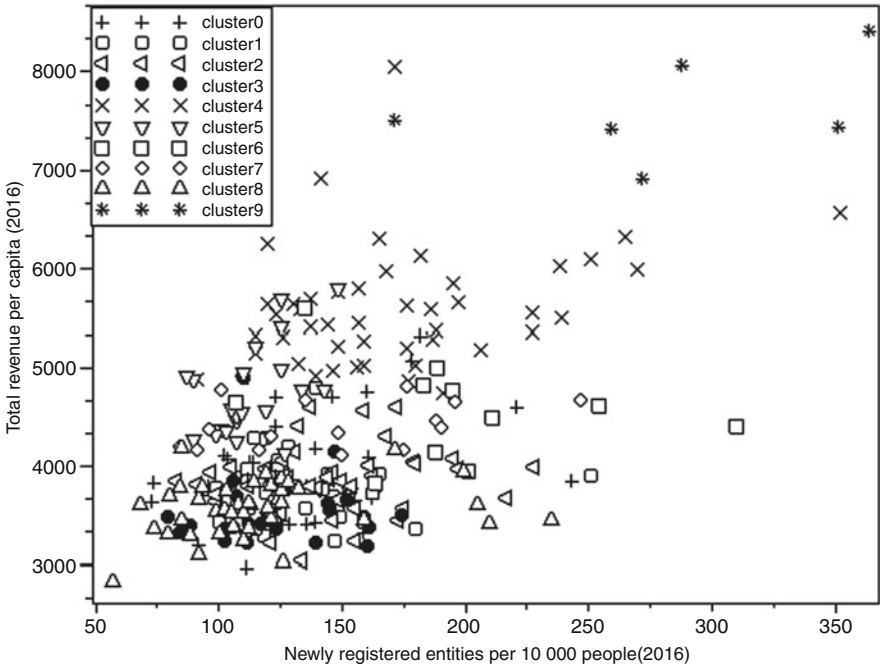

Fig. 1 The relationship between total revenue per capita (2016) and newly registered economic entities per 10,000 population (2016) in urban communes. Source: Own study

Table 2 Correlation between total revenue per capita (2016) and newly registered economic entities per 10,000 population (2016) in urban communes

Cluster	Correlation coefficient
0	0.368
1	0.056
2	0.095
3	0.045
4	0.297
5	0.470
6	0.230
7	0.366
8	0.214
9	0.358

Source: Own study

values (Table 2) don't prove strong correlations. The highest value 0.47 is for cluster 5. In cluster description we don't need correlation measured by correlation coefficient. We analyze the ranges of values for both axes in figure. The data division into clusters assume dependencies between the data on the base of distance to cluster mean. If in the whole data there is no strong correlation we don't expect strong correlation for separate clusters. From this reason we will not provide the correlation

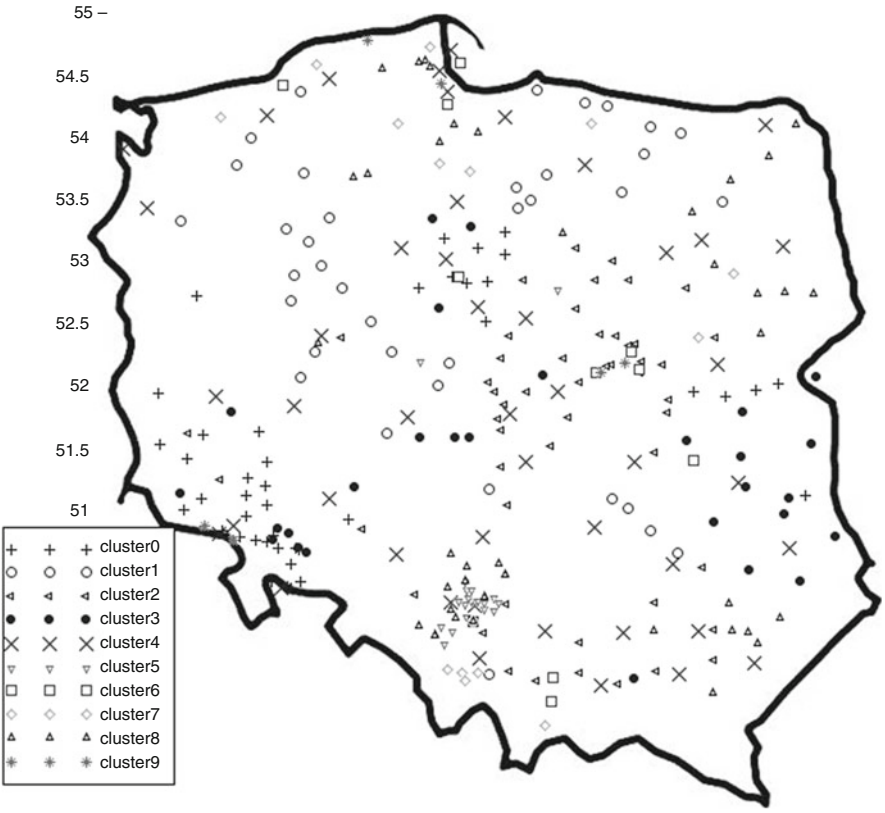

Fig. 2 Locations of urban communes according to division into clusters. Source: Own study, source of contour map: https://pl.pinterest.com/pin/333829391126901000/

analysis for other discussed variables. In the same way we think, that regression function analysis is unnecessary.

In our case division into clusters don't assume geographical location (we don't use such variables). However we can check if some clusters may be specific for some regions. On Fig. 2 we observe that some of clusters are distributed over larger areas of country. Some of them are limited to a smaller area, e.g. cluster 5 covers Upper Silesia. Cluster 3 extends from Lubelskie Voivodship, by Lower Silesia region to central parts of Poland.

The relationship between total revenue per capita and share of investment expenditures in urban communes (Fig. 3) seems to be more complicated. We can observe the area densely located characters: 2–22% share of investment expenditures and the revenue around 3100–4100 PLN. Lower level of investment expenditures (here in 2013) may result in lower level of revenue (year 2016). We can also observe widely scattered investments: 3–30% associated also by a wide range of communes' revenue per capita (3500–6200 PLN).

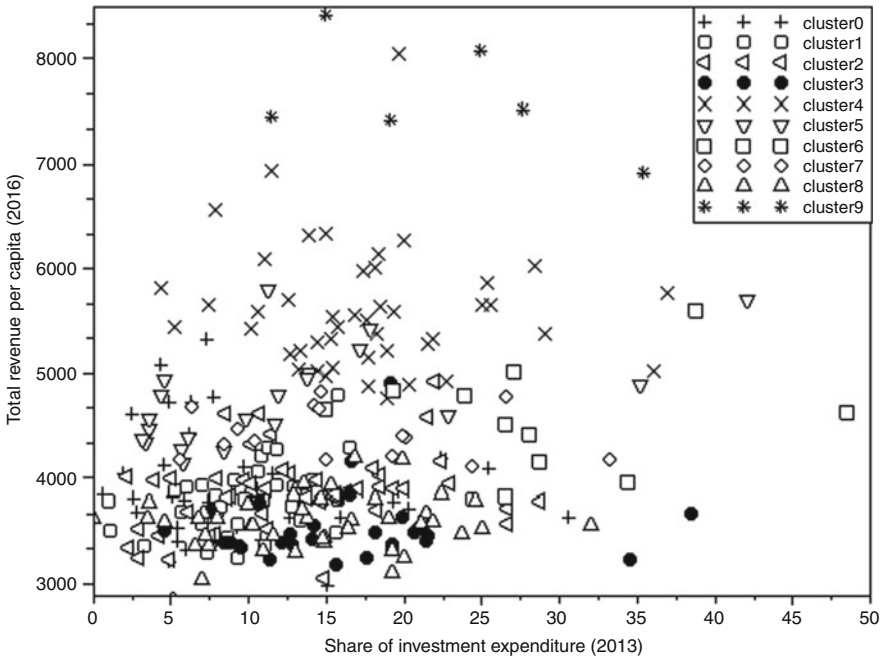

Fig. 3 The relationship between total revenue per capita (2016) and share of investment expenditures (2013) in urban communes. Source: Own study

The expenditures on transportation and communication, public administration, public safety and healthcare also significantly influence the communes revenue. Regarding the transportation (Fig. 4) the relationship is not very strong—e.g. in cluster 4 the moderate expenditures in the range 400–1400 PLN result in moderate revenue in the range from 4800 to 5800 PLN. The lower level of expenditures (<500 PLN per capita), results in the lower level of revenue (3200–4100 PLN), cluster 3.

For rural communes we observe weak relationship between total revenue per capita and the number of newly registered entities per 10,000 people (2009) and similarly with expenditures on servicing public debt (2015), (Fig. 5). Regarding the number of newly registered entities there is a densely dotted area at the range 30–180 of entities (lower and moderate number), which results in smaller and moderate revenue 3200–5000 PLN. We can also observe characters, that belong to cluster 1, where the number of entities is moderate and high (70–250) and of high revenue >5000 PLN per capita.

The expenditures on education per capita (2010) same as expenditures on healthcare are weakly related with the revenue (Fig. 6). The most densely marked area shows that expenditures on education within the range 500–1300 PLN per capita, result in revenue within the range of 3300–5000 PLN per capita. There are some cases confirming the significant dependence, especially, that belongs to cluster

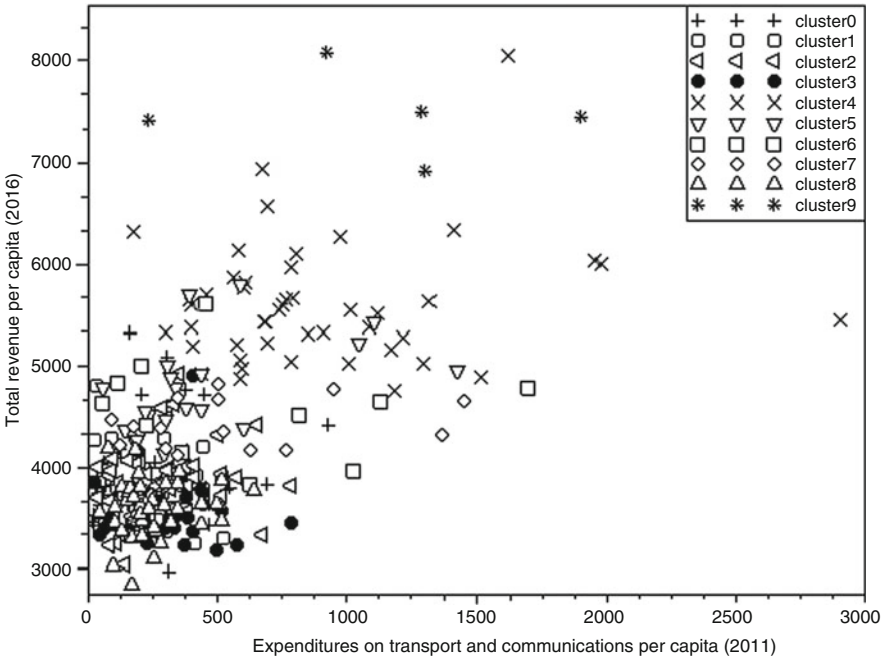

Fig. 4 The relationship between total revenue per capita (2016) and expenditures on transport and communication (2011) in urban communes. Source: Own study

1: higher expenditures >1000 per capita result in higher total revenue >5000 per capita.

In case of urban-rural communes, the relations between total revenue per capita (2016) and share of investment expenditures (2013) is relatively weak (Fig. 7). The high density of data marks we can observe at the range 2–25% of share which result in the total revenue per capita from 3200 to 4500 PLN. On the other hand there are cases, in which the share of investment expenditures was as above, but revenue >5000 PLN, or >25% share that resulted in revenue <5000 PLN per capita.

The similar relation can be observed between total revenue per capita and expenditures on public debt. A bit more stronger relation is between total revenue per capita and expenditures on education, healthcare and public safety. For example, higher expenditures on education may result in higher level of total revenue per capita—we can observe weak dependence for densely marked area but also for cluster 5 (Fig. 8).

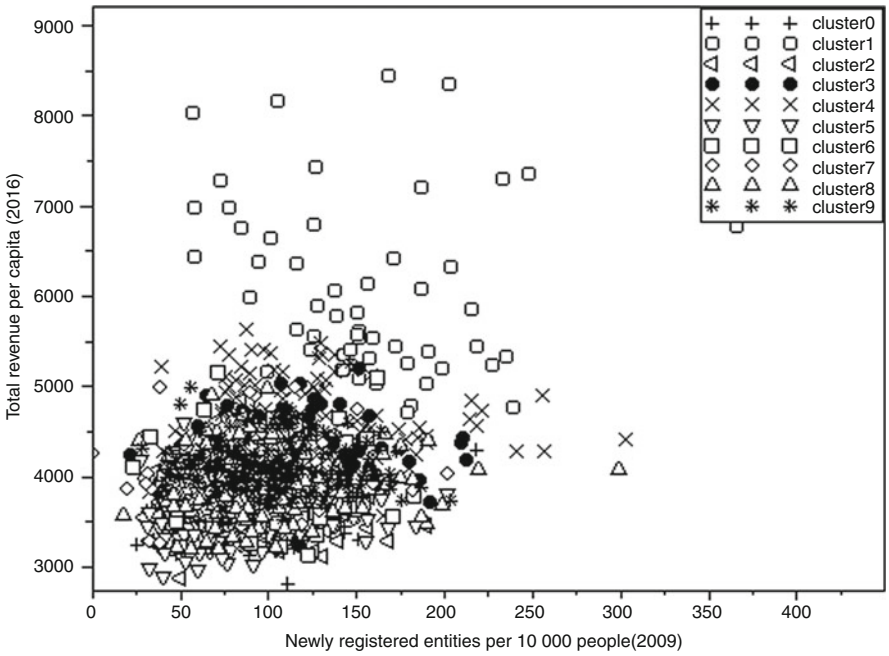

Fig. 5 The relationship between total revenue per capita (2016) and number of newly registered entities per 10,000 people (2009) in rural communes. Source: Own study

5 Conclusions

The article presents the results of the conducted research and refers to the explanation of total revenue per capita as the variable describing the intensive and extensive development of the communes as local self-government communities.

We clustered the territorial units according to chosen sets of variables measuring the local development, but we did not assigned any subjective weighs to variables to ensure objectivity of the results. We used correlation in the process of the variables selection and clustering. In the next phase of the analysis We focused on verification on if and how the variables (that are already identified by other researchers as measures of local development, and with data available for the communes—the lowest level of territorial units) actually influence the local development.

The results achieved do not fully confirmed our initial assumptions as they show no visible relation between communes' total revenue per capita and level of entrepreneurship (measured by the newly registered companies). What seemed less obvious the expenditures on transportation and communication, public administration, public safety and healthcare significantly influence the urban communes revenue (but that relation is not visible for rural and rural—urban communes). This can be explained that communes revenues are of a less "entrepreneurial nature", however it's a "business type" indicator.

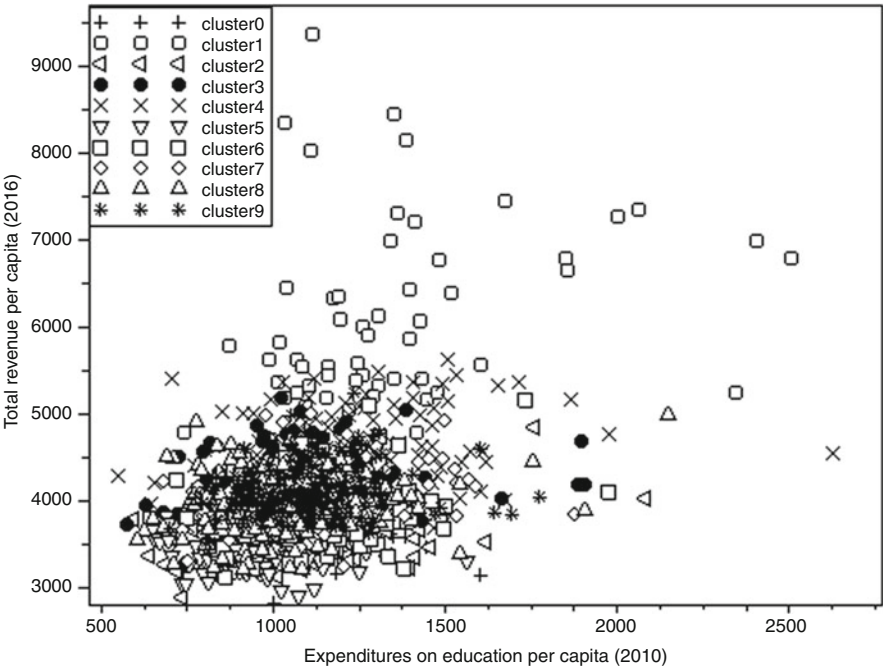

Fig. 6 The relationship between total revenue per capita (2016) and expenditures on education per capita (2010) in rural communes. Source: Own study

The obtained results allow us to formulate several interesting conclusions. The first one proves the possibility of explaining local development by application of selecting essential attributes and clustering methods. The research concept applied by the authors can be applied to all municipalities in the country, regarding the communes categories' division.

Secondly, another important research finding is also the fact that individual explanatory variables have a differentiated impact on the variable explained depending on their values, and on the municipalities' categories (urban, rural, urban-rural). Studies have shown that the same explanatory variables in different categories of municipalities and at a different level of describing them values result in different level of communes' development. Therefore it is possible, to try to configure variables affecting the development according to the type of commune and the required minimum values, starting from which the stimulus effect begins to be identified.

The third finding resulting from the conducted research indicates the need to include in the analyzes the effects of using explanatory variables—delays between the year in which the instrument was used (e.g. increased investment expenditure) and the year in which the results it influenced the local development (total revenue per capita). Studies have shown that comparing explanatory variables and their effects (in the commune development) in the same year often did not prove the

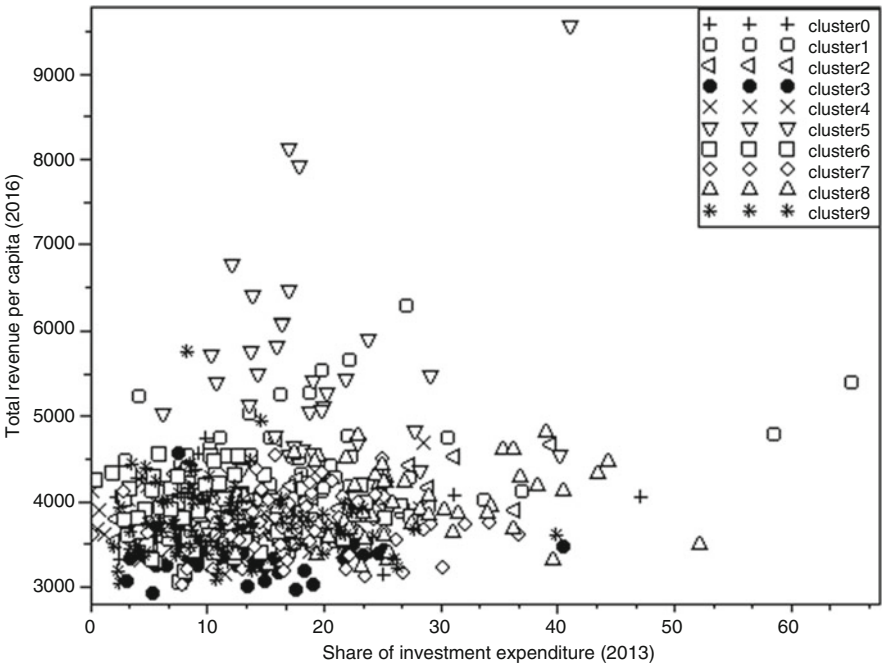

Fig. 7 The relationship between total revenue per capita (2016) and share of expenditures on investments (2013) in urban-rural communes. Source: Own study

possibility of using a given variable to explain the total revenue per capita level. However, comparing it with the use of delay gave a different result, confirming its usefulness in explaining local development.

Fourthly, the research carried out so far very clearly indicates the relationship with the local development of variables belonging to two groups, i.e. budgetary (expenditure) policies of municipalities, as well as entrepreneurship, but not with every single variable among these groups. Therefore, these studies will be repeated in relation to the another explanatory variable describing the development, i.e. own revenue per capita, reflecting the intense development of the analyzed communes.

Fifth, the results obtained justify taking into account in the research on local development, not only the relationships concerning individual explanatory variables with the variable explained in the form of the level of development (extensive and intensive together). The further research will also verify the relations between the variables explaining development, classified as: budget policy and entrepreneurship.

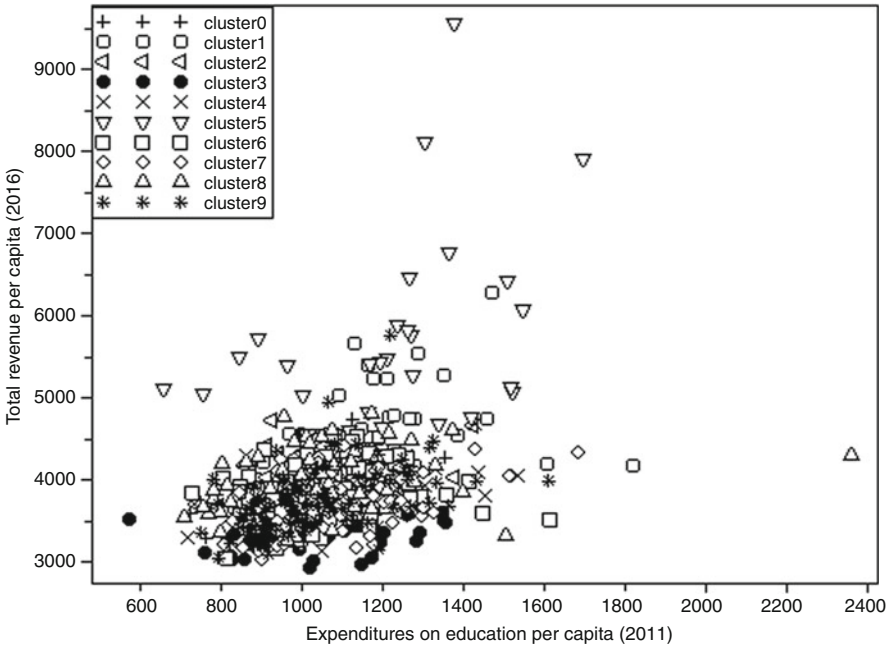

Fig. 8 The relationship between total revenue per capita (2016) and expenditures on education (2011) in urban-rural communes. Source: Own study

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