DIVERSIFICATION OF THE ECONOMIC POTENTIAL OF HOUSEHOLDS IN PROVINCES OF POLAND

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ABSTRACT

Household disposable income, although it is not the only measure of quality of life and standard of living, is a key factor affecting the level and structure of consumption. Regional differences related to the economic situation of households were evaluated with the use of data describing the level of household disposable income per person, wages and disposable income. Although GDP can be only indirectly identified with the economic potential of households, the study also included disposable income per capita and the GDP achieved by administrative units. Based on descriptive characteristics of variables assumed for the analysis, the method of *k*-means was applied to group objects (provinces). The aim of the paper is to group the provinces based on the variables assumed for the analysis. The applied method of multidimensional analysis made it possible to group provinces into segments. Each of the segments contains provinces that are most similar to each other in terms of features assumed for the analysis. The presented results permit us to draw the indirect conclusion that in provinces with higher GDP per capita, the population acquires higher income and, consequently, consumption expenditures make up a smaller portion of the obtained income.

Key words: regional differentiation, GDP, disposable income, households

INTRODUCTION

Differences in the level of wages earned by a population in a given region are the effect of various mechanisms and regularities determining regional development. Often, very erroneously, it is assumed that interregional disproportions can be of a temporary nature and after taking certain actions, differences in the disproportions between provinces can be eliminated. However, interregional disproportions are not a short-term phenomenon. Differences between developed regions and economically poorer regions persist over a longer period of time and can even deepen [Grosse 2002]. According to the unsustainable development theory, differences between regions are unavoidable [Chądzyński et al. 2007] and the

existence of imbalance is treated as a driving force for development. Polarization in a socio-economic space means that its individual elements develop at various rates. According to the polarization theory [Korenik 2011], the presence of a driving economic unit in any area can lead to transformation of the entire regional structure and affect its development. According to Friedmann [Friedmann and Alonso 1964], regions in a better economic situation develop as a result of their domination over those less developed [Stawasz 2004]. The existing regional development very often deepens over time due to accumulation and the interactions between various economic, political and cultural factors. Pursuant to this theory, areas of high economic development are developing at an increasing rate, while the poorer areas are sinking deeper into stagnation. In the

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socio-economic development of every country, one of measures of the economic situation is the level of income of its inhabitants. Income differentiation at the regional level is determined by various development disproportions, primarily concerning the standard of living of its population.

The aim of this paper was to group the provinces based on the variables assumed for the analysis. The analysis used materials originating from secondary sources, mainly the studies on household budgets, carried out by the Central Statistical Office (GUS), and statistical yearbooks and covered 16 provinces of Poland.

The level of differentiation of living conditions and regional disproportions are affected by such factors as the level of average wage, income per person in a household, the GDP level and other factors not taken into account in the analysis (e.g. investment opportunities for investors). The literature emphasizes that differences in the level of population income are reflected in the level of macro- and microeconomic indicators [Grzywińska-Rąpca 2011].

RESULTS

With reference to the economic situation, the most synthetic indicator reflecting the level of economic development of provinces is GDP. The contribution of individual provinces to the national GDP is presented in Figure 1.

Inhabitants of the province of Mazowieckie contribute to the GDP to the highest extent (Fig. 1). The share of this province in creating GDP in 2015 amounted to 22.17%. It was followed in this regard by the province of Śląskie, generating 12.38% of the GDP. The province of opolskie contributed to the generated level of the GDP to the lowest extent (2.10%), which made a difference of more than 20% when compared to the province of Mazowieckie.

The data describing regional differentiation of the economic situation of provinces, taking into account variables assumed for the analysis, are presented in Table 1.

Based on the data provided in Table 1, regional disproportions can be observed resulting from differences
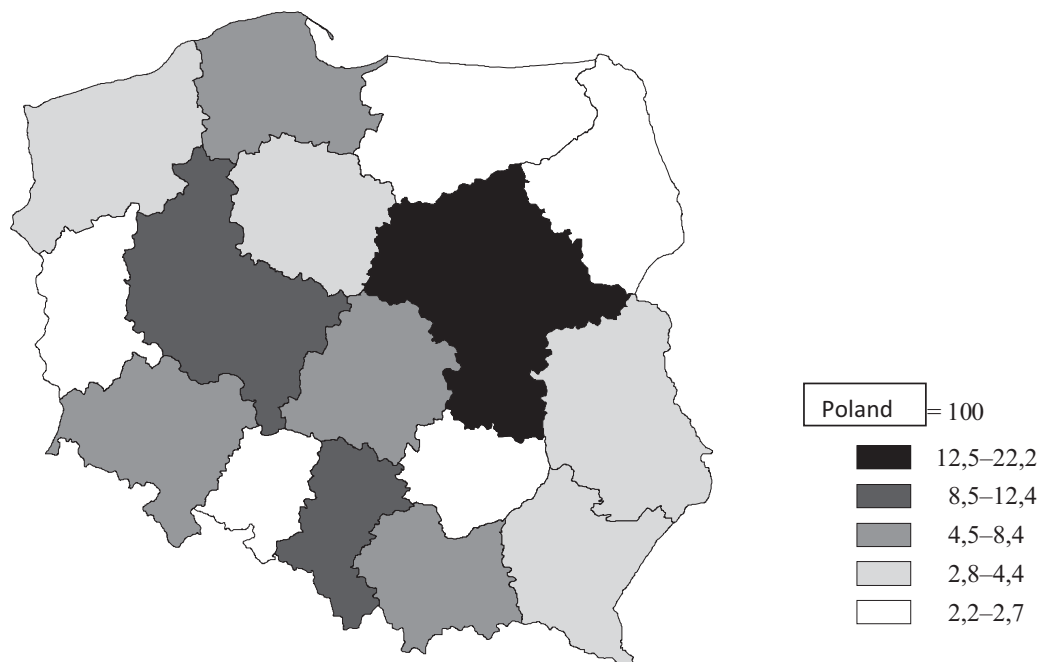
Fig. 1.   Contribution of individual provinces to the national GDP in 2015

Source: Own study based GUS data.

Table 1. Numerical characteristics of variables (data of 2015)

Province	Average monthly gross wages	Average monthly disposable income per person in total	Gross disposable income per capita	Gross domestic product per capita
	PLN			
Dolnośląskie	4,204.24	1,471.84	29,013	52,203
Kujawsko-Pomorskie	3,540.25	1,245.69	24,469	38,190
Lubelskie	3,699.48	1,226.74	23,522	32,074
Lubuskie	3,567.60	1,419.58	24,759	39,052
Łódzkie	3,790.76	1,362.03	28,165	43,772
Małopolskie	3,906.96	1,305.45	26,263	42,160
Mazowieckie	5,094.46	1,756.15	33,674	74,682
Opolskie	3,793.28	1,288.74	24,871	37,816
Podkarpackie	3,527.62	1,081.64	21,825	33,176
Podlaskie	3,647.08	1,257.93	22,630	33,272
Pomorskie	4,132.13	1,380.92	26,746	44,955
Śląskie	4,221.45	1,420.54	31,402	48,670
Świętokrzyskie	3,580.62	1,202.80	24,111	33,841
Warmińsko-Mazurskie	3,495.02	1,280.51	23,557	33,179
Wielkopolskie	3,728.52	1,287.79	28,871	50,790
Zachodniopomorskie	3,793.68	1,426.85	26,727	39,569

Source: Own study based on GUS data.

in the levels of variables assumed for the analysis which describe the economic situation of provinces. Average gross disposable income per capita in 2015 amounted to PLN 26,288.00. The highest level of this feature was recorded in the province of Mazowieckie. The lowest level of this variable was recorded for the province of Podkarpackie. The average gross disposable income per capita in this province was lower than the national mean by 16.98%. The lowest levels of the presented economic measures were demonstrated by the provinces of Warmińsko-Mazurskie, Lubelskie and Podkarpackie. This is typical for the eastern part of Poland which is considered to be one of the poorest and most marginalized regions, featuring a low level of wages, unfavourable structure of household expenditures and a significant scale of poverty. Such a situation, along with an unfavourable structure of economy, proves the low quality of life and standard of living of the population in this area. Despite numerous activities, on both the national and regional scale, the income level of inhabitants is diversified. Gross domestic product per capita in 2015 was the highest in the province of mazowieckie. At the same time, GDP per capita generated in the province of Mazowieckie exceeded the average value for the country by 76.39%, which amounted to PLN 74.682 per capita. The following provinces recorded values above the average national value in generating GDP per capita: Dolnośląskie, Łódzkie, Pomorskie, Śląskie and Wielkopolskie.

In order to analyse regional diversification of the examined variables, basic descriptive statistics were determined (Table 2).

Table 2. Basic descriptive statistics of variables assumed for the analysis

Specification	$\overline{x}$	SD	Min	Max	CV (%)
Gross domestic product per capita	42 337.56	10 793.86	32 074.00	74 682.00	25.49
Disposable gross income per capita	26 287.81	3 261.21	21 825.00	33 674.00	12.41
Average monthly gross wages	3 857.70	405.03	3 495.02	5 094.46	10.50
Average monthly disposable income per person in total	1 338.45	149.93	1 081.64	1 756.15	11.20

Source: Own study based on GUS data.

Variability in the gross domestic product per capita is almost twice higher than in case of gross disposable income per capita. In order to group provinces based on the variables assumed for the analysis, standardized[1] values of variables were determined according to the formula: $z_{ij} = x_{ij} - x_j / S(x_j)$, in which $i = 1, 2, \ldots, n, j = 1, 2, \ldots, m$. Values of variables after standardization are presented in Table 3.

Table 3. Values of variables after standardization

Province	Average monthly gross wages	Average monthly disposable income per person in total	Disposable gross income per capita	Gross domestic product per capita
Dolnośląskie	0.8556	0.8897	0.8356	0.9140
Kujawsko-Pomorskie	–0.7838	-0.6187	-0.5577	-0.3843
Lubelskie	–0.3906	–0.7451	–0.8481	–0.9509
Lubuskie	–0.7162	0.5411	–0.4688	–0.3044
Łódzkie	–0.1653	0.1573	0.5756	0.1329
Małopolskie	0.1216	–0.2201	–0.0076	–0.0165
Mazowieckie	3.0535	2.7861	2.2649	2.9966
Opolskie	–0.1590	–0.3316	–0.4344	–0.4189
Podkarpackie	–0.8149	–1.7129	–1.3685	–0.8488
Podlaskie	–0.5200	–0.5371	–1.1216	–0.8399
Pomorskie	0.6776	0.2833	0.1405	0.2425
Śląskie	0.8981	0.5475	1.5682	0.5867
Świętokrzyskie	–0.6841	–0.9048	–0.6675	–0.7872
Warmińsko-Mazurskie	–0.8954	–0.3865	–0.8374	–0.8485
Wielkopolskie	–0.3189	–0.3379	0.7921	0.7831
Zachodniopomorskie	–0.1581	0.5896	0.1347	–0.2565

Source: Own study.

[1] Following the classical standardization, normalization parameters typically assume the value: $p = 1$; $a = \overline{x}_j$; $b = S(x \overline{x}_j)$.

A negative value of indicators is demonstrated when some objects are characterized by a significantly poorer level [Zeliaś 2000]. The variable for a given province takes a value lower than the average for all provinces.

Based on standardized data, objects (provinces) were grouped using the *k*-means method. The starting point was to determine the number of clusters. Further, based on the performed analyses, the membership of objects in the clusters was determined [Panek and Zwierzchowski 2013]. Intragroup differentiation is described as the sum of distances between the intragroup objects and the centroid of

groups into which they have been classified [Jóźwiak and Podgórski 2011].

As a result of applying the *k*-means method, five groups of provinces were distinguished (Table 4). Provinces forming subsequent clusters are characterized by diversification as regards diagnostic features assumed for classification purposes.

Table 4 also presents distances from the centroid of the proper cluster (calculated on the basis of standardized data). The values show which of the provinces in the identified groups are located further from the centre of a given cluster and, therefore, differ the most in terms of the analysed structure from other provinces in

Table 4. Elements of identified clusters

Province	Distances from the centroid of the proper cluster
Cluster 1 elements	
Dolnośląskie	0.22
Śląskie	0.22
Cluster 2 elements	
Łódzkie	0.20
Małopolskie	0.26
Pomorskie	0.36
Wielkopolskie	0.41
Cluster 3 elements	
Kujawsko-Pomorskie	0.28
Lubelskie	0.18
Podkarpackie	0.51
Podlaskie	0.20
Świętokrzyskie	0.12
Warmińsko-Mazurskie	0.25
Cluster 4 elements	
Lubuskie	0.25
Opolskie	0.33
Zachodniopomorskie	0.27
Cluster 5 elements	
Mazowieckie	0

Source: Own study.

the cluster. In the second group identified, the provinces most differing from each other are Łódzkie and Wielkopolskie, while in the third group, it is Podkarpackie. The fifth cluster is a single-element cluster, made up of the province of Mazowieckie. This means that province of Mazowieckie (according to the variables assumed for the analysis) is the most remote from the other 15 provinces. In order to compare identified clusters, cluster statistics were determined (Table 5, Fig. 2).

Figure 3 presents the mean values of variables for individual clusters. It is worth noting the values determined for the second cluster (Łódzkie, Małopolskie, Pomorskie, Wielkopolskie) and for the fourth cluster (Lubuskie, Opolskie, Zachodniopomorskie). The mean

Table 5. Basic descriptive statistics for clusters

Variable	$\bar{x}$	SD	Variance
Descriptive statistics for cluster 1			
Gross domestic product per capita	0.75	0.23	0.05
Disposable gross income per capita	1.20	0.52	0.27
Average monthly gross wages	0.88	0.03	0.00
Average monthly disposable income per person in total	0.72	0.24	0.06
Descriptive statistics for cluster 2			
Gross domestic product per capita	0.29	0.35	0.12
Disposable gross income per capita	0.38	0.37	0.14
Average monthly gross wages	0.08	0.44	0.19
Average monthly disposable income per person in total	−0.03	0.30	0.09
Descriptive statistics for cluster 3			
Gross domestic product per capita	−0.78	0.20	0.04
Disposable gross income per capita	−0.90	0.30	0.09
Average monthly gross wages	−0.68	0.19	0.04
Average monthly disposable income per person in total	−0.82	0.47	0.22
Descriptive statistics for cluster 4			
Gross domestic product per capita	−0.33	0.08	0.01
Disposable gross income per capita	−0.26	0.34	0.11
Average monthly gross wages	−0.34	0.32	0.10
Average monthly disposable income per person in total	0.27	0.52	0.27
Descriptive statistics for cluster 5			
Gross domestic product per capita	3.00	0.00	0.00
Disposable gross income per capita	2.26	0.00	0.00
Average monthly gross wages	3.05	0.00	0.00
Average monthly disposable income per person in total	2.79	0.00	0.00

Source: Own study.
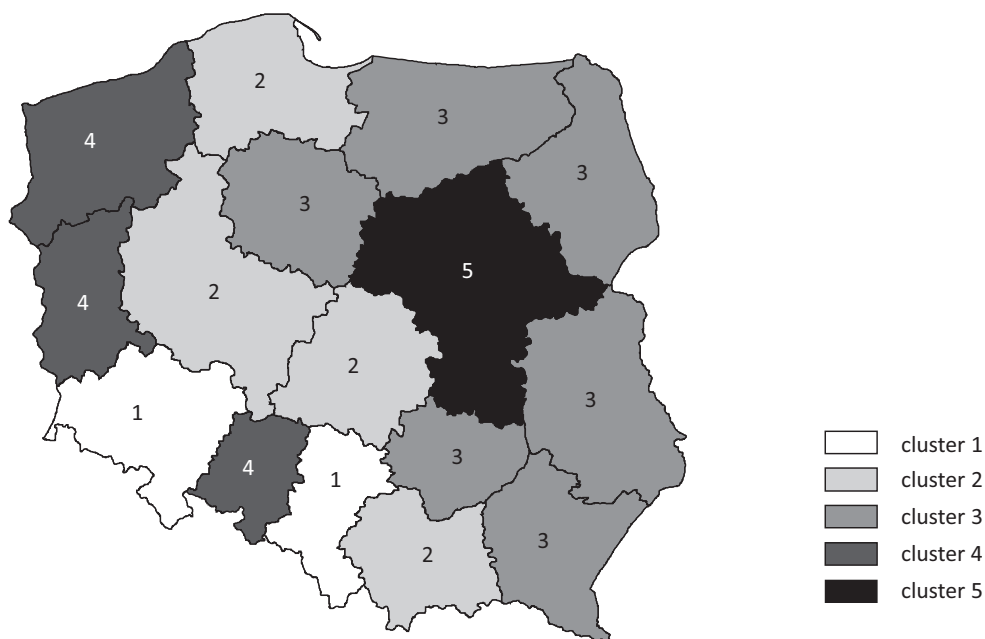
Fig. 2. Geographical distribution of cluster elements obtained as a result of grouping provinces
Source: Own study.
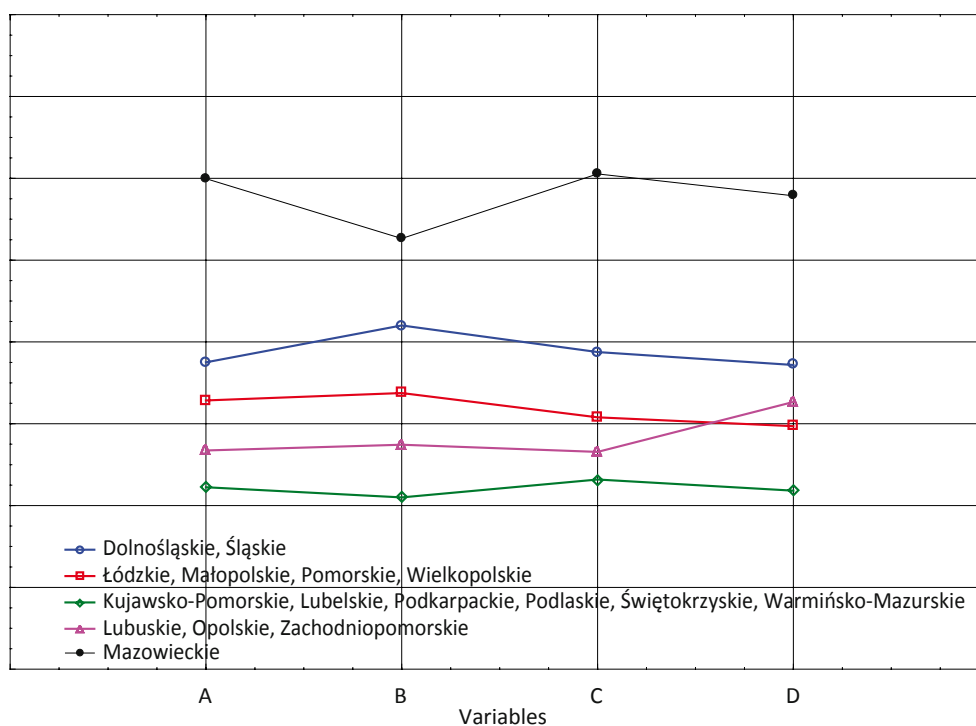
A – gross domestic product per capita, B – gross disposable income per capita, C – Average monthly gross wages, D – average monthly disposable income per person in total

Fig. 3. Mean values of variables for clusters obtained as a result of grouping provinces
Source: Own study.

values of gross domestic product per capita, gross disposable income per capita and average monthly gross wages are higher than the values for the fourth cluster. On the other hand, the average value of monthly disposable income per person in total is higher for the second cluster.

In order to supplement the study, an analysis of discriminatory variable variance was carried out (Table 6).

The results of the analysis of variance presented

representing provinces in eastern Poland have lower gross disposable income per person in the household. The province of Mazowieckie was the most diverging from others. Large spreads in values representing variables assumed for the analysis caused that Mazowieckie formed a separate, single-element cluster. High means were obtained for the cluster represented by provinces of Dolnośląskie and Śląskie. Higher values of the parameters assumed for the

Table 6. Analysis of variance

Variable	Intergroup variance	df	Intragroup variance	df	F	p
Gross domestic product per capita	14.37	4	0.63	11	62.71	0.000000
Disposable gross income per capita	13.64	4	1.36	11	27.58	0.000011
Average monthly gross wages	14.03	4	0.97	11	39.73	0.000002
Average monthly disposable income per person in total	13.02	4	1.98	11	18.10	0.000084

Source: Own study.

in Table 6 show the plausibility of applying diagnostic variables. The variables used for the analysis discriminate clusters at the significance level of 0.01. The classification of a given object (province) to a specific cluster is made upon the principle of minimizing variability inside the cluster and maximising the variability between clusters. A high variability between the identified clusters and a relatively low variability inside the clusters proves the proper grouping of provinces with regard to the analysed variables. Based on the F-test evaluation (Table 6), it can be concluded that variables well discriminate the clusters.

SUMMARY

To summarize the analysis, regional disproportions of the economic situation can be observed in Poland. Although the literature [Harjes 2007, Rodriguez-Pose and Tselios 2008, Berloffa and Modena 2012] increasingly often indicates that high concentration of income is a desirable phenomenon, income inequalities also have a negative effect on economic development.

This study will make it possible to formulate conclusions regarding the aim of this paper. Households

analysis, describing the economic situation of provinces, was certainly affected by the better economic situation of those regions (infrastructure, investments and capital).

The presented results permit us to draw the indirect conclusion that in provinces with higher GDP per capita, the population earns a higher income and, consequently, consumption expenditures make up a smaller share in the income received. The observed phenomenon is a characteristic feature for polarization of development. Although the existence of differentiation is acceptable in the economy, persistent and increasing diversification in individual areas has become one of the challenges in the contemporary economy. Prolonged and excessive differences between the levels of phenomena describing the economic situation of provinces and, consequently, living conditions, are not favourable for the process of social and economic development, and can often be one of the main barriers to regional development. The analyses described in the paper are a part of the research carried out on the subject of diversification of provinces and the obtained results confirm the plausibility of using multidimensional analyses in the examined regions.

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ZRÓŻNICOWANIE POTENCJAŁU EKONOMICZNEGO GOSPODARSTW DOMOWYCH W WOJEWÓDZTWACH POLSKI

STRESZCZENIE

Dochód rozporządzalny gospodarstw domowych chociaż nie jest jedynym miernikiem jakości i poziomu życia to jest podstawowym czynnikiem kształtującym konsumpcję, jej poziom i strukturę. Do oceny regionalnych różnic związanych z sytuacją ekonomiczną gospodarstw domowych wykorzystane zostały dane opisujące poziom dochodów rozporządzalnych na osobę w gospodarstwie domowym, wynagrodzenia oraz dochody do dyspozycji. Chociaż PKB może być tylko pośrednio identyfikowany z potencjałem ekonomicznym gospodarstw domowych, to uwzględnione zostały także dochody do dyspozycji na mieszkańca oraz poziom PKB uzyskiwany przez jednostki podziału administracyjnego. Na podstawie charakterystyk opisowych przyjętych do analizy zmiennych zastosowano metodę k-średnich w celu pogrupowania obiektów (województw). Celem artykułu jest pogrupowanie województw na podstawie przyjętych do analizy zmiennych. Zastosowana metoda analizy wielowymiarowej pozwoliła na pogrupowanie województw. Każdy z segmentów zawiera województwa najbardziej podobne do siebie ze względu na przyjęte do analizy cechy. Przedstawione wyniki pozwalają pośrednio na wysnucie wniosku, że w województwach o wyższym poziomie PKB na mieszkańca ludność uzyskuje większe dochody, a w konsekwencji ich wydatki konsumpcyjne stanowią mniejszy udział w uzyskiwanych przychodach.

Słowa kluczowe: zróżnicowanie regionalne, PKB, dochód rozporządzalny, gospodarstwa domowe