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**DIFFERENTIATION OF EUROPEAN HOUSEHOLDS LIVING
RURAL AREAS INCLUDING SUBJECTIVE ASSESSMENTS
OF THEIR FINANCIAL AND ECONOMIC SITUATION
– COMPARATIVE ANALYSIS**

Key words: households, rural areas, financial situation of households,
Mahalanobis immersion measure

ABSTRACT. Subjective assessments of the financial situation of households are a measure that is increasingly used in comparative analyses of living conditions and quality of life, as well as satisfaction with the economic and economic situation. Due to the fact that assessments of financial situation are highly individual and subjective, it is important to emphasise that different households may assess their situation differently, even under similar economic conditions. The material in this study was secondary data collected and published by Eurostat on households living in rural areas. The aim of this study was to answer the question: (1) whether the diagnostic variables adopted for the analysis statistically significantly differentiate European households and (2) whether the clustering effect in 2015 and 2022 is the same. To analyze the diversity of diagnostic variables, Mahalanobis measures of observation immersion in the sample were used. The analysis made it possible to evaluate the analysis of spatial diversity of European households living in rural areas and to distinguish groups of countries showing similarities due to the diagnostic variables adopted for the analysis.

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INTRODUCTION

The financial situation of households living in rural areas can be analyzed from different perspectives [Nanda, Banerjee 2021]. The main aspects that are taken into account in the analyses concerning the assessment of the financial situation of households and the conditions and quality of life are: the level of income obtained by households, the level and structure of household expenditure, investments and available infrastructure, or access to education and health care [Ali et. al. 2019, Grzywińska-Rapca 2019, Hira, Mugenda 2000]. Undoubtedly, one of the key factors determining the subjective feeling of financial satisfaction of households (not only in rural areas) is the level of income they obtain. Rural household incomes tend to be lower than those in urban areas. This is due to fewer employment opportunities and less availability of higher-paying jobs [Kasprzyk, Leszczyńska 2012, Murawska 2014b, Brzozowski, Visano 2020]. It should be emphasized that rural areas are often characterized by lower access to jobs, especially in the service sector. The cost of living in rural areas can vary from region to region and country to country. In some areas, housing and living costs are lower than in cities, but the availability of some services (e.g. health care or public transport) may be limited. Many rural areas face a shortage of infrastructure such as roads, energy grids and internet access. This may lead to a poorer financial situation for households living in rural areas, as well as a lower quality of life for households and opportunities for household development, which is certainly reflected in subjective assessments of the financial situation of households. Some rural families may experience financial difficulties due to low incomes and limited access to services, while others may enjoy quality of life and economic stability [Halamska 2007, Kronenberg, Bergier 2010]. The final assessment of the financial situation of rural households can be determined by specific circumstances such as region, country, household sector of activity and many other factors [Fuentes, Rojas 2001, Joo, Grable 2004, Dudek 2013, Głowicka-Wołoszyn, Wołoszyn 2014, Murawska 2014a, Grzywińska-Rapca 2021] (Figure 1).

Among the key points concerning the impact of disposable income on subjective assessments of the financial situation of households, the level of income obtained by households is the first to be mentioned in the literature [Żelazna et al. 2002, Gąsiorowska 2010, Frączek 2012, Zalega 2012, Ali et al. 2019, Yu et. al. 2020, Duczkowski, Słowik 2022]. Households with higher disposable income often have a greater sense of financial security, which allows them to cope comfortably with sudden expenses and avoid financial crises. A higher disposable income allows a household to save or invest more money, which can increase a sense of financial stability and future security.

The availability of disposable income has an impact on the extent of household spending. Households with higher incomes often have greater opportunities to invest, save and consume luxury goods, which can affect their subjective assessments of their financial

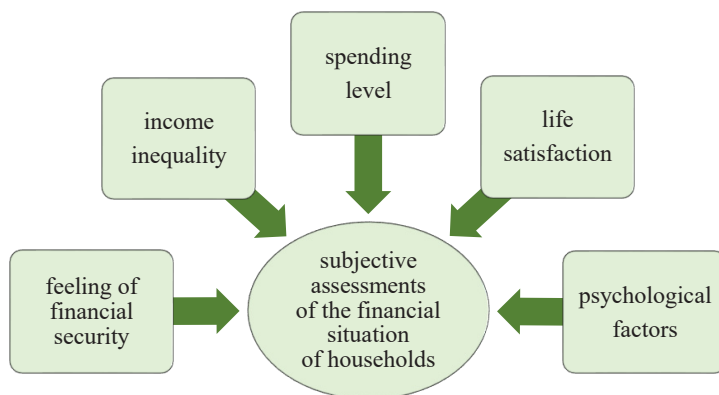


Figure 1. Factors determining subjective assessments of the financial situation of households
Source: own elaboration

situation. Thus, disposable income has a significant impact on the subjective assessments of the financial situation of households, but this impact is complex and can be modified by various factors such as income inequality, cultural context. Subjective assessments of financial situation can also be shaped by psychological factors, such as perceptions of relative social position and comparisons with other households [Szopa, Leszczyńska 2004, Keese 2012, Parlińska, Pietrych 2014, Mahdzan et al. 2019, Wołoszyn et al. 2019, Downward et al. 2020, Grzywińska-Rąpca, Ptak-Chmielewska 2023]. A higher income does not always automatically mean a greater sense of satisfaction or a better assessment of the financial situation, as other factors such as debt levels, lifestyle or inflation rates also play a role. It is therefore worth noting that assessments of financial situation are highly individual and subjective, which means that different households may assess their situation differently, even under similar economic conditions. The impact of these determinants can vary from person to person and from life situation to person, and above all from household to household.

MATERIAL AND METHODS

The aim of the study was to demonstrate the spatial diversity of European households living in rural areas in the context of their subjective assessments of their financial situation in 2015 and 2022. The main objective was implemented in the following stages:

1. Determination of the level of changes in subjective assessments of the financial situation of farms.
2. Identification of changes in subjective assessments of the financial situation of households.

3. Grouping of European countries according to subjective assessments of the financial situation of households in 2015 and 2022 using the Mahalanobis immersion measurement method.
4. Conducting a comparative analysis of the obtained clusters.

The following research hypotheses were verified:

1. Subjective assessments of the financial situation of European households living in rural areas are diverse.
2. Comparative analysis of subjective assessments of the financial situation of European households living in rural areas makes it possible to distinguish similar countries in terms of the analyzed variables.

In the study, the diagnostic variables are: financial situation over the last 12 months, financial situation over the next 12 months, general economic situation over the last 12 months, general economic situation over the next 12 months, gross domestic product, HDI, Consumer Confidence Indicator, actual individual consumption and median equivalised net income. The variables financial situation over the last 12 months, financial situation over the next 12 months, general economic situation over the last 12 months, general economic situation over the next 12 months and consumer confidence indicator can range from -100 to +100. A positive value indicates that optimistic consumers outnumber pessimistic consumers, while a negative value indicates that pessimistic consumers outnumber optimistic consumers.

The material in this study was secondary data collected and published by Eurostat. The aim of this study was to answer the question whether (1) the diagnostic variables adopted for the analysis significantly differentiate statistically European households and (2) whether the effect of clustering in 2015 and 2022 is the same. To analyze the diversity of diagnostic variables, measures of Mahalanobis immersion of observations in the sample were also used [Donoho, Gasko 1992, Ruts, Rousseeuw 1996, Wagner, Kobylińska 2002, Grzywińska-Rapca Kobylińska 2015]. A measure of the immersion of Mahalanobis ($Mzan_p$) point θ in the sample P_n^p we call a function:

$$Mzan_p(\theta; P_n^p) = [1 + Q(\theta, P_n^p)]^{-1} \quad (1)$$

where: $Q(\theta, P_n^p) = (\theta - \bar{x})^T S^{-1} (\theta - \bar{x})$ is the Mahalanobis distance of the vector θ from the vector of means \bar{x} , where $\bar{x} = \frac{1}{n} \sum_{j=1}^n x_j$, S is the covariance matrix between the considered p -vectors, however S^{-1} is its inverse matrix [Grzywińska-Rapca, Kobylińska 2015].

The measure of Mahalanobis immersion was determined for each point (country) of the analyzed set of diagnostic variables. The values for the immersion measures range from 0 to 1. Countries that correspond to higher values of this measure are located more centrally in the data set. The measure of immersion of observations (countries) in the sample allows to determine countries that are similar in terms of the values of the variables. The countries corresponding to the highest value of the Mahalanobis immersion measure are located the most centrally in the analyzed data set.

RESULTS

VARIABLES CHARACTERIZING THE HOUSEHOLDS IN RURAL AREAS

The analysis of the diversity of European countries was carried out on the basis of data on households living in rural areas. The study included nine diagnostic variables, which can be divided into two main groups: (1) financial situation over the last 12 months, financial situation over the next 12 months, general economic situation over the last 12 months, general economic situation over the next 12 months, HDI, Consumer confidence indicator and (2) objective data (gross domestic product, actual individual consumption, median equivalised net income). The average subjective assessments of the financial situation of European households living in rural areas were -9.77 (financial situation over the last 12 months) and -0.42 (financial situation over the next 12 months) (Table 1).

In 2022, the average values of subjective assessments of the financial situation of households living in rural areas were: -17.90 (financial situation over the last 12 months) and -16.28 (financial situation over the next 12 months). Therefore, it can be concluded that in the opinion of households, their financial situation has deteriorated. The average values of the General economic situation over the last 12 months and also decreased significantly. In 2015, the General economic situation over the last 12 months was -14.09, and in 2022 -47.81 (a downgrade of 33.72). In 2015, the average for the General economic situation over the next 12 months variable was -6.23, and in 2022 it was -39.16, which is a decrease of 32.93.

The presented statistical data (Table 1) indicate that the variables describing subjective assessments of the financial situation are characterized by very high volatility in both analysed years (2015 and 2022). The determined values of descriptive statistics of variables observed in 2015 reached high values. High values of coefficients of variation were observed (above 20% for all diagnostic variables), which indicates a large diversity of the analyzed features. Positive values of the skewness coefficients indicate a strong positive asymmetry, which means that for the majority of the analyzed objects (European

Table 1. Descriptive statistics of the distribution of average values of the analyzed variables

Year	Variable	Average	Minimum	Maximum	Coefficient of skewness	Coefficient of variance
2015	Financial situation over the last 12 months	-9.67	-61.60	9.60	-149.91	-1.76
	Financial situation over the next 12 months	-0.42	-40.60	14.90	-2633.63	-2.10
	General economic situation over the last 12 months	-14.09	-81.50	31.40	-157.58	-0.73
	General economic situation over the next 12 months	-6.23	-68.90	33.90	-304.33	-1.09
	Gross domestic product	91.39	48.30	136.20	27.81	0.10
	HDI	0.89	0.81	0.94	4.00	-0.28
	Consumer confidence indicator	-8.61	-58.30	9.30	-147.42	-2.42
	Actual individual consumption	93.30	44.80	143.60	31.37	0.14
	Median equivalised net income	14,154.54	2,514.00	37,372.00	64.70	0.65
2022	Financial situation over the last 12 months	-17.90	-50.70	0.50	-54.26	-1.28
	Financial situation over the next 12 months	-16.28	-48.60	1.30	-66.05	-1.03
	General economic situation over the last 12 months	-47.81	-64.00	-9.00	-27.85	0.96
	General economic situation over the next 12 months	-39.16	-61.50	3.50	-34.33	1.10
	Gross domestic product	95.28	59.90	132.30	23.09	0.14
	HDI	0.90	0.80	0.95	4.29	-0.71
	Consumer confidence indicator	-22.87	-51.30	-0.10	-43.26	-0.40
	Actual individual consumption	99.04	55.00	153.20	27.72	0.40
	Median equivalised net income	18,080.00	4,286.00	44,574.00	56.07	0.71

Source: own analysis based on Household budgets [GUS]

countries) the subjective assessments of the financial situation were below the average level. The coefficient of volatility for Financial situation over the last 12 months in 2022 was 54.26% and for Financial situation over the next 12 months 66.05%. This means that subjective assessments of the financial situation of households living in rural areas were characterised by a wide variation between European countries. Among the subjective variables, the Consumer confidence indicator was also characterized by a high volatility factor (43.16%). When analysing descriptive statistics for objective variables (defined for the purposes of this study), in 2022 the highest value of the coefficient of variation was recorded for the variable Median equivalised net income (56.07%).

CLUSTERING OF EUROPEAN HOUSEHOLDS LIVING IN RURAL AREAS IN THE LIGHT OF THEIR SUBJECTIVE ASSESSMENTS OF THE FINANCIAL SITUATION

In order to group European countries according to subjective assessments of the economic situation of households living in rural areas in 2015 and 2022, the Mahalanobis immersion measurement method was used. The use of this method was supported by the fact that it is a distance weighted by a covariance matrix, which makes it possible to compare objects described by mutually correlated features. In addition, the use of the Mahalanobis distance gives two basic benefits: (1) there is no requirement to standardize/normalize the variables before starting the analysis, and (2) it takes into account the mutual correlation of the features describing the compared objects (when using a covariance matrix, we use information about the relationship between features that is outside the diagonal of the matrix). The highest measures of Mahalanobis draught in 2015 were recorded for Slovakia (0.3809), Hungary (0.3386) and Croatia (0.3225). It can be assumed that the values of diagnostic variables (subjective and objective) reached typical values in these countries (Table 2).

The values of the measures of the Mahalanobis immersion (Table 2) made it possible to classify the States according to the corresponding value of this measure. The changes in the values of the immersion measures (2015 and 2022) are shown in Figure 2.

For the purposes of this study, four classes have been defined (clusters of European countries) (Table 3).

Table 2. Mahalanobis immersion values in 2015 and 2022

Specification	Mahalanobis distance	Mahalanobis immersion	Mahalanobis distance	Mahalanobis immersion
	2015		2022	
Austria	2.2926	0.3037	2.2320	0.3094
Belgium	2.4685	0.2883	2.3404	0.2994
Bulgaria	2.8846	0.2574	3.7301	0.2114
Croatia	2.1007	0.3225	2.8914	0.2570
Cyprus	2.4599	0.2890	1.6372	0.3792
Czech Republik	3.5571	0.2194	2.7981	0.2633
Denmark	2.7748	0.2649	2.3731	0.2965
Estonia	2.2820	0.3047	2.0246	0.3306
Finland	3.5255	0.2210	2.8536	0.2595
France	3.6592	0.2146	2.4738	0.2879
Germany	2.8110	0.2624	2.3783	0.2960
Greece	4.5681	0.1796	4.0204	0.1992
Hungary	1.9526	0.3387	2.2171	0.3108
Ireland	4.0181	0.1993	4.2805	0.1894
Italy	2.3659	0.2971	2.1026	0.3223
Latvia	2.2545	0.3073	2.0299	0.3300
Lithuania	3.3383	0.2305	3.2596	0.2348
Luxembourg	4.4654	0.1830	4.1516	0.1941
Malta	2.3746	0.2963	4.0857	0.1966
Netherlands	2.6093	0.2771	3.1841	0.2390
Poland	2.4081	0.2934	3.2682	0.2343
Portugal	3.0119	0.2493	1.9256	0.3418
Slovakia	1.6249	0.3810	2.2074	0.3118
Slovenia	2.4252	0.2920	3.6141	0.2167
Spain	2.5688	0.2802	3.2856	0.2333
Sweden	3.2493	0.2353	2.5208	0.2840

Source: own analysis

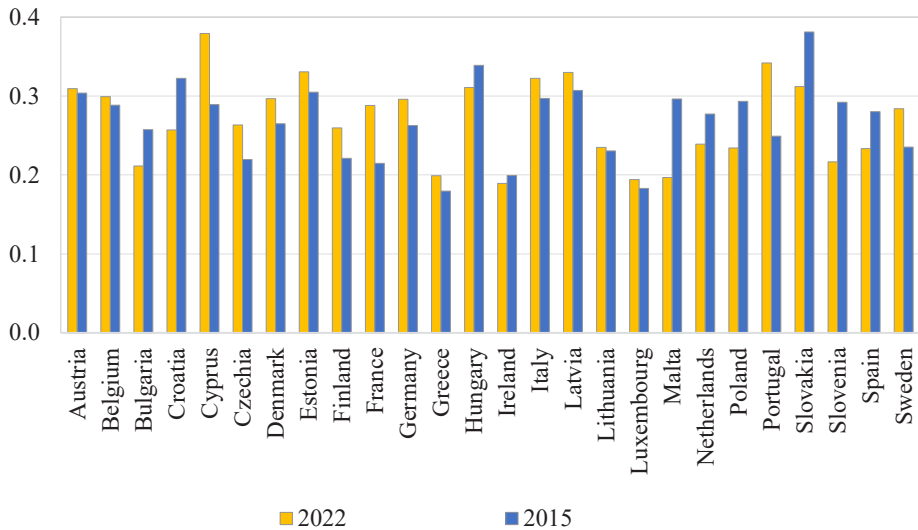


Figure 2. Values of Mahalanobis immersion

Source: own analysis based on Table 2

Table 3. Clusters of European countries in 2015 and 2022

Cluster number	Value of the measure of Mahalanobis immersion	2015	2022
I	< 0.20	Greece, Ireland, Luxembourg	Greece, Ireland, Luxembourg, Malta
II	0.21-0.25	Bulgaria, Czech Republik , Finland, France ,	Bulgaria, Croatia , Finland,
III	0.26-0.3	Belgium, Cyprus , Denmark, Germany, Italy , Lithuania, Malta , Netherlands, Poland, Portugal , Slovenia, Spain, Sweden	Belgium, Czech Republic , Denmark, France , Germany, Lithuania, Netherlands, Poland, Slovenia, Spain, Sweden
IV	> 0.3	Austria, Croatia , Estonia, Hungary, Latvia, Slovakia	Austria, Cyprus , Estonia, Hungary, Italy , Latvia, Portugal , Slovakia

Source: own analysis

Countries belonging to the same clusters can be considered similar in terms of the diagnostic variables used in the analysis. For both 2015 and 2022, the most abundant focus is the third cluster. The value of the Mahalanobis dip measure for this focus was set from 0.26-0.30. In the clusters of countries determined on the basis of data for 2022, an increase in the value of the Mahalanobis immersion measure was observed for the following countries: Czech Republic, France, Cyprus, Italy and Portugal. As a result, the Czech Republic and France were classified in the third cluster in 2022. The increase in the value of the Mahalanobis immersion measure for Cyprus, Italy and Portugal has caused these countries to change their affiliation to the cluster.

CONCLUSIONS

On the basis of the available literature, we can conclude that the issue of the financial condition of households is a complex, multidimensional phenomenon. The multitude of factors determining the financial situation of households prompts the supplementation of research and analyses with subjective assessments of the financial situation of households. The statistical analysis carried out in this study indicates that the variables describing subjective assessments of the financial situation are characterized by very high volatility in both analysed years (2015 and 2022). The observed high values of coefficients of variation indicate a large diversity of the analyzed characteristics of households. In most of the European countries analysed, subjective assessments of the financial situation were below average. It should be emphasised that the balance of subjective assessments of household finances in 2022 deteriorated compared to the data for 2015 in most European countries. There was also a significant deterioration in the balance of assessments of the economic situation. The highest deterioration in subjective assessments of the financial situation of households living in rural areas was recorded in Bulgaria, the Czech Republic and Greece. In 2022, Finland had the highest assessments of financial position (for the Financial situation over the last 12 months variable and for the Financial situation over the next 12 months variable). The best subjective assessments of the economic situation were recorded in Malta. The calculated values of the Mahalanobis immersion measures made it possible to order the European countries according to the level of the analyzed features and groups of these countries were distinguished in the years 2015 and 2022. The clusters are a confirmation of the diversity of European households living in rural areas in terms of the level of their subjective and objective assessments of their financial situation.

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ZRÓŻNICOWANIE EUROPEJSKICH GOSPODARSTW DOMOWYCH
Z OBSZARÓW WIEJSKICH Z UWZGLĘDNIENIEM SUBIEKTYWNYCH
OCEN ICH SYTUACJI FINANSOWEJ I GOSPODARCZEJ
– ANALIZA KOMPARATYWNA

Słowa kluczowe: gospodarstwa domowe, obszary wiejskie, sytuacja finansowa
gospodarstw domowych, miara zanurzenia Mahalanobisa

ABSTRAKT. Subiektywne oceny sytuacji finansowej gospodarstw domowych są miarą coraz częściej wykorzystywaną w analizach porównawczych, dotyczących warunków i jakości życia, a także zadowolenia z sytuacji ekonomicznej i gospodarczej. Ze względu na to, że oceny sytuacji finansowej są wysoce indywidualne i subiektywne, należy podkreślić, że różne gospodarstwa domowe mogą oceniać swoją sytuację inaczej, nawet przy podobnych warunkach ekonomicznych. Wykorzystano dane wtórne zgromadzone i opublikowane przez EUROSTAT, dotyczące gospodarstw domowych na obszarach wiejskich. Badania miały na celu uzyskanie odpowiedzi na pytania: (1) czy przyjęte do analizy zmienne diagnostyczne różnicują istotnie statystycznie europejskie gospodarstwa domowe oraz (2) czy przeprowadzony efekt grupowania (skupienia) w latach 2015 i 2022 był taki sam. Do analizy zróżnicowania zmiennych diagnostycznych wykorzystano miary zanurzenia Mahalanobisa obserwacji w próbie. Przeprowadzona analiza pozwoliła na ocenę analizy przestrzennego zróżnicowania europejskich gospodarstw domowych zlokalizowanych na obszarach wiejskich i wyodrębnienie grup państw, wykazujących podobieństwa ze względu na przyjęte do analizy zmienne diagnostyczne.

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