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Cultural Differences and the Consumption Structure in the European Union Countries

Abstract: The aim of the paper is to study the cultural differentiation in the European Union countries and compare it with the differentiation in their consumption spending. The question is whether similar countries in terms of culture have similar final consumption expenditures and consumption structures. Culture in this research is characterised by six Hofstede dimensions – power distance, individualism vs. collectivism, masculinity vs. femininity, uncertainty avoidance, long term orientation and indulgence vs. restraint. The consumption structure is characterised by share of durable goods, semi-durable goods, non-durable goods and services in households' final consumption. In the analysis, the influence of culture on the share of non-durable goods and services in final consumption expenditures is considered. Countries' similarities in these two aspects are evaluated with the use of the cluster analysis approach – the *k*-means algorithm and the Ward clustering method. The dependence between the structure of final consumption expenditures and culture is investigated using spatial autoregressive (SAR) and spatial error (SE) panel data models.

Keywords: culture, consumption structure, cluster analysis, spatial models

JEL: C1, D1, E2

1. Introduction

Consumption is the main factor in all economies. Household final consumption expenditures are a significant part of Gross Domestic Product (GDP). There are a few determinants of consumption expenditures, e.g. economic, technological, socio-demographic, cultural and psychological ones (Janoś-Kresło, Mróz, 2006; Bywalec, 2009; Khan et al., 2015). Among economic determinants, for example, disposable income and price indices are included, whose influence on consumption was investigated by researchers (e.g.: Campbell, Mankiw, 1990; Masih, Masih, 1997; Jovanovic, 2016; Bunn et al., 2018; Jankiewicz, 2018a; 2018b). Demographic determinants are, for example, the age structure of consumers and the size of households. The product manufacturing technology, which affects product prices, is a very important technological determinant. However, it is necessary to study the impact of cultural determinants on households' final consumption expenditures too (Małysa-Kaleta, 2015). Many researchers considered the dependence of consumption on culture, for example: De Mooij and Hofstede (2002), Yenyurt and Townesend (2003), Zukin and Maguire (2004), Schaefer and Crane (2005), Borg (2011), Podoshen, Li and Zhang (2011).

This paper is a continuation of the investigation regarding consumption expenditures in the European Union countries (Jankiewicz, 2018b). The previous study focuses on their convergence with the influence of disposable income and consumer prices in the light of consumption sustainability. Moreover, final consumption expenditures of households were considered. In this research, the impact of culture on households' consumption structure is added.

The primary aim of the investigation is to analyse the cultural differentiation of the EU countries using the national culture 6-D model of Geert Hofstede. Initially, it was the 5-D model (see: Hofstede, Hofstede, 2007). The Hofstede dimensions approach is the most frequently used approach to characterise culture. Soares, Farhangmehr and Shoham (2007) compared the Hofstede dimensions with other culture models. Based on the results of culture differentiation, a connection matrix is built. Another aim is to study the influence of culture on final consumption expenditures of households with the use of spatial panel data models.

2. The subject and scope of investigation

The study concerns the influence of culture on the consumption structure in the EU countries (excluding Croatia, Cyprus and Malta) in the period of 1999–2016. Moreover, the influence of disposable income and inflation is considered. The consumption structure is characterised by two processes: the share of final consumption expenditures on non-durable goods in the final consumption expendi-

tures (Y_1) and the share of final consumption expenditures on services in the final consumption expenditures (Y_2).

The adopted spatial aggregation and time range of this study make it easy to adopt tools of spatial econometrics to analyse consumption structure differences. The cultural dependence is investigated with the use of the spatial autocorrelation approach (based on Moran's I statistics). In the previous analysis of consumption in the EU countries, the spatio-temporal dependence approach was used by Jan-kiewicz (2018a; 2018b). Spatial models are estimated in order to verify the cultural impact on the consumption structure hypothesis.

The first hypothesis in this study concerns large diversity of household final consumption expenditures on non-durable goods and services in the EU countries. The second one applies to a significant influence of the cultural factor on the consumption structure in the EU countries (countries with a similar culture are characterised by a similar consumption structure).

3. Data

Data applied in this study come from the Eurostat database and the website of the Hofstede insights. The variables Y_1 and Y_2 are obtained through own calculation. Data about culture are taken directly from the website.

Culture is characterised by the following six indicators (according to Hofstede 6-D model, adopted from: <https://www.hofstede-insights.com/models/national-culture/>):

- 1) Power distance index (PDI),
- 2) Individualism versus collectivism (IDV),
- 3) Masculinity versus femininity (MAS),
- 4) Uncertainty avoidance index (UAI),
- 5) Long term versus short term orientation (LTO),
- 6) Indulgence versus restraint (IND).

The characteristics of all the dimensions can be found in Hofstede and Hofstede (2007); Subocz (2012).

4. Methodology

The first step of the research is to group the EU countries according to similarity of their cultural conditions. The countries are clustered according to the Ward and k -means methods. Ward's method is an example of hierarchical clustering. The first step in the hierarchical methods is to build the distance matrix between considered objects. A k -means algorithm is an optimisation-iterative method of clustering. The

first step of the *k*-means grouping is to choose the number of groups. The Ward clustering method and the *k*-means algorithm are described by Frątczak (2009).

Assuming the similarity of the countries according to cultural conditions, the similarity of the household consumption structures is analysed based on Moran's *I* statistics (and its significance). The test statistic takes the following form (Schabenberger, Gotway 2005; Suchecki, 2010):

$$I = \frac{1}{\sum_{i=1}^n \sum_{j=1}^n w_{ij}} * \frac{\sum_{i=1}^n \sum_{j=1}^n w_{ij} [y_i - \bar{y}][y_j - \bar{y}]}{\frac{1}{n} \sum_{i=1}^n [y_i - \bar{y}]^2} = \frac{n}{S_0} * \frac{\mathbf{z}^T \mathbf{W} \mathbf{z}}{\mathbf{z}^T \mathbf{z}}, \tag{1}$$

where: y_i – an observed value of the phenomenon in the region *i*, \mathbf{z} – a column vector with elements $z_i = y_i - \bar{y}$, $S_0 = \sum_{i=1}^n \sum_{j=1}^n w_{ij}$ – a sum of the corresponding elements

of the weights of matrix **W**, *n* – the number of regions. In this research, the matrix **W** of connections based on a common culture is used. The common culture is understood as membership in the same cluster according to both methods presented above.

In the next step of the investigation, spatial panel data models are used for verifying the dependence of the consumption structure in the EU countries on culture analysis (Suchecki, 2012). The LM tests are used to choose between the spatial autoregressive (SAR) model and the spatial error (SE) model. The spatial panel data models are estimated in the following forms:

$$Y_{i,t} = \alpha_0 + \alpha_1 d_in_{i,t} + \alpha_2 cpi_{i,t} + \eta_{i,t}, \quad \eta_{i,t} = \lambda \mathbf{W}(\eta_{i,t}) + \varepsilon_{i,t}, \tag{2}$$

$$Y_{i,t} = \alpha_i + \alpha_1 d_in_{i,t} + \alpha_2 cpi_{i,t} + \eta_{i,t}, \quad \eta_{i,t} = \lambda \mathbf{W}(\eta_{i,t}) + \varepsilon_{i,t}, \tag{3}$$

$$Y_{i,t} = \alpha_i + \alpha_1 d_in_{i,t} + \alpha_2 cpi_{i,t} + \rho \mathbf{W}(Y_{i,t}) + \varepsilon_{i,t}. \tag{4}$$

The *d_in* and *cpi* variables denote the level of disposable income of households and consumer price indices respectively. The significance of parameters ρ/λ shows the influence of culture on the consumption structure in the EU countries. Models (2) and (3) are called the spatial error panel data model (SE_Pooled) and the spatial error panel data model with fixed individual effects (SE_FE_IND) respectively. Model (4) is called as the spatial autoregressive panel data model with fixed individual effects (SAR_FE_IND). The connection matrices (**W**) in this investigation are created with the use of the cluster analysis results. The **W** is a row-standardised matrix, created from a binary matrix, where: $w_{ij} = 1$ when countries are in the same cluster and $w_{ij} = 0$ when countries are in separate clusters. Two different matrices are built: the first matrix of connections – based on the Ward method clustering, and the other matrix of connections – based on the *k*-means clustering.

5. Empirical results

The first step of the investigation is to cluster the EU countries according to cultural similarity. Clustering with the Ward and *k*-means methods is done. The EU countries are divided into eight groups – the number of groups is chosen by the Author. The subject of the study – cultural diversity – means that the number of clusters cannot be too small. Cultural diversity in the European Union is considerable. The EU countries are not homogeneous considering cultural characteristics. That is why the EU countries are divided into eight clusters. No methods to evaluate efficiency of the division are used. Table 1 shows the results of the clustering with the two methods mentioned above.

Table 1. The results of clustering of the EU countries according to similarities in their cultural conditions

Cluster	Ward clustering	<i>k</i> -means clustering
Cluster 1	Austria, Czech Republic, Germany, Hungary, Italy, Luxembourg	Austria, Germany, Hungary, Italy
Cluster 2	Belgium, France	Belgium, Czech Republic, France, Luxembourg
Cluster 3	Estonia, Lithuania, Latvia	Estonia, Lithuania, Latvia
Cluster 4	Denmark, Finland, Netherlands, Sweden	Denmark, Finland, Ireland, Netherlands, Sweden, United Kingdom
Cluster 5	Slovakia	Slovakia
Cluster 6	Spain, Greece, Poland	Spain, Greece, Poland
Cluster 7	Bulgaria, Portugal, Romania, Slovenia	Portugal, Slovenia
Cluster 8	Ireland, United Kingdom	Bulgaria, Romania

Source: author's own elaboration

The results of clustering of the EU countries according to their cultural similarity do not differ significantly using the Ward and *k*-means methods. Two countries from Cluster 1 according to the Ward clustering (the Czech Republic and Luxembourg) are included in the second group according to the *k*-means clustering (with Belgium and France). The third group is the same in both methods of clustering. Cluster 4 and Cluster 8 in the Ward clustering form one cluster in the *k*-means clustering (Ireland and the United Kingdom join the Scandinavian countries and the Netherlands) and Cluster 7 in the first method of clustering is divided into two clusters according to the second clustering method (Bulgaria and Romania are separated from Portugal and Slovenia). The other two groups are the same in both clustering methods. Figure 1 shows the spatial differentiation of cultural similarities in the EU across countries.

On the maps in Figure 1, the EU countries are divided based on the previously made clustering. Spatial differentiation of their cultural conditions does not differ

significantly while using both methods of clustering. Most of the clusters form geographically coherent areas. Countries in the north part of the continent are characterised by similar cultural conditions, same as countries in the middle and in the eastern-northern parts of the EU. Only countries from two clusters are located relatively far away – Spain, Greece and Poland, and also Portugal and Slovenia.

Based on the results of the clustering, two matrices of connections (neighbourhood matrices) are created. Two spatial units are neighbours if they are in the same group according to cultural conditions. A division into eight clusters characterises the first-order neighbourhood. Based on these matrices, Moran's I statistics is calculated and a test of its significance is performed. Table 2 shows the results of the spatial autocorrelation test.

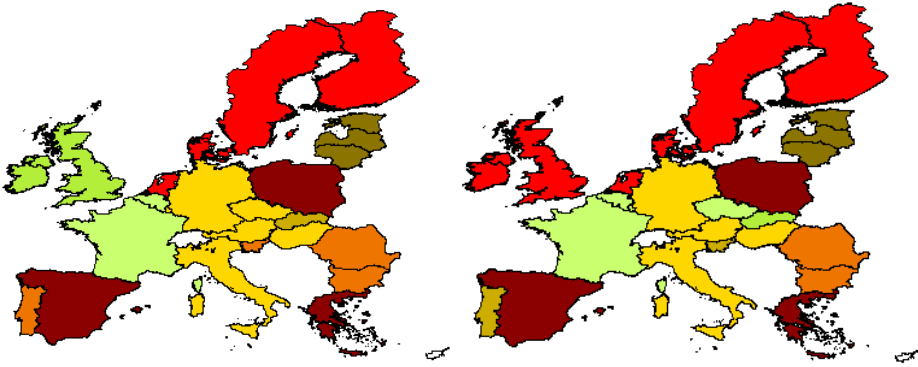


Figure 1. Spatial differentiation of culture similarities according to the Ward clustering (left map) and the k -means clustering (right map)

Source: author's own elaboration

In the years 1999–2016, Moran's I statistics are positive and statistically significant for both methods of clustering and for both considered variables. It means that the countries with similar cultural conditions have similar values of the share of final consumption expenditures on non-durable goods in the final consumption expenditures (variable Y_1) and the share of final consumption expenditures on services in the final consumption expenditures (variable Y_2). The dependence is relatively stronger for variable Y_2 than for variable Y_1 according to the first matrix of connections (Moran's I statistics are higher in the major part of the research period). For the second matrix of connections, the differences in Moran's statistics from 2008 are not large.

The cultural dependence of the consumption structures is investigated based on Moran's I statistics. Next, panel data models and spatial panel data models with fixed individual effects are estimated and verified. Table 3 presents the results of estimation and verification of panel data and spatial panel data models for variable Y_1 . In spatial models, the connection matrix based on the Ward clustering is used (1st matrix of connections).

Table 2. The results of the spatial autocorrelation test

Year	Ward clustering matrix				<i>k</i> -means clustering matrix			
	Non-durable goods		Services		Non-durable goods		Services	
	Moran's <i>I</i>	<i>p</i> -value	Moran's <i>I</i>	<i>p</i> -value	Moran's <i>I</i>	<i>p</i> -value	Moran's <i>I</i>	<i>p</i> -value
1999	0.3728	0.0121	0.3591	0.0150	0.4755	0.0025	0.3384	0.0197
2000	0.3602	0.0148	0.3449	0.0186	0.4637	0.0031	0.3445	0.0187
2001	0.3690	0.0130	0.3839	0.0106	0.4721	0.0027	0.3698	0.0129
2002	0.3641	0.0135	0.4131	0.0065	0.4679	0.0028	0.3980	0.0081
2003	0.3620	0.0134	0.4137	0.0062	0.4612	0.0029	0.3862	0.0093
2004	0.3845	0.0098	0.4613	0.0028	0.4974	0.0016	0.4552	0.0031
2005	0.3488	0.0161	0.3902	0.0083	0.4074	0.0069	0.3467	0.0155
2006	0.2683	0.0460	0.3591	0.0122	0.3060	0.0295	0.3206	0.0210
2007	0.2796	0.0416	0.3701	0.0112	0.3423	0.0193	0.3601	0.0129
2008	0.3249	0.0234	0.3845	0.0086	0.3710	0.0127	0.3809	0.0091
2009	0.4042	0.0080	0.4364	0.0035	0.4412	0.0046	0.4267	0.0042
2010	0.4083	0.0078	0.4734	0.0024	0.4555	0.0038	0.4624	0.0029
2011	0.4090	0.0077	0.4654	0.0025	0.4246	0.0061	0.4281	0.0046
2012	0.3916	0.0098	0.4234	0.0051	0.4056	0.0080	0.4092	0.0064
2013	0.3808	0.0115	0.4085	0.0067	0.3793	0.0117	0.3891	0.0089
2014	0.3972	0.0092	0.4227	0.0057	0.4021	0.0085	0.3908	0.0092
2015	0.3770	0.0122	0.4197	0.0059	0.3588	0.0157	0.3635	0.0134
2016	0.3747	0.0125	0.4209	0.0059	0.3650	0.0143	0.3589	0.0146

Source: author's own calculations

Four types of models are estimated – the OLS panel data model (Pooled), the panel data model with fixed individual effects (FE_IND), the spatial error panel data model (SE_Pooled) and the spatial error panel data model with fixed individual effects (SE_FE_IND). Based on Wald statistics, individual effects are significant (at the 0.05 level of significance). The residuals in the FE_IND model show a spatial autocorrelation. It means that cultural connections between the EU countries are statistically significant. That is why the FE_FE_IND model was estimated. The parameter λ is positive and also significant. Culturally similar countries have similar values of the Y_1 variable.

Next, the same models were estimated and verified for variable Y_2 . Table 4 shows the results of their estimation and verification. As previously, fixed individual effects are statistically significant and a spatial autocorrelation in residuals of the FE_IND model is present. Finally, in the SE_FE_IND model, the spatial dependence is also significant (*p*-value for the parameter λ is less than 0.05). The sign of parameter λ is opposite than in the model for the variable Y_1 .

The cultural dependence is also evaluated with the *k*-means (2nd) connection matrix – matrix based on the results of *k*-means clustering. Table 5 presents the results of estimation and verification of models for the variable Y_2 considering the 2nd matrix of connections.

Table 3. The results of estimation and verification of panel data and spatial panel data models for the variable Y_1 with the Ward method connection matrix

Parameter	Pooled	FE_IND	SE_Pooled	SE_FE_IND
α_0	0.4654 (0.0000)	–	0.4634 (0.0000)	–
α_1	-8.2630e-06 (0.0000)	-2.5190e-06 (0.0000)	-8.1433e-06 (0.0000)	-2.4953e-06 (0.0000)
α_2	0.0013 (0.0476)	-0.0002 (0.2840)	0.0016 (0.0170)	-0.0002 (0.3188)
λ	–	–	0.0706 (0.1659)	0.1804 (0.0000)
Wald test	$F = 207.6854,$ $p\text{-value} = 0.0000$	–	$F = 217.3994,$ $p\text{-value} = 0.000$	–
Moran test	0.0598 (0.0864)	0.1802 (0.0000)	-0.0007 (0.5139)	-0.0044 (0.4818)
LMerr	1.8549 (0.1732)	16.8054 (0.0000)	–	–
LMlag	0.1007 (0.7510)	16.5903 (0.0000)	–	–
RLMerr	1.9683 (0.1606)	0.2687 (0.6042)	–	–
RLMlag	0.2141 (0.6436)	0.0535 (0.8170)	–	–

Source: author's own calculations

Table 4. The results of estimation and verification of panel data and spatial panel data models for the variable Y_2 with the Ward method connection matrix

Parameter	Pooled	FE_IND	SE_Pooled	SE_FE_IND
α_0	0.3882 (0.0000)	–	0.3922 (0.0000)	–
α_1	6.4690e-06 (0.0000)	4.8890e-06 (0.0000)	6.1769e-06 (0.0000)	5.0428e-06 (0.0000)
α_2	-0.0016 (0.0081)	-0.0007 (0.0011)	-0.0018 (0.0038)	-0.0007 (0.0002)
λ	–	–	0.1630 (0.0008)	-0.1045 (0.0414)
Wald test	$F = 192.4807,$ $p\text{-value} = 0.0000$	–	$F = 187.5800,$ $p\text{-value} = 0.000$	–
Moran test	0.1505 (0.0004)	-0.0883 (0.0296)	-0.0043 (0.5173)	0.0092 (0.4003)
LMerr	11.7207 (0.0006)	4.0315 (0.0447)	–	–
LMlag	17.8016 (0.0000)	0.1233 (0.7255)	–	–
RLMerr	2.7637 (0.0964)	36.7035 (0.0000)	–	–
RLMlag	8.8446 (0.0029)	32.7953 (0.0000)	–	–

Source: author's own calculations

Table 5. The results of estimation and verification of panel data and spatial panel data models for the variable Y_1 with the k -means connection matrix

Parameter	Pooled	FE_IND	SE_Pooled	SE_FE_IND
α_0	0.4654 (0.0000)	–	0.4624 (0.0000)	–
α_1	–8.2630e–06 (0.0000)	–2.5190e–06 (0.0000)	–8.0792e–06 (0.0000)	–2.5410e–06 (0.0000)
α_2	0.0013 (0.0476)	–0.0002 (0.2840)	0.0016 (0.0184)	–0.0006 (0.0112)
λ	–	–	0.0801 (0.1037)	0.2007 (0.0000)
Wald test	$F = 207.6854$, p -value = 0.0000	–	$F = 219.5648$, p -value = 0.000	–
Moran test	0.0728 (0.0498)	0.1985 (0.0000)	–0.0084 (0.5532)	–0.0249 (0.3104)
LMerr	2.7442 (0.0976)	20.4052 (0.0000)	–	–
LMlag	0.8573 (0.3545)	19.7045 (0.0000)	–	–
RLMerr	1.8929 (0.1689)	0.7018 (0.4022)	–	–
RLMlag	0.0060 (0.9383)	0.0011 (0.9733)	–	–

Source: author's own calculations

As above, four types of models are estimated. Non-spatial and spatial pooled models show the significance of fixed individual effects. Moreover, residuals of the FE_IND model show a spatial autocorrelation, measured using the 2nd connection matrix. The parameter λ of the SE_FE_IND model is positive and statistically significant. It means that culturally similar countries have similar values of the Y_1 variable. The residuals of spatial models do not show a spatial autocorrelation – cultural connections explain well the similarities of the consumption structure in the EU countries.

Models for the variable Y_2 taking into account the 2nd matrix of connections are estimated too. Table 6 presents the results of their estimation and verification.

The difference compared with the previous models is that instead of the SE_FE_IND model the spatial autoregressive panel data model with fixed individual effects (SAR_FE_IND) is estimated. Significance of fixed individual effects in non-spatial and spatial models is observed. Moreover, the spatial autocorrelation in the Pooled and FE_IND models is noted. The parameter λ is negative and statistically significant (as for the SE_FE_IND model in Table 4). It means that the cultural connections are important in formation of the household consumption structure.

In all estimated models, the influence of additional processes on the consumption structure in the EU countries is considered – disposable income and inflation. Disposable income influences positively the variable Y_2 and negatively the variable Y_1 – the parameter α_1 is statistically significant and also positive and negative respectively. Inflation in all models for the variable Y_2 has a negative influence (the

parameter α_2 is statistically significant and negative). For the variable Y_1 , the impact is weaker and not always significant.

Table 6. The results of estimation and verification of panel data and spatial panel data models for the variable Y_2 with the k -means connection matrix

Parameter	Pooled	FE_IND	SAR_Pooled	SE_FE_IND
α_0	0.3882 (0.0000)	–	0.3598 (0.0000)	–
α_1	6.4690e–06 (0.0000)	4.8890e–06 (0.0000)	5.9427–06 (0.0000)	5.2761e–06 (0.0000)
α_2	–0.0016 (0.0081)	–0.0007 (0.0011)	–0.0016 (0.0058)	–0.0007 (0.0008)
λ	–	–	–	–0.1585 (0.0058)
ρ	–	–	0.0784 (0.0006)	–
Wald test	$F = 192.4807$, p -value = 0.0000	–	$F = 192.2160$, p -value = 0.000	–
Moran test	0.0854 (0.0272)	–0.1055 (0.0117)	0.0037 (0.5525)	–0.0009 (0.4879)
LMerr	3.7714 (0.0521)	5.7644 (0.0164)	–	–
LMlag	11.8113 (0.0006)	0.7081 (0.4001)	–	–
RLMerr	0.1613 (0.6879)	66.8813 (0.0000)	–	–
RLMlag	8.2013 (0.0042)	61.8250 (0.0000)	–	–

Source: author's own calculations

6. Conclusions

Culture is one of important determinants of consumption expenditures and the consumption structure. However, the cultural factor is usually skipped in quantitative studies of consumption. One of the barriers can be the difficulty with its measurement – culture is difficult to quantify. Moreover, there are many models of culture. Nevertheless, supplemented consumption models including cultural conditions have their added value. The most frequently used is the 6-D model defined by Hofstede.

The conducted analysis of cultural differentiation shows that countries located in similar parts of the continent have similar cultural conditions. The results do not depend on the method of research used in this paper. Both clustering methods give similar results. Cultural connections between countries have a significant influence on the share of final consumption expenditures on non-durable goods in the final consumption expenditures (shocks not related with the considered process in countries with similar cultural conditions have a positive impact) and the share of fi-

nal consumption expenditures on services in the final consumption expenditures (shocks not related with the considered process in countries with similar cultural conditions have a negative impact). Moreover, other determinants of consumption did not lose their significance after adding the cultural connection matrix. Disposable income has a positive impact on consumption of services and a negative impact on consumption of non-durable goods (in the majority being necessity goods).

In the next step of the investigation in this field, other connections matrices will be considered. Moreover, consumption structure convergence models will be estimated – with the influence of the culture factor. The consumption structure analysis will be supplemented by the sustainable development theory.

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Różnice kulturowe a struktura konsumpcji w krajach Unii Europejskiej

Streszczenie: Celem artykułu jest zbadanie zróżnicowania kulturowego w krajach Unii Europejskiej oraz jego porównanie ze zróżnicowaniem wydatków konsumpcyjnych tych krajów. Pytanie badawcze dotyczy tego, czy podobieństwo kulturowe krajów jest równoznaczne z podobieństwem w ramach struktury konsumpcji. W badaniu kulturę opisano z wykorzystaniem sześciu wymiarów zaproponowanych przez G. Hofstede'go – dystansu do władzy, indywidualizmu a kolektywizmu, męskości a kobiecości, unikania niepewności, orientacji długoterminowej, odpustu a powściągliwości. Struktura konsumpcji została opisana przez udział w wydatkach konsumpcyjnych gospodarstw domowych wydatków na następujące grupy dóbr: dobra trwałego użytku, dobra półtrwałego użytku, dobra nietrwałego użytku oraz usługi. W badaniu zweryfikowano wpływ kultury na udział wydatków na dobra nietrwałego użytkowania oraz usługi w finalnych wydatkach konsumpcyjnych. Podobieństwo kulturowe oraz konsumpcyjne krajów Unii Europejskiej zostało zweryfikowane z wykorzystaniem analizy skupień – algorytmu *k*-średnich oraz metody Warda, a zależność między rozważanymi aspektami badania z wykorzystaniem przestrzennego modelu autoregresyjnego oraz modelu błędu przestrzennego.

Słowa kluczowe: kultura, struktura konsumpcji, analiza skupień, modele przestrzenne

JEL: C1, D1, E2

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