

Comparison of income poverty and social exclusion in the EU in 2008 and 2016

Erik Šoltés¹, Tatiana Šoltésová²

Abstract

Poverty, material deprivation and joblessness are serious problems to which the European Union still has to pay close attention since, according to the European Commission, meeting the Europe 2020 strategy goals in the area of poverty and social exclusion seems improbable. The aim of the article is to map a spatial distribution of income poverty and social exclusion from point of view of three-dimensional concept including poverty, material deprivation and joblessness in EU-28 in 2016 (the most recent available data from EU-SILC survey and selected statistics provided by Eurostat). For that purpose, multivariate statistical methods were used, such as correlation analysis, factor analysis and cluster analysis. Results gained for the year 2016 are compared to the reference year 2008 (the most recent data available when the target for Europe strategy 2020 was adopted (in 2010)). The paper puts emphasis on the visualisation of results obtained by statistical methods, therefore, the analyses were carried out by means of SAS JMP.

Keywords: *poverty and social exclusion, income poverty, material deprivation, joblessness, cluster analysis*

JEL Classification: I32, C38, E24

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1 Introduction

Combating against poverty and social exclusion is one of the headline targets of Europe 2020 strategy. This strategy for smart, sustainable and inclusive growth is approaching its final year so we decided to compare the conditions of income poverty and social exclusion in the EU member countries in 2016 (the most recent available data from EU-SILC survey) and in 2008. In order to assess poverty and social exclusion, Europe 2020 strategy uses 3-dimensional concept which take into account three dimensions: income poverty, material deprivation and labour market exclusion. These three negative social phenomena influence one another. In recent 10 years more studies have appeared that evaluate a one dimension of poverty and social exclusion in relation to other dimensions rather than in isolation. From scientific works that analyse relation between poverty and material deprivation or even deal with consistent poverty, we were inspired by (Guio and Maquet, 2006; Labudová et al., 2010; Nolan and

¹ University of Economics in Bratislava, Faculty of Economic Informatics, Department of Statistics, Dolnozemská cesta 1, 852 35 Bratislava, Slovakia, e-mail: erik.soltes@euba.sk

² University of Economics in Bratislava, Faculty of Economic Informatics, Department of Mathematics and Actuarial Science, Dolnozemská cesta 1, 852 35 Bratislava, Slovakia, e-mail: tatiana.soltesova@euba.sk

Whelan, 2010; Želinský, 2010). The influence of labour market exclusion or low work intensity of households on poverty was proven for example in papers (Guagnano et al., 2013; Mysíková et al., 2015; Kis and Gábos, 2016). Ayllón and Gábos (2015) and Řezanková and Želinský (2014) confirmed the impact of very low work intensity and joblessness of households on material deprivation in Central and Eastern Europe and the Czech Republic, respectively.

The article maps and compares the conditions of income poverty and social exclusion in the member countries of EU in 2008 (the year 2008 is the reference year for strategy Europe 2020) and in 2016. As the partial indicators (at-risk-of poverty rate, severe material deprivation rate, very low work intensity rate) of the aggregate indicator AROPE (at risk of poverty or social exclusion) map “only” the occurrence of income poverty and social exclusion but not the depth of those negative phenomena, we decided to also use some indicators characterising the severity of poverty and social exclusion in the EU to create a more objective and more complex picture. Each dimension of poverty and social exclusion was captured in the paper by means of 4 indicators. For the dimension of *Income poverty and income inequality* we used the following indicators: the *at-risk-of poverty rate after social transfers* (AROP), the *relative median at-risk-of-poverty rate gap* (PG), the *income quintile share ratio* or *S80/S20 ratio* (S80-S20), the *persistent at-risk-of poverty rate* (Persistent_P). The dimension of *Material deprivation* was represented by the following indicators: the *material deprivation rate* (MD), the *severe material deprivation rate* (SMD), the *mean number of deprivation items among the deprived* (Depth_MD), the *severe housing deprivation rate* (Housing_D). The dimension of *Exclusion from labour market* was represented by the following indicators: the *unemployment rate* (UR), the *long-term unemployment rate, % of active population aged 15-74* (Long_term_U), the *jobless households rate* (Jobless_H), the *very low work intensity rate* (VLWI).

2 Analysis of source variable dependence and data preparation for cluster analysis

As it was mentioned in the introduction of the article there are many scientific studies that confirmed significant relationships between dimensions of poverty and social exclusion. For this reason, it is not surprising that most of observed indicators, especially those ones that belong to the same dimension, are mutually dependent (Fig. 1).

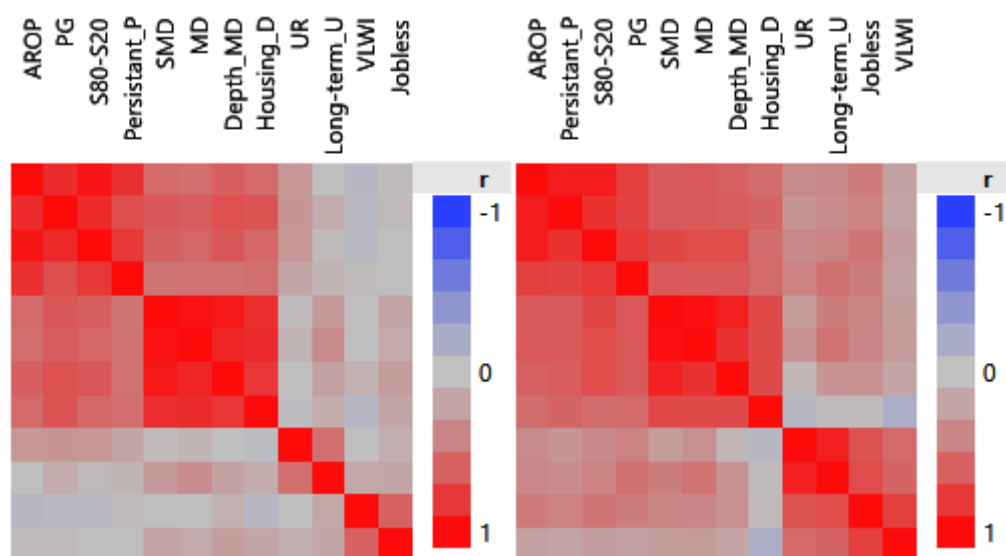


Fig. 1. Correlation maps of source indicators for 2008 (on the left) and 2016 (on the right).

Source: Eurostat, self-processed in SAS JMP.

In both analysed years we can notice weaker relationship between unemployment rates on the one side and very low work intensity rate or joblessness of households on the other side than between the unemployment rates themselves or between indicators of labour market exclusion of households. It is particularly visible for the year 2008. On the one hand, the analysed indicators characterize poverty and social exclusion from various perspectives, on the other hand, those perspectives more or less overlap as the significant correlations among the monitored indicators testify. As a result, for the purpose of the cluster analysis, the set of original indicators had to be redesigned into a set of new, mutually independent variables. Factor analysis was implemented to serve that purpose. We attempted to create such factors that would be determined by those source indicators which would facilitate their interpretation. Simultaneously, we wanted to decrease the number of dimensions, i.e. to achieve a reduced number of factors compared to the original indicators while those factors would still carry at least 85% of information provided by the original indicators.

To assess the suitability of source indicators for the factor analysis, we applied the Kaiser-Meyer-Olkin measure (Stankovičová and Vojtková, 2007). The KMO statistics (Table 1) showed excellent suitability of the source variables for factor analysis.

If we applied the Kaiser's rule for eigenvalues in correlation matrices which states that only factors with eigenvalues greater than average eigenvalue should be used (the average eigenvalue of a correlation matrix is 1) then we would consider 4 factors in 2008 and 2 factors

in 2016 (Fig. 2). In order to obtain comparable results, we decided to set the number of factors to 4.

Table 1. Values of Kaiser-Meyer-Olkin measure for source indicators.

Kaiser's Measure of Sampling Adequacy: Overall MSA = 0.88382018											
AROP	PG	S80-S20	Persistent_P	SMD	MD	Depth_MD	Housing_D	UR	Long-term_U	VLWI	Jobless_H
0.885	0.925	0.822	0.949	0.855	0.870	0.830	0.923	0.857	0.872	0.926	0.913

Source: Eurostat, self-processed in SAS EG.

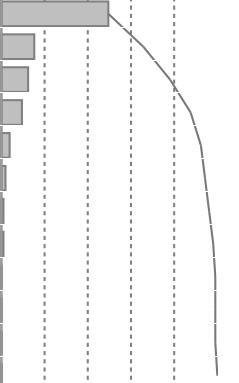
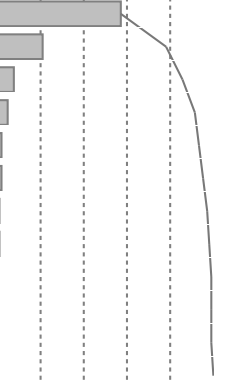
Number	2008				2016			
	Eigen-value	Percent		Cum Percent	Eigen-value	Percent		Cum Percent
1	6.0453	50.377		50.377	6.8598	57.165		57.165
2	1.8684	15.570		65.948	2.5375	21.146		78.311
3	1.5201	12.668		78.615	0.9342	7.785		86.096
4	1.1729	9.774		88.389	0.6416	5.346		91.442
5	0.5213	4.345		92.734	0.2781	2.317		93.759
6	0.2889	2.408		95.141	0.2633	2.194		95.953
7	0.2186	1.821		96.963	0.1945	1.621		97.574
8	0.1818	1.515		98.478	0.1332	1.110		98.684
9	0.0749	0.625		99.102	0.0876	0.730		99.414
10	0.0617	0.514		99.616	0.0429	0.357		99.771
11	0.0384	0.320		99.937	0.0234	0.195		99.966
12	0.0076	0.063		100.000	0.0041	0.034		100.000

Fig. 2. Eigenvalues of the correlation matrices (PCA method) for 2008 and 2016.

Source: Eurostat, self-processed in SAS JMP.

After obliquartimax rotation we obtained factor loadings shown in Table 2. Based on those factor loadings, we found out that the 1st factor had strong positive correlation with the indicators of material deprivation, the 2nd factor demonstrated strong positive correlation with the indicators of income poverty and income inequalities, the 3rd factor showed strong positive correlation with the indicators of labour market exclusion of inhabitants (unemployment rate and long-term unemployment rate) and the 4th factor was characterized by mostly labour market exclusion of households and had moderate positive correlation with the very low work intensity rate and the jobless households rate.

Table 2. Factor loadings after obbiquartimax rotation for 2008 and 2016.

	2008				2016			
	Factor				Factor			
	1	2	3	4	1	2	3	4
AROP	-0.033	0.997	0.046	0.017	0.056	0.969	-0.017	-0.011
PG	0.194	0.584	0.167	0.085	0.251	0.736	0.074	0.043
S80-S20	0.179	0.772	0.010	0.154	0.133	0.895	0.013	0.022
Persistent_P	0.039	0.904	0.018	0.001	0.101	0.775	0.080	-0.073
SMD	0.926	0.043	0.093	0.102	0.933	0.107	0.015	0.061
MD	0.901	0.045	0.272	-0.044	0.943	0.052	0.152	-0.064
Depth_MD	0.806	0.127	-0.233	0.293	0.776	0.264	-0.093	0.254
Housing_D	0.677	0.256	-0.062	-0.270	0.782	0.179	-0.029	-0.064
UR	-0.105	0.104	0.912	0.095	-0.231	0.299	0.717	-0.015
Long-term_U	0.182	-0.037	0.780	0.212	0.276	-0.259	0.830	0.120
VLWI	0.001	-0.029	0.118	0.707	-0.109	-0.010	0.007	0.651
Jobless	0.002	0.192	0.174	0.702	0.082	0.007	0.026	0.582

3 Cluster analysis of EU member countries in terms of income poverty and social exclusion in 2008 and 2016

The factor analysis resulted in 4 mutually independent factors, each representing one dimension of poverty and social exclusion. These factors were appropriate for the cluster analysis with the aim to create clusters of EU member countries where the countries falling into a common cluster would be most similar in terms of poverty and social exclusion while the countries in different clusters would be significantly different. Using Ward's method (Hebák et al., 2005) which due to its excellent results belongs among the most popular hierarchical procedures (Loster and Pavelka, 2013), we obtained a dendrogram in Fig. 3. The dendrogram is supplemented by colour maps of the 4 factors. The colour map in the 1st column refers to the 1st factor representing the material deprivation dimension, the colour map of the 2nd factor representing the dimension of income poverty and income inequality is shown in the 2nd column, and in the 3rd and 4th column we can find the colour map of the 3rd and 4th factor characterising labour market exclusion of inhabitants and households, respectively.

In 2008, *Cluster 1* includes Belgium, Germany, Ireland and France and is characterized by the highest labour market exclusion of households. Comparable poor values of indicators from this dimension were recorded in Bulgaria and Italy, as well. Cluster 1 achieved above-average good results in material deprivation.

Cluster 2 is created by three countries out of V4 countries, specifically Hungary, Poland and Slovakia. For the countries of this cluster was typical high threat of material deprivation. In 2008 the highest material deprivation across EU-27 was in Bulgaria and Romania followed by countries of Cluster 2. Slovakia recorded high unemployment rate and long-term unemployment rate (3rd factor). On the other hand, Slovakia and Hungary as well as the Czech Republic (from Cluster 5) achieved the best results within 1st dimension (2nd factor) – income poverty and income inequality.

Cluster 3 includes Baltic States (Estonia, Lithuania and Latvia), most countries of Southern Europe (Greece, Italy, Spain, Portugal) and the United Kingdom. These countries manifested above-average risk of income poverty and income inequality. Latvia even had significantly the worst situation in this dimension. Although countries of Southern Europe did not create a separate cluster, we can see that already in 2008 these countries were subject to a larger labour market exclusion than the rest of Cluster 3. While Portugal, Spain and Greece were threatened by high unemployment rates, Italy had trouble with high occurrence of households with very low work intensity and jobless households.

Cluster 4 is very specific due to extremely high social exclusion for reason of material deprivation. In addition, Bulgaria and Romania, which belong to this cluster, had to face a considerable income poverty and income inequality in 2008.

Overall, *Cluster 5* achieved the best results in area poverty and social exclusion. To Cluster 5 were merged up to 9 countries (the Czech Republic, Slovenia, Luxembourg, Malta, Denmark, the Netherlands, Austria, Finland and Sweden) so this cluster naturally shows some heterogeneity. Although most of countries had positively low values of factors as well as original indicators, in Slovenia and the Czech Republic we can observe slightly higher material deprivation but relatively very low income poverty and income inequality. A specific situation was in Cyprus which created a separate cluster (*Cluster 6*) with the lowest exclusion of households from labour market. Moreover, Cyprus had also good condition in other dimensions of poverty and social exclusion. Several states (mainly from Southern Europe) have failed to recover from the economic crisis yet and this was also revealed by cluster analysis for 2016.

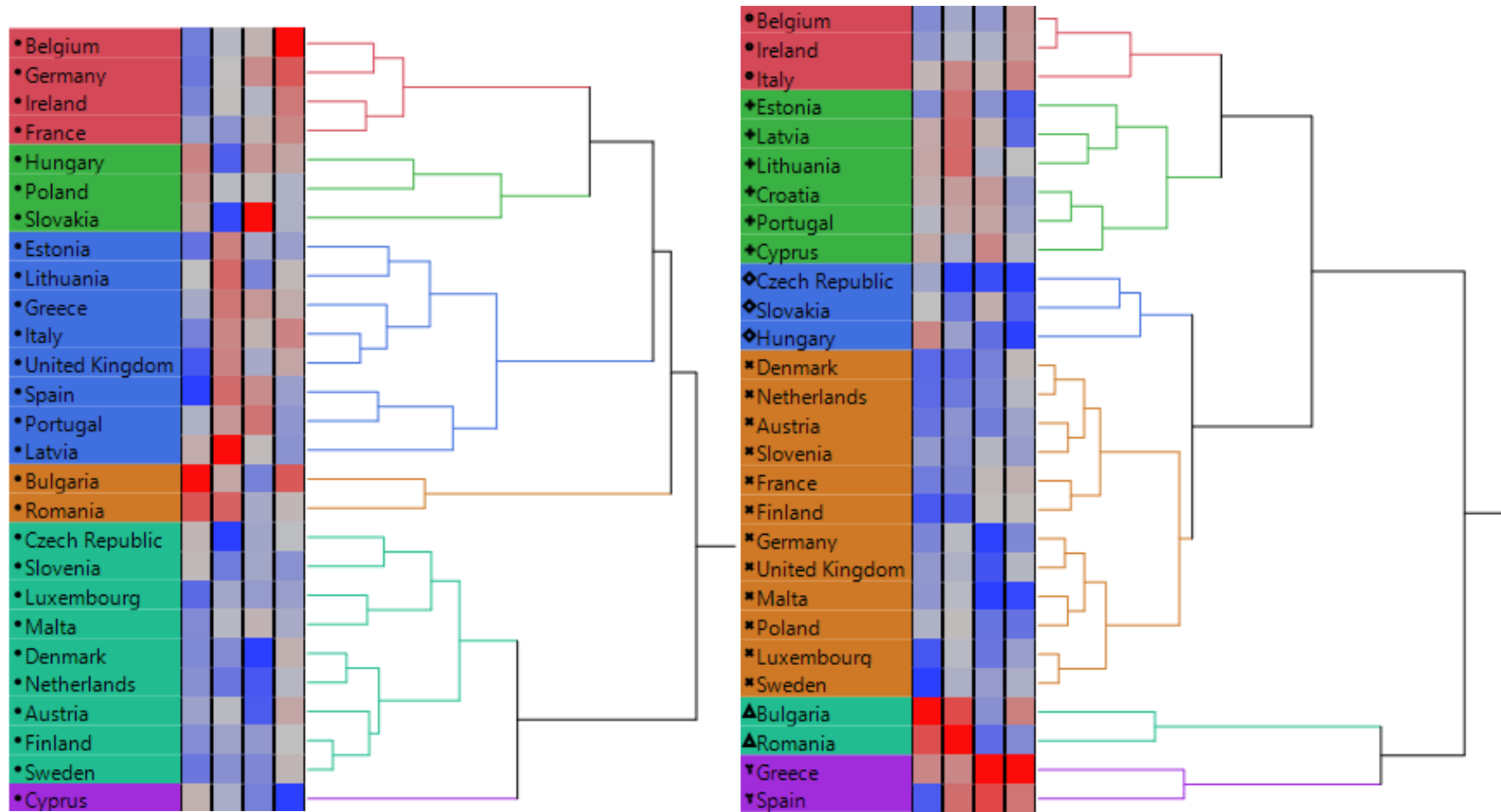


Fig. 3. Dendrogram of EU country clusters according to poverty and social exclusion factors in 2008 (on the left) and 2016 (on the right).

In 2016, *Cluster 1* consists of Belgium, Ireland and Italy and is characterized by relatively high exclusion of households from labour market.

Cluster 2 similarly like *Cluster 3* from the year 2008 includes Baltic States and most countries of Southern Europe. But the only common country of Southern Europe for these two clusters is Portugal though. To *Cluster 2* also belong Croatia and Cyprus. This cluster recorded relatively high income poverty and income inequality, especially in Baltic States.

Cluster 3 is very similar to *Cluster 2* from the year 2008 and consists of three out of V4 countries but this time the cluster consists of Hungary, Slovakia and the Czech Republic. This cluster achieves the lowest exclusion of households from labour market. The leader of the group is the Czech Republic which does not have such problems with material deprivation as Hungary and neither problem with unemployment of population as Slovakia.

The most populous among the other clusters is *Cluster 4* that consists of 12 EU-28 member countries (Denmark, the Netherlands, Austria, Slovenia, France, Finland, Germany, the United Kingdom, Malta, Poland, Luxembourg and Sweden). This cluster together with *Cluster 3* manifests the lowest risk of poverty and social exclusion. On a basis of the dendrogram in Fig. 3 *Cluster 4* could be divided into 2 sub-clusters. The first sub-cluster includes first 6 abovementioned countries that are characterized by a bit higher degree of labour market exclusion but lower income poverty and income inequality than the second group of six countries.

The remaining 2 clusters were much more affected by poverty and social exclusion than others. Bulgaria and Romania which created *Cluster 5*, have in 2016 equally like in 2008 a significantly worst condition in area of material deprivation despite progress they have made since 2008. Moreover, these 2 countries recorded negative trend in area of income poverty and their inhabitants have to face the largest risk of poverty, persistent poverty and the highest income inequalities.

Cluster 6 includes Greece and Spain. In 2016, in both countries we can observe the largest labour market exclusion of population as well as households. Furthermore, both countries have experienced a deteriorating situation in the area of income poverty and income inequality. Greece also reached poor results in indicators of material deprivation and followed only by Bulgaria and Romania. In contrast with Greece, in 2016 Spain recorded a relatively satisfactory incidence and depth of material deprivation. Differences in the dimension of material deprivation between Spain and Greece caused that *Cluster 6* was created last of all the clusters.

Conclusions

The paper evaluates and compares poverty and social exclusion in EU member countries based on statistical analyses of selected indicators in 2008 and 2016. Multidimensional statistical methods were used for that purpose, such as correlation analysis, factor analysis and cluster analysis. The correlation analysis confirmed the strong dependence among indicators included in each dimension. On the basis of the results of the factor analysis we compiled 4 relevant factors of poverty and social exclusion. These independent factors were created from the set of 12 original indicators. Our analysis showed that the 1st factor characterizes material deprivation, the 2nd one represents income poverty and income inequality, 3rd factor reflects labour market exclusion of population and 4th factor characterizes labour market exclusion of households. If we look at 3-dimensional concept which Eurostat uses for monitoring of progress in fighting against poverty and social exclusion, we find out that the first 2 factors obtained by our analysis cover the first 2 dimensions and the 3rd dimension is divided into 2 factors that evaluate labour market exclusion separately for population and for households.

The cluster analysis highlighted differences in the area of poverty and social exclusion within European Union in 2016 and revealed some changes that have occurred since 2008. According to European Commission (2017) it has been around four years since the EU economy started its slow though consistent recovery from economic crisis due to which the employment level in the EU now exceeds the 2008 peak (although the impact of this is yet to be fully reflected in all social indicators). Our analysis confirmed that the impact of economic crisis and recovery after crisis were different in various states of EU.

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