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## Article

# Poverty in selected European countries: A spatio-temporal analysis from 2003-2020

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# Poverty in Selected European Countries A Spatio-temporal Analysis from 2003–2020

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## Abstract

The problem of poverty, both in theory and practice, gained a new meaning with the beginning of the transformation of selected European economies from being centrally planned to market economies. The transition and the accompanying ownership changes resulted in significant shifts in the income distribution, which affected the increase in the stratification of society in terms of material situation and the deterioration of the living conditions of some social groups. Developing and evaluating anti-poverty programs should be preceded by identifying who is considered poor. Defining poverty is the first and a key step in measuring its characteristics, e.g., its intensity. Hence, the choice of a specific definition of poverty is of fundamental importance for the results of this measurement. The aim of the paper is to assess the material situation of European societies in terms of poverty change in a holistic approach – considering all the information available in international statistics on the problem. To achieve the research objective at the regional data level, we used the URi measure to decompose changes in structure and estimate the direction and intensity of poverty recorded. Further, we evaluated whether the transformations coincide temporarily and spatially. Applying the Hellinger distance (HD) allowed us to identify the significance of trends in changes in the poverty structure, especially in the years of the COVID-19 pandemic, when an increase in the importance of individual structural components of poverty was observed in the analysed European NUTS-2 spatial units. For some economies, the transition was also a consequence of European economic crises or major events of international importance, e.g., sports events or countries acceding to the EU.

**Keywords:** poverty, deprivation, spatial similarity, structural changes

**JEL:** C1, D60, I30, P46, R13



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## Introduction and literature review

The United Nations defines poverty as a reduction in choice and life chances, which is perceived as a violation of human dignity. It means that people are unable to participate effectively in society. It also indicates a scarcity of food and clothes that a family needs, no possibility to go to school or use health services, and no access to land to farm or work to earn and meet a living standard. Poverty also hides within powerlessness and exclusion of individuals, families and communities. It denotes a vulnerability to violence and is often associated with precarious living conditions without access to clean water and sanitation (Hunt, Nowak, and Osmai 2004, pp. 13–19).

The most common measurement of poverty is to establish a line (known as a poverty line) in terms of household income or expenditure. Then, any person or household with comparable income or expenses (expressed *per* equivalent person) lower than this limit is considered poor (or in poverty). Much of the discussion about measuring poverty has focused on defining the poverty line. In the past, there were problems with defining income – should it be disposable or gross/net, expressed in monetary or physical units, counted per day, month, year, etc. (Spicker 2007; 2012).

Equivalence scales were used to determine comparability between households, i.e., the second person and subsequent people are less important in the household. Further, how should income be distributed within a household, assuming that there is no inequality in this dimension? Should additional statistical indicators be considered in relation to the overall number of poor people and their share in the population, or the expenditure gap, which estimates the depth of poverty (Jewczak and Korczak 2019)?

White (2002) claims that poverty is defined and assessed from the perspectives of quantitative and qualitative approaches. In the quantitative approach, individuals consider themselves poor when their standard of living falls below the poverty line. It can be determined based on a certain minimum income level or household expenditure for basic needs or other desires of everyday life. From a qualitative perspective, the poor are individuals who define what they understand by poverty or being in poverty. It broadens the significance of poverty and connects it with deprivation caused by other factors, not necessarily in the material sense, expressed by the level of missing income or consumption (Saltkjel and Malmberg-Heimonen 2017). This is in line with the theory that income poverty does not consider aspects connected to well-being (Dhongde, Pattanaik, and Xu 2019). On the one hand, they are important for those who claim to be in poverty, but on the other, they are non-monetary determinants such as housing status or access to services.

Myck, Najsztub, and Oczkowska (2015) believe it is necessary to include other dimensions of poverty. They propose expanding material deprivation, which is perceived as

a primary variable that represents poverty. It illustrates the proportion of the population that cannot afford at least four of the nine predefined material needs that most people consider desirable or even necessary to lead a decent life. It covers indicators of items related to participating in everyday life or social activity, age, work intensity, and disposable income. This is convergent with Sen's concept of abilities and functioning (Sen 1976), in which attention was paid to the multidimensionality of human needs and that fulfilling these needs depends on external conditions. The deprivation indicators were primarily aimed at identifying those conditions that make it impossible to meet the various needs of people.

Townsend (1987) defined deprivation as the lack of access to opportunities and resources seen as common in each society. He further distinguished two types of deprivation, i.e., material and social. The former focuses on access to resources and services, but also on environmental conditions that allow a decent standard of living. The latter, on the other hand, refers to an individual's ability to participate fully in the life of the community. Sowell (2016) claims that it is necessary to define the surroundings/environment in which society, a household or individuals exist. It is possible to indicate both the environment, understood as socio-economic or geographic conditions, as well as historical experiences that societies accumulated over time. This leads to the conclusion that influence on the processes occurring in one spatial object is not a result of geographic and non-geographic determinants separately, but a consequence of interactions between them, both inside the unit and between neighbouring facilities. This is in line with Tobler's (1970) First Law of Geography. In this approach, what seems crucial for one unit will not necessarily have a similar effect in other locations of even one economic and social system. Therefore, the proposed approach introduces a lower level of spatial data aggregation, as the tendencies/impacts observed for a phenomenon at the national level are not always consistent with the local/regional level (Suchecky 2010; Krzysztofik et al. 2017).

The considerations demonstrate that poverty is a multifaceted issue. Depending on the research methodology, which determines when a person/household is viewed as poor, it is possible to obtain an ambiguous poverty indicator. It was possible to assess the overall transformation of the structure of poverty by not focusing on only one poverty criterion (income or unmet needs) and by taking advantage of all the circumstances when a person/household is considered poor or living in poverty.

The study assesses the significance of individual components of poverty in terms of its structure between 2003 and 2020. To this end, a measure of the decomposition of changes in structure ( $UR_i$ ) is proposed, which made it possible to estimate the intensity of changes both in terms of direction and value. Compared to other research on poverty, which mainly focuses on one indicator (see, e.g. Spicker 2012; Saunders 2013), this study uniquely broadens the scope of interest by considering all the aspects of poverty available in in-

ternational statistics. Then, using the Hellinger distance (*HD*), the similarity/differences in the distribution of the changes in the poverty level among selected European NUTS–2 regions were assessed, with emphasis on global turbulences such as the COVID–19 pandemic. The combination of the analysis of structural changes over time for individual components that describe a given aspect of poverty with an assessment of changes in distributions makes this study exceptional. In this way, it was possible to verify the actual impact of the pandemic on the poor in Europe, with special attention to the lower level of spatial data aggregation.

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## Data and methods

The source of statistical data on poverty categories by NUTS–2 regions was Eurostat. For the analysis, only complete records for the selected period were used; thus, some NUTS–2 spatial units had to be considered “no data available”. They are not, as it may seem from the graphic visualisations presented later in the paper, “unimportant areas”. The selection of objects to be investigated was, therefore, intentional and dependent on the complete availability of records in the Eurostat database. Overall, the number of spatial NUTS–2 units selected was 253 regions, which allows the analysis to be considered quite detailed and, in its completeness, in some way exceptional.

The evaluation of poverty in European NUTS–2 regions in the selected years was described by a set of variables that illustrate most aspects related to poverty. The dataset consisted of different poverty concepts described and defined in the Europa 2020 strategic documents (COM 2010), such as:

- overall poverty rate – the share of people with an equivalent disposable income (including social transfer) below the at-risk-of-poverty threshold, which is set at 60% of the national median equivalent disposable income after social transfers;
- severe material deprivation rate – a proportion of the population who experience an enforced lack of at least four of the nine deprivation items (i.e., ability to pay their rent, mortgage, or utility bills; keep their home adequately warm; face unexpected expenses; eat meat or protein regularly; go on holiday; have a television; be equipped with a washing machine; own a car; use a telephone);
- the share of people aged up to 59 years living in households with very low work intensity – defined as the number of people living in a household where the members of working age worked a time equal to or less than 20% of their total work-time potential during the previous year;
- the share of people at risk of poverty or social exclusion – the share of people with an equivalent disposable income before social transfers that is below the at-risk-of-pov-

erty threshold calculated after social transfers. This concept is related to minimum social standards and a relative understanding of poverty.

The structure is then a computational effect that exists only as a result of comparing parts with the whole, which could indicate the shape of a complex phenomenon. The values of the elements of a structure define its size. For a non-trivial structure to exist, at least two components are needed.

Because the data set consisted of determinants describing poverty that focus on different perspectives, to capture the changes in the structure and to identify the tendencies in the poverty level, the data was first reduced to a common denominator. Here the technique for structural changes was introduced. The concept of structure can be used in two ways. Firstly, it is a configuration of points in a multidimensional space. Secondly, it is a sequence of non-negative numbers summing up to unity – it is in this sense that we consider structure in the research. For comparing structures in two objects (or periods), following Markowska (2016), the measure of the share of structural components was used, which can be defined as:

$$UR_i = \frac{x_{2i} - x_{1i}}{\sum_{i=1}^m |x_{2i} - x_{1i}|}, \quad (1)$$

where:

- $i$  – the structural component number,
- $m$  – the number of structural components,
- $x_{1i}$  – the value of the  $i$ -th structural component in the first moment/period,
- $x_{2i}$  – the value of the  $i$ -th structural component in the second moment/period.

The total value of decomposition measure  $UR_i$  modules is equal to one, while the sign shows whether the value of a given structure element has increased (positive value) or decreased (negative value). In that matter, the  $UR_i$  makes it possible to define a component's contribution to overall changes in the phenomenon.

When assessing changes in the structure, three possibilities should be expected: stabilisation or an increase or decrease in the share of a given element(s) in the total sum. However, there are several variants for each of these possibilities. For two components of the structure (e.g., employed/unemployed), the result of the assessment of changes that indicates the stabilisation of the structure may result from the lack of changes in both components, but also from the simultaneous increase (and decrease) of both components by a relatively equal value. That was the motivation to investigate the trends, assess the structural decomposition by applying the  $UR_i$  measure, and compare the structural changes in terms of the distributions in the NUTS–2 regions using the Hellinger distance.

The Hellinger distance measures the distance between two discrete probability distributions, let us say  $p_1$  and  $p_2$  – distributions that are contained in the space of probability distributions common to them. The Hellinger distance is defined as follows:

$$HD(V_1, V_2) = \sqrt{\frac{1}{2} \sum_{i=1}^K \left( \sqrt{\frac{n_{1i}}{N_1}} - \sqrt{\frac{n_{2i}}{N_2}} \right)^2}, \quad (2)$$

where:

- $V_1$  and  $V_2$  are comparable 1<sup>st</sup> and 2<sup>nd</sup> data sets,
- $K$  is the parameter of the total number of valid fields in the contingency table,
- $n_{1i}$  and  $n_{2i}$  are the frequencies of the  $i$ -th field in the 1<sup>st</sup> and 2<sup>nd</sup> data sets, respectively,
- $N_1$  and  $N_2$  are the total sizes of the data sets.

The Hellinger distance is a metric in the space of probability distributions that takes values between zero and unity and is used to measure the degree of similarity between two distributions. When the distance equals 0, the distributions are identical, and when it strives for unity, the variation between the distributions increases. Usually, an  $HD$  value greater than 0.5 indicates differences between the two distributions.

The  $HD$  distance meets the criteria assigned to distance measures such as the positivity condition:  $HD(p_1, p_2) > 0$  and supports symmetry ( $HD(p_1, p_2) = HD(p_2, p_1)$ ) and identity properties:  $HD(p_1, p_2)$  equals 0 if and only if  $p_1 = p_2$ . It also meets the conditions of triangular inequality:  $HD(p_1, p_2) < HD(p_1, p_3) + HD(p_3, p_2)$ . The advantage of this distance measure is that the estimate is a metric. This quality is not supported in the Bhattacharyya coefficient ( $BC$ ), for example (Kailath 1963). Although there is a link between the Hellinger distance and the  $BC$  coefficient ( $HD(p_1, p_2) = \sqrt{1 - BC(p_1, p_2)}$ ), the latter does not necessarily meet the condition

of triangular inequality, and the Bhattacharyya parameter is not a metric. Therefore, for ease of interpretation, the Hellinger distance was used in the research instead.

The data was first evaluated in terms of structural changes in poverty components. The  $UR_i$  measure was calculated both for the national level and the NUTS–2 Europe regions. Further, the results were compared regarding spatial similarities with the *Geographic Information System* tools and the cluster analysis.

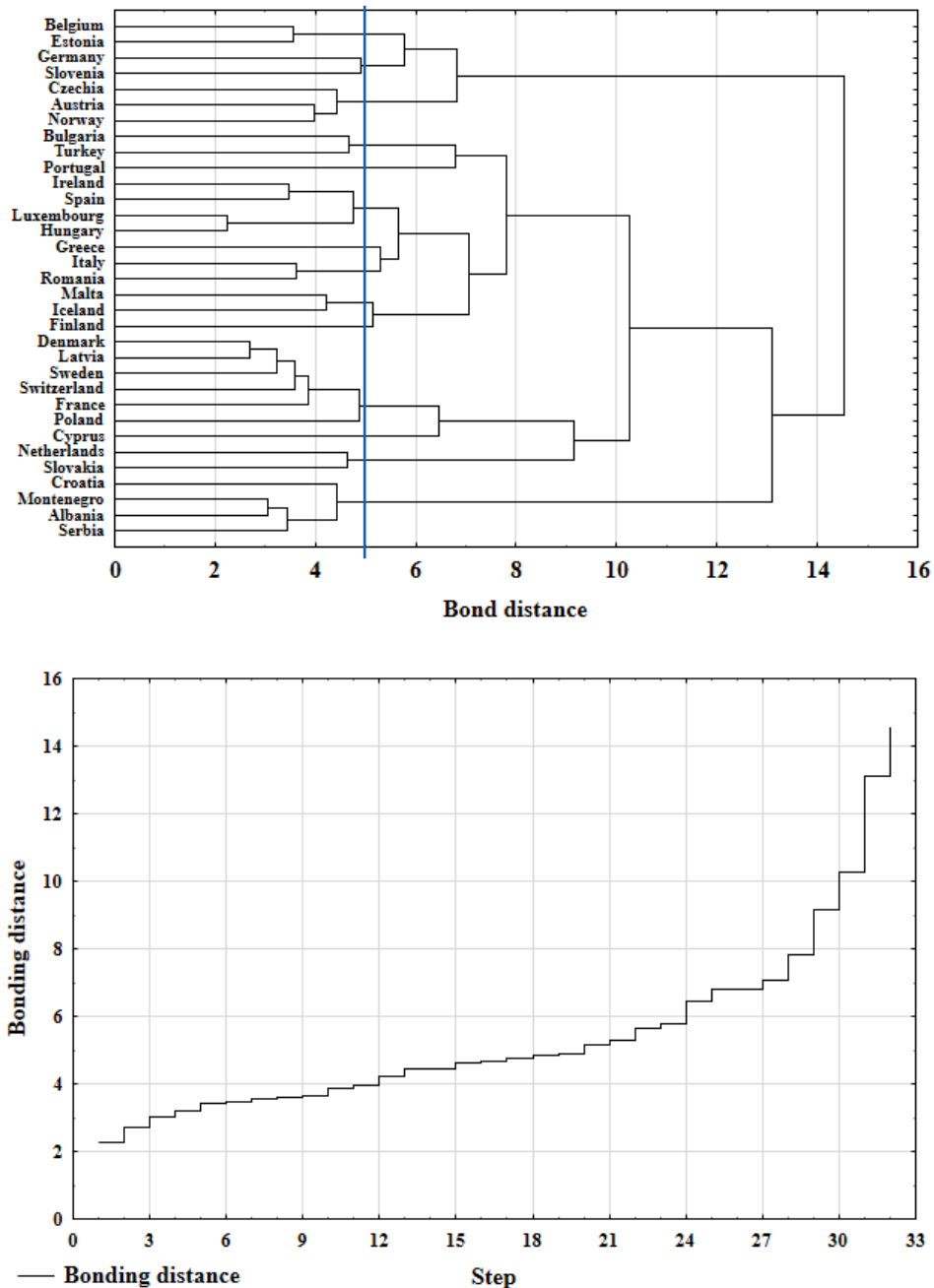


Figure 1. Tree diagram and bonding steps for Euclidean distance and Ward's grouping

Source: own elaboration.

Agglomeration methods were used to group European countries in clusters of similar changes in the overall poverty structure (Figure 1). The results were used as a background for regional assessment. Finally, the changes in the poverty structure estimated for selected European NUTS–2 regions were assessed in terms of the temporal similarity of tendencies with the Hellinger distance.



## Results and discussion

### Clustering

The research focuses on European countries and the NUTS–2 data aggregation level, although, as has already been pointed out, estimates are presented only for all available data records for reasons of comparability. The cluster analysis carried out at the national level was intended to indicate general tendencies in the countries concerned. The results allowed us to group countries that demonstrated similar trends of changes in the poverty structure throughout the analysed time horizon.

In the diagram of the agglomeration path (Figure 1), it is easy to see fragments of flattening, which indicates a decrease in the differentiation of subsequent objects included in the classification. This distance should be approx. 4.82, but for interpretational simplicity, it has been rounded to the nearest whole number. With a bond length of 5 (indicated by the straight blue line), 14 clusters are created, including three single elements. The tree diagram indicates when there is sufficient distance between objects/clusters to join another object/group of objects.

On the tree diagram (Figure 1), the more similar objects are in terms of changes in the distribution of the poverty structure over the time horizon, the sooner they are combined into a cluster (moving from the zero-bond distance to the right, with a lower bond distance). In this perspective, the most diverse group of countries is included in the last step (at the bond distance of 14.53). As can be seen, this cluster includes countries considered to be among the richest, such as Belgium, Germany, Austria, and Norway, but also Estonia, Czechia, and Slovenia. This cluster was the biggest outlier in the study. Considering changes in poverty, Poland formed a cluster with France, Switzerland, Sweden, Latvia, and Denmark. Although it was the last to join this group, this similarity should be perceived as exceptional.

Comparing the *HD* values that represent the changes that occurred in two time periods, it is possible to access the trends. Taking into account the most numerous cluster, Figure 2 presents the compilation for the selected economies.

When comparing 2018 and 2020, for instance, the changes in Poland were similar to the structural ones noted in 2017 and 2019, which can be summarised by the value of  $HD = 0.13$ . The Hellinger distance (Figure 2) indicated that the overall tendencies in the components of poverty between 2018 and 2020 were quite like in 2017 and 2019. However, the metric shows only the similarity. To have a closer look at what the changes in poverty mainly resulted in and where they originated from, it is necessary to investigate the  $UR_i$  values for comparable time points. Between 2018 and 2020, there was a 21% decrease in the structural share in the overall poverty rate, with a 14% decrease in the structural share of poverty, which resulted from the share of people aged up to

59 years living in households with very low work intensity. During this period, the structural share in overall poverty included in the factor of severe material deprivation rate dropped by 34%, and the significance of the structural component of people at risk of poverty or social exclusion decreased by 31%. The tendencies should be evaluated as a positive result of social policy and the increased welfare level.

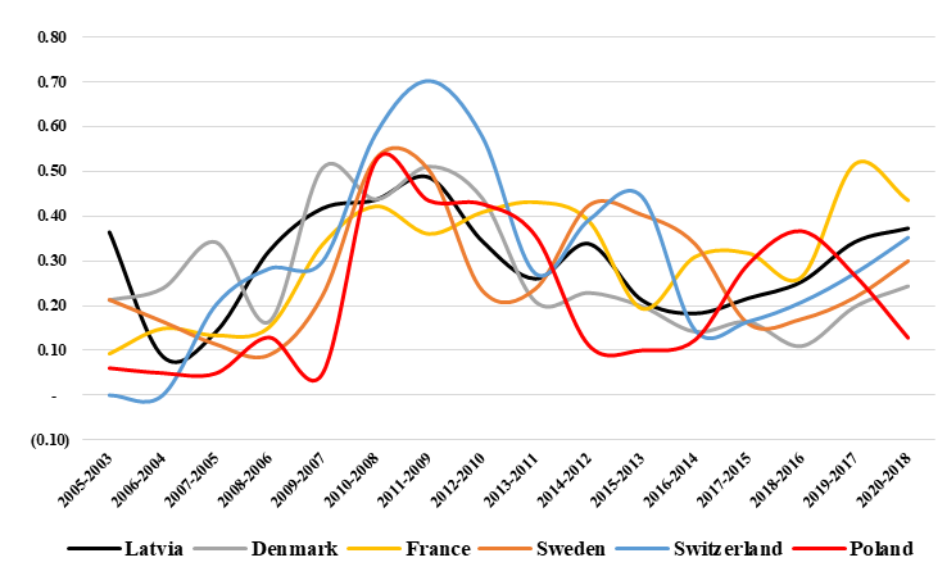


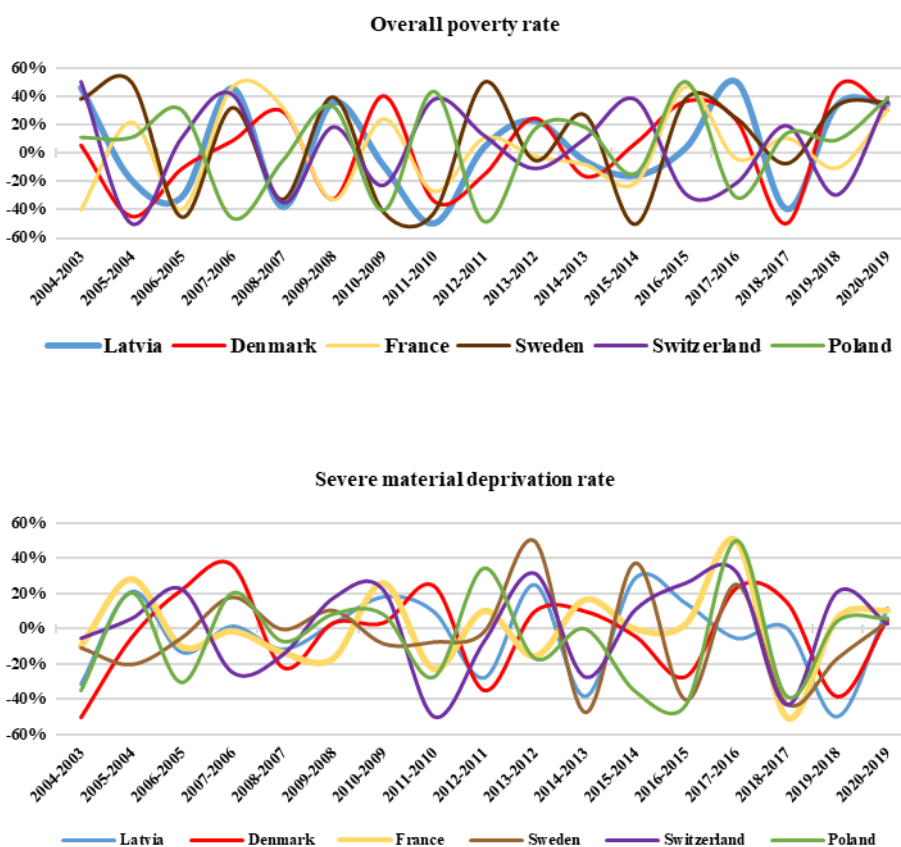
Figure 2. Cluster similarity in terms of tendencies in *HD* level by period

Source: own elaboration.

The curves of the *HD* index change for selected countries indicate quite comparable similarities in the level of recorded poverty. The biggest peak during the economic crisis in 2010 is noteworthy, although it was not a record level in the difference’s distribution for France, where the highest level of dissimilarity was recorded in 2018. It may have been the result of the influx of immigrants and the deterioration (increase in weights) of structural indicators for poverty. When investigating the period between 2017 and 2020, the results of the *HD* index indicated dissimilarity:  $HD_{2019-2017} = 0.52$  and  $HD_{2020-2018} = 0.44$ . The estimates are a consequence of changes noted in the influence of structural components of overall poverty in France. In the first period, these changes resulted mainly from a 25% increase in the share of people in the structure of the overall poverty rate, a 63% increase in the share of people at risk of poverty or social exclusion, a 13% increase in the share of people aged up to 59 years living in households with very low work intensity, and no change in severe material deprivation rate. In the second period, there was a slight change in the structural significance of individual poverty components. These changes resulted mainly from a 13% increase in the share of people in the structure of the overall poverty rate, a 20% increase in the share of people at risk of poverty or social exclusion, and a 60% increase in the share of people aged up

to 59 years living in households with very low work intensity. Changes also occurred in severe material deprivation rate – a 7% increase was noted.

The changes in the structure of poverty might not necessarily be considered spectacular, but they indicate which components weighed down on the structure of poverty and changed over time the most. This specific information can be quite useful in developing social policies at the regional level to counteract, for example, social exclusion or material deprivation. Following that, the Hellinger distance allowed us to assess whether the dynamic changes in the structure of poverty stimulated similarly or whether they should be assessed differently. The evaluation with the *HD* coefficient makes it possible to assess whether the long-term poverty-related social, demographic, and economic changes are proceeding in the desired direction or not. One should also remember that the last periods of the analysis were influenced by the policies adopted during the SARS-COV-2 virus pandemic when countries introduced different regulations for their societies.



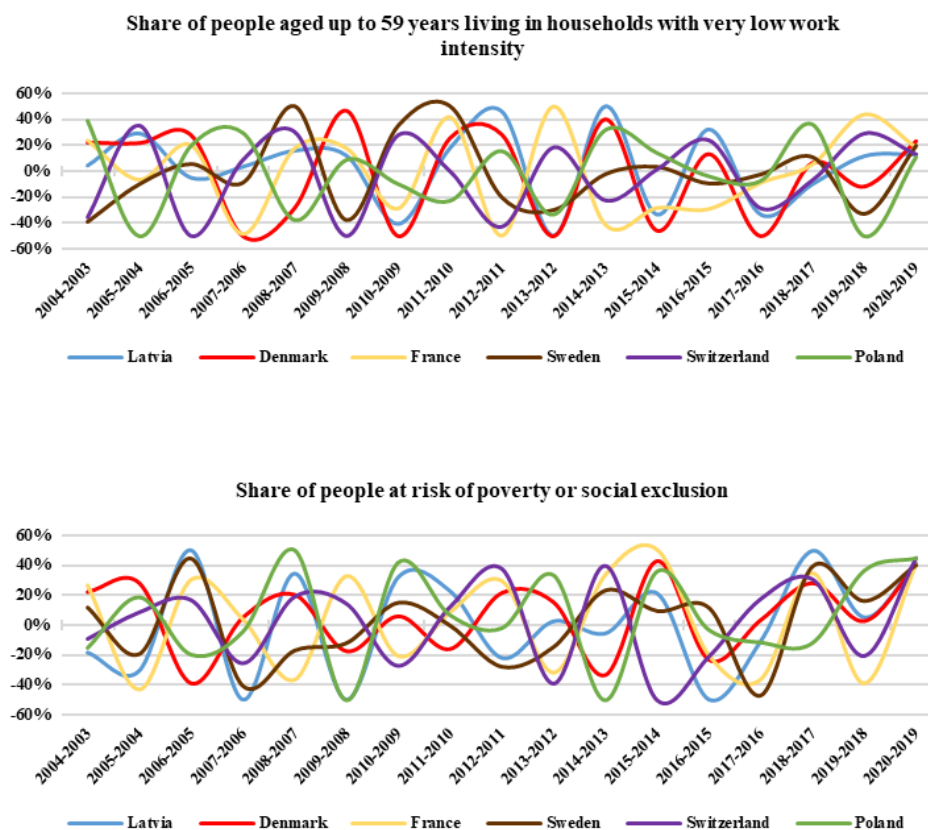


Figure 3. Shares of poverty determinants in selected countries

Source: own elaboration.

The summary for selected countries (cluster including Poland) in Figure 3 indicates how difficult it is to design a social policy in different countries, not to mention at the lower regional or local levels. The higher the differentiation, the higher the fluctuations in the tendency of changes in the share of a given aggregate in the structure. Further, the social policy should be effective and react quickly to changes. The results show, however, that the variability of poverty is dynamic (in order to be easy to control, it should take the form of a straight line with a structure variability of approximately 0%). This is especially visible in the crisis years 2008–2010, initiated by the collapse of the high-risk mortgage market, and from 2019, as a result of the COVID–19 pandemic.

### Spatio-temporal changes in poverty structure

Looking at the NUTS–2 level in the assessment of the trends in changes in the poverty structure, the Hellinger distance values were determined for all possible consecutive periods analogously to the procedure for the national level. The values of the tendency compliance assessment are presented as graphical maps with the same value ranges. The most significant value from the point of view of the study,  $HD \geq 0.5$ , in-

dicates the incomparability of the distributions; they are marked with shades of red. It is in these NUTS–2 objects that a change in the poverty structure was observed, and  $UR_i$  measures allowed for the assessment of these objects in terms of changing trends. Time intervals (six time periods) characterised by the highest variability of the distribution of the poverty structure were selected for the visualisation.

Between 2004 and 2006, 12 regions had an *HD* value greater than or equal to 0.5, with the vast majority in Norway (6 regions). Of these, the Trøndelag region was characterised by the highest variability, with an *HD* of 0.712 (Figure 4). This results in a disproportion in this region. The share of people included in the poverty rate in the structure increased from 16% to 38%, with a simultaneous decrease in the importance of the structure of people in severe material deprivation in the poverty structure by 40% and by 10% for households with low work intensity. The changes should be assessed as significant.

In the next period, the number of regions that differ from the convergence of the distribution of changes increased to 16. Additionally, the highest noted value slightly increased between 2007 and 2009, with an *HD* of 0.718 noted in the Centro region in Italy. Comparing the visualisations for these periods, one can clearly see a change in the spatial distribution/location of regions with the highest disproportions of changes in the poverty structure. In the Centro region, a change in the structure of the components of poverty was clearly identified – in fact, the tendencies were reversed in each of the analysed structural elements. For example, in earlier periods, there were declines in the structure share for the poverty rate (25%), those at risk of poverty or social exclusion (9%), and material deprivation (19%), with a significant increase in households with low work intensity (50%). However, from 2007–2009, a decrease in the importance of the structure of poverty was identified for households with low work intensity (–50%) with a simultaneous increase in poverty rate (10%), those at risk of poverty or social exclusion (31%), and material deprivation (9%).

Interestingly, during the economic crisis of 2008–2010, there were no significant changes in the distribution of the poverty structure. However, it was possible to indicate nine regions with a measure of the consistency of the structure distributions greater than 0.5, with the highest value of  $HD = 0.736$  for the Spanish region of Illes Balears. The periods of the COVID–19 pandemic showed a greater impact on 13 individual spatial units in 2019 and 12 in 2020. In the Région Wallonne in Belgium, between 2018 and 2020, the last analysed period, the highest Hellinger distance of 0.895 was recorded. Such a high value is the result of the growing importance in the structure for all four elements of poverty: 34% for poverty rate, 42% for people at risk of poverty or social exclusion, 9% for households of low work intensity, and 15% for material deprivation share.

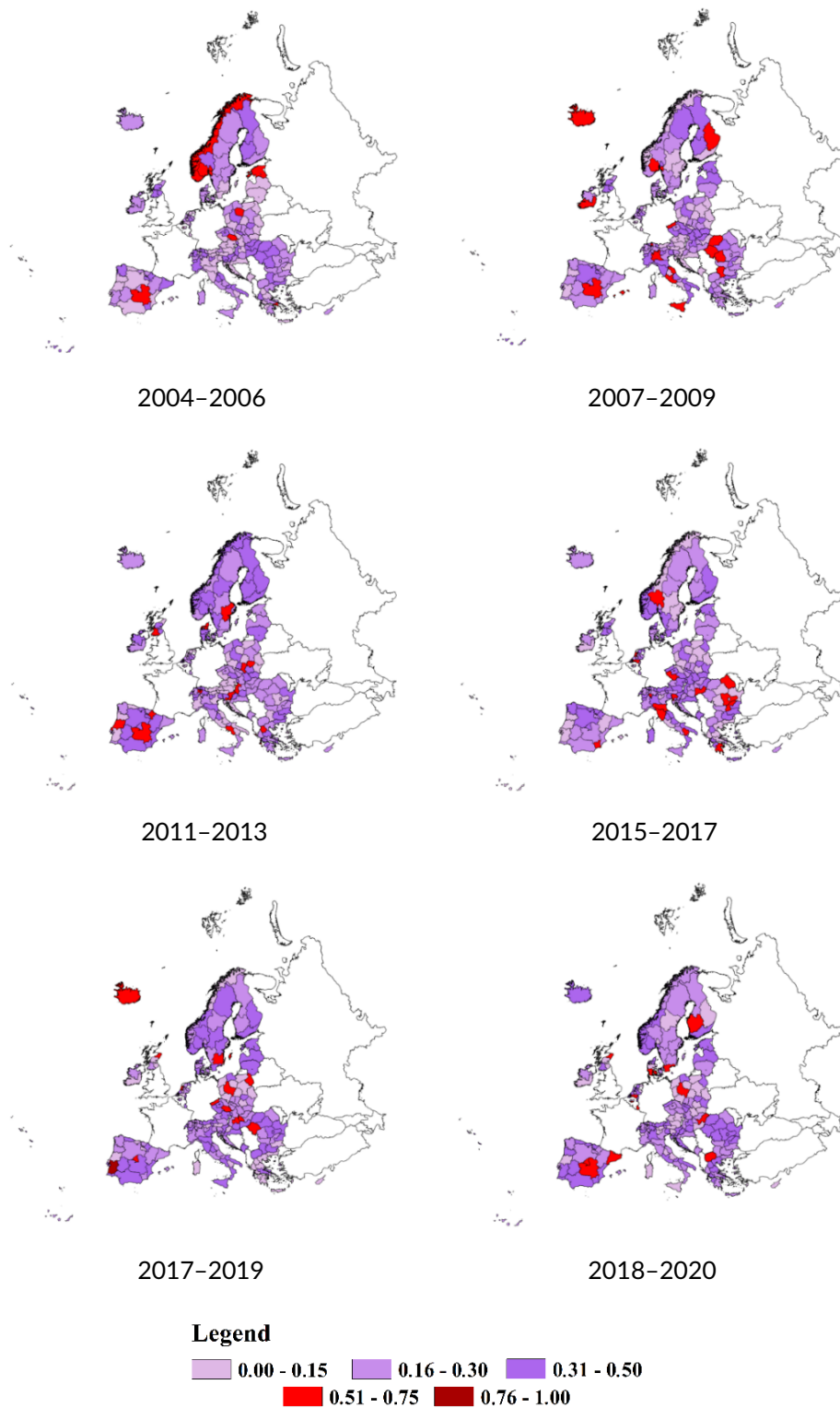


Figure 4. Hellinger distance for NUTS-2 regions

Source: own elaboration.

In selected European regions, the dissimilarity of structures was also identified. Table 1 summarizes the changes in tendencies.

Table 1. Extreme Hellinger distance values for selected NUTS-2 regions

Country	NUTS-2 region	Hellinger distance values
Czechia	Praha	$HD_{2015-2013} = 0.547$
	Jihozápad	$HD_{2017-2015} = 0.628$ ; $HD_{2018-2016} = 0.507$
	Severozápad	$HD_{2009-2007} = 0.532$ ; $HD_{2019-2017} = 0.526$
	Jihovýchod	$HD_{2006-2004} = 0.502$ ; $HD_{2019-2017} = 0.574$
	Střední Morava	$HD_{2008-2006} = 0.646$
	Moravskoslezsko	$HD_{2011-2009} = 0.694$ ; $HD_{2014-2012} = 0.509$
Denmark	Syddanmark	$HD_{2020-2018} = 0.690$
	Midtjylland	$HD_{2010-2008} = 0.545$
	Nordjylland	$HD_{2012-2010} = 0.536$ ; $HD_{2013-2011} = 0.665$
Estonia		$HD_{2006-2004} = 0.506$ ; $HD_{2007-2005} = 0.575$ ; $HD_{2012-2010} = 0.538$ ; $HD_{2017-2015} = 0.623$
Hungary	Közép-Magyarország	$HD_{2019-2017} = 0.557$
	Közép-Dunántúl	$HD_{2019-2017} = 0.643$
	Nyugat-Dunántúl	$HD_{2013-2011} = 0.707$ ; $HD_{2014-2012} = 0.614$
	Észak-Alföld	$HD_{2020-2018} = 0.720$
	Dél-Alföld	$HD_{2017-2015} = 0.675$ ; $HD_{2018-2016} = 0.631$
Poland	Śląskie	$HD_{2013-2011} = 0.555$
	Świętokrzyskie	$HD_{2013-2011} = 0.561$
	Podlaskie	$HD_{2018-2016} = 0.580$ ; $HD_{2019-2017} = 0.533$
	Kujawsko-Pomorskie	$HD_{2006-2004} = 0.510$ ; $HD_{2014-2012} = 0.514$
Slovakia	Bratislavský kraj	$HD_{2007-2005} = 0.506$
	Stredné Slovensko	$HD_{2012-2010} = 0.782$ ; $HD_{2014-2012} = 0.518$ ; $HD_{2014-2012} = 0.549$

Source: own elaboration.

The dynamics of structural changes were rapid in Estonia and Hungary. The most intensive changes in the structure of poverty, which occurred during the COVID-19 pandemic, took place in the region of Észak-Alföld. This is a result of swapping the tendencies in structural intensity. In the 2018–2020 period, the *HD* amounted to 0.720. The dissimilarity was a result of the growing importance of every element of the structure: the poverty rate increased by 29%, people at risk of poverty or social exclusion increased by 44%, material deprivation increased by 21%, and the share of households with low work intensity increased by 6%. The Hellinger distance noted a high value, while in the previous period, only households with low work intensity grew (by 50%). The other poverty components decreased in importance, e.g., the share of the poverty rate dropped by 32%.

## The case of Poland

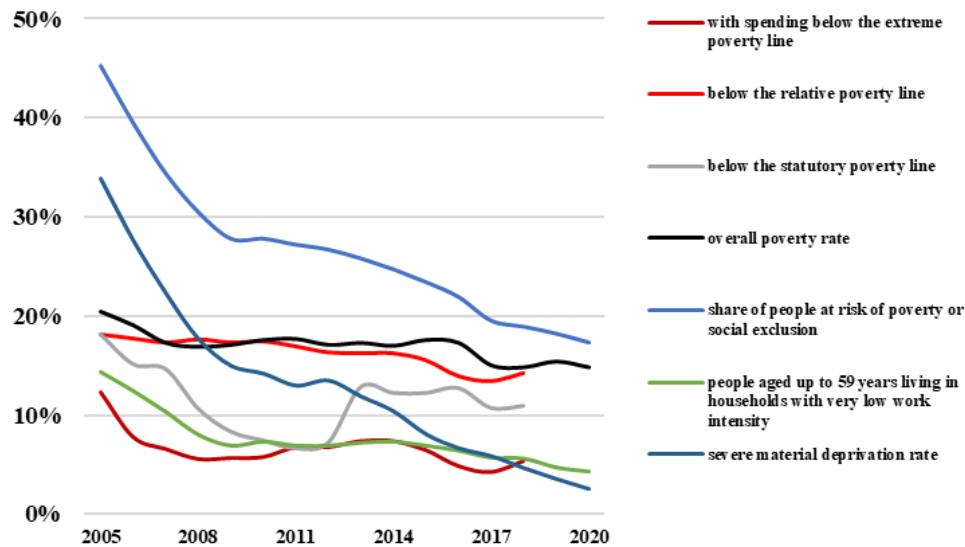
In Poland, only four regions recorded significant changes in the poverty structure. In Świętokrzyskie and Śląskie, it happened once as a result of the economic crisis. Podlaskie and Kujawsko-Pomorskie recorded a change twice. Kujawsko-Pomorskie recorded a change in structure caused by Poland's accession to the EU and later, perhaps because of the European Football Championships organised in 2012 in Poland and Ukraine. Here, the region recorded increases in the importance of people at risk of poverty or social exclusion by 42%, while in 2012, this share was 43% lower. Podlaskie, especially at the beginning of the COVID–19 period, recorded an increase in the structure of poverty for people at risk of poverty or social exclusion of 45%.

Statistics Poland presents information on poverty only on an annual basis and in terms of expenditure, based on household budget surveys. If household expenses, calculated per person, are lower than the subsistence minimum (in 2020, it was PLN 640 for a single-person household), then we are dealing with extreme poverty. If relative poverty is assessed, then a 50% criterion of average expenditure is introduced (e.g. in 2019, it was less than PLN 858 per single-person household). In addition, for several years, Statistics Poland has re-published data on the scale of social exclusion, which reflects the scarcity sphere, where the social minimum is the limit. Within this concept, it is not only human survival that is taken into consideration, but also the goods and services necessary for work, education, and maintaining family and social ties, as well as modest participation in culture and recreation. The limit based on this criterion was PLN 1218 for a working single-person household and PLN 1195 for farmers, retirees, and pensioners.

The multitude of categories creates problems in assessing the phenomenon on a general level, the more so that not all data are published below the national level of data aggregation. One could say that, depending on which category is selected for the assessment, it is possible to obtain different poverty scores for a given spatial unit and its changes over time. For Poland, the graph presents different categories of poverty, both from public statistics and Eurostat data.

Of course, based on Figure 5, it can be concluded that poverty is decreasing, regardless of the selected category. However, it would be difficult to assess the problem considering all categories at the same time point without an initial assessment of the weight of a given aggregate in the overall structure of the problem.





Note: for data published by Statistics Poland, there is no information on statutory, extreme, or relative poverty for 2019–2020 which is unfortunately unfavourable as it makes it impossible to conduct comparative analyses for the years of the COVID–19 pandemic.

**Figure 5.** Poverty coverage indicators of people in a household in Poland

Source: own elaboration.

## Conclusions

Evaluating poverty as a complex phenomenon is justified by different approaches to the issue, as well as different ways of defining the poor. The paper first introduced a determination of the weight for each component in the structure of the overall poverty level, considering simultaneously all the statistics published at the national level and selected NUTS–2 spatial units in European countries. In this way, it was possible to assess which category in each period was important for the overall poverty level in the regions. It provided an opportunity to identify the direction of this change for the tendency analysis. Finally, using the Hellinger distance and comparing the distribution of change tendencies, we verified whether the changes in the poverty structure at the national/regional levels were consistent or significantly different.

The sense of cumulative analysis of poverty is emphasised by, among others, Szarfenberg (2021), who pointed out a decrease in poverty levels, e.g., in relative poverty in the first year of the COVID–19 pandemic. However, these declines are due to the overall reduction of 50% in average spending and not to an improvement in the financial situation of households. In addition, Eurostat data on material and social deprivation describe the impossibility of meeting at least five out of nine (or seven out of thirteen according to the Europe 2030 Strategy) needs for financial reasons, not to mention people living in low work intensity households. The EU2030 Strategy has introduced new measures of poverty but

only changed the definitions and perception of two of the poverty categories used, such as the severe material deprivation and low work intensity indicators. They extended the age range of the respondents from 59 to 64 years.

Notwithstanding, these changes do not affect the analytical capabilities of the proposed tools for assessing changes in the poverty structure in general terms, thanks to the possibility of normalising unit indicators and their share in the total level of the structure. Applying a structure decomposition measure circumvents the layout requirements of a contingency table-like database. In conjunction with an analysis of changes in the multivariate distribution using the Hellinger distance, the analysis allowed for a multivariate assessment of the distributions of hitherto non-summable variables that shape multivariate phenomena. It may allow a better understanding of this phenomenon as well as others not yet analysed. What is noteworthy is that, as expected, high values for the disproportion of change were recorded in different parts and different regions of Central and Eastern European countries. Here, one may mention the regions of Poland, Estonia, the Czech Republic, Slovakia and Hungary (Table 1). At some of the analysed time points, they showed extreme changes in the distribution for the analysed poverty aggregates according to the Hellinger Distance measure. Poverty transitions have not spared regions in countries considered to be more developed, such as Norway, Spain or Italy, which have not undergone a socio-economic transformation, unlike Central and Eastern European countries.

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## Ubóstwo w wybranych krajach Europy Analiza przestrzenno-czasowa w latach 2003–2020

Problem ubóstwa, zarówno w teorii, jak i w praktyce, nabrał nowego znaczenia m.in. wraz z początkiem transformacji wybranych gospodarek europejskich z centralnie planowanej do gospodarki rynkowej. Transformacja systemowa i towarzyszące jej zmiany własnościowe wywołały zmiany w rozkładzie dochodów, co wpłynęło na wzrost rozwarstwienia społeczeństwa pod względem sytuacji materialnej i pogorszenie warunków życia niektórych grup społecznych. Projektowanie i ocenę programów walki z ubóstwem powinna poprzedzać identyfikacja, kto jest uważany za biednego bądź żyjącego w ubóstwie. Zdefiniowanie ubóstwa to zatem pierwszy i kluczowy krok w pomiarze jego cech, np. jego natężenia, stąd wybór konkretnej definicji zjawiska ma fundamentalne znaczenie dla uzyskanych wyników tego pomiaru.

Celem artykułu jest ocena sytuacji materialnej społeczeństw europejskich w kontekście zmian ubóstwa w ujęciu holistycznym, z uwzględnieniem wszystkich informacji dostępnych w krajowych i międzynarodowych statystykach dotyczących tego problemu. Realizując cel badawczy dla poziomu danych regionalnych, poprzez zastosowanie miary dekompozycji zmian struktury (*URi*), oszacowano kierunki i natężenie zmian w strukturze ubóstwa rejestrowanego. W dalszej kolejności oceniono, czy przemiany w sferze analizowanego zjawiska pokrywają się czasowo i przestrzennie. Zastosowanie odległości Hellingera (*HD*) pozwoliło na określenie znaczenia trendów zmian w strukturze ubóstwa, szczególnie w latach pandemii COVID-19, kiedy to w analizowanych regionach NUTS-2 zidentyfikowano wzrost znaczenia poszczególnych składowych strukturalnych ubóstwa. Dla niektórych gospodarek procesy transformacji były także konsekwencją pojawiających się w Europie kryzysów gospodarczych lub ważnych wydarzeń o znaczeniu międzynarodowym, np. sportowych czy przystępowaniu krajów do struktur UE.

**Słowa kluczowe:** ubóstwo, deprivacja, podobieństwo przestrzenne, zmiany strukturalne