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## Spatial Distribution of Poverty in the European Union

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# Spatial Distribution of Poverty in the European Union

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## Abstract

According to the latest estimates over 16 per cent of the EU citizens are poor (based on monetary concept). Using Europe 2020 strategy indicator people at risk of poverty or social exclusion over 23 percent of EU citizens can be considered poor. Analyses of poverty may be based on several poverty concepts. This paper focuses on monetary poverty, and then it analyses the aggregated poverty measure “people at risk of poverty or social exclusion” as one of the 2020 Strategy headline indicators. This aggregated indicator reflects three dimension: monetary poverty, material deprivation and work intensity. The goal of this paper is to analyse the level of poverty in the European Union, while analyses will be performed with respect to various concepts of poverty. The paper further focuses on the spatial aspects of selected poverty indicators.

**Keywords:** monetary poverty, spatial Durbin model, regional spillovers

**JEL Classification:** I32, R11, R15.

## 1 Introduction

Even at the beginning of the 20<sup>th</sup> century poverty still remains a global problem of huge proportions. Also the European Community considers the topic very important and according to the European Council the level of poverty and social exclusion in the EU is not acceptable.

One of the European Union’s objectives is to alleviate poverty – in accordance with the principles of solidarity and social equity. To reinforce the EU commitment to making significant impact on poverty alleviation, the year 2010 has been proclaimed by the European Commission as the European Year for Combating Poverty and Social Exclusion.

Poverty can be defined in terms of several concepts. The most of broadly used poverty definitions have two common elements. Usually the first step is to determine a welfare indicator. Then it is necessary to draw a cut-off point (poverty line) below which a person is classified as poor.

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The goal of this paper is to analyse the level of poverty in the European Union, while analyses will be performed with respect to various concepts of poverty. We further focus on the spatial aspects of poverty.

## 2 Methods

This section briefly describes data, poverty line determination and poverty measures used.

### 2.1 Description of Data

Analyses performed in the paper are based on 2005 - 2011 EU SILC microdata. First, *monetary poverty* is analysed, while equivalised disposable income is used. *Equivalised disposable income* is defined as the total disposable income of household divided by the equivalent household size. Total disposable household income can be computed by adding together the personal incomes received by all of household members plus income received at household level. Equivalence scale is used to compute equivalised household size. In accordance with methodology of Eurostat, the modified OECD scale for calculation of poverty indicators is used.

As the sole concept of monetary poverty is not sufficient, we further analyse aggregated measure of poverty introduced by the European Union: share of *people at risk of poverty or social exclusion*. At risk of poverty or social exclusion refers to the people who are either *at risk of poverty* (i. e. their equivalised disposable income (after social transfer) is below the at-risk-of-poverty threshold, which is set at 60 % of the national median equivalised disposable income after social transfers), or are *severely materially deprived* (they are not able to afford four of nine items considered by most people to be desirable or even necessary to lead an adequate life) or live in a household with a *very low work intensity* (they live in a household having a work intensity below a threshold set at 0.20, while the work intensity of a household is the ratio of the total number of months that all working-age household members have worked during the income reference year and the total number of months the same household members theoretically could have worked in the same period.). See e. g. Savova (2012) for details.

### 2.2 Poverty Line

A poverty line is a tool necessary for measuring poverty. It is a value of income (or consumption) necessary for the minimum standard of nutrition and other necessities. In drawing a poverty line, the goal is to define an income (consumption) level that is sufficient to purchase the minimum standard of nutrition and other necessities. People are counted as poor when their measured standard of living (usually income or consumption) is below the poverty line - a minimum acceptable level (World Bank, 1993).

Poverty lines can be set in *subjective* or *objective* terms. The subjective approach explicitly recognizes that poverty lines are inherently subjective judgements people make about what constitutes a socially acceptable minimum standard of living in a particular society (Ravallion, 1992).

Absolute and relative poverty lines are the most used objectively determined poverty lines. The most common approach in defining *absolute poverty line* is to estimate the cost of a bundle of goods deemed to assure that basic consumption needs are met (Lipton and Ravallion, 1993). The difficulty is in identifying what constitutes 'basic needs'. E.

g. for developing countries the most important component of a basic needs poverty line is generally the food expenditure necessary to attain some recommended food energy intake. This is then augmented by a modest allowance for non-food goods (Ravallion, 1992). *Relative poverty line* is usually set as a constant proportion of the mean value of welfare indicator (Ravallion, 1992).

Relative poverty refers to the position of an individual or household compared with the average income in the country, while absolute poverty refers to the position of an individual or household in relation to a poverty line whose real value is fixed over time (World Bank, 1993). Another difference is that absolute poverty considerations have dominated in developing countries, while relative poverty has been more important in developed countries analyses (Ravallion, 1992).

In this study we adopt relative approach, and in accordance with Eurostat methodology, at-risk-of-poverty rate is defined as *the share of persons with an equivalised total net income below 60 % national median income* (European Commission, 2003). Apart from the “basic” poverty line we also apply a EU-wide poverty line to the data. The EU-wide poverty line is based on PPP converted income data and the same poverty line is applied to all EU countries.

## 2.3 Poverty Measures

Poverty measures used in this paper are based on Foster-Greer-Thorbecke class of poverty measures (Foster, Greer, Thorbecke, 1984), i.e. head-count index, poverty gap index and measure of severity of poverty.

Let  $\mathbf{y} = (y_1, y_2, \dots, y_n)$  be a vector of personal incomes in increasing order. Suppose that  $z > 0$  is the predetermined poverty line,  $q$  is the number of poor persons ( $y_1 \leq y_2 \leq y_3 \leq \dots \leq y_q \leq z$ ),  $n$  is the total number of persons.

Consider the poverty measure  $P_\alpha$  for a non-negative parameter  $\alpha$  defined by (Foster, Greer, Thorbecke, 1984):

$$P_\alpha(y, z) = \frac{1}{n} \sum_{i=1}^q \left( \frac{z - y_i}{z} \right)^\alpha \quad (1)$$

**Head-Count Index** For  $\alpha = 0$  in (1) we get:

$$H = P_0(y, z) = \frac{q}{n} \quad (2)$$

which is the *head-count index*, the simplest and the most common measure of poverty. It refers to the proportion of population for whom the consumption (or level of another welfare indicator)  $y$  is not greater than the poverty line  $z$ . Using Eurostat terminology, head-count index can be referred to as *at-risk-of-poverty rate*.

A great advantage is its simplicity of calculation and understanding. But e. g. suppose that a poor person suddenly becomes much poorer. The value of  $H$  will not change. It is totally insensitive to differences in the depth of poverty.

Let  $\mathbf{w} = (w_1, w_2, \dots, w_q, \dots, w_n)$  be a vector of personal cross-sectional weights of observations. If we want the weights to be included in the computation, the formula (2) turns to:

$$H_w = \frac{\sum_{i=1}^q w_i}{\sum_{j=1}^n w_j} \quad (3)$$

**Poverty Gap Index** For  $\alpha = 1$  in (1) we get:

$$PG = P_1(y, z) = \frac{1}{n} \sum_{i=1}^q \frac{z - y_i}{z} \quad (4)$$

which is the poverty gap index ( $PG$ ), i. e. a measure based on the aggregate poverty deficit of the poor relative to the poverty line. The value of  $PG$  depends on the distances of the poor below the poverty line, so it gives a good indication of the depth of poverty. We then obtain mean proportionate poverty gap across the whole population. The measure is not sensitive to the distribution among the poor. It means that the value of  $PG$  will be unaffected by a transfer from a poor person to someone who is very poor, so it may not convincingly capture differences in the severity of poverty.

Including the household cross-sectional weights to (4) we get:

$$PG_w = \frac{1}{\sum_{j=1}^n w_j} \sum_{i=1}^q \frac{z - y_i}{z} w_i \quad (5)$$

**Foster-Greer-Thorbecke measure of severity of poverty** For  $\alpha = 2$  in (1) we get:

$$P_2 = P_2(y, z) = \frac{1}{n} \sum_{i=1}^q \left( \frac{z - y_i}{z} \right)^2 \quad (6)$$

which is the Foster-Greer-Thorbecke measure of severity of poverty. The measure is based on weighting the poverty gaps of the poor by those poverty gaps in assessing aggregate poverty.  $P_2$  is mean of squared proportionate poverty gaps. One of disadvantages of the measure is that it is not easy to interpret. The measure can be considered as the sum of two components: an amount due to the poverty gap, and an amount due to inequality amongst the poor. It can be used e. g. in comparing policies which are aiming to reach the poorest.

Weighting the equation (6) with the household cross-sectional weights we get:

$$P_{2w} = \frac{1}{\sum_{j=1}^n w_j} \sum_{i=1}^q \left( \frac{z - y_i}{z} \right)^2 \cdot w_i \quad (7)$$

**The General Measure** As already mentioned, Foster-Greer-Thorbecke class of poverty measures is defined by  $P_\alpha$  (1). For both the poverty-gap index and  $P_2$  the individual poverty measure (i. e. value  $(1 - \frac{y_i}{z})^\alpha$  for  $i$ -th household) is strictly decreasing in the living standard of the poor (the lower the standard of living the poorer the person is deemed to be). The parameter  $\alpha$  determines the degree to which the measure is sensitive to the degree of deprivation for those below the poverty line (Morduch, 2005). For  $\alpha > 1$  the measure is distributionally sensitive. The higher the value of  $\alpha$  the more sensitive the measure is to the well-being of the poorest person. As  $\alpha \rightarrow \infty$  the measure collapses to 1 which only reflects the poverty of the poorest person (Ravallion, 1992).

Weighting  $P_\alpha$  given by (1) with household cross-sectional weights we get:

$$P_{\alpha w} = \frac{1}{\sum_{j=1}^n w_j} \sum_{i=1}^q \left( \frac{z - y_i}{z} \right)^\alpha \cdot w_i \quad (8)$$

### 3 Results and Discussion

#### 3.1 Monetary Poverty

Measurement and comparison of monetary poverty levels (see Table 1) in the European Union is based on national poverty line. Adopting this approach poverty levels range between 9 and 25,9 %. Such a poverty line reflects income situation in certain countries.

Country	National			EU (official rate)			EU (PPP rate)		
	2005	2008	2011	2005	2008	2011	2005	2008	2011
AT	12,3	12,4	12,6	4,3	4,1	4,4	4,1	4,5	4,7
BE	14,8	14,7	15,3	7,6	7,2	5,9	8,2	9,1	7,8
BG	x	21,4	22,3	x	98,2	97,2	x	85,4	78,0
CY	16,2	16,2	14,5	18,3	10,2	9,3	11,2	5,5	5,5
CZ	10,4	9,0	9,8	93,1	82,5	68,5	53,4	39,5	37,2
DE	12,3	15,2	15,8	7,2	8,4	8,1	7,2	8,6	8,5
DK	11,8	11,8	13,0	3,1	3,0	4,1	5,7	6,2	6,7
EE	18,3	19,5	17,5	95,1	81,0	79,7	79,3	61,8	60,5
EL	19,6	20,1	21,4	40,4	35,7	38,9	28,8	29,1	33,6
ES	19,7	19,6	21,8	33,8	25,6	30,3	25,7	21,4	27,8
FI	11,7	13,6	13,7	4,0	3,9	2,7	8,8	8,3	5,9
FR	13,0	12,6	14,0	7,3	4,7	5,0	8,9	6,3	6,6
HU	13,4	12,4	13,8	96,6	94,9	92,9	80,1	77,0	69,6
CH	x	x	15,0	x	x	1,8	x	x	4,1
IE	19,7	15,5	x	7,1	2,4	x	13,6	7,3	x
IS	9,7	10,1	9,2	1,8	0,9	4,6	4,3	2,4	5,7
IT	18,8	18,7	19,6	16,9	16,0	17,2	17,3	17,0	17,5
LT	20,5	20,0	20,0	98,0	91,1	91,7	86,5	66,6	74,3
LU	13,7	13,4	13,6	1,0	0,6	1,2	1,0	1,4	1,6
LV	19,2	25,6	19,3	97,8	83,8	89,1	87,4	60,7	73,8
MT	x	x	15,4	x	x	36,0	x	x	18,2
NL	10,8	10,5	11,0	5,9	3,6	3,5	6,1	3,7	4,1
NO	11,5	11,6	10,6	2,4	2,3	1,8	4,2	3,8	2,9
PL	20,6	16,9	17,7	97,0	91,6	87,5	81,0	69,3	56,4
PT	19,4	18,5	18,0	59,7	55,1	55,5	47,0	44,2	44,4
RO	x	23,4	22,2	x	99,1	99,4	x	95,7	95,1
SE	9,3	12,2	14,0	4,3	4,0	3,8	7,2	6,2	6,4
SI	12,2	12,3	13,6	42,8	29,7	24,7	17,6	14,4	14,8
SK	13,3	10,9	13,0	98,7	94,0	80,5	94,9	75,6	50,1
UK	19,1	18,7	16,2	8,4	8,8	10,9	9,8	9,3	10,7

Table 1: At-risk-of-poverty rates estimates according to poverty line (2005–2011)

On the other hand, comparing the results across the European Union considering a single poverty line for all countries, gives a view on differences among the countries. Such a poverty line considers all EU member states as “one country”, and countries are considered as regions of this fictive country. It is necessary to apply purchasing power poverty rates to account for differences in prices among countries.

It is obvious that countries with higher levels of disposable income have lower values of at-risk-of-poverty rates than countries with lower levels of income.

According to Table 1 there are considerable differences in at-risk-of-poverty rates between national and EU-wide poverty lines, mainly in case of countries with lower levels of income. For instance, applying national poverty line there was 13,3 % at-risk-of-poverty rate in Slovakia in 2005, but applying EU-wide poverty line the rate increased to almost 95 %.

As already mentioned at-risk-of-poverty rate can be easily interpreted, but is insensitive to differences in the depth of poverty, i.e. if people under the poverty line become poorer, this will not be reflected in the head-count index (at-risk-of-poverty rate). Depth of poverty is taken into account in poverty gap index ( $P_1$ ). But on the other hand this measure is not sensitive to the distribution among the poor (suppose that a person becomes poorer by one unit of income, but another person becomes richer by one unit of income -  $P_1$  measure would be unaffected). Differences in the severity of poverty are taken into account in case of  $P_2$  measure.

Country	2008			2011		
	$P_0$	$P_1$	$P_2$	$P_0$	$P_1$	$P_2$
AT	12,36	2,59	0,95	12,64	3,21	1,47
BE	14,73	3,40	1,45	15,30	3,66	1,55
BG	21,42	6,67	3,25	22,32	7,62	3,85
CY	16,18	3,21	1,00	14,53	3,13	1,09
CZ	9,05	2,08	0,83	9,80	2,30	0,92
DK	11,84	3,32	1,84	12,98	4,27	2,61
EE	19,46	5,22	2,35	17,46	5,54	2,89
EL	20,14	5,98	3,04	21,37	7,02	3,78
ES	19,65	6,15	3,26	21,76	8,39	5,17
FI	13,58	2,72	0,96	13,69	2,68	0,99
FR	12,65	2,65	0,93	14,06	3,19	1,28
HU	12,38	2,72	1,04	13,84	3,00	1,03
CH	16,24	4,95	2,69	15,03	3,97	1,80
IE	15,46	3,28	1,24	x	x	x
IS	10,01	2,31	1,02	9,31	2,74	1,45
IT	18,67	5,73	3,03	19,57	6,75	3,91
LT	19,99	6,20	3,07	20,00	6,88	3,74
LU	13,40	2,88	1,05	13,57	2,95	1,24
LV	25,58	8,18	3,83	19,29	6,94	3,81
MT	x	x	x	15,41	3,42	1,35
NL	10,50	2,76	1,48	10,99	2,68	1,32
NO	11,55	3,62	1,99	10,57	3,07	1,61
PL	16,88	4,56	2,06	17,67	4,79	2,15
PT	18,53	5,00	2,10	18,04	4,72	1,99
RO	23,60	8,61	4,66	22,38	8,25	4,56
SE	12,20	3,30	1,72	13,99	3,67	1,85
SK	10,87	2,81	1,34	12,98	3,70	1,79
UK	18,68	5,12	2,42	16,20	4,55	2,29

Table 2: Foster-Greer-Thorbecke class of poverty measures

Estimates of FGT  $P_\alpha$  measures of poverty can be found in Table 2. The table provides several interesting results. E. g. according to 2008 EU SILC data head-count index in Austria and Belgium is higher than head-count index in Denmark, but severity-of-poverty index ( $P_2$ ) is higher in Denmark than in Austria or Belgium. This means that poverty is more severe in Denmark than in Austria or Belgium, or in other words, the income situation of the poorest from the poor is worse in Denmark than in Austria or Belgium.

The results further indicate that in case of 15 countries values of all poverty measures increased between 2008 and 2011. The values of poverty gap indices increased in case of 18 countries and the values of severity-of-poverty indices increased in 19 cases. Decrease in all measures was recorded only in Norway, Portugal, the United Kingdom, Romania and Latvia.

In general, the overall situation from the viewpoint of poverty worsened in the European Union between 2008 and 2011. Incomes of people under the poverty line were in 2011 relatively lower than in 2008, and the income situation of the poorest from the poor worsened as well.

### 3.2 Spatial Distribution of Poverty Indicators

As already mentioned, the share of people at risk of poverty or social exclusion (see Figure 1) is one of the Europe 2020 headline indicators, aggregating three dimensions: monetary poverty, material deprivation and work intensity of a household.

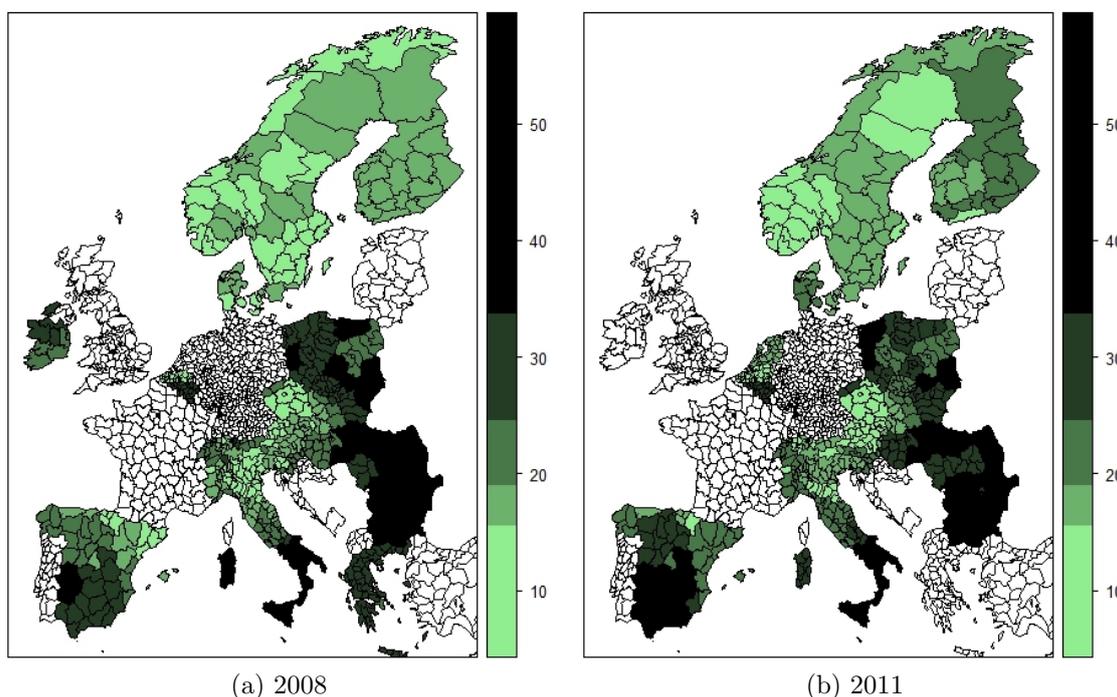


Figure 1: At-risk-of-poverty rate or social exclusion (%)

The regional data on poverty measures are not available for all EU countries, and hence there are several observations with missing values. But the pictures in Figure 1 indicate that poverty is strongly spatially autocorrelated.

This is also truth for sub-indicators included in the aggregated indicator (see Figures 2, 3 and 4).

The figures indicate that the strength of spatial autocorrelation is the lowest in case of “living in a household with a very low work intensity” sub-indicator, but still statistically significant (see the values of spatial autocorrelation coefficients in Table. 3)

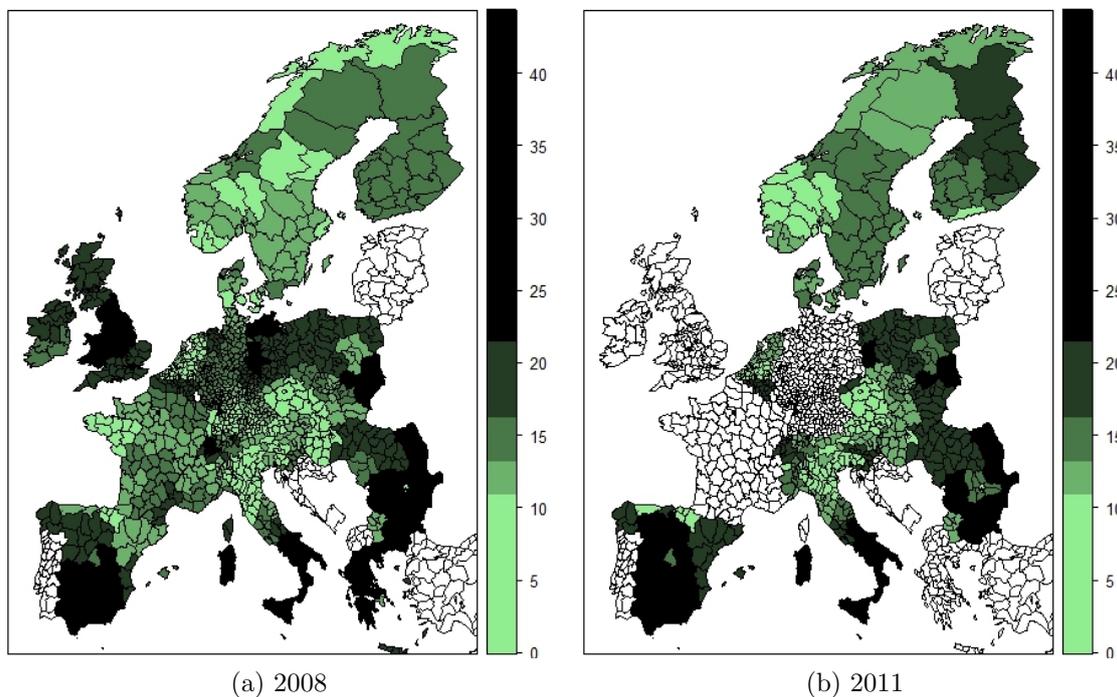


Figure 2: At-risk-of-poverty rate (%)

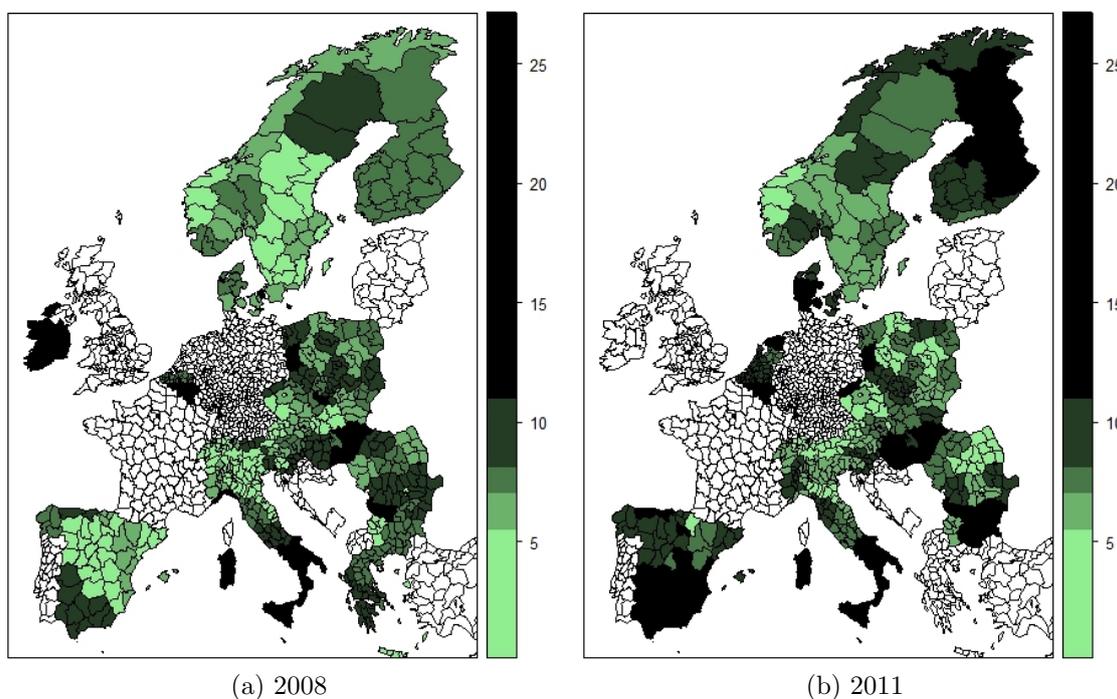


Figure 3: Living in a household with a very low work intensity (%)

Maps in Figure 4 indicate that there is a very strong concentration of high level of relative material deprivation in the Eastern part of the European Union.

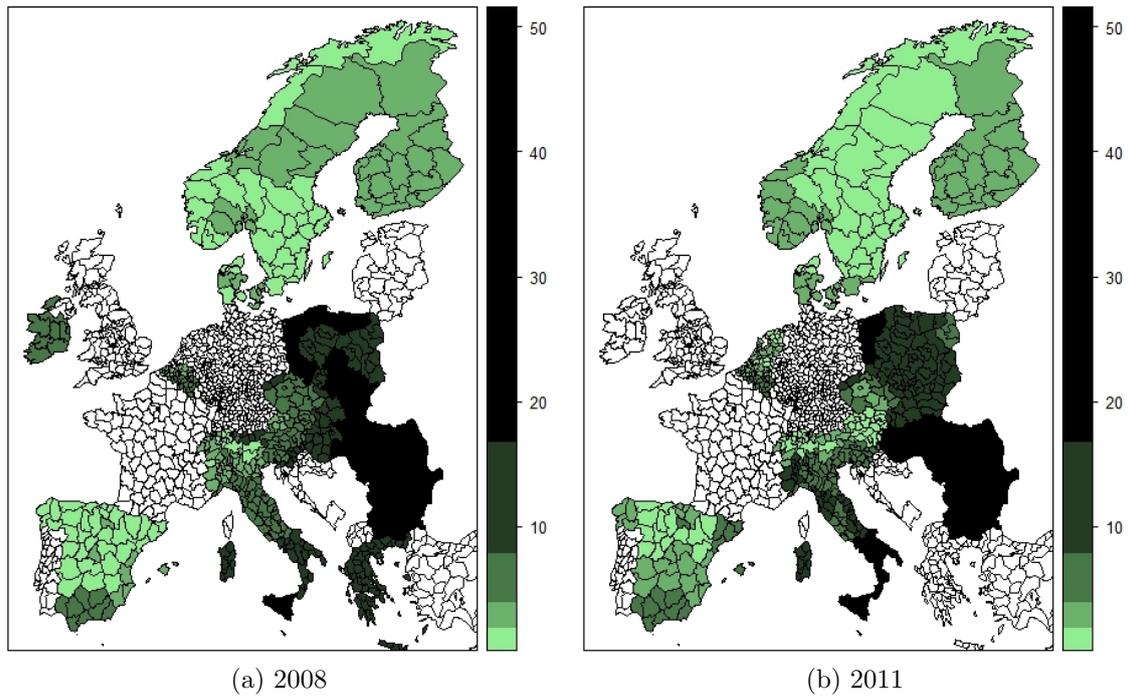


Figure 4: Severe material deprivation (%)

As the figures indicate, all poverty indicators are strongly spatially autocorrelated (see Table 3).

	AROPSE	AROP	WORK	DEPR
2005	0,5451 ( $< 0,0001$ )	0,4772 ( $< 0,0001$ )	0,4625 (0,0004)	0,5965 ( $< 0,0001$ )
2006	0,4229 (0,0011)	0,4962 ( $< 0,0001$ )	0,4399 (0,0007)	0,4911 (0,0001)
2007	0,4401 (0,0004)	0,4491 ( $< 0,0001$ )	0,3923 (0,0014)	0,4417 (0,0003)
2008	0,5458 ( $< 0,0001$ )	0,4648 ( $< 0,0001$ )	0,3810 (0,0004)	0,5981 ( $< 0,0001$ )
2009	0,6141 ( $< 0,0001$ )	0,5137 ( $< 0,0001$ )	0,4749 ( $< 0,0001$ )	0,6617 ( $< 0,0001$ )
2010	0,5906 ( $< 0,0001$ )	0,5308 ( $< 0,0001$ )	0,4995 ( $< 0,0001$ )	0,6133 ( $< 0,0001$ )
2011	0,5990 ( $< 0,0001$ )	0,5410 ( $< 0,0001$ )	0,4642 ( $< 0,0001$ )	0,6217 ( $< 0,0001$ )

Table 3: Moran's I spatial autocorrelation coefficient (p-values in parentheses)

According to the results the poverty levels are strongly positively autocorrelated, which indicates that high levels of poverty are concentrated at certain places across the European Union.

## 4 Conclusion

This paper is an introductory analysis to the current situation in terms of poverty in the European Union and its spatial aspects. As poverty is a multidimensional phenomenon, concentrating only on income as the main indicator of poverty might lead to biased conclusions. According to the standard Eurostat methodology based on relative concept of poverty, at-risk-of-poverty rate in Slovakia is around 10-13 %. But applying the EU-wide poverty line the poverty rate increases considerably.

As assumed, high levels of poverty are concentrated in the Eastern part of the European Union, which is still the “poorer” part of the EU.

One of the most significant limitations of this study is the fact that the variable “region” is not included in the micro data set, and hence it is not possible to estimate the poverty rates at regional level in case of all EU countries, and only cross-country comparisons can be made.

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