SPATIAL ASPECTS OF POVERTY IN SLOVAKIA

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Abstract

According to the latest official statistics around 20.6 per cent of the Slovak population is at risk of poverty or social exclusion, which is less than the EU average. On the other hand regional differences in Slovakia are considerable. This is also truth for the differences in poverty levels in the Slovak regions.

The first objective of the study is to analyze spatial aspects of poverty in Slovakia. The share of beneficiaries of material need benefit and contributions is used as a proxy for poverty levels in the counties (LAU-1 administrative level) of Slovakia. Three explanatory variables are employed in the survey: long-term unemployment rate; average nominal monthly earnings; educational level. In order to consider regional spillovers a spatial Durbin model is employed in the study.

Key words: Poverty, Spatial Autoregressive Model, Slovakia.

JEL Code: I32, R11, R15

Introduction

There have been many studies dealing with poverty in Slovakia and its regions. Most of them were focused on description of various aspects of poverty in the regions of the country. One of the first complex studies incorporating regional aspect to poverty analysis was performed by Michalek (2004) and later was followed e. g. by Dzambazovic (2007). Michalek (2004) measured the level of poverty in 79 districts in Slovakia (LAU-1 territorial level) using the conception of multiply deprivation based on the measurement of deprivations of important elements in human life. Dzambazovic (2007) analysed interregional disparity concentrating on social-spatial marginal regions, intercommunity disparity and local disparity. Later, Ivancikova and Vlacuha (2010) described the level of poverty and social exclusion in the regions of Slovakia using an aggregate indicator for social inclusion proposed in Europe 2020 Strategy. Similarly Zelinsky (2010) described poverty in the NUTS3 regions in Slovakia from the viewpoint of monetary poverty, subjective perception of poverty and relative material

deprivation. Further analyses focused on modelling of financial power of households (Bartosova, 2009), comparison of monetary poverty in the regions of the Czech Republic and Slovakia (Bartosova and Forbelska, 2010). Some studies concentrated on wage levels in the regions of Slovakia (Sipkova and Sipko, 2010) or on regional viewpoint of households expenditures (Pacakova and Labudova, 2010).

Most of the papers focusing on regional aspects of poverty neglect the spatial spillovers of the analysed phenomena. The aim of this paper is to estimate a simple spatial econometric model taking into account the effects of regional spillovers.

1 The model

1.1 Description of the Model

In this study spatial econometric model is employed. Our aim is to incorporate spatial effects working through the dependent and explanatory variables. First we will decide between the *first order spatial autoregressive model* (SAR) given by Eq. (1)

$$\mathbf{y} = \rho\mathbf{W}\mathbf{y} + \mathbf{X}\boldsymbol{\beta} + \boldsymbol{\varepsilon} \tag{1}$$

and the *spatial Durbin model* (SDM) given by Eq. (2)

$$\mathbf{y} = \boldsymbol{\iota}_n\alpha + \mathbf{X}\boldsymbol{\beta} + \rho\mathbf{W}\mathbf{y} + \mathbf{W}\mathbf{X}\boldsymbol{\gamma} + \boldsymbol{\varepsilon} \tag{2}$$

where

- $\mathbf{y}$ is n-by-1 vector of observations of at-risk-of-poverty rates,
- $\boldsymbol{\iota}_n$ is n-by-1 vector of ones with the associated scalar parameter α,
- $\mathbf{X}$ is n-by-q matrix of observations of the seven explanatory variables with the associated vector parameter $\boldsymbol{\beta}$,
- $\mathbf{W}$ is n-by-n non-stochastic row-standardised spatial weight matrix specifying the spatial dependence among regions. $\mathbf{W}$ is based on the nearest neighbours with $k = 6$ (see e. g. LeSage and Fischer, 2008).
- $\mathbf{W}\mathbf{y}$ is n-by-1 spatial lag vector of y with associated scalar spatial dependence parameter $\rho \in (-1; 1)$,
- $\mathbf{W}\mathbf{X}$ is n-by-q matrix of the spatially lagged explanatory variables with associated vector parameter $\boldsymbol{\gamma}$,
- $\boldsymbol{\varepsilon}$ is n-by-1 normally distributed, constant variance disturbance term, $\boldsymbol{\varepsilon} \sim \mathrm{N}(0, \sigma_\varepsilon^2\mathbf{I}_n)$.

In order to identify the best model likelihood ratio test will be used.

1.2 Observation Units and Description of the Data

The sample includes 79 counties of Slovakia (i.e. LAU-1 territorial level). All variables refer to observation year 2010.

The ***share of beneficiaries of material need benefit and contributions*** is used as a proxy for *poverty levels*. The benefits are provided to the individuals in material need (in accordance with the Act No. 599/2003 Coll. on material need assistance and on amendments and supplements of certain laws).

Three explanatory variables are employed in the survey: long-term unemployment; average nominal monthly earnings; educational level.

Share of long-term unemployed is the share of people who are out of work and have been actively seeking unemployment for at least a year relative to the number of unemployed, and is measured in per cent.

Average nominal monthly earnings are surveyed from quarterly statistical reporting. Data on earnings are based on reporting of enterprises with 20 and more employees.

As a proxy for ***education level*** share of unemployed persons with primary or no education attainment is used. The category *primary education* refers to ISCED-97 level 1, *no education* refers to ISCED-97 level 0.

In the proposed regression model the poverty level in region i (denoted by y_i) depends on poverty levels in the neighbouring regions captured by the spatial lag variable $\mathbf{W}_{i\cdot}\mathbf{y}$ ($\mathbf{W}_{i\cdot}$ representing i^{th} row of $\mathbf{W}$). It further depends on the own-region (and possibly neighbouring regions) levels of long-term unemployment rate, average nominal monthly earnings and education.

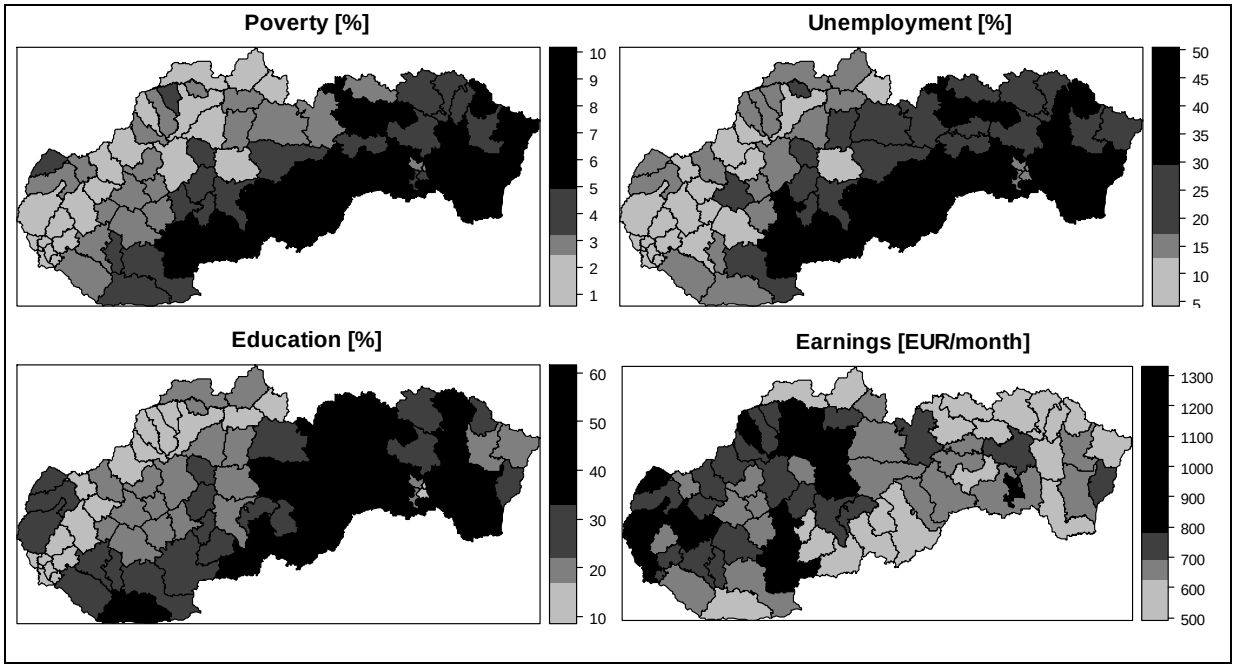
1.3 Spatial Distribution of the Variables

First we take a look at the dependent and explanatory variables used in the model. The share of beneficiaries of material need benefit and contributions (proxy for poverty level) ranged from approx. 1 per cent of population in the West to almost 10 per cent of population in the south-eastern part of Slovakia. The share of long-term unemployed on the total number of unemployed ranged from approx. 5 per cent to around 50 per cent. Share of people with low education level is concentrated in the eastern part of the country, and high (labour) earnings

are typical for the western counties, while low earnings are typical for the eastern counties of the Slovak Republic.

According to thematic maps (Fig. 1) we can assume that poverty (measured in terms of share of of beneficiaries of material need benefit and contributions) as well as long-term unemployment are concentrated in the eastern and southern part of the country. Similarly, low level of education and low levels of earning are concentrated in the eastern part of the country.

Fig. 1: Spatial distribution of model variables



Source: own

This assumption is supported by Moran's test for spatial autocorrelation (used in order to identify the spatial distribution of the given variables). According to the values of Moran's coefficient of spatial autocorrelation and associated p-values (Table 1) there is a high concentration of similar values appearing together.

Table 1: Model estimates

Variable	*Moran's I*	*st. dev.*	*p-value*
Poverty level	0.63	10.76	$2.2 \cdot 10^{-16}$
Unemployment	0.70	11.82	$2.2 \cdot 10^{-16}$
Earnings	0.39	6.87	$6.3 \cdot 10^{-12}$
Education level	0.58	9.88	$2.2 \cdot 10^{-16}$

Source: Own

2 Results and Discussion

SAR and SDM are estimated at the first stage of the best model determination. According to the likelihood ratio test we fail to reject the null hypothesis of SAR model specification (*test statistic:* 5.28 with the corresponding *p-value*: 0.07), hence we can assume the first order spatial autoregressive model as appropriate.

2.1 SAR Model Estimation

The following results are obtained using ML estimation in R (R Development Core Team, 2012) using package `spdep` (Bivand, 2012):

Table 2: Model estimates

Variable	*Coefficient*	*z-value*	*p-value*
constant	1.22	0.91	0.361
log(unemployment)	**0.44**	**4.53**	**0.000**
log(education)	**0.24**	**2.54**	**0.011**
log(earnings)	**–0.37**	**–2.04**	**0.042**
ρ	**0.34**		**0.000**

Source: Own

According to the model estimates (Table 2) all explanatory variables are statistically significant. In order to interpret the model average direct, total and indirect effects (as suggested by LeSage and Pace (2009)) have to be taken into account.

2.2 Impacts Estimates

Interpretation of ***average direct impacts*** (Table 3) is similar to interpretation of typical regression coefficients, i.e. impact of changes in the i^{th} observation of q^{th} variable on dependent variable y_i.

Table 3: Direct Impacts

Variable	*Coefficient*	*St. dev.*	*t-stat*
log(unemployment)	**0.44**	**0.10**	**4.50**
log(education)	**0.24**	**0.10**	**2.46**
log(earnings)	**–0.40**	**0.19**	**–2.11**

Source: Own

Direct impacts of all explanatory variables are significant (t-stat greater than 2). As expected the average direct impacts of long term unemployment and low education proxy are positive, i.e. if long term unemployment and share of low-educated available labour force increase in region *i*, the poverty level proxy is likely to increase in region *i*, too. On the other

hand, earnings are negatively associated with poverty level (measured in terms of share of beneficiaries of material need benefit and contributions).

Average indirect impacts (Table 4) represent the total impact on individual observation y_i resulting from change in of the q^{th} explanatory variable by the same amount across all n observations. Another interpretation of average indirect impacts is based on impacts to an observation (i.e. how changes in all observations influence a single observation).

Table 4: Indirect Impacts

Variable	*Coefficient*	*St. dev.*	*t-stat*
log(unemployment)	**0.21**	**0.05**	**4.50**
log(education)	**0.12**	**0.05**	**2.46**
log(earnings)	**–0.19**	**0.09**	**–2.11**

Source: Own

The indirect impacts can be interpreted in the following way: if long-term unemployment and education increase by the same unit in all n regions, the poverty rate in region i is likely to increase, too. As for the impacts of earnings, if earnings increase by the same unit in all n regions, the poverty rate in region i is likely to increase, too.

Average total impacts (Table 5) represent the sum of average direct and indirect effects.

Table 5: Total Impacts

Variable	*Coefficient*	*St. dev.*	*t-stat*
log(unemployment)	**0.66**	**0.15**	**4.50**
log(education)	**0.36**	**0.15**	**2.46**
log(earnings)	**–0.58**	**0.28**	**–2.11**

Source: Own

Summing up average direct effects and average indirect effects yield statistically significant average total impacts of all explanatory variables on poverty rate.

Conclusion

The aim of this article was to estimate a simple spatial econometric model explaining the level of poverty in the Slovak counties (proxied by the share of beneficiaries of material need benefit and contributions) using three explanatory variables: long-term unemployment;

average nominal monthly earnings; educational level. According to the results all variables are statistically significant. As one would suppose, long-term unemployment and low education level have positive impacts (in terms of direct, indirect and total effects) on poverty levels; and earnings level has negative impacts on poverty level.

According to the results we can assume that space and spatial spillovers should be taken into account when analysing poverty. The presented paper is a preliminary output of a more complex study of the spatial analysis of poverty in Slovakia to be prepared within the project *Spatial distribution of poverty in the European Union*.

Acknowledgment

This work was supported by the Slovak Scientific Grant Agency as part of the research project *VEGA 1/0127/11 Spatial Distribution of Poverty in the European Union*.

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