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Determinants of Monetary Poverty in the European Union

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Abstract

The main objective of the study is to analyze the most important determinants of monetary poverty (at macro-level) in the Western EU countries taking into account the effects of regional spillovers. 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. In this study a spatial Durbin model (SDM) is employed. The sample includes 145 regions at NUTS-2 (in few cases at NUTS-1) level of 11 countries from the western part of the European Union. The at-risk-of-poverty rate (i.e. monetary poverty indicator) across western EU regions is the dependent variable, and four explanatory variables are employed in the survey: 1. disposable per capita income; 2. long-term unemployment rate; 3. education level; 4. population density. All variables refer to observation year 2008. In order to quantify the impacts of explanatory variables the scalar summary measures are used. According to the results two non-spatially lagged explanatory variables (education and population density) and two spatially lagged explanatory variables (income and education) are not statistically significant. In terms of the scalar summary measures the following patterns can be observed: average direct impacts, as well as indirect and total impacts of income are negative. Average direct impacts of unemployment are positive, indirect impacts are negative, and the average total effects are statistically insignificant. Average direct effects of population density are not statistically significant, but indirect and total effects are positive. Impacts of proxy for education level (defined as share of persons aged 25-64 with lower secondary education attainment) are statistically not significant. Such a result cannot be interpreted in sense that education has no impact on poverty levels. On the other hand we can assume that the given proxy measures only quantity, not the quality of education, and hence the variable is not significant.

Keywords: monetary poverty, spatial Durbin model, regional spillovers

JEL Classification: I32, R11, R15,

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1 Introduction

It is estimated that over 80 million of EU citizens are poor (based on monetary concept). The assessment of well-being for poverty analyses is usually based on two main conceptual approaches: the *welfarist approach* and the *non-welfarist approach* (Ravallion, 1992).

The welfarist approach (or the indirect method) assumes that individuals are rational and are able to make production and consumption choices that maximize their utility. A *lack of command over commodities* measured by low income or consumption is the working definition of poverty in terms of the welfarist conceptual approach (Duclos and Araar, 2006).

The non-welfarist approach (or the direct method) recognizes two basic concepts: *basic needs concept* linked to Sen's (1984) *functionings concept* and the *capabilities concept* also introduced by Sen (1999). Basic needs are usually understood as physical inputs that are usually required for individuals to achieve functionings while capabilities are defined as the capacity to achieve the functionings (Duclos and Araar, 2006).

Measurement of well-being using welfarist approach is based on proxies such as income, consumption or expenditures data, and using non-welfarist approach is based on proxies such as material deprivation (Želinský, 2010).

The main objective of the study is to analyze the most important determinants of monetary poverty (at macro-level) in the Western EU taking into account the effects of regional spillovers.

2 Description of the model

2.1 The Spatial Durbin Model

In this study a spatial Durbin model (SDM) given by Eq. (1) is employed. The rationale behind this model is to incorporate spatial effects working through the dependent variable and spatial effects working through the explanatory variables.

$$\mathbf{y} = \boldsymbol{\iota}_n \alpha + \mathbf{X}\boldsymbol{\beta} + \rho \mathbf{W}\mathbf{y} + \mathbf{W}\mathbf{X}\boldsymbol{\gamma} + \boldsymbol{\epsilon} \quad (1)$$

where

- \mathbf{y} is n -by-1 vector of observations of at-risk-of-poverty rates (log of values relative to “EU-11” average),
- $\boldsymbol{\iota}_n$ is n -by-1 vector of ones with the associated scalar parameter α ,
- \mathbf{X} is n -by- q matrix of observations on the seven explanatory variables with the associated vector parameter $\boldsymbol{\beta}$,
- \mathbf{W} is n -by- n non-stochastic spatial weight matrix specifying the spatial dependence among regions. In accordance with LeSage and Fischer (2008) \mathbf{W} is based on the nearest neighbours with $k = 6$. When region j is a neighbour of region i , $W_{ij} = 1$, and $W_{ij} = 0$ otherwise. The diagonal elements of \mathbf{W} are set to zero by convention. \mathbf{W} is row-standardised, which ensures that all weights are between zero and one, while sum of weights in each row is one (as six nearest neighbours are used, spatial weights equal $1/6$).

- $\mathbf{W}\mathbf{y}$ is n -by-1 spatial lag vector of \mathbf{y} with associated scalar spatial dependence parameter (parameter of the first order spatial autoregressive process) ρ , and is assumed to lie within interval $(-1, 1)$. In our model we assume that $0 < \rho < 1$, which indicates that regional at-risk-of-poverty rates are positively related to at-risk-of-poverty rates in neighbouring regions,
- $\mathbf{W}\mathbf{X}$ is n -by- q matrix of the spatially lagged explanatory variables with associated vector parameter $\boldsymbol{\gamma}$,
- $\boldsymbol{\epsilon}$ is n -by-1 normally distributed, constant variance disturbance term, $\boldsymbol{\epsilon} \sim N(0, \sigma_{\epsilon}^2 \mathbf{I}_n)$.

2.2 Observation units and description of the data

The sample includes 145 regions at NUTS-2 level (in few cases at NUTS-1 level) of 11 countries from western part of the European Union: Austria (nine regions), Germany (39 regions), Denmark (five regions), Spain (19 regions), Finland (three NUTS-2 regions and one NUTS-1 region), France (22 regions), Ireland (two regions), Italy (21 regions), Sweden (eight regions), Belgium (three NUTS-1 regions) and the United Kingdom (two NUTS-2 regions and 11 NUTS-1 regions).

The *at-risk-of-poverty rate* across western EU regions is the dependent variable. At-risk-of-poverty rate (after social transfers) is defined as the share of persons with an equivalised disposable income below the risk-of-poverty line, which is set at 60% of the national median equivalised disposable income after social transfers. The disposable income is defined as gross income less income tax, regular taxes on wealth, compulsory social insurance contributions, while the gross income is the total monetary and non-monetary income received by the household over a specified income reference period. Income is measured at household level, and in order to gain equivalised disposable income, the total disposable income of a household has to be divided by equivalised household size according to the modified OECD scale (giving a weight of 1.0 to the first adult, 0.5 to other persons aged 14 or over and 0.3 to each child aged less than 14). EU SILC 2009 are used, and they refer to reference year 2008.

Four explanatory variables are employed in the survey: 1. disposable per capita income; 2. long-term unemployment rate; 3. education level; 4. population density. All variables refer to observation year 2008.

Disposable per capita income is the total income of a household, after tax and other deductions, that is available for spending or saving, divided by the number of household members. Disposable per capita income is measured in terms of purchasing power standard based on final consumption per inhabitant.

Long-term unemployment rate is the share of people who are out of work and have been actively seeking unemployment for at least a year, and is measured in per cent.

As a proxy for *education level*: share of persons aged 25-64 with lower secondary education attainment is used. The category *lower secondary education* refers to ISCED-97 level 2, and usually the end of this level coincides with the end of compulsory education, usually age 15-16.

Population density is measured in terms of the number of inhabitants per square kilometre.

Logs of original values (of both dependent and explanatory) relative to “EU-11” average are used in the model.

In the proposed regression model the at-risk-of-poverty rate in region i (denoted by y_i) depends on poverty rates in the neighbouring regions (as defined in spatial weight matrix \mathbf{W}) captured by the spatial lag variable $W_i \mathbf{y}$ where W_i is the i^{th} row of the spatial weight matrix \mathbf{W} . It further depends on the own-region levels of disposable per capita income, long-term unemployment rate, education and population density (given by i^{th} row of matrix \mathbf{X}) as well as levels of disposable per capita income, long-term unemployment rate, education and population density in the neighbouring regions represented by $\mathbf{W}_i \mathbf{X}$.

Taking into account relationships among neighbouring regions, a change of q^{th} variable in region i has not only direct impact on at-risk-of-poverty rate of this region, but also indirect impact on other regions $j \neq i$. The estimated model will be discussed in terms of direct, indirect and total effects as proposed by (LeSage, Pace, 2009), and interpretation is followed by Fischer et al. (2008).

3 Results and Discussion

Estimation results of the spatial Durbin model and quantification of the explanatory variables on at-risk-of-poverty rates are presented in this section.

In order to quantify the impacts of explanatory variables the scalar summary measures as suggested by LeSage and Pace (2009) are used.

3.1 Model Estimation

In order to discriminate between the unrestricted spatial Durbin model and spatial error model, i.e. between substantive and residual dependence the likelihood ratio test is used. A likelihood ratio test rejects the null hypothesis of a spatial error model specification (*test statistic*: 19.41 with the corresponding *p-value*: 0.00006). This supports our belief that spatial externalities are substantive rather than random. The estimated spatial autoregressive parameter ($\hat{\rho} = 0.497$) provides evidence for significant spatial effects working through the dependent variable.

Variable	Coefficient	<i>t</i> -stat	<i>z</i> -probability
constant	-0.148	-3.71	0.0002
income	-0.708	-3.32	0.0009
unemployment	0.314	8.44	0.0000
education	-0.047	-0.67	0.5018
pop.density	0.012	0.65	0.5170
W*income	-0.466	-1.38	0.1676
W*unemployment	-0.306	-5.86	0.0000
W*education	0.072	0.91	0.3613
W*pop.density	0.137	3.60	0.0003
ρ	0.497	5.24	0.0000
R^2	0.707		

Table 1: Model estimates

In Table 1 we can see that two non-spatially lagged explanatory variables (education and population density) and two spatially lagged explanatory variables (income and education) are not statistically significant. Taking into account that quantifying the impacts

of explanatory variables is based on direct, indirect and total effects as suggested by LeSage and Pace (2009), output in Table 1 is not of high importance for explanatory variables impacts interpretation purposes.

3.2 Impacts Estimates

This section is focused on interpretation of the estimated model with using interpretation in terms of direct, indirect and total effects.

Average direct impacts (Table 2) or in other words the impact of changes in the i^{th} observation of x_q , denoted as x_{iq} , on y_i is similar in spirit to typical regression coefficient interpretations (LeSage and Pace, 2009). The direct impacts includes feedback influences arising as a result of impacts passing through neighbours, and back to the observation itself (Fischer and Wang, 2011).

Variable	Coefficient	t -stat	t -prob
Income	-0.788	-3.84	0.0002
Unemployment	0.298	8.72	0.0000
Education	-0.042	-0.64	0.5233
Pop.density	0.026	1.44	0.1530

Table 2: Direct Impacts

As expected the average direct impact of income is negative and the impact of unemployment is positive. If median income increases in the region i , poverty rate is likely to decrease. On the other hand the rise of unemployment rate in region i results in increase of poverty rate in the same region.

Average indirect impacts (Table 3) represent the total impact on individual observation y_i resulting from changing the q^{th} explanatory variable by the same amount across all n observations. On the other hand, average indirect effects represent also impacts to an observation, i.e. how changes in all observations influence a single observation i .

Variable	Coefficient	t -stat	t -prob
Income	-1.554	-3.58	0.0005
Unemployment	-0.283	-3.64	0.0004
Education	0.094	1.00	0.3194
Pop.density	0.275	3.96	0.0001

Table 3: Indirect Impacts

Indirect impact of income change is stronger than the direct impact. If income rises by the same unit in all n regions, the poverty rate in region i decreases almost twice as fast as it would decrease due to income rise reported in the given region only. The indirect impact of unemployment on poverty rate is negative, too, while the impact of population density is positive. These impacts are discussed in the next chapter in a greater detail.

Average total impacts (Table 4) are represented by the sum of average direct effects and average indirect effects. If the values of q^{th} explanatory variable change by the same unit in all regions, the value of the dependent variable will change by $(1 - \rho)^{-1}\beta_q$ units.

Variable	Coefficient	<i>t</i> -stat	<i>t</i> -prob
Income	-2.343	-5.93	0.0000
Unemployment	0.015	0.21	0.8356
Education	0.050	0.69	0.4900
Pop.density	0.301	4.19	0.0000

Table 4: Total Impacts

Summing up average direct effects and average indirect affects yields statistically significant average total impacts of income and population density on the monetary poverty rates.

According to the results there is no significant impact of education (defined only in a quantitative way) on poverty rates which is also discussed in the following chapter.

3.3 Discussion and Conclusions

Let us discuss the obtained results in a greater detail. Interpretation of the *average direct impacts* is straightforward and no additional aspects have to be considered.

In case of *average indirect impacts* several possibilities might arise and one has to consider them. The average indirect impact of income is negative and is stronger than the average direct impact, i.e. if incomes rise by the same unit in all n regions, the poverty rate in region i decreases almost twice as fast as it would decrease due to income rise reported in the given region only. Intuitively we would expect such finding, as economic activity in one region is usually associated with activities in other regions. If economic performance of region's i surrounding regions improves, the region i is likely to perform better as well and vice-versa.

A comment on regional poverty rates is necessary. Estimation of share of persons at risk of poverty (poverty rate) is based on the national poverty line. Consider a region i from country k with median value higher than the national median, and a region j from the same country k with median value lower than the national median. Increase in region's j median is likely to affect the national median upwards, while decrease in region's i median is likely to affect the national median downwards. If all regional medians increase, the national median increases as well and vice-versa. The regional poverty rate is dependent on the national poverty line, i.e. the regional poverty rates change only if income situation of people from that region changes with regard to the national poverty line.

That is why the change of aggregated income levels (i.e. disposable median income in the regions) has to be analysed at two stages: 1. *changes in the regional medians lower than the national* and 2. *changes in the regional medians higher than the national*. The national poverty line changes only if the national median income is changed (as described above).

There is also negative relationship between poverty rate and unemployment rate. Unemployment is associated with jobs losses and again two possibilities have to be taken into account. If people from all n regions who earn less than the national poverty lines lose their jobs, the povety rate for that particular region i will not change. If people from all n regions who earn more than the national median income lose their jobs, the national medians are likely to decrease. This will result in the decrease of national poverty line, and hence the decrease in poverty rate for a particular region i . The decrease is only

“visual” and is not thought to be associated with alleviating poverty in that region.

Further there are positive average indirect impacts of population density on poverty rate. This might be explained as a result of people’s moving from one region to another. If people living in region i work in region j (and earn more than the national poverty line), their wages are included in region’s i statistics, and they are part of region’s i population. If they move from region i to region j , population density in region j increases. If the number of the poor in region i is not changed, and the number of population decreases, which leads to increase in poverty rate in the particular region.

As for the *average total impacts*, income has negative significant impacts and population density positive significant impacts. As the average direct impacts of unemployment are positive, average indirect impacts are negative both with approximately the same magnitude, the average total impacts are not statistically significant.

According to the findings there are no significant effects of education on the poverty rate. Share of persons aged 25-64 with lower secondary education attainment is used as a proxy for education level. Such a result can not be interpreted in the sense that education has no impact on poverty levels. On the other hand it can be assumed that the given proxy measures only quantity, not the quality of education, and hence the variable is not significant. This finding is also supported by EU SILC 2009 microdata. There are about 16 % of people living in poverty, of those about 8.5 % have $ISCED \leq 3$, and about 7.5 % have $ISCED \geq 4$.

The results indicate that space matters in explaining poverty. Analysing poverty (similarly to other economic phenomena) without taking space into account results in a loss of important information concerning space. The presented paper is an output of complex study on the spatial distribution of poverty in the European Union intended to be prepared within the project *Spatial Distribution of Poverty in the European Union*.

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