SPATIAL INCOME CONVERGENCE PROCESSES IN HUNGARY AT SETTLEMENT LEVEL

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Abstract: *In our study, we examined the role of geographical proximity, which was re-appreciating during the period of regime change, and its effect on settlement income inequality in the Hungarian settlement space. Our analyzes point to the clubbing of incomes and the significant concentrated processes behind it. The regionalization of incomes is most influenced by the knowledge and the flow of social transfers.*

Key words*: spatial econometrics, territorial development, income inequalities, convergence*

INTRODUCTION

The socio-economic transformation of the Central and Eastern European region in the period following the change of regime can be described by very clear spatial characteristics [6, 2]. Compared to the previous period, new and novel phenomena (innovations, transnational companies, foreign direct investment, standing in international competition, metropolitanization, economic restructuring, etc.) have significantly changed and still change the spatial structure of each country [12, 14, 2]. Geographical proximities play a prominent role in the emergence and spread of the above phenomena, thus shaping territorial income inequalities. In the course of the examination of the territorial income inequality in Hungary, the effects arising from the geographical proximity are clearly and implicitly shown. Analyzes describing the distribution of incomes, income convergence and the phenomenon of income clubbing point to the spatial organizing role of geographical proximity [10, 4, 11]. In our dissertation we are looking for the answer to the following research questions regarding the Hungarian settlement space.

- Do income (convergence) clubs appear as a result of municipal income movements? In our study, we use the hypothesis that income mobility due to geographical proximity "directs" neighboring settlements towards clubbing. In this way, similarities can be detected in the spatial pattern of settlement income positions, which are arranged on the basis of neighborhood effects.

- What factors and to what extent contribute to the formation of income clubs?

MATERIALS AND METHODS

The answers to the research questions are given by the ESTDA (Exploratory Space-Time Data Analysis) methods. The key phenomenon of the analyzes is the geographical proximity, which we approach with the methods of spatial autocorrelation. With the global approach, we explore the average pattern of the income situation of Hungarian settlements. This is illustrated by Moran I. To describe the spatial patterns, we used the local test function of spatial autocorrelation, Local Moran I statistics developed by Luc Anselin [1]. Local Moran statistics (LISA) are suitable for showing areas that are similar or different from their neighbors [16]. The Moran scatterplot created by the trial divides the settlements into four groups according to their location in the given planar quarters: (1) High-High (HH): territorial units with a high income value, for which the neighborhood also has a high value. (2) High-Low (HL): high-income territorial units with a low neighborhood

value. (3) Low-Low (LL): low-value territorial units where the neighborhood also has a low income. (4) Low-High (LH): low value area units with a high neighborhood value.

Instead of the static point of view, the bivariate Moran I and LISA describes the relationships between spatial dynamics and the strength of the relationship between two different variables (or the value of the same variable at two times) in the space under study [16].

The basic indicator of income inequality at the municipal level is the taxable income per capita. The knowledge dimension is described by the average level of education of the population (at least the graduate population in the 18-X age group). The agglomeration processes are expressed by the logarithmized population density, while the flow of human resources is expressed by the migration balance and the daily commuter rate. In addition, we included the proxy variable for foreign direct investment, the network characteristics that allow the movement of individual factors (the proportion of broadband Internet users and the accessibility of motorways by road), and the proportion of recipients of social transfers. (Table 1.) Due to the availability (mainly the qualification and commuting characteristics from the census) and the compatibility of the period under review, the database basically covers the year 2012. The unit of observation is the settlement (3154 pieces). The data source is the National Spatial Development and Spatial Planning Information System.

Table 1.

Variables of the analyses

variables	average	std. deviation	Moran's I
income per capita			0,584***
knowledge	30,230	11,630	0,490***
agglomeration processes	3,830	0,880	0,490***
migration balance	-10,680	105,390	0,200***
foreign direct investment	2,420	3,330	0,210***
internet usage	10,090	6,740	0,470***
commuter rate	60,090	18,830	0,370***
accessibility of motorways	38,830	23,840	0,950***
proportion of beneficiaries	43,090	40,800	0,540***

*Note: for Moran I, the spatial weight matrix is based on the first-order queen matrix. *** - significant at the 0.001 level.*

Source: own calculation and editing, 2021

RESEARCH RESULTS

We first show the phenomenon of income clubbing. The value of global Moran I is +0.584, with a very high significance level (p<0.001). That is, incomes show a very significant spatial autocorrelation, we can assume the phenomenon of convergence clubbing. The income spatial structure in 2012 indicates a very stable image of the center-periphery that is clearly separated in space. In the examined period, a very significant part of the settlements in north-western Hungary merge with the agglomeration of Budapest, thus forming a cohesive stable developed club and hot spot. In addition, the settlement agglomerations (Miskolc, Eger, Pécs, Zalaegerszeg, Szombathely, etc.) located along the main expressway axes (M3, M6, M7, M86) represent the HH cluster members.

The low-low settlements also form stable peripheral clubs (cold spots) in the north-east, south-west, as well as in the areas bordering the eastern part of the country and along Lake Tisza. HL spatial outliers represent the local centers of the peripheries (district centres, etc.). The members of the low-high (LH) group appear mainly on the outskirts of the contiguous hot spot. (Figure 1)

Now we report the combined average pattern of spatial interaction factors and incomes (Bivariate Global Moran's I). The values of the bivariate global tests range from -0.453 to 0.447 (Z-values from -50.14 to 46.73), which differ significantly from the critical value (-0,0003), so there is a perceptible common spatial regionalization. The univariate Global Moran I value of incomes exceeds all bivariate Moran I values. (Table 2) The regionalization of incomes is most similar to the knowledge dimension and the ratio of beneficiaries.
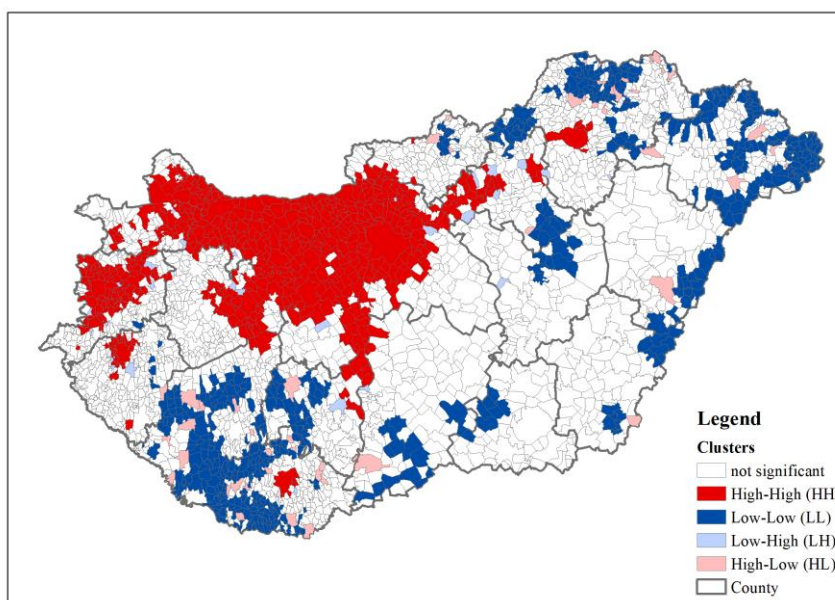

Figure 1. Local spatial configuration of income per capita
Note: the weight matrix used is the first-order queen.
Source: own editing, 2021

Thus, we can reasonably assume that the concentration of knowledge not only shapes urban income inequalities, but also contributes to income clubbing. In the case of the spread of ICT (in this case the proportion of broadband internet users), it is a common and decisive question whether it strengthens agglomeration economies or results in more fragmented spatial structures [17]. Based on the bivariate Global Moran I results, the supportive position prevails, with broadband internet use contributing to income concentration. The significant similarity of the agglomeration processes can be considered less close. This is partly due to the very heterogeneous level of the settlement, but it can also point to the weakness of the functional cooperation of the settlements [18]. The highly concentrated presence of foreign direct investment tied to urban areas [9] results in only a weak to moderate co-movement with the clubbing of incomes. The migration balance in the period following the change of regime is a stable predictor of per capita income [10], and the present medium-strength spatial identification is presumably the result of suburbanization (and thus commuting common interaction) processes. The slighter spatial similarity between commuting and income is presumably due to the complexity of the mobility dimension, together with its territorial, sectoral and educational differentiation [7]. The direct accessibility of motorways is also weaker, but shows a territorial "special movement" in the opposite direction with the regionalization of incomes. Behind this are the very different and multifaceted common mechanisms of the two phenomena, such as the role of path dependence and agglomeration effects, tunnel effects [3, 15]. The proportion of social beneficiaries shows a similar relationship, indicating the spatial effect of income redistribution to compensate [8].

Values of the univariate and bivariate Global Moran's I

variables	Moran's I	Z-score
income per capita	0,584***	54,93
knowledge	0,447***	46,73
agglomeration processes	0,291***	34,43
migration balance	0,308***	37,39
foreign direct investment	0,245***	29,91
internet usage	0,339***	38,82
commuter rate	0,351***	43,47
accessibility of motorways	-0,214***	-27,26
proportion of beneficiaries	-0,453***	-50,14

*Note: for Moran I, the spatial weight matrix is based on the first-order queen matrix. *** - significant at the 0.001 level.*
Source: own calculation and editing, 2021

As indicated by Global Moran I, the knowledge dimension and income are in a relatively significant local co-moving relationship. (Figure 2.) At the same time, the single high-income hot spot is broken in many places by spatial outlier and low-high (LH) settlements. In other words, settlements with a low level of education are located in a higher income environment, and settlements with a low average level of education can also be characterized by a more favorable income per capita. (Such a unified LH area is, for example, the border of Győr-Moson-Sopron and Komárom-Esztergom counties, or the settlements along the borders of the connected HH income block.)
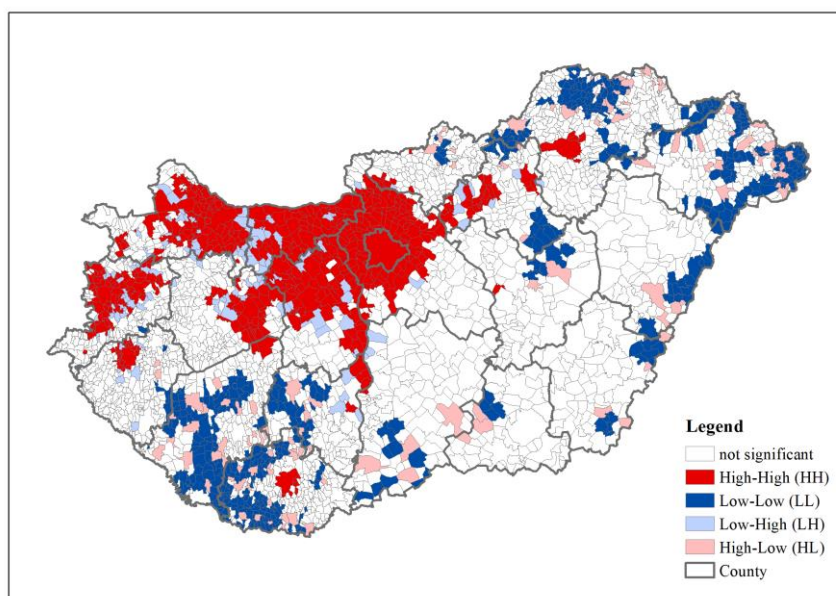

Figure 2. Local common spatial configuration of income per capita and knowledge
Note: the weight matrix used is the first-order queen.
Source: own editing, 2021

The reason for this is the spillover of knowledge [5]. We can assume that these relationships also appear in the neighborhood system. The relatively high knowledge-low income relationship, which stands out from its microenvironment, is spectacular in the LL and HL income spaces. At the same time, despite the relative knowledge advantage, it can only be used in a few and very narrow areas (only in the given settlement), it is not enough for overflow and income regionalization. So the clubbing of knowledge and income shows a valid connection in space, resulting in a real common organization of space.

Figure 3 shows the relationship between social transfers and regionalizing incomes, with the most significant relationship based on the bivariate global Moran I being discovered here. The most congruent spatial picture points to the "traditional" direction of social transfers, the flow from developed income agglomerations to rural peripheries [8].
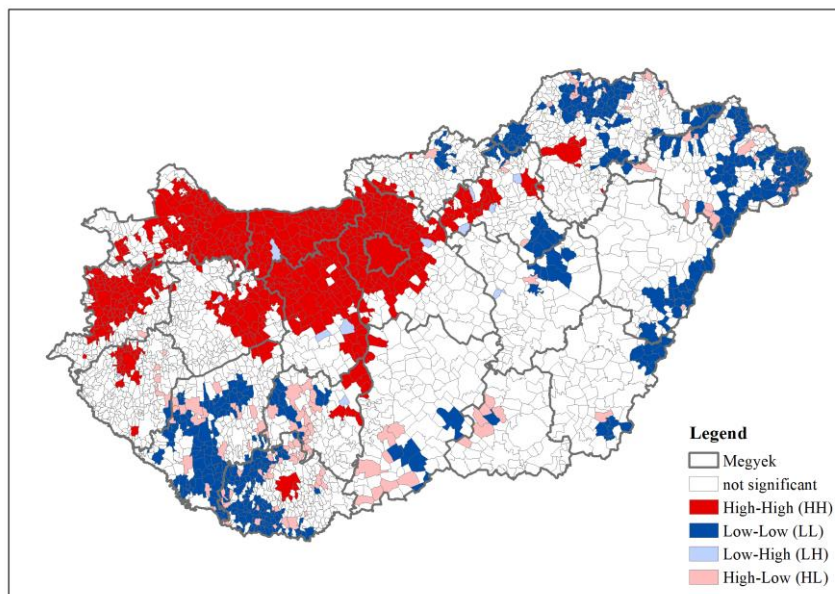

Figure 3. Local common spatial configuration of income per capita and proportion of recipients of social transfers

Note: the weight matrix used is the first-order queen. For those receiving social transfers, the inverse scale of the indicator was used. Thus, HH shows the relationship between favorable social situation and favorable income, LL shows the relationship between unfavorable social situation and unfavorable income, LH shows the relationship between unfavorable social situation and favorable income, and HL shows the relationship between favorable social situation and unfavorable income.

Source: own editing, 2021

CONCLUSIONS

In the period under review, the income spatial structure indicates a very stable, spatially distinct meso-level (larger-scale) center-periphery image (income clubbing). This spatial stability of income centers and peripheries can be an opportunity for regional and economic policy makers to address territorial disparities. Overall, there is a statistically significant spatial concentration process behind the settlement income clubbing based on geographical proximity, the images of which indicate a very significant complexity of the socio-economic spatial structure based on spatial interactions.

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