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## Conference Paper

# Is there a county border effect in spatial income differences in Hungary?

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# **Is there a county border effect in spatial income differences in Hungary?**

Paper presented to the 52<sup>th</sup> Congress of the European Regional Science Association  
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## **Abstract**

The economic and social importance of administrative borders can be examined from the point of view of internal homogeneity and external heterogeneity of the delimited spatial units and from the point of view of the effect on the intensity of spatial interactions. This paper deals with the first question. Hungarian county borders can be treated as sharp limits from the administrative point of view. However, choropleth maps with county borders can suggest that county borders are sharp limits for the social and economic indicators also. It is a conceptually interesting question whether presenting data at county level is justified by the sharp differences of various indicators along the county borders or it is determined only by the availability of data. The aim of this study is to examine empirically the existence or non-existence of the county border effect by the example of spatial distribution of personal incomes in Hungary. The analysis is possible due to the availability of personal income data at the level of more than 3000 Hungarian settlements. The analysis is conducted by the comparison of average personal incomes of settlements along the county borders to the following areas: average of own county, average of neighbouring county, average of neighbouring settlements, average of neighbouring settlements in own county, average of neighbouring settlements in neighbouring county. The results show that county borders have effect only in those cases, where the border is determined by a sharp geographical barrier, namely Danube River and Lake Balaton. The settlements are more similar to the close settlements of a neighbouring county than to the average of own county.

Keywords: spatial analysis, border effect, spatial income differences

JEL codes: R1, R19

## Introduction

The economic and social importance of administrative borders can be examined from the point of view of internal homogeneity and external heterogeneity of the delimited spatial units and from the point of view of the effect on the intensity of spatial interactions. This paper deals with the first question. Hungarian county borders can be treated as sharp limits from the administrative point of view, because Hungarian counties have important public administration tasks. The medium level administrative traffic flows is directed from the periphery of the counties to the county town of the counties. County borders have impact on road structure, because road maintenance and building of lower level intersettlement roads are managed by county road offices. (Kanalas-Kiss, 2006) Roads across the county borders are sparser than average road density. The spatial structure of bus public transport companies are organized also according to the county system: each county has an own bus company with lines often terminated in settlements at the county border. These factors maybe have a discouraging effect on spatial interactions between counties, but in the lack of empirical data about the traffic flows it is not possible to analyze this question.

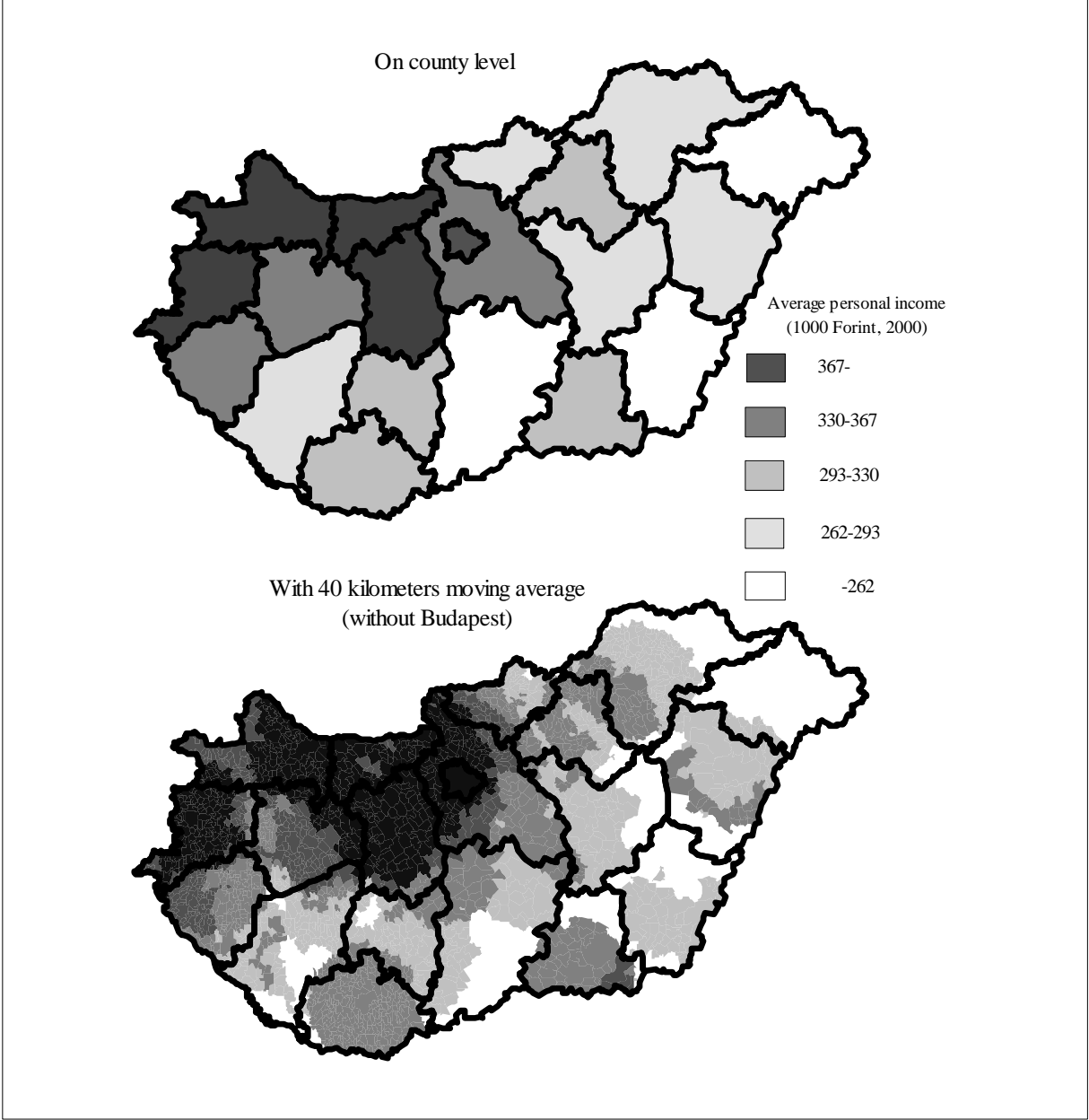
However, choropleth maps of various attribute characteristics with county borders can suggest that county borders mean sharp limits for the social and economic indicators also. (See figure 1) It is a conceptually interesting question whether presenting data at county level is justified by the sharp differences of various indicators along the county borders or it is determined only by the availability of data. If county borders have an effect on the social and economic indicators, then the differences along the county borders should be larger than the differences along other (imaginary) borders or intracounty differences. The aim of this study is to examine empirically the existence or non-existence of the county border effect by the example of spatial distribution of personal incomes in Hungary. The analysis is possible due to the availability of personal income data at the level of more than 3000 Hungarian settlements.

The speciality of the research can be found in the fact, that intracountry analysis of this type of question is extremely rare. We do not have knowledge of same research just researches which has some common conceptual part with our approach. For example, abundant literature exists about the border effect on price differences between countries. Smaller, but rapidly increasing is the literature about intracountry price differences (Zsibók-Varga, 2009; Zsibók, 2011; a survey can be found in Márkusné Zsibók, 2012). Most of these studies treats regions as points therefore intraregion differences and distance effect are not taken into account. Border effect of counties is analysed by Bujdosó (2004), but for interregional flows and not for attribute characteristics of border regions. Fábíán (2008) deals with comparison of personal incomes of border regions and non-border regions in Western Hungary. Her aim was also different from ours, because she did not analyse the possible border effect.

In the first part of the paper the conceptual questions are presented about the delimitation of county border area. The second part deals with the empirical analysis. Here comparison will be made between the personal incomes of settlements along the county borders to the following areas: average of own county, average of neighbouring county, average of

neighbouring settlements, average of neighbouring settlements in own county, average of neighbouring settlements in neighbouring county. Then the neighbourhood of county border settlement will be compared with the neighbourhood of any other settlements.

Figure 1 Average personal income, 2000



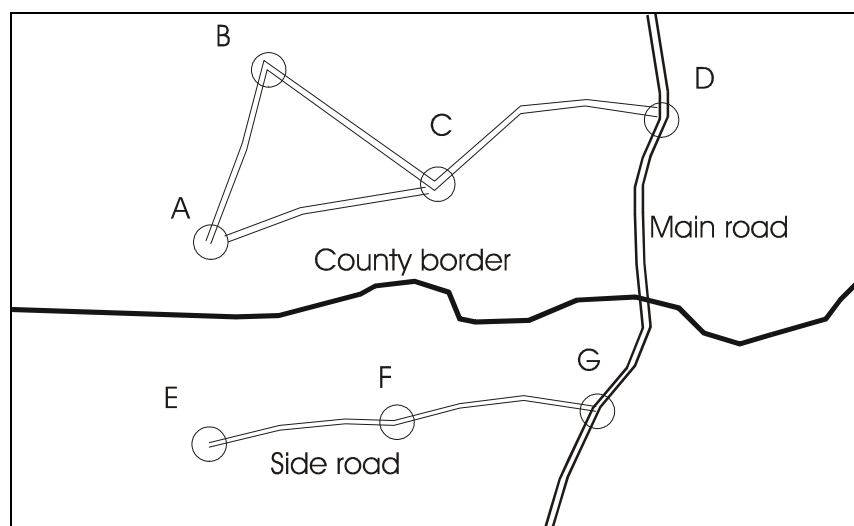
## 1. Delimitation of settlements along the county borders

The starting point of any border research is the definition of borders and the delimitation of border region. In the present case the definition of borders is simple, because the borders are determined by the administrative division of Hungary. Hungary has 19 counties plus Budapest, the capital city. The borders of the counties are quite stable from 1951.

There are many opportunities for the delimitation. For country border regions these opportunities are surveyed by Péntzes (2010). The distance of settlements from various point objects or line objects can be taken into consideration. Several distance definition can be applied, air distance or various forms of network, time and cost distances can be scrutinized. Present paper uses the following definition: a settlement is treated as county border settlement, if within x kilometer distance band (distance measured in air distance) from the center of the settlement an other settlement center can be found which belongs to different county.

Instead of air distance the use of road network distance would be an inappropriate solution because of following reason. In this case the settlements close to the county border but without direct road connection with the neighbouring county would be classified as a non-border settlement, which result would be conceptually questionable. On Figure 2 a typical example can be seen. According the road structure the two most peripheric settlements are “A” and “E”, both is close to the county border. “E” is at the end of a dead-end street. However, applying the road distance definition, A and E would be very far from each other and from the county border and would be classified as not a border region settlement. Combining and comparing the two distance definition (the air distance and road network distance) would provide a sufficient, but quite complicated solution.

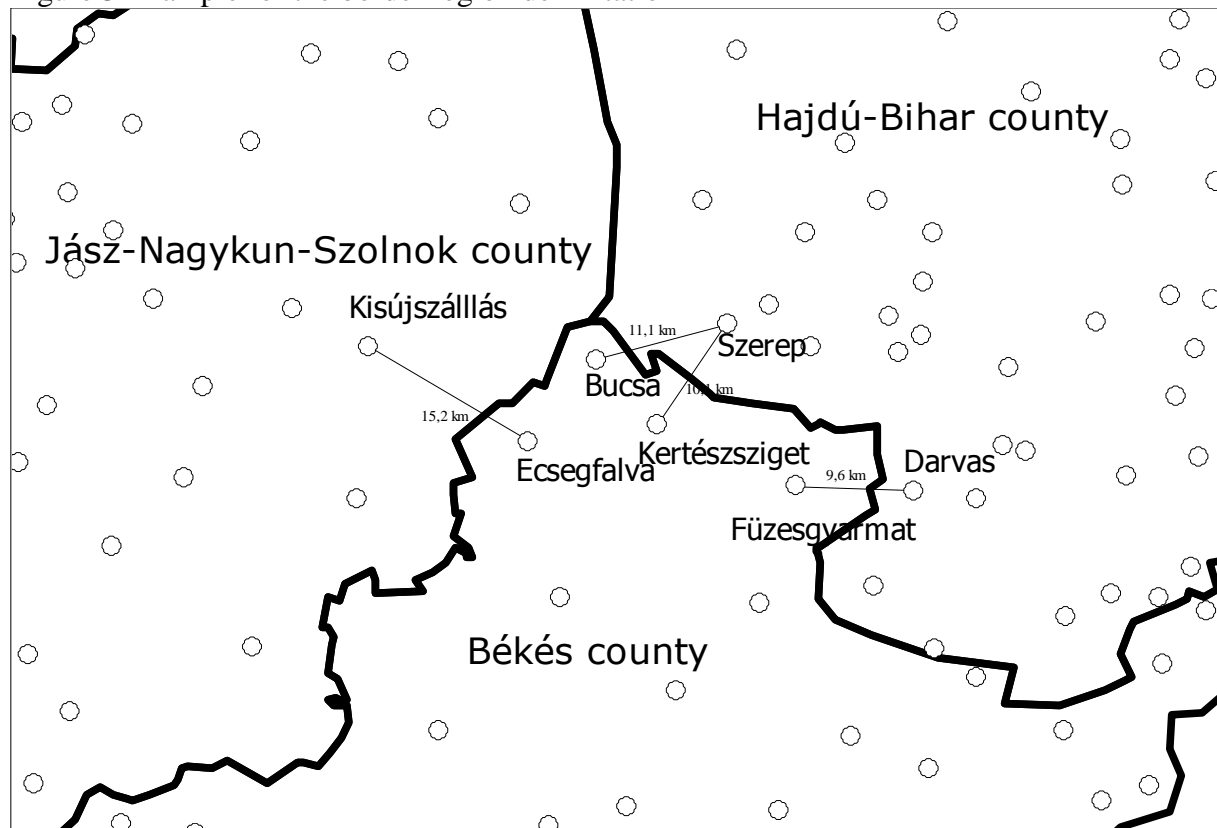
Figure 2 The problem of road network distance in delimitation of county border regions



An other possible solution, the delimitation according to the border line of settlement, which was used in Fábíán (2008), has three disadvantages in our case. Firstly, border line of settlements is determined mostly by historical accidents, the location of inhabited area can be

very close and very far from the administrative settlement border. Secondly, in this case only settlements with county border line would be classified without contradiction as county border settlements, and other settlements without borderline, which center might be closer to the border, would be classified as non-border region settlement. Thirdly, there are some extremely big settlements in Hungarian Great Plain close to the county border with their unpopulated areas but far from their center and inhabited area. On Figure 3 an example can be seen for this: the distance between Kisújszállás and Ecsegfalva, two settlements which have common border with county border, is 15.2 kilometers.

Figure 3 Example for the border region delimitation



The border region settlements at different distance band can be seen on Figure 4, the number of settlements on Table 1. For the sake of simplicity Budapest is treated both as a county and as a settlement, but its effect is minor among the 3145 settlements. The calculation will be made to the 11 distinct delimitation of Table 1. However, we give the most detailed calculations for 10 kilometers distance band, because the border is not too wide or too narrow with this distance. 10 kilometers distance band is not equal with a 10 kilometers wide border zone but with a smaller one.

Figure 4 Settlements in border region

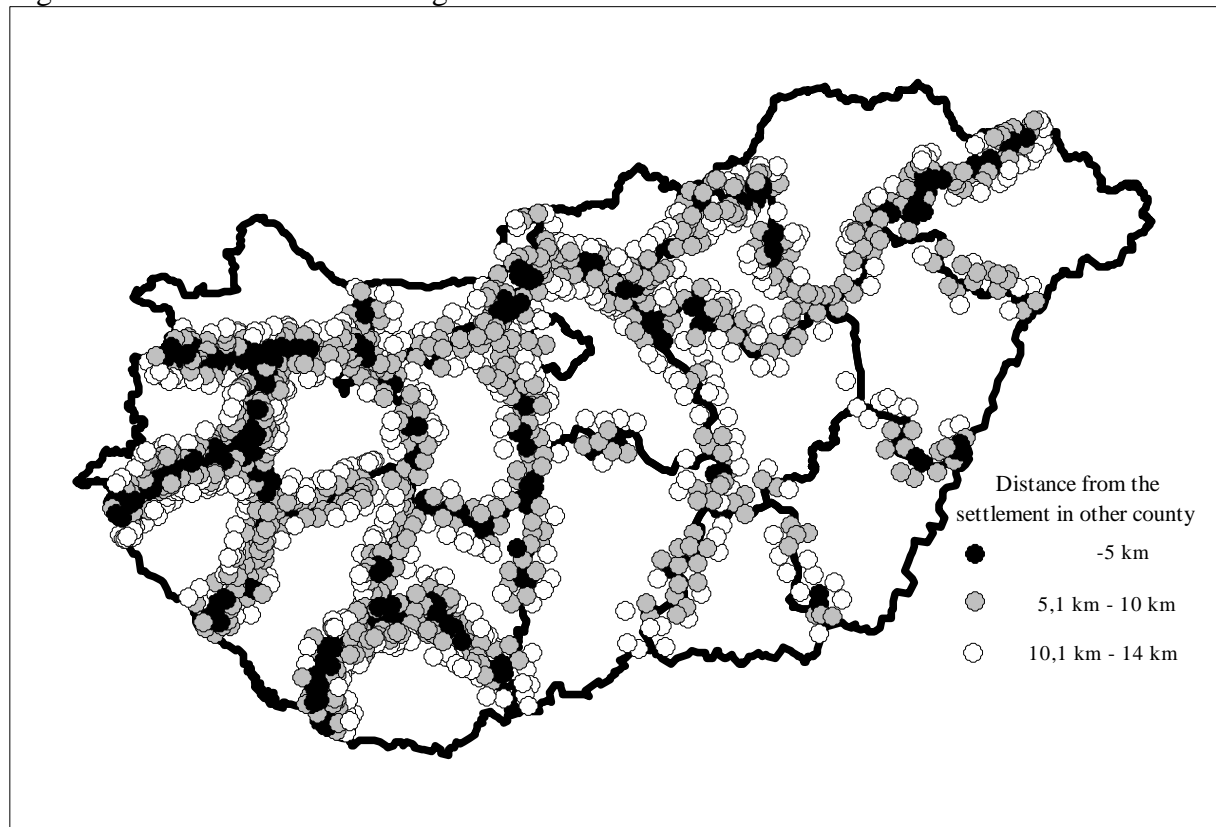


Table 1. The number of settlements and inhabitants in county border regions as a function of distance (2005)

Distance(km)	Settlements		Population	
	number	Proportion, %	number	Proportion, %
5	312	9,9	366 233	3,6
6	454	14,4	620 781	6,2
7	609	19,3	882 315	8,8
8	755	23,9	2 891 386	28,7
9	894	28,3	3 333 624	33,1
10	1040	32,9	3 769 147	37,4
11	1157	36,6	4 027 689	40,0
12	1280	40,5	4 392 772	43,6
13	1398	44,3	4 678 971	46,4
14	1506	47,7	5 101 506	50,6
15	1627	51,5	5 420 644	53,8

Forrás: Own calculation



## 2. Empirical analysis

### 2.1 The difference between border region settlements and other areas

The average personal income in settlements at border region was compared to the following five other areas:

1. Own county average
2. Average of the neighbouring settlements, which was calculated as a weighted average of every settlement inside x kilometers
3. Average of the neighbouring settlements, but only in own county
4. Average of the neighbouring settlements, but only in neighbouring county
5. Neighbour county average

The measure of dissimilarity was calculated with the following formula:

$$SS = \sum (x_i - \bar{x}_j)^2$$

$x_i$ : average personal income of the settlement at county border region

$\bar{x}_j$ : average personal income of other area

The calculations were conducted for 14 different years. The results are very similar therefore for the sake of simplicity only one year, 2005 will be presented. Beside the distance the size of the settlement can play an important role, therefore the analysis has three dimensions:

1. Type of comparison (5 different areas).
2. Distance (11 distance band categories from 5 kilometers to 15 kilometers, but 10 kilometers is the most important).
3. Size of settlement (4 size categories).

The calculations were made by an own written Visual Basic program. It can be seen very well on Figure 5 that the settlements are more similar to their neighbourhood than to their county average. However, there are interesting differences between the size categories. For larger settlements this connection is generally not true, but for small settlements the connection is stronger. This can be explained by the fact, that for a smaller settlement with less own potential the impact of the neighborhood is more important than for a larger settlement with a larger own potential. This is a manifestation of the asymmetry of neighbourhood effect. For example, it is more important to Seer Green (village with two thousand inhabitants), that London lies twenty kilometers from it, than for London, that Seer Green is twenty kilometers from it. The other important factor behind the settlement size differences is that the larger settlements have larger average income also which is closer to the county average than the lower average of smaller settlements (see Table 2).

Figure 5 The sum of difference of average personal income between the settlement and x kilometers neighbourhood of settlement/The sum of difference of average personal income between the settlement and own county average, %

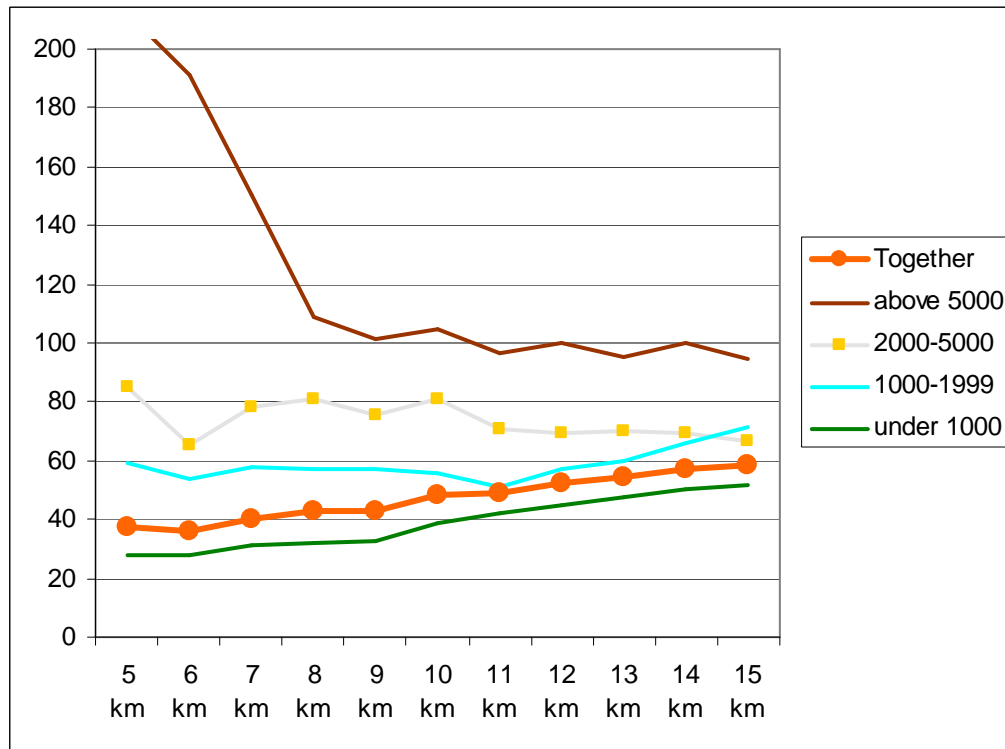


Table 2 Average personal income of county border settlements (with 10 kilometers distance band); other areas = 100; 2005

Size of settlement	Own county average	Neighbourhood	Neighbourhood at own county	Neighbourhood at neighbour county	Neighbour county average
Together	77,6	91,9	93,2	98,3	77,1
Above 5000	99,6	107,5	110	112,9	98,2
2000-5000	86	94,1	96,2	103,4	86,5
1000-1999	82,1	94	95,3	99,4	80,5
Under 1000	70,8	88,6	89,4	94,7	70,6

Detailed result for 10 kilometers distance band can be seen on Table 3. As regards the settlement size, the conclusions are the same as before. However, there are interesting differences between the various neighbourhood: the settlements are most similar to neighbourhood in own county, then at second place is the neighbourhood, then the neighbourhood in different county, then average of own county and at last average of different county. The difference between neighbourhood in own county and neighbourhood in different county is not big and can be explained by the larger distances between the two neighbourhoods. However, there is a striking difference between the neighbourhood and the county average. The settlements are more similar to the neighbourhood than to the average of own county.

Table 3 The sum of difference of average personal income between the settlement and 10 kilometers neighbourhood of settlement/The sum of difference of average personal income between the settlement and other areas

	Own county average	Neighbourhood	Neighbourhood at own county	Neighbourhood at neighbour county	Neighbour county average
Together	36032038	17377177	16322029	21111094	38253025
According to the size of settlement					
Above 5000	1901021	1994463	1885104	2763174	1945236
2000-5000	2874281	2331984	1928777	3706915	3219720
1000-1999	5138042	2856031	2647229	3871097	6084164
Under 1000	26118693	10194699	9860919	10769908	27003904
Differences compared to own county average (own county=100)					
Together	100	48	45	59	106
According to the size of settlement					
Above 5000	100	105	99	145	102
2000-5000	100	81	67	129	112
1000-1999	100	56	52	75	118
Under 1000	100	39	38	41	103

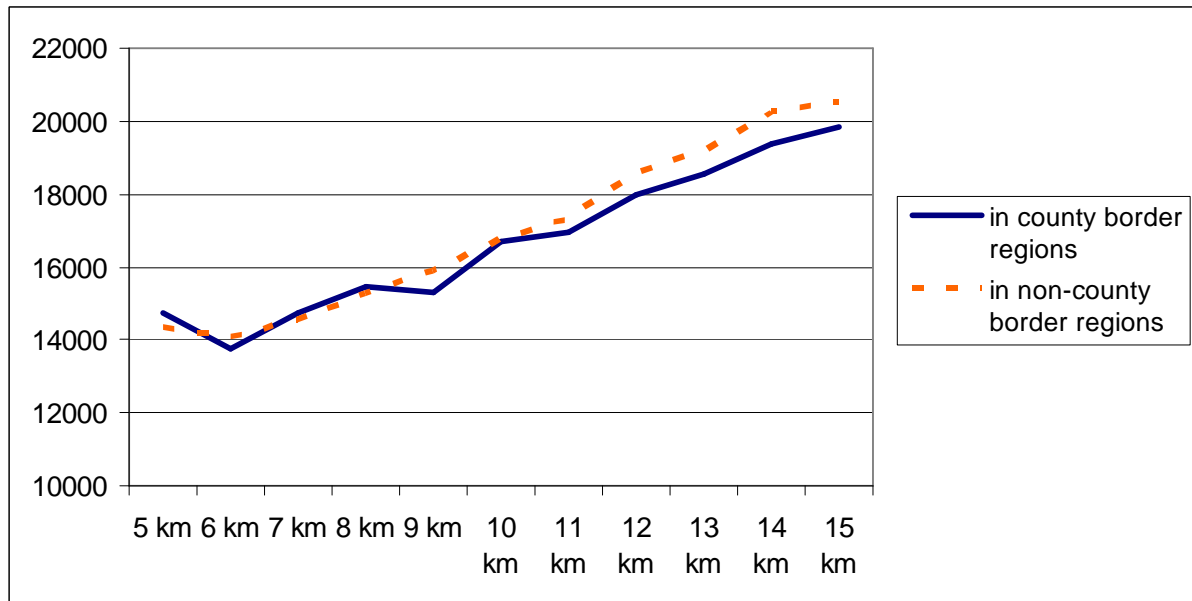
This results show, that county border effect does not exist on average. Later we examine the spatial distribution of the results.

## 2.2 The difference of border region and non-border region settlements from their neighbourhood

In this part we compare the difference of border region settlements and non-border region settlements from their neighbourhood. If the differences are larger along the county borders than at any other, imaginary borders, then the county borders have a real effect on the separation of areas.

The results can be seen on Figure 6. There is not sensible difference between border regions and non-border regions. With 5, 7 and 8 kilometers distance band the difference is slightly larger (with maximum 2,8% according to squared difference) at border regions, with other distances the differences of intracounty settlements are larger (at most with 8,5%). This very small difference shows that county borders do not have an effect on the difference between the settlements and their neighbourhood. With other words, the difference between settlements and their neighbourhood is approximately the same along the county borders that along any other arbitrary or random borders.

Figure 6 Average difference between the settlements and their neighbourhood



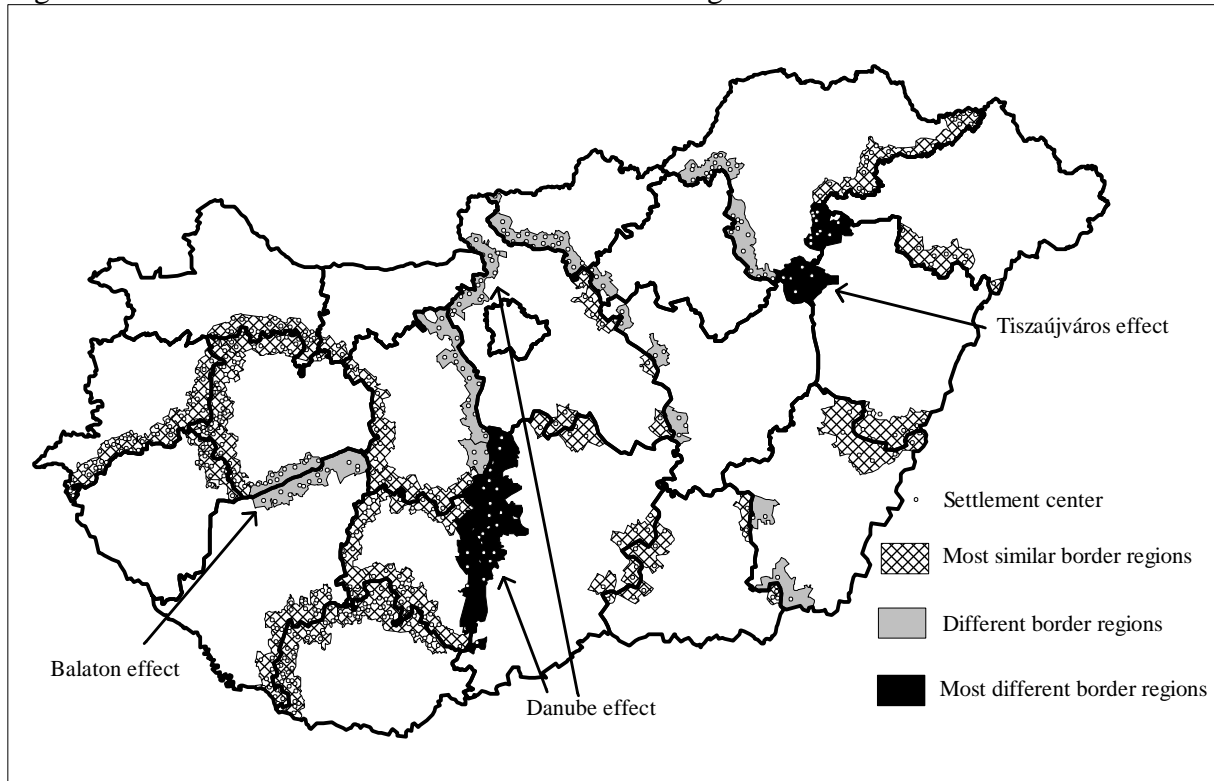
### 2.3 Spatial differences along the border sections

The previous analysis was whole map analysis. Spatial viewpoint was represented only in the settlement size difference and the distinction between border and non-border regions. Otherwise the whole country was the subject of the analysis. In this part we examine individually the county border regions. Only those borders are examined, where at least four settlements can be found. The small number of settlements by individual border regions makes not possible the analysis by settlement size.

The results can be presented by a map. On Figure 6 the most similar and most different border regions can be seen. The results support the barrier role of two natural borders, the Danube river and lake Balaton. Along the Danube river there are 43 border settlements with ten kilometers distance. These settlements are very different from the neighbouring county average: the sum of squares of the difference from neighbour county average is twice as from own county average, the sum of squares of the difference from neighbourhood in neighbouring county five as much. Across Danube river, 200 kilometers long between the northernmost and southernmost points, apart from Budapest, there were just two small bridges until 2002, therefore the contact between the two sides is very weak.

Large difference can be detected in East Hungary between Borsod-Abaúj-Zemplén and Hajdú-Bihar counties. Here the difference is attributable to Tiszaújváros, a small, but thanks to a big chemical factory, a very rich county border town compared to its neighbourhood. This special case of difference cannot be treated as a county border effect, it is rather an effect because of an outlier settlement.

Figure 6 The most similar and most different border regions



### 3. Conclusions

According to the results the settlements are more similar to their neighbourhood than to their county average. This similarity is decreasing with the increase of distance and the size of the settlement. This result are in harmony with the first law of geography and with other results concerning to the decreasing autocorrelation with increasing distance. (Dusek, 2004, 219-220) The special characteristics of county border regions is the smaller average settlement size, and due to the settlement size the smaller average income.

There are only two exceptions of the general tendency: the border regions along the Danube river and along the lake Balaton. Here the natural geographical county borders have not only barrier effect on spatial interaction, but this barrier effect is manifested in observable income differences in two sides of the borders. If every county border was this type, then there would be county border effect.

The moral of the story touches upon the methodology of spatial analysis. In the analysis of spatial income differences and similar data the counties or other medium level spatial units are often used as a basis of aggregation. The results are presented in the form of choropleth maps. This practice cannot be criticized due to practical reasons of data availability, but always should keep in mind that space is unlike a mosaic and there are not sharp, abrupt differences between the two sides of county borders. County borders may be important for administrative reasons but counties are mostly arbitrary, modifiable spatial units in the analysis of economic and social phenomena.

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