THE CONFORMATION OF DIFFERENCES IN REGIONAL MORTALITIES IN HUNGARY
1980-2006

PhD-dissertation theses

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1. Introduction, Antecedentes

The low lifespan of the Hungarian population as well as the lack of their life expectancy compared to those of developed countries is a grave social and national health problem. The presentation of the course and cause of the mortality together with it's placement within international context offers possibilites to reflect upon the disorders constantly lasting in the Hungarian society – way beyond the limits of demography and epidemiology. Since the beginning of the 20th century to the middle of the 1960s the mortality of the civilian population decreased in the advanced countries of the world. In Middle and Eastern Europe an unexceptional demographical and epidemological turn occurred in the middle of the 1920s. The phenomenon took form in the period of permanent stagnation or occasionally decrease in the population's life expectancy and of the collapse of the socialist regimes – apart from few examples – took form as crisis varying measure, timing and permanency from country to country. Taking the demographical process of the past century under consideration, the decrease of lifespan within the developed countries is completely unparalelled.

In the first half of the 1990s a grave socio-economical crisis gave convulsion to the former socialist countries as the communist regimes collapsed. However the mortality crisis did not affect the members of the former eastern block on an equal level. In Eastern Germany as well as in Czechoslovakia the transition in respect to the total population's mortality went without shock and the amelioration unbroken. In Poland the crisis proved to be moderate and lasted briefly with the mortality-indicators showing progress after 1992. The average life expectancy of the Hungarian population at the time of birth had reached it's lowest value in 1992 and 1993 after which amelioration occurred. In the more peripherical countries of the Balkans, such as in Romania an Bulgaria the bane of health lasted well until the end of the 90s. In former Sovietunion the collapse's account of mortality showed tremendous detriment. Shortly after the shock therapy however, in 1994 an abrupt amelioration began, altough following the bankruptcy of the russian bank system and the twisting forth of the economical shocks in 1998 the mortality crisis recurred.

There are many common parameters in the mortality profiles of the societies of the wider region. It is a well known fact that the decay of health striking the eastern european societies, especially excess mortality during the years of transition – except the Sovietunion and it's successors – occurred exclusively among men. It is also well documented, that among

the men the decay of the probabilites of the survivalship of the middleaged was determinative. Among the social groups the least erudite, the most uneducated were the victims to the last decades of the socialist setup and to the early period of the political transformation. Both cross-sectional and longitudinal evaluation of data supports the importance of education' exploratory role. The contribution of vary causes of death to the formulation of life expectancy should be regarded as a common criterion weaving through borders. The distinctive criterion between the east and the west is essentially sought to be of the early occurrence of mortality and not of the profile of mortality. In the period of decrease and stall lasting from the 1960s to the end of transformation the most notable effects were of mortaly were those involving cardiovascular and those of malign. In Hungary the effect of mortalities involving the digestive system (illness of liver) proved to be significant in this respect the country differs from the middle-european modell. The amelioration recorded between the time of the mortality crisis to the turn of millenium in all countries is primarily due to the decrease of cardiovoscular mortalities. In the countries pertinent to the russian terrenum the high rate of mortality due to external causes could be interpreted as an unambigous sign of social desorganization.

Table 1

The two causes of death consenting the alteration of lifespan at the time of birth in different periods in a few middle european countries (men)

Countries	Infecitous diseases	Swellings	diseases of circulatory system	diseases of respiratory system	diseases of digestion syste	other diseases	violential causes	total
Hungary								
1965-1993	0,40	-1,19	-1,25	0,61	-1,33	1,07	-0,56	-2,24
1993-2000	0,05	0,01	1,07	0,23	0,38	0,38	0,51	2,63
Poland								
1965-1991	1,14	-0,75	-2,11	1,34	0,20	0,57	-0,88	-0,50
1991-1999	0,07	0,02	1,59	0,06	-0,09	0,52	0,51	2,68
Bulgary								
1965-1997	0,25	-0,22	-3,74	1,37	-0,19	0,06	-0,15	-2,62
1997-1999	0,00	0,04	0,67	0,26	0,12	0,08	0,08	1,26
Rumania								
1969-1997	0,48	-0,35	-1,58	1,81	-0,33	0,34	-0,26	0,12
1997-2000	0,04	-0,01	1,02	0,40	0,28	0,46	0,39	2,57
Czech Republic								
1988-2000	0,02	0,44	1,97	0,21	0,14	0,77	0,03	3,58
Slovakia								
1992-2000	0,00	-0,04	0,41	0,31	0,08	0,34	0,41	1,50

Source: Meslé, 2001: 53.

Several theories were created to elucidate the halted epidemiological progress of eastern and middle european countries.

(1) According to the system-specific approaches the mortality crisis eventuated in Middle and Eastern Europe should be traced back to the unsuitable functioning of the political

regimes and to the blind-gut modernization efforts of the socialist setup which had led to excess in mortality via grevious social disruptions. The theories mentioned above all share the common feature of vigorous critique of setup and the general lack of explanatory models.

(2) The epidemiological theory implies the region's separation could be traced back to the unhealthy behavior of it's population and to the lack of changing lifestyle. The descriptive epidemiological papers clearly verify that the number of mortalities due to smoking took extreme measures in most of the former socialist countries – especially in Hungary and Poland. Along with smoking the presence of abusive alcohol consumption in many countries of the region is undoubted. The epidemiological approach doesn't provide answers for motifs of behaviour as it regards the effect of smoking and alcohol consumption genial.

(3) The third most important school emphasises the roles of the hardship of managing, distress, low social capital and level of trust, furthermore that the cause of the middle european mortality is not solely a socio-economical arrears but the increased peresence of a depressional symptoms which lead to the bane health state of the low-educated strata. This approach could firstly and mainly could give appropriate guidelines at morbidity analises.

(4) Domestic and internationational references in technical litterature support that neither environmental harms neither the standards of healthcare was significant in the deterioration of life expectancy. At the same time, hence the dynamic of the changes were the diseases of the circulatory system it is far from impossible to suggest that the amelioration following the middle of the 1990s was determinatively due to the widening possibility of therapies and advance in cardiological capacities.

2. Aims

The aim of the dissertation is the presentation of the subregional (kistérség) mortality process and differences from the period of state socialism to present day (1980-2006) as well as the exploration of causes using cross-sectional spatial autoregressive modells. The essay's theoretical and applied methodolical approach is closest to the spatial demography. This area of science, evolving dynamically in the past broad decade amalgametes the knowledge of social sciences (demography, sociology) with the attainment of spatial sciences, mainly with those of spatial economy. Following in the footsteps of the political economy soon after the social sciences realized that in neglecting spatiality in data inferring spatial references lies great a hazard. By using spatial methods, substantially more precise conclusions may be deducted making our assumptions more reliable, also granting the chance of reconsidering and modelling outworn theories. I have analyzed the regional unequivalencies of mortality on a subregional level. Several reasons might be aligned up for microregional analysis. Primary this spatial structure could be handled rather conventionally, making the database effortlessly managable. Secondary, from the aspect of geography spatial continuity could more spactacularly be provided compared to counties. Thirdly the terms of distribution necessary for the employment of linear models could be thus supported.

3. The variables of research

All demographical data (mortality events, population number of different age groups) ensue from DEMO the electronic demographic database of the Central Statistical Office. To assure homogenity the data were sampled on the level of settlements and aggregated according to the microregional structures valid between 2004 and 2007. According this selection the number of microregions was 168. Many indicators stand behest for determination of regional mortality. The reason for creation of microregional mortality tables and determination of life expectancy at time of birth is that using this method – contrary to standardized mortality indicators – there's no need for the demographic composition or the mortality rate of the referency population used for straining the age-repartition, thus temporal comparison is possible without the use of any predefined age-setup. I completed calculations with a modification of the Chiang-method which was successfully applied by the British Statistical Office to determine the mortality of low populated areas. Compared to the original the advantage of this method is that confidence intervals (variances) are possible to be

determined for age groups without demise. For the sake of reliability along with rallying the years I have tried to draw up conclusions as accurately as possible having confidence intervals put to use.

3. Results

3.1. The conformation of regional disparities between 1980 and 2006

I examined the temporal conformation of life expectancy using five year intervals regarding the two genders separately and together as well. To study the conformation of regional inequivalities I took classic dispersal indicators, which were not regarding spatial location. In the Table 2. every value contains results of unweighted calculations.

Table 2

The conformation of several disparity indicators regaring microregional lifespans

Intervals	Men	Women	Total
Lifespan (years)*			
1980–1984	65,35	73,05	69,13
1985–1989	65,45	73,64	69,50
1990–1994	64,79	73,91	69,23
1995–1999	65,71	74,81	70,17
2002–2006	68,63	77,06	72,87
Range (years)			
1980–1984	7,53	5,14	6,31
1985–1989	10,35	6,58	8,31
1990–1994	10,37	6,21	8,33
1995–1999	8,53	7,28	7,24
2002–2006	8,85	4,84	7,25
Mean absolute deviation (years)			
1980–1984	1,30	0,75	0,96
1985–1989	1,37	0,81	1,07
1990–1994	1,55	0,91	1,22
1995–1999	1,42	0,88	1,19
2002–2006	1,52	1,01	1,32
Variation coefficient (%)			
1980–1984	2,47	1,29	1,73
1985–1989	2,67	1,42	1,96
1990–1994	3,04	1,56	2,26
1995–1999	2,63	1,55	2,08
2002–2006	2,77	1,56	2,18

* Nationwide average of five years, source: my own calculations.

The following statements may be made by the results of nonspatial, dispersal indicators (Table 2)

1. The gender differences on a microregional level considerably differ. In every aspect of period and regarding all unequivality indexes, the regional differences of the men's life expectancies exceeded those of the women.

2. Among women the ever highest value of average absolute deviation was recorded in the period between 2002 and 2006.

3. The relativ dispersion (variation coefficient) regarding women enrolled on a higher level in the early 1990s and has not moved since.

4. The classic inequivality indicators showed the increase of regional unequivalities among women altough their average life expectancy showed a nationwide improvement. Thus regions did not share the same rate of amelioration.

5. The difference between microregion's with the highest and lowest life expectancies for women occurred between 1995 and 1999 (7.3 years).

6. According to the last status examined, the smallest difference of not-overlapping periods is less than five years.

7. Among men the difference between microregions with the lowest and highest life expectancy at the time of birth occurred in the last five years of state socialism and the first five of the political transformation. A difference longer than 10 years – despite the sensitivity of the indicator – is exceedingly significant.

8. Since the second part of the 1990s the difference in volume moderated altough still a rather significant digression of nine years separates the subregions with the best and worst life expectancies.

9. The relative dispersion calculated for men refers to the escalating unequivalities of the early 1990s which moderated afterwards.

10. Similarly to the relative dispersion the highets value of average absolute deviation is connected to the period of political transformation.

11. Among men the escalation of differences fell to the period of the socio-economical shock.

12. Among the indicators calculated for both genders, volume had reached it's maxim at the end of the 1980s and the beginning of the 1990s (8.3 years). A volume two years shorter had been possible to record in the initial period (6.3 years). The last period reflects a difference slightly more moderate (7.3 years).

13. Both the rate of average absolute deviation and relative dispersion escalated in the early 1990s.

14. The standard unequivality indexes irrespective of gender reflected a higher level of regional unequivalities following the political transformation.

3. 2 Temporal conformation of regional mortality

The temporal conformation of regional mortality is presented by applying correlation, scatter plot with linear regresssion and mappation.

1.1. Between the whole of the population and men regarding the periods directly following each other a strong association can be traced (r > 0.8, p < 0.01). Substantive excursion occurred in longer time interval. Regional realignment of greater significance occurred in the period following the beginning of the period examined and the second half of the 1990s, or moreover the period following the millenium. This could be interpreted by assuming that the spatial mortality patterns of the state-socialist regime held a significant force of inertia after the fall of it's setup.

1.2. In the case of the women there is no such a close association between the following periods as seen above regarding men. The relation between the first examined period and the one following the turn of millenium suggest an association weaker than average (r = 0.36). In the case of women the relation between following periods is significantly more weaker than men thus suggesting a bit more notable regional realignment.

1.3. I have analyzed the relations between individual intervals with the application of a simple scatterplot and linear regression based on the scatters. According to the general picture in the fallback in the beginning of the 1990s within men and the total population was not closely associated with the level of life expectancy experienced earlier, more like it is possible to state the effect of a general fallback. The greatest fallback certainly occurred in the north-eastern microregions of rhe country.

2.1. I presented the conformation of microregional life expectancies using maps in three different periods, from 1980 to 1984, from 1990 to 1994 and from 2002 to 2006.

2.2. The spatial concentration of microregions with high life expectancies gradually grouping up in the vicinity of the capital is well distinctable from the microregional life expectancies of men.

2.3. The falling into line of the Duna-Tisza Lane, an area showing particularly low life expectancy in the early 1980s, the relative position drop of the initially advantegous Tiszántúl microregions, furthermore the loss of number's of the auspiciously positioned microregions of Western Danubia, and at the same time constant increase and flare of the zones of north-eastern countryside which shares disadvantegous mortality features is well distintable.

2.4. The maps generated regarding men are almost completely identical with those of the whole population thus reenforcing the fact that mens' mortality has the main influence on the mortality patterns of the total population
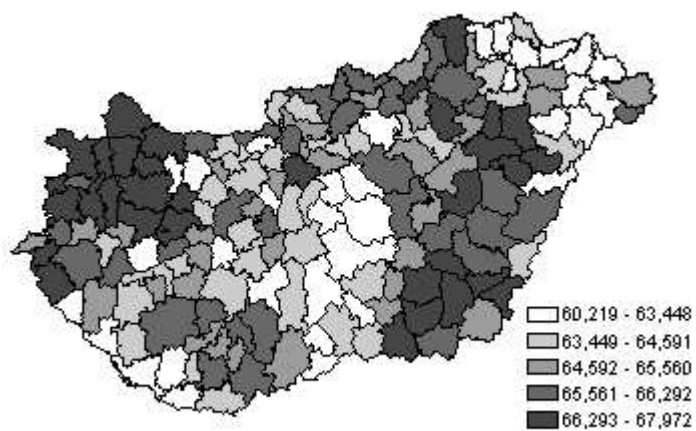
2.5. Many identities and differences can be observed within the spatial pattern of women's life expectancies compared to those of the men's.

2.6. It is possible to distinct the coherent chain of regions with high life expectancies a characteristic of the western countryside in the early stage of our research and their erodation in the 1990s. The emerging of clusters showing high life expectancies for women in the vicinity of Budapest and Balaton are well traceable. However the women's cluster nearing Budapest is distinctly smaller than that of the men's. Similar to men, women had a microregional ensemble showing high life expectancies in the eastern countryside, altough these were located in Northern Hungary and not in Tiszántúl.

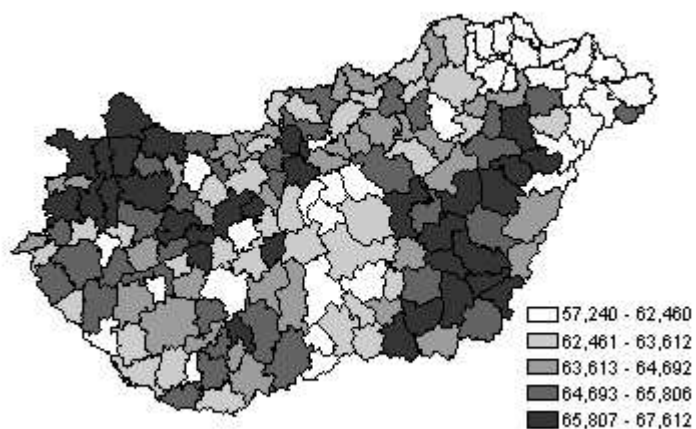**Life expectancy at birth of men by microregions in different years**
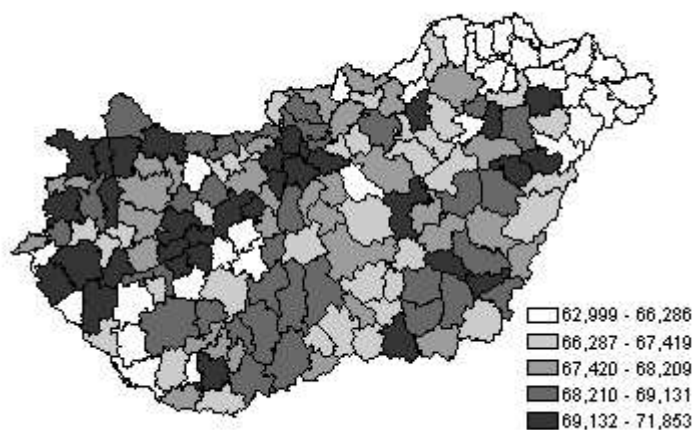
Map 1

1980–1984

60,219 - 63,448
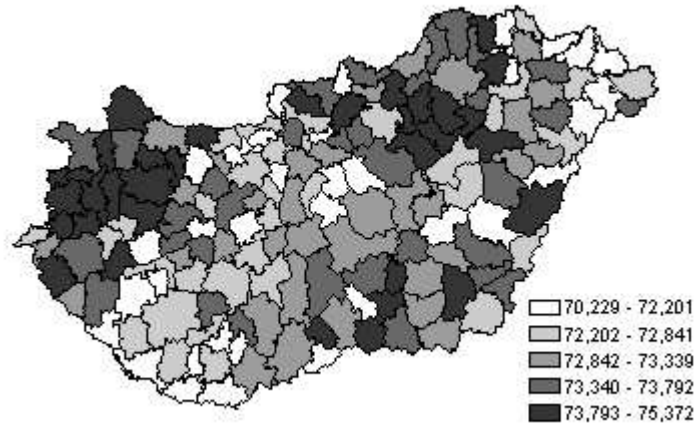63,449 - 64,591
64,592 - 65,560
65,561 - 66,292
66,293 - 67,972

Map 2

1990–1994

57,240 - 62,460
62,461 - 63,612
63,613 - 64,692
64,693 - 65,806
65,807 - 67,612

Map 3

2002–2006

62,999 - 66,286
66,287 - 67,419
67,420 - 68,209
68,210 - 69,131
69,132 - 71,853

Life expectancy at birth of women by microregions in different years

Map 4

1980–1984

70,229 - 72,201
72,202 - 72,841
72,842 - 73,339
73,340 - 73,792
73,793 - 75,372

Map 5

1990–1994

70,664 - 72,764
72,765 - 73,583
73,584 - 74,102
74,103 - 74,753
74,754 - 76,873

Map 6

2002–2006

74,246 - 75,693
75,694 - 76,325
76,326 - 76,851
76,852 - 77,774
77,775 - 79,083
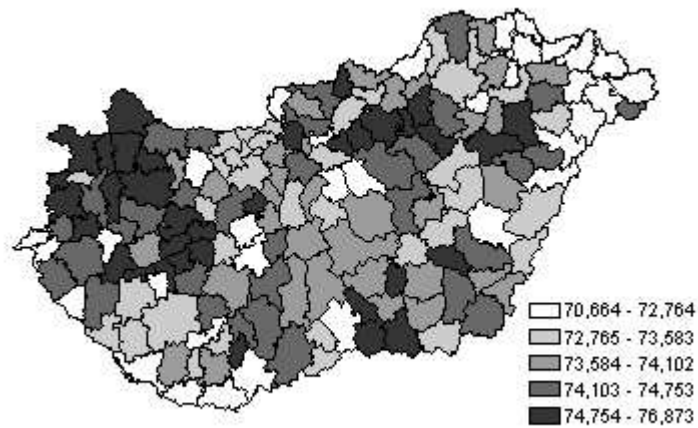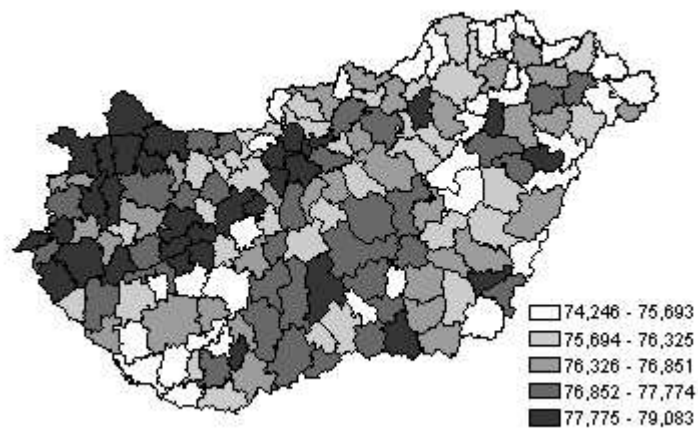
3.3. The use of global autocorrelational tests on microregional life expectancies

Mappation as a whole can support formulating hypotheses although it is unsuitable to determine the exact degree of clusterization, also spatial pattern. For this particular reason I have applied autocorrelational tests prevalent in technical litterature on a general basis, to determine the degree of clusterization. Instead of identifying individual clusters global indexes sum up the similarities and dispersities of spatial abundances in a single indicator. It determines the degree of similarities or differences of neighbouring regions or those sharing certain vicinity. In the case of continual distribution variables the application of Moran I. and Geary C tests are the most common among the global index numbers of autocorrelation. In this thesis spatiality is defined by so-called first order queen contiguity. Global autocorrelation came up with the following results:

1. The degree of autocorrelation was generally more significant in the case of men or both genders together in on any vicinity structure than it was in the women's.

2. In the beginning of the 1980s a regional autocorrelation of significant measure occurred. Moran I. values dispersed between 0.4 and 0.45.

3. The degree of autocorrelation regarding men and total population in the initial of the 1980s decreased for a short period of time, after which it set on a level slightly lower than the former higher value.

4. Contrary to expectations the transitional crisis did not lead to a higher spatial arrangement among men.

5. The degree of autocorrelation decreased by the second half of the 1990s. In these years a short interval might be percepted, when trends of gender crossed over. Recent development suggest clusterization gaining strenght.

6. The present degree of spatial clusterization practically does not differ from that of the early 1980s.

7. The trend of Moran I. values regarding women can be typified by a short-lasting decrease, then an increase reaching a higher level similar to the one of the early 1980s.
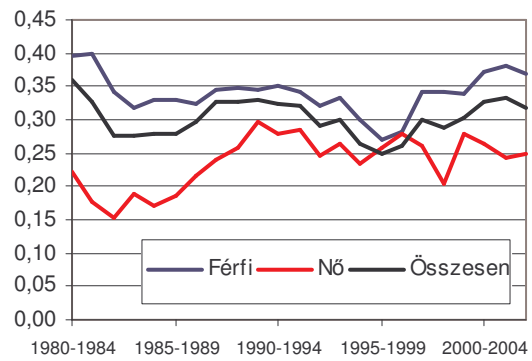
Figure 1

**Global autocorrelation of life expectancies under different kernels
between 1980 and 2006**

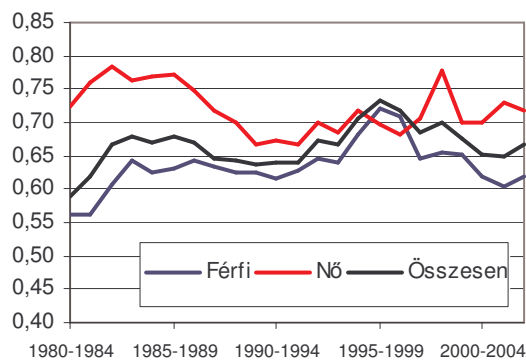**Moran I.**

Binary queen contiguity, row standardized
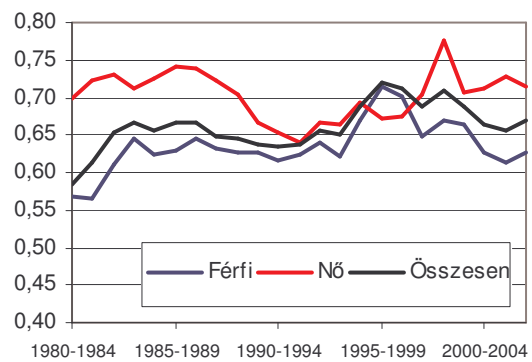weight
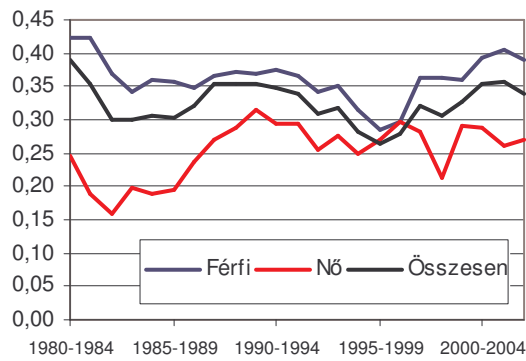
Binary queen contiguity weight

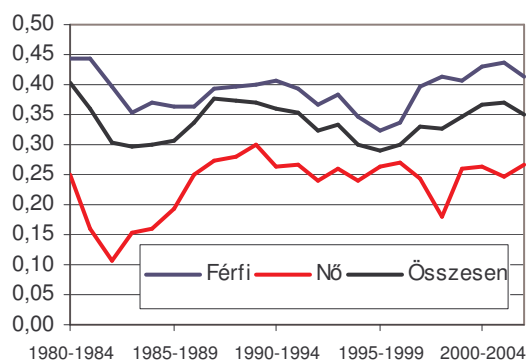**Geary C**

Binary queen contiguity, row standardized
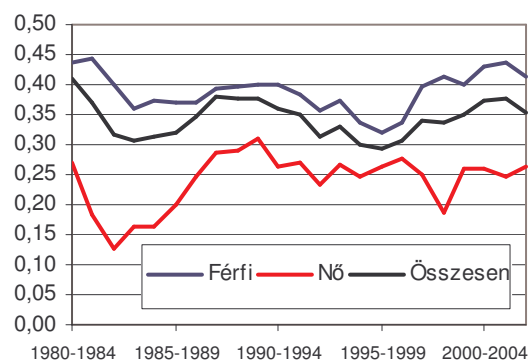weight

Binary queen contiguity weight

Moran I

Nearest four neighbours

Nearest five neighbours
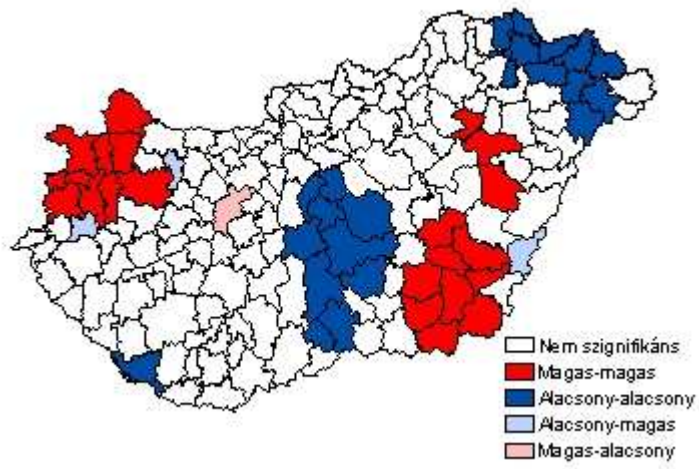
3.4 The results of local autocorrelation

The global standards of regional autocorrelation examine similarities of spatial locations which are subjects of the research, however these standards do not furnish an answer of 'where', that is they do not assign individual clusters. As the name implies local autocorrelational indicators permit the determination the local patterns of spatial patterns and also discovery of local tendencies. Among local indicators Moran I.'s local variant is the most common. The following statements of importance may be deducted from the three cross-sections parsed:

1. In the early years of the 1980 neither eastern-western neither northern-southern diversification may be experienced among men. High-high cluster occurred both in Dunántúl and Alföld, while low-low clusters did so along the north-eastern border, in the Duna-Tisza Lane and Southern Dunántúl.

2. In the period of transition the low-low cluster in the Duna-Tisza Lane moderated, the Southern Dunántúlian disappeared, while the one in the north-eastern countryside expanded. Among the high-high clusters the one mainly depending on Békés County and the one in Western Dunántúl sustained, the latter even modified.

3. According to the status of the turn of millenium a significant high-high cluster came into existence in the vicinity of Budapest. The Western-Dunántúlian cluster transmogrified. It grew into a narrow corridor reaching from the microregions flanking the northern shores of Balaton to the Győrian Microregion. According to present status there is a permanent low-low clustered region in the north-eastern countyside which constantly expanded in recent times.

4. In the initial of 1980s high-high female clusters occurred in different parts of the country. Most ranging of these are located in the western and south-eastern part of the country. The Southern Dunántúlian, north-eastern bordering region and the regins neighbouring Budapest may be emphasized. The pattern of female clusters proved rather muddled.

5. With the political transformation underway the number of clusters decreased, having made a more articulate image. High-high valued clusters were formed by the microregions of Győr-Moson-Sopron and Veszprém Counties plus those located south of Balaton. The regions with lowest life-expectancies in the north-eastern countryside are found in greater extent than they previously were.

6. According to the cluster structure of present day the regions having the lowest life expectancies are coherent territories in Southern-Dunántúl, in the northern part of Borsod County and scattered on Tiszántúl. Differing from the men' clusters the one around Budapest is minimal, while Western Dunántúlian affects microregions of several counties.
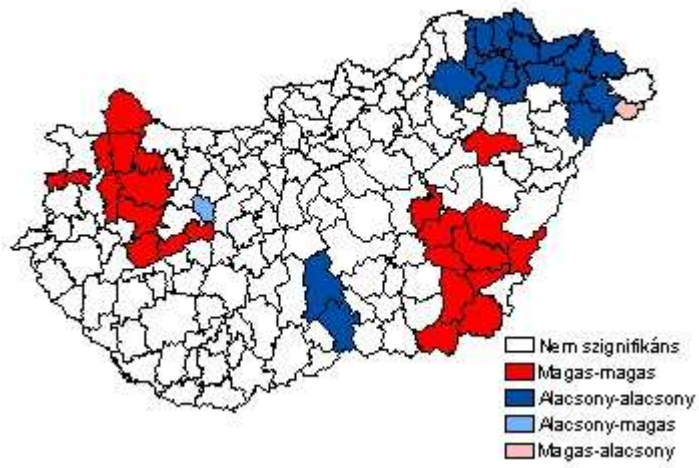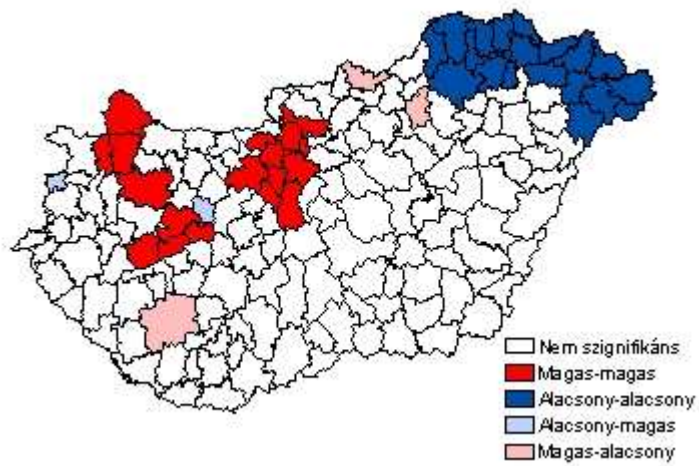
Local Moran maps (Men)

Map 7

1980–1984

Map 8

1990–1994

Map 9

2002–2006

Local Moran maps (Women)

1980–1984

Map 10

☐	Nem szignifikáns
🟥	Magas-magas
🟦	Alacsony-alacsony
🟦	Alacsony-magas
🟥	Magas-alacsony

Map 11

1990–1994

☐	Nem szignifikáns
🟥	Magas-magas
🟦	Alacsony-alacsony
🟦	Alacsony-magas
🟥	Magas-alacsony

Map 12

2002–2006

☐	Nem szignifikáns
🟥	Magas-magas
🟦	Alacsony-alacsony
🟦	Alacsony-magas
🟥	Magas-alacsony
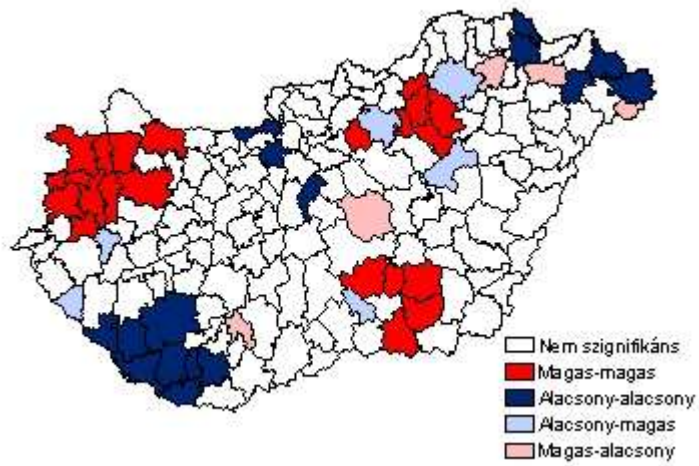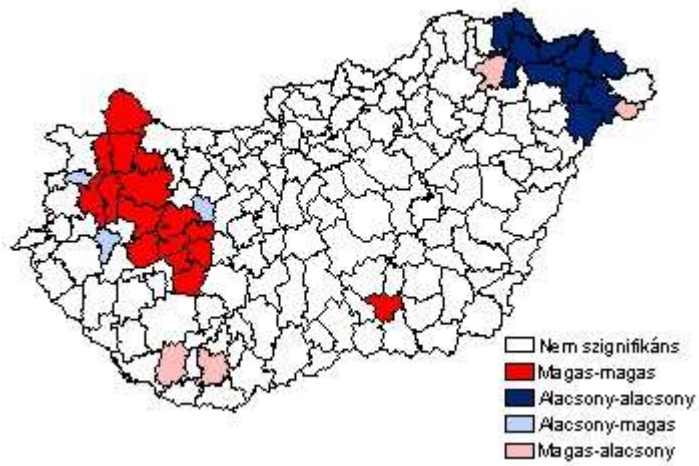
4. The explanatory model of microregional mortality

4.1 The explanatory variables

The investigation of population health status on regional level can be studied by the use of individual variables or composite indicators. In the present paper I reviewed the parameters also, the advantages and disadvantages of the application of composite indicators applied on microregional level by the researchers of healthcare in detail. The reason to create and use composite indicators in this essay was to avoid multicollinearity.

I compressed the information carried by variables with the help of factor analysis. The indicators of material welfare (motor-cars, specific number of ISDN strings) direct indicators of deprivation (comfortless apartments, rate of socially supported) socio-economical status, labour market, variables of financial status (education, rate of executive intellectuals, rate of unemployment, level of income) furthermore the degree of social stock (rate of participation in elections, specific number of nonprofit organisations) were included in the factor-analysis. In every case I have standardized the variables therefore depriving them of their original units of measure. This was followed by factor-analysis, where I have applied the method of unweighted least squares. During the factor-analysis to ensure unabigous interpretation I performed a varimax rotation. After the rotation two factors came into existence one referring to the low employment rate, the high weight of social transfers, the other representing higher income and the higher rate of social involement implied by it, thus reflecting to the rate of groups of higher-society. I named the first factor deprivation the second welfare/affluent. I have analyzed ethnical affect (ratio of gipsy population) role of social support (ratio of divorced) and additive influence of health-attitude (standardized mortality ratio involving cancer of bronchus and lungs) with the tally of these two indipendent explanatory variables.

4.2 Appliance of spatial autoregressive models

In every case the starting point was to assumption using the method ordinary least squares. The OLS method assumes the independency of regression residuals. This does not occur with the presence of spatail autocorrelation. I applied the two most widespread econometrical methods of spatial autocorrelation, the spatial auterogressive lag model and spatial error model. I choose the appropriate model using Lagrange multiplicator.

4.3 The result of regression

1. In every model's the composite indicators of life expectancy were in significant relation with lifespan. The two indicators created by factor-analysis are closely related to mortality. Thus it is worthy noting that creating indicators referring to social, material, direct and indirect effect are worth creating mainly if they are to gain general acceptance and enter financialisation.

2. The portents of welfare and deprivation confirmated according to preconcept. The more considerable presence of deprivation decreased lifespan while higher life expectancy and more advantegous social compositon increased it. These two variables offered adequate assumptions for men and both genders together in relation of models of spatial errors.

3. There was no need to apply spatial models for the regressional assumption of women's life expectancy. The method of ordinary least squares complied with the diagnostical needs in case of the best model. Moran I. inspecting the autocorrelation of residuals was not significant.

4. Among women the factors mostly affecting life expectancies were those of gypsy population and standardized ratio of lung-swelling mortalities.

5. The fractions explained by the model were higher than those achieved by national researchers on the same regional scale using similar methods.

6. The effect of healthcare – both examining settlements without doctoral attendance, both the dummy effect referring to presence of hospitals - was insignificant in case of both gender. Although it is well possible that this effect was already covered by the composite indicator.

7. The spatial grouping of terms of error is still persistent among OLS models referring to men and the total population. In every case the application of the spatial error model was implied by the Lagrange multiplicator.

8. Among men the ratio of gypsy population was not significant.

9. Contrary to women, among men the important role of social support was demonstrated while the effect modus vivendi and health-attitude proved important as well.

10. In case of the total population's mortality apart from factors only the ratio of divorced turned out to be significant along with quality of life.

11. Compared to former studies establishment of more reliable model succeded which suits spatial approach better.

5. Contingent further course of research

(1) This present essay completed the spatial analysis of life expectancy at the time of birth applying methods of spatial-econometrics, using two-dimesional spatial data. On the same regional level, with the same method and explanatory variables the mortality patterns of broader age-groups and considerable causes of death may be construed.

(2) The polished analysis of spatial and temporal processes may still lie ahead

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