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Regional level analysis of the population by real data and projections in Hungary

Abstract

The population projections of László Hablicsek (1953–2010) have made a major scientific contribution to understanding the demographic processes of Hungary. Its social and economic usefulness cannot be questioned; although, trends of the past ten years indicate the need for some corrections. The present analysis shows that, for the past ten years, the population estimates were very close to reality. There was no significant difference between the estimated and real data; only last year's data showed some variation (however, it should be noted that the projections for smaller territories are in need of significant corrections). In recent years, regional disparities in the country rather increased. The migration towards large cities from undeveloped areas to more developed ones raise dissonance among regions. The population concentration proved to be stronger than the forecast, and the analysis showed that the regional concentration of the population, as well as the loss of population, has further reinforced the unfavourable position of underdeveloped regions at micro-regional level. Immigration from abroad further enhances regional differences since immigrants presumably do not prefer rural, disadvantaged areas; they most probably favour economically developed micro-regions, which are close to big cities. The observed changes in the socio-economic environment require corrections in the demographic projections for both the professional audience as well as actors in social policy.

Keywords: long-range population projection, demographic trends, economic development.

László Hablicsek, population projections expert in the HCSO Demographic Research Institute, was the author of numerous demographic studies and the leader of many research projects. He is credited with the long-range population projection and estimation in Hungary. He performed the population estimation based on the 2001 census data and projected changes in the population number by different projection variants until 2050. Later, in 2006, he updated and corrected the model on the basis of the 2005 micro-census. He applied the Cohort component method[2], in the course of which he took into account demographic phenomena directly influencing the population number, such as fertility, mortality and migration.

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2 For more details about the method see H. Richter Mária (2002).

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His projections made in the previous decade will still be in use for a long time. Hablicsek established the database for regional population, qualification and activity/inactivity projections, the so-called PQW (population, qualification, workforce) system. This is built up by the projections of the following factors: population, educational attainment, economically active population, employed, jobseekers, economically inactive population, full-time students, people rearing child(ren), pensioners, dependents and other inactive people.

The present study reviews the results of the Hungarian population projection procedures in commemoration of the recently deceased scientific researcher. On the basis of some analyses, studies, research reports and articles, as well as the data of HCSO, the study investigates how the population of Hungary has changed in the last forty years, and then compares the real data with the estimated on a regional, county and, finally, on a micro-regional level.

In addition to the country-level population projections, the study analyses the relationship between micro-regional demographic inequalities and socio-economic development with the help of multivariable statistical methods using the data of micro-regional population projections.

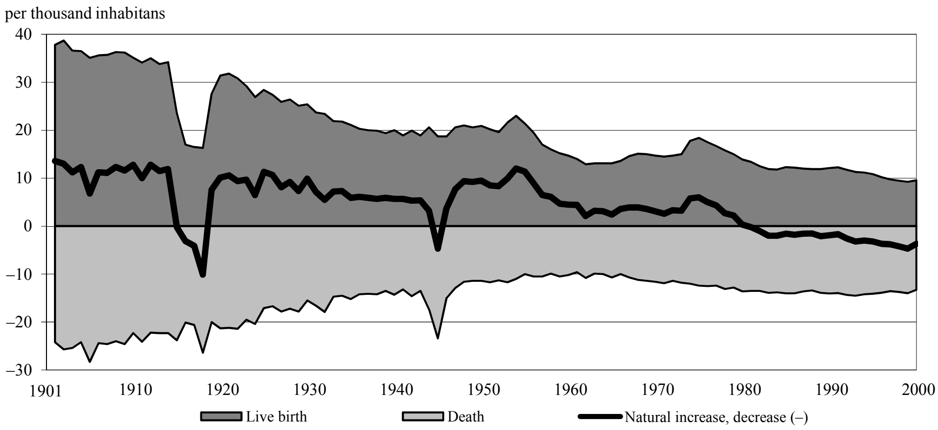
Population projection variants on country level

Population projection is an estimation method, in the course of which the number of births and deaths, migration processes and changes in life expectancy at birth are taken into account.

The population of Hungary increased until 1980, followed by the start of a slow decline. The population number grew by 4% between 1970 and 1980, while it fell by 4% between 1980 and 1990. Figure 1 presents the changes in the number of births and deaths as well as the difference between them. The figure clearly demonstrates that the natural increase of the population turned to a natural decrease in 1980.

Figure 1

Birth and death rates between 1901 and 2000



Source: nepszamlalas2001.hu

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László Hablicsek prepared the projections according to different variants. The variants were prepared as a function of demographic processes taking into account their different changes in the future. He made the estimations for gender, age cohorts, educational attainment and economic activity, but in practice, there are examples for projecting the number of the elderly, the pensioners, or even the number of the school-age population.[3]

In line with the different trends in the number of children, life expectancy at birth and the balance of migration[4], the Hablicsek projection was prepared in the following variants: (1) baseline variant, (2) young variant, (3) old variant, (4) low and (5) high variant and (6) European variant. This latter variant shows demographic trends based on a shorter timescale; thus, it is not covered within the present study (Hablicsek 2009). The basic characteristics of indicators relating to each projection variant are included in Tables 1 and 2, while Figure 2 compares the population estimations calculated based on the different variants at a country level.

Table 1

Components of population projection variants

Projection variants	Average number of children	Average age of women at childbirth	Life expectancy	Balance of international migration
Baseline	medium	medium	medium	medium
Old	low	low	high	low
Young	high	high	low	high
Low	low	low	low	low
High	high	high	high	high

Source: Hablicsek (2009).

The baseline variant seems to represent the real future. The low variant corresponds to the pessimistic, while the high variant to the optimistic estimation. The young and the old projections show only slight deviation from the baseline variant. The difference between the young and the old variants is also only half a million persons (Hablicsek 2009).

Table 2

Characteristics of population projection variants

Category	Average number of children, child	Average age of women at childbirth, years	Life expectancy men/women, years	Balance of international migration, persons
Low	1.3	29	72.6/80.8	8 000
Medium	1.5	31	75.3/83.0	15 000
High	1.8	33	78.0/85.2	22 000

Source: Hablicsek (2009).

In the baseline variant, medium number of children (fertility rate grows from 1.3), medium life expectancy (75.5 years for men, 82.5 years for women) and medium migration, i.e. an annual surplus of 14–15 thousand persons in the long run are assumed. In the higher version of the baseline variant, an annual international migration surplus of

3, 3 http://fogalomtar.eski.hu/index.php/Népesség-előreszámítás.

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30 thousand persons is assumed over the long term along with low life expectancy, which is slightly higher than at present, and a medium number of children.

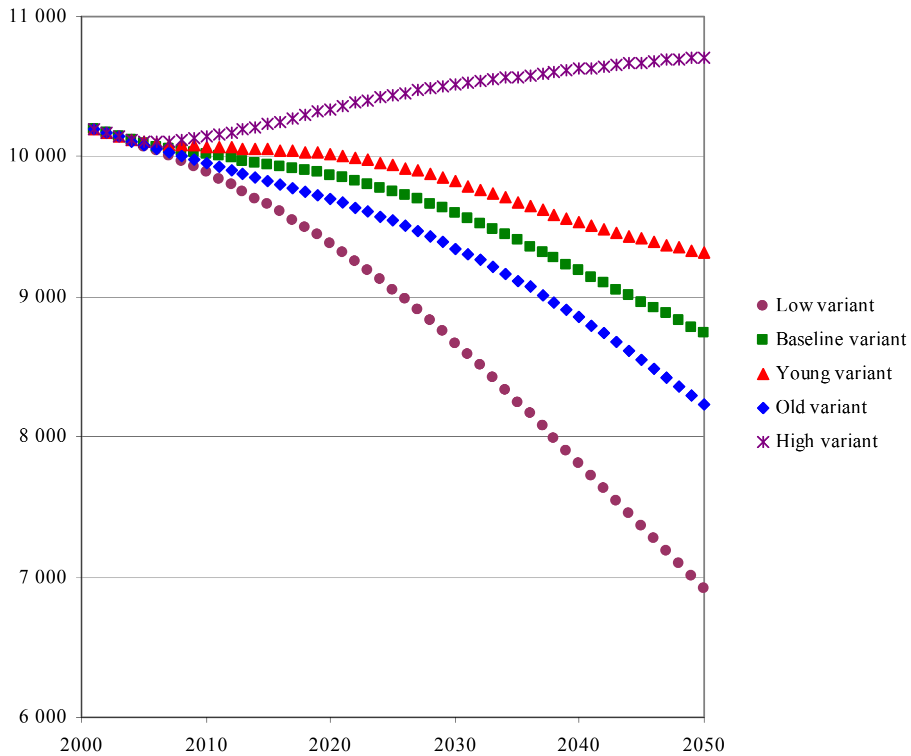
In the low version of the baseline variant, the number of children is also medium; life expectancy is high (82 years for men and 88 years for women) as opposed to the low balance of migration. (Due to emigration/further migration of foreigners having immigrated to Hungary, the surplus of the migration balance decreases to seven thousand persons (Polónyi–Tímár 2006).)

In the young variant, the number of children is high (fertility rate increases from 1.3 to 1.6 and then to 1.9), life expectancy is low, while migration is high. Finally, in the case of the old variant, each component is reversed, i.e. low number of children (fertility rate remains 1.3), high life expectancy and low migration are assumed.

According to the estimation of Hablicsek (2001), if the baseline variant was associated with a positive balance of migration of 40 thousand persons every year (47 thousand immigrants, 7 thousand emigrants every year), the population number would steadily remain at 10 million even with relatively low fertility and a slowly increasing life expectancy.

Figure 2

Change in the number of the population according to the different projection variants



Source: Own calculation based on the data of HCSO.

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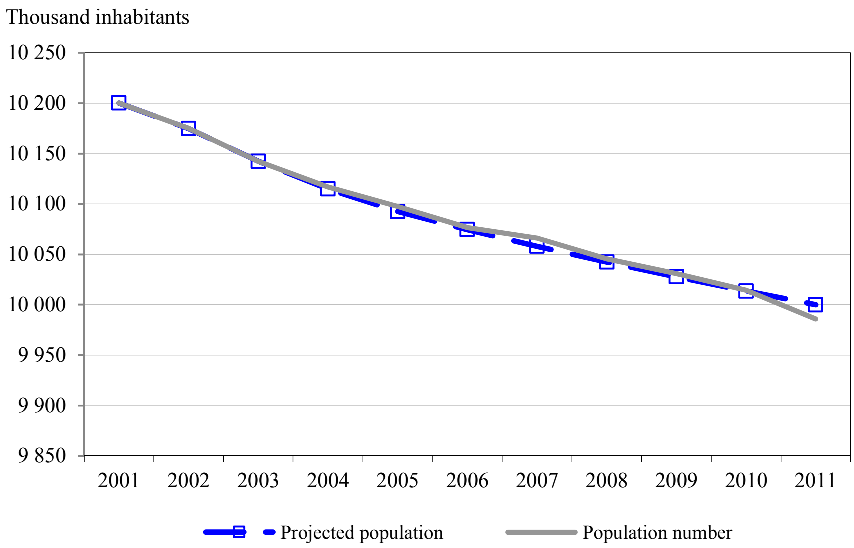
The long-range projection of Hablicsek analysed in my present study is based on the 2001census. The 10 years since then is not a long period in this context. However, it is worth examining whether there are any differences, and if yes, how large the difference is between the projection and the real population data.

Out of the different population projection variants, the baseline variant approximated reality the most accurately for the past ten years. However, it could not be foreseen in 2001 that, by the end of the decade, the economic crisis would also exert its effect on demographic processes, so a slightly larger difference can be observed between the projection and the real data of the last year (Figure 3).

In addition to the economic crisis, modifications in social allowances and changes in tax laws and family support could also influence our indicators of natural population movement. We have to be of course aware that measures aiming at increasing childbearing intention may change the trend towards another variant, or unfavourable economic processes may result in approaching just the old variant. All these effects are of course only probable, and there is only speculation as to their extent.

Figure 3

Population number and projected population number between 2001 and 2011 (baseline variant)



Source: Own calculation based on the data of HCSO.

It is clearly demonstrated by Figure 3 that the values of estimated and real population numbers are very close to each other on the time-base. When subjecting the two curves to statistical control as well, the results can be considered very good (The relative dispersion of the residua is 5.5%). Except for three data points, each estimated value is within the confidence interval. The data of 2007 showed a somewhat lower population number than the real data, while the estimation for 2011 was somewhat higher than the real data; i.e. the real data of these two years showed an upward and a downward deviation, respectively from the estimations. This deviation is presumably not the result of internal coherences in demographic processes, but can be better attributed to the social policy, the support system and the economic changes.

Regional projections

In a regional breakdown, the results are not nearly so clear. Demographic processes show great diversity just as socio-economic processes. For that very reason, population projection made only on country level is not sufficient, it is also necessary to present the differences within the country. The regional, county-level and micro-regional projections prepared by László Hablicsek also come from this recognition, and take a good step forward in demographic projections and in demonstrating the connections between social and economic policies.

According to projections, Hungary will probably record an 8.3% population loss by 2021 compared to 1980. Special attention is paid to regions diverging from the national trend in negative or positive directions (Table 3).

Table 3

Population projection and change in population size between 1980 and 2021 by regions

Year	Southern Great Plain	Southern Trans-danubia	Northern Great Plain	Northern Hungary	Central Trans-danubia	Central Hungary	Western Trans-danubia	Country
1980[a)]	1 464 658	1 059 160	1 590 901	1 400 079	1 120 956	3 033 056	1 040 653	10 709 463
1990[a)]	1 397 627	1 015 783	1 546 612	1 323 508	1 110 302	2 966 523	1 014 468	10 374 823
2001[a)]	1 380 383	997 668	1 563 709	1 302 833	1 116 721	2 831 095	1 007 860	10 200 269
2006[b)]	1 347 294	970 700	1 533 162	1 261 489	1 108 124	2 855 670	1 000 142	10 076 581
2011[c)]	1 320 040	943 002	1 503 758	1 221 183	1 098 640	2 917 461	993 030	9 997 114
2016[c)]	1 292 479	915 471	1 473 083	1 182 618	1 085 648	2 974 491	982 664	9 906 454
2021[c)]	1 268 030	889 153	1 446 569	1 148 000	1 072 055	3 026 871	972 378	9 823 056
Population number (previous year=100%)								
1980								
1990	95.4	95.9	97.2	94.5	99.0	97.8	97.5	96.9
2001	98.8	98.2	101.1	98.4	100.6	95.4	99.3	98.3
2006	97.6	97.3	98.0	96.8	99.2	100.9	99.2	98.8
2011	98.0	97.1	98.1	96.8	99.1	102.2	99.3	99.2
2016	97.9	97.1	98.0	96.8	98.8	102.0	99.0	99.1
2021	98.1	97.1	98.2	97.1	98.7	101.8	99.0	99.2
Population number (1980=100%)								
1980	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1990	95.4	95.9	97.2	94.5	99.0	97.8	97.5	96.9
2001	94.2	94.2	98.3	93.1	99.6	93.3	96.8	95.2
2006	92.0	91.6	96.4	90.1	98.9	94.2	96.1	94.1
2011	90.1	89.0	94.5	87.2	98.0	96.2	95.4	93.3
2016	88.2	86.4	92.6	84.5	96.9	98.1	94.4	92.5
2021	86.6	83.9	90.9	82.0	95.6	99.8	93.4	91.7

Source: Own calculation based on VÁTI TEIR.

a) Real data. b) Further calculation. c) Projection.

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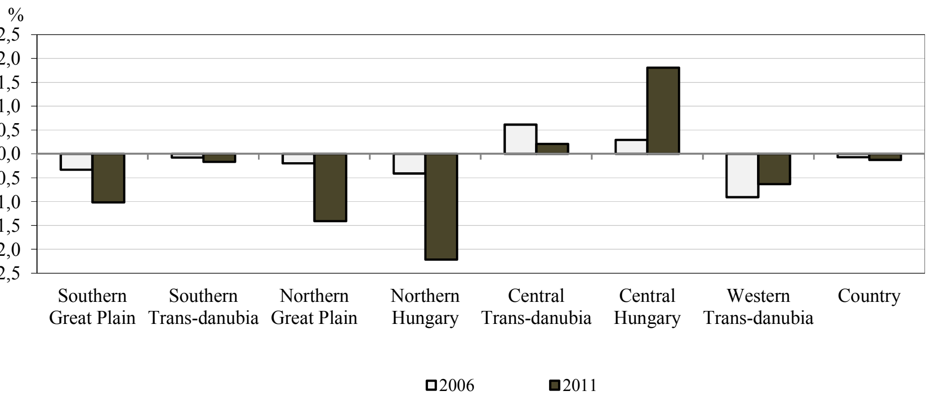
The most drastic population loss is expected in Northern Hungary and Southern Transdanubia. The population of the Southern Great Plain will decrease more than in the whole country, and its annual decline will slightly exceed the national average. A positive deviation can be observed in the case of Central Hungary and Central Transdanubia. In these two regions, stagnation or even a population increase could be observed in some periods. Central Hungary is the only region of Hungary, where, compared to 1980, the population number practically will not change by 2021, and since the new projection in 2006, the population has been increasing. It should be noted that this region also comprises Budapest. Despite the considerable population loss in Budapest, a positive change is probable in the total population size of the region, which can be attributed to the very significant development, the population attracting ability, the favourable age-structure and the high fertility rate of the agglomeration. Although there was some fluctuation at the beginning of the observed period, between 1990 and 2001, the population loss here was the largest in the country, but this negative peak was largely offset by the positive population balance in the following period.

The population dynamics of Central and Western Transdanubia is more favourable than in the whole country. The following figure presents the comparison of the estimated population number with the real population data for the years 2006 and 2011.

Figure 4

Difference between real and projected population as a percentage of the population by regions*



Source: Own calculation based on the data of HCSO.
* An indicator per real population number: (real-estimated)/real.

The divergence between the population projection and the real data in 2006 is less than 1% in each region. In 2011, the projected value slightly exceeds the actual one in Northern Great Plain and Northern Hungary, while in Central Hungary the population number is underestimated. This points to the fact that the estimation was made with lower in-migration and fertility for Central Hungary and with lower out-migration and higher fertility for Northern Hungary and the Northern Great Plain than the actual trends. In the divergence from the estimated migration, the economic crisis would play a role, which the population projection obviously could not reckon with.

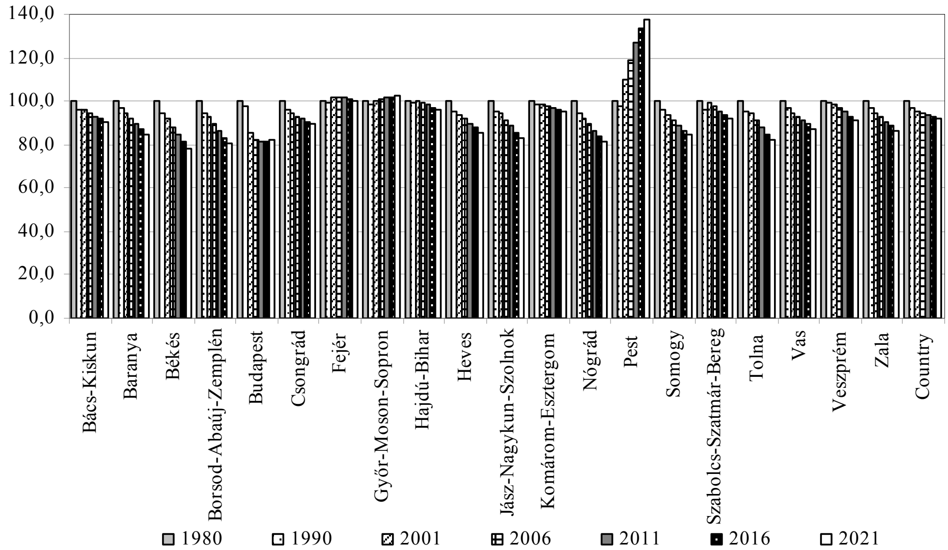
County level population projection

After regions, the population projections for smaller territorial units are compared to the real trends. It is again clearly demonstrated in Figure 5 that the population increase in Central Hungary described in the foregoing is due to the growth in Pest county.

A significant population growth can be expected only in Pest county, with a slight one in Fejér and Győr-Moson-Sopron counties. The most drastic fall will occur in Békés county, where the population number will decrease by 22% compared to 1980, while a nearly 20% population loss will occur in Tolna, Nógrád, Borsod-Abaúj-Zemplén counties and in Budapest according to the projections.

Figure 5

Probable change in population size between 1980 and 2021 by counties (1980=100%)



Source: Own calculation based on VÁTI TEIR.

The population projection for 2006 differs significantly from the real data in only two counties (the difference as a percentage of the population is more than 1%); it was overestimated in Győr-Moson-Sopron county and underestimated in Veszprém county.

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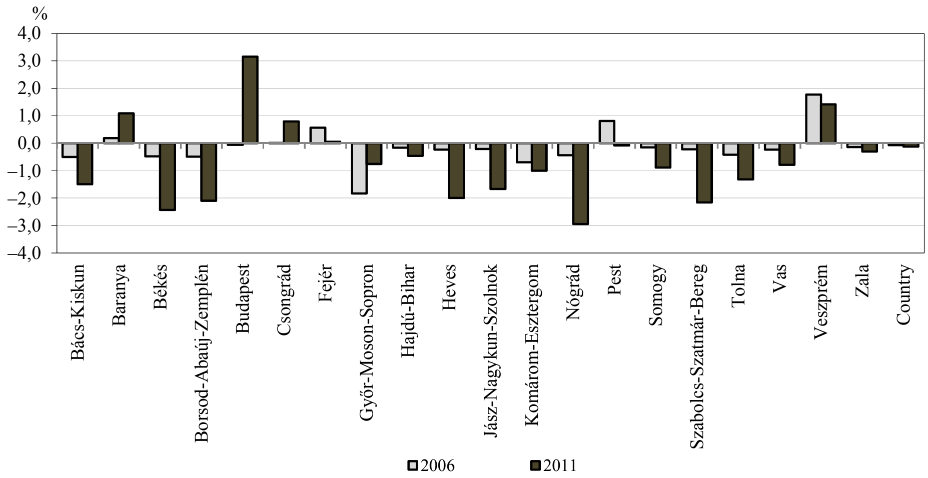
Figure 6

Difference between real and projected population as a percentage of the population by counties



Source: Own calculation based on VÁTI TEIR.

In 2011, the difference exceeded 2% in five counties; only the population of Budapest was underestimated by the projection model, while in the case of Békés, Borsod, Nógrád and Szabolcs-Szatmár-Bereg counties, it was overestimated.

The economic crisis deepened inequalities, which brought large uncertainties into the system, and this also contributed to the fact that larger differences could be observed between projections and the real population data of 2011. Projections cannot take into account the effects of such changes, and even if these prevail for a relatively short period, demographic trends already follow a different line after the 'restoration'.

Micro-regional population projection

By examining population dynamics on a micro-regional level, we can come to two conclusions. The population of most micro-regions is continuously decreasing, which is not surprising, as the tendency is similar for the population of the whole country. Although there are 37 micro-regions where the balance of the population is positive, and another 26 micro-regions where the population loss is lower than the national average, micro-regions belonging to the catchment area of large cities and county seats are in a very good position. Eight micro-regions are in the direct catchment area of Budapest (Veresegyháza, Gödöllő, Érd, Budaörs, Szentendre, Pilisvörösvár, Ráckeve, Dunakeszi), and another eight micro-regions belong to the larger catchment area of the capital. From these micro-regions, Budapest is easily accessible within one hour. Although the Gárdony micro-region is not located in Central Hungary, the transport conditions are excellent, and according to projections, its population will increase by one third by 2021 compared to 1980.

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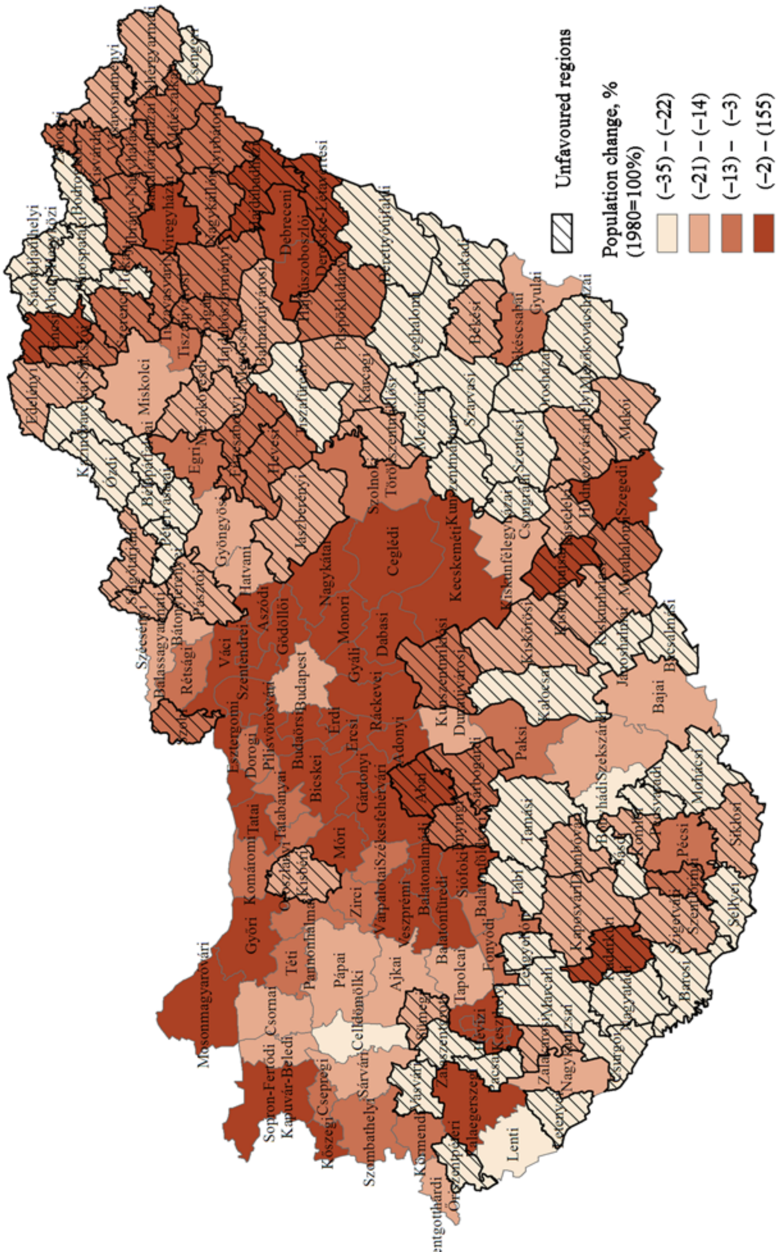
Figure 7

Projected population change between1980 and 2021 and unfavoured regions*



Sources: Own calculation based on VÁTI TEIR.

* According to Tipold–Faluvégi (2007) (Less developed Micro regions with Social-economic Disadvantages).

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The other, much more sensitive issue of the study is the considerable population growth of micro-regions densely populated by Roma people, e.g. the micro-region of Hajdúhadház (25.3%).

While in the case of county seats and the agglomeration of Budapest, all demographic trends positively affect the population increase, i.e. the fertility rate, the balance of migration, the balance of natural increase/decrease and the age-structure are all favourable, in the micro-region Hajdúhadház, the population growth results only from the outstandingly high fertility rate, which offsets the effect of the negative trend in migration (Hablicsek 2007b).

The proportion of less developed micro regions with socio-economic disadvantages is very high in Northern Great Plain, Southern Transdanubia, Northern Hungary and Southern Great Plain. The serious situation in Northern Great Plain is also shown by the fact that 86% of all micro-regions of the Northern Great Plain Region belong to this category.

Micro-regional population projections and real data

In 2006, the population projection on a country level differed from the real population number by only 0.06%. This difference was 0.1% in 2011. Both values are negative, i.e. a smaller population decrease was assumed versus the actual trend.

Table 4

Difference between real and projected data as a percentage of the population, 2006

Micro-region	Difference, %	Micro-region	Difference, %
Gödöllői	1.08	Adonyi	–10.12
Siófoki	1.16	Balatonföldvári	3.05
Dunakeszi	1.35	Salgótarjáni	1.79
Pilisvörösvári	1.37	Bodrogközi	1.07
Budaörsi	1.45	Mezőtúri	1.06
Ráckevei	1.49	Őriszentpéteri	1.01
Veresegyházi	2.11		
Bátonyterenyei	2.35		
Dunaújvárosi	2.58		

Source: Own calculation.

Based on this indicator, the clearly separable groups of micro regions are as follows:

- In 2006, micro-regions that surpassed expectations, i.e. where the population growth exceeded the projection by more than 1%, were, apart from a few exceptions, dynamically developing regions belonging to the Budapest agglomeration.
- An overestimated population number with a more than 1% difference was observed in six micro-regions; among them, the difference is striking - more than 10% in the Adony micro-region.

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Table 5

Difference between real and projected data as a percentage of the population, 2011

Micro-region	Difference, %	Micro-region	Difference, %
Ráckevei	2.08	Kiskunmajsai	–15.52
Nyíregyházai	2.11	Adonyi	–14.75
Sopron-Fertődi	2.54	Bodrogközi	–8.62
Székesfehérvári	2.72	Füzesabonyi	–6.19
Pécsi	2.88	Polgári	–5.64
Dunaújvárosi	2.95	Bélapátfalvai	–5.60
Veszprémi	3.03	Sarkadi	–5.52
Váci	3.09	Mezőkovácsházai	–5.48
Budapest	3.16	Mezőcsáti	–5.45
Szegedi	3.22	Balatonföldvári	–5.44
Debreceni	3.27	Szerencsi	–5.17
Bátonyterenyei	3.56	Hevesi	–5.16
Lengyeltóti	4.14	Salgótarjáni	–5.03
Gárdonyi	4.48		
Dunakeszi	6.86		

Source: Own calculation.

In 2011, the projected population number in the catchment area of some big cities was less than the real data, while in some micro-regions of Northern Hungary and Northern Great Plain, overestimated population numbers can be observed.[5]

These results indicate that the extent of migration towards larger towns is higher than the predicted trends. Due to a lack of jobs, young people and those with higher educational attainment probably move to towns to a larger extent than was expected by the projection. These are of course only assumptions, exploring the reasons and checking the hypotheses needs further research.

Regional factors influencing population dynamics: educational attainment and the effect of the Roma population

In the opinion of Hablicsek (2006), regional differences will diminish in the following period due to the "educational boom". If it is true, the white micro-regions in Figure 8 will shift to the grey ones; however, in this paper, this is not considered to be the case; the out-migration of people with higher educational attainment from disadvantaged regions will continue. Detailed migration data for analysing the reason for migration, the educational attainment and age of migrants are unfortunately not available. The hypothesis is that those with higher educational attainment do not find a suitable job in the disadvantaged regions; as a result, they settle down in towns or in their catchment areas. Thus, the "educational

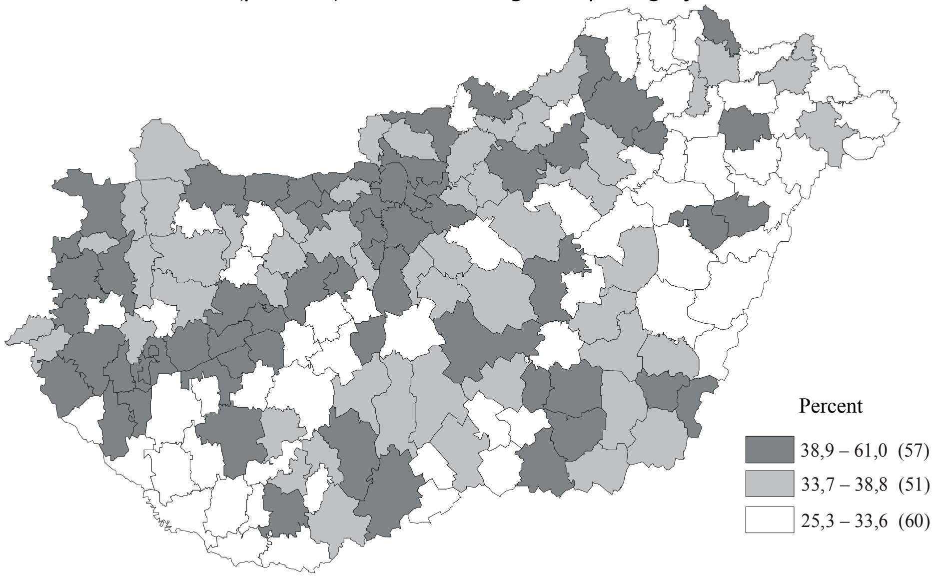
5 The interpretation of micro-regional data and drawing the conclusion requires care. The composition of micro-regions is continuously changing (the number of micro-regions was 138 in 1994, 150 from 1997, 168 from 2004, 174 from 2007 and 175 from 1 January 2011); settlements were transferred from one micro-region to another or even from one county to another, which distorts the results. Although "homogenising" the differences deriving from the changes is attempted in the VÁTI TEIR system, it does not work perfectly, and the long-range population projection does not naturally calculate with the separation of settlements (http://hu.wikipedia.org/ wiki/Kistérség).

boom" induces not the decrease but just the increase of regional inequalities, i.e. regions suffering considerable population loss will be faced with further depopulation. The scientific literature has already indicated this trend, since, in contrast with all previous expectations, regional inequalities increase rather than diminish (Spéder 2002, Kulcsár 2009, Bódi 2010).

The correlation between educational attainment and belonging to the Roma population is very close. It is well documented that the educational attainment of the Roma population is well below that of the non-Roma population (Polónyi–Tímár 2006). In the regions afflicted by the crisis, the proportion of Roma in the population is outstandingly high. This was explained by the fact that out-migrants with higher educational attainment have better chances to find a job, as the educational attainment of the Roma population is generally lower, they would find a job with more difficulty even if they moved; therefore, they would rather stay. In addition, in regions with a declining economy, their chances for out-migration are worse due to the lower property prices, while these regions may be attractive in respect of settling. All these result in an increase in the proportion and the concentration of the Roma population in these economically underdeveloped regions (Kertesi–Ábrahám 1996).

Figure 8

Projection of proportion of people with at least secondary educational attainment (for 2021) in the micro-regions of Hungary



Sources: Hablicsek (2007a).

The projections of László Hablicsek also covered the estimation of the proportion of the Roma population. This is shown in Table 6.

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Table 6

Number and proportion of Roma population between 1991and 2021

Region	Estimated number of Roma population, thousand persons				Proportion of Roma population, %			
	1991	2001	2011	2021	1991	2001	2011	2021
Budapest	40.4	59.6	80.5	103.2	2.0	3.4	4.8	6.1
Central Hungary without Budapest	65.8	97.0	132.7	173.0	2.2	3.4	4.6	5.7
Central Transdanubia	22.8	31.0	39.8	49.5	2.1	2.8	3.6	4.6
Western Transdanubia	22.2	26.4	30.2	33.7	2.2	2.6	3.0	3.5
Southern Transdanubia	63.5	72.4	79.3	84.9	6.3	7.3	8.4	9.6
Northern Hungary	123.8	151.5	181.9	215.5	9.4	11.6	14.9	18.8
Northern Great Plain	114.5	129.6	145.0	161.3	7.4	8.3	9.6	11.2
Southern Great Plain	35.5	41.8	48.7	56.3	2.5	3.0	3.7	4.4
Hungary, total	448.1	549.7	657.6	774.2	4.3	5.4	6.6	7.9
Change on country level, %, previous data=100		+22.7	+19.6	+17.7				

Source: Hablicsek (2007b), own calculation.

According to the projection of László Hablicsek, the population number will be around 9 million by 2050, of which the Roma population will be one million, i.e. 11% of the population will belong to the Roma minority. He also estimated the number of immigrants at one million. In the baseline variant, the increase in the Roma population shows a declining trend, and the decrease in the country's population is also likely to slow.

Along with this, the proportion of the Roma population in the total population will continue to grow[6], and by 2050, it may reach or exceed 12% (Polónyi–Tímár 2006, Hablicsek 2007b).

In three regions, i.e. in Northern Hungary, Northern Great Plain and Southern Transdanubia, the high proportion of disadvantaged micro-regions and the high proportion of Roma population prevail in parallel. The exception is Southern Great Plain, where the proportion of disadvantaged micro-regions is high (more than 20%), but the proportion of Roma population is quite low (4.44%).

Socio-economic development and population dynamics

Demographic trends are partly the reasons and partly the consequences of the socio-economic situation of a region. Researchers often assume significant correlation between the state of development and the age-structure of a region. The generally accepted opinion is that, in underdeveloped settlements and regions with limited resources and services, the old-age dependency ratio is increasing.

However, it can be demonstrated that the favourable age-structure is not always accompanied with advanced socio-economic development. In some micro-regions of Hungary, the disadvantaged situation and underdevelopment is coupled with a favourable age-structure. In other ones, the good geographical position (it is near a town, there are

6 According to the projections of Hablicsek (2000), the number of Roma population increases yearly by 9–10 thousand.

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tourist attractions, etc.) partly offsets the unfavourable age-structure and the demographic disadvantage.

Migration is one of the most important indicators of regional socio-economic inequalities. Migration from the less developed regions to the more developed ones is prompted among other factors by the better job opportunities (Teaford 2008, Brown–Glasgow 2008). However, this situation needs to be examined with a more detailed approach. Some disadvantaged regions are characterized by the ageing of the population and out-migration, while in others the situation is just the opposite. Thus, it is not true in all instances that in underdeveloped regions, the population is ageing and young people are leaving, while the developed ones are always characterized by increasing population and young age-structure. The less developed micro-regions in Hungary have the youngest age structure because of the high level of Roma population.

From this point, the correlation of the features of the age structure with the population projection and the socio-economic development will be examined, and a complex typology will be presented; this pictures the relationship between the dynamics of the age-structure and the economic development.

As a first step of the multivariate statistical analysis, a variance reduction method is applied, the principal component analysis (PCA)[7] in order to define the main socio-economic characteristics. In the second step, by involving the resulted principal components the micro-regions are grouped by a cluster analysis.[8]

Table 7

Rotated component matrix

Indicators	1st principal component: economic force	2nd principal component: young population
In- and out-migration, %[a)]	0.907	0.119
Number of enterprises per 1,000 inhabitants[a)]	0.903	0.065
Unemployment rate[b)], %[a)]	–0.860	0.281
Logarithm of income/capita[a)]	0.855	–0.106
Population change, %[c)]	0.836	0.418
Change in dwelling stock %[c)]	0.835	0.304
Proportion of new dwellings, %[a)]	0.833	0.307
Number of passenger cars per 100 persons[a)]	0.790	–0.414
Population density, persons/km^2[a)]	0.697	0.304
Proportion of population under 14 years of age, %[a)]	–0.234	0.931
Birth rate per 1,000 persons[a)]	0.001	0.888
Old-age dependency ratio, %[a)]	–0.243	–0.817
Number of persons per households[a)]	0.289	0.790

Source: Own calculation.
a) In 2009. b) Proportion of jobseekers in the population aged 18–65 years. c) 2009/2001.

The KMO value (how the variables fit in the model) is 0.839, which shows that the variables involved in the analysis fit well in the PCA model. In the applied principal

7 For more details about the method see Bartók (1983), Francia (1976) és Czirfusz (2010).
8 The data of the VÁTI TEIR system was used in the analysis.

component analysis, the total variance explained is 78.3%, if only eigenvalue components higher than one are taken into account. Two principal components meet this requirement. After rotation (applying varimax rotation), the variance explained by the first principal component is 50%, while the explanatory value of the second factor is 28.3%.

The first two strongest variables are the in-migration/out-migration ratio and the number of enterprises per 1,000 persons. The correlation between the principal component and the variables is very strong. In the first principal component, the third strongest variable is the unemployment rate, which is connected with a negative sign to the principal component. There are some further demographic and economic indicators in the first principal component; therefore, this factor was named as the 'economic development' factor.

The second factor correlates best with the proportion of young people. The old-age dependency ratio is connected with a negative, while the birth rate is connected with a positive sign to this factor. Therefore, this factor could be named as the 'young population' factor. Based on the results, we can say that the factors can be unambiguously identified and are suitable for further analysis.

In Table 8, micro-regions having extreme factor values are highlighted.

Table 8

Micro-regions with extreme factor values

Micro-region	Economic development	Young population
Őriszentpéteri	0.18	–2.69
Hévízi	1.27	–2.03
Gödöllői	2.27	1.35
Monori	2.06	1.32
Ráckevei	2.51	1.73
Budaörsi	3.63	1.87
Dunakeszi	3.84	2.09
Pilisvörösvári	2.28	1.44
Szentendrei	2.23	0.95
Veresegyházi	3.06	2.61
Érdi	2.69	1.47
Hajdúhadházi	–0.62	2.49
Edelényi	–1.46	2.13
Encsi	–1.22	2.49
Szikszói	–1.25	2.04
Baktalórántházai	–1.17	2.08

Source: Own calculation.

Among micro-regions having extreme values, there are economically developed, dynamically developing ones with a young population near Budapest (Gödöllő, Monor, Ráckeve, Budaörs, Dunakeszi, Pilisvörösvár, Szentendre, Veresegyháza, Érd), on one hand, and economically underdeveloped micro-regions having young populations (Hajdúhadház, Edelény, Encs, Szikszói, Baktalórántháza micro-regions, where the proportion of Roma population is high) on the other. The third group is made up by the Hévíz micro-region with a high proportion of old population but with quite good economic potential, and by the Őriszentpéter micro-region with moderate economic conditions.

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In order to create a micro-regional typology based on the correlation of the two examined factors, I made a cluster analysis on the factors. As a result of the cluster analysis based on the factor values, micro-regions are divided into four groups. The cluster centre values for the two factors are included in Table 9, while Figure 9 shows the location of the clusters.

Table 9

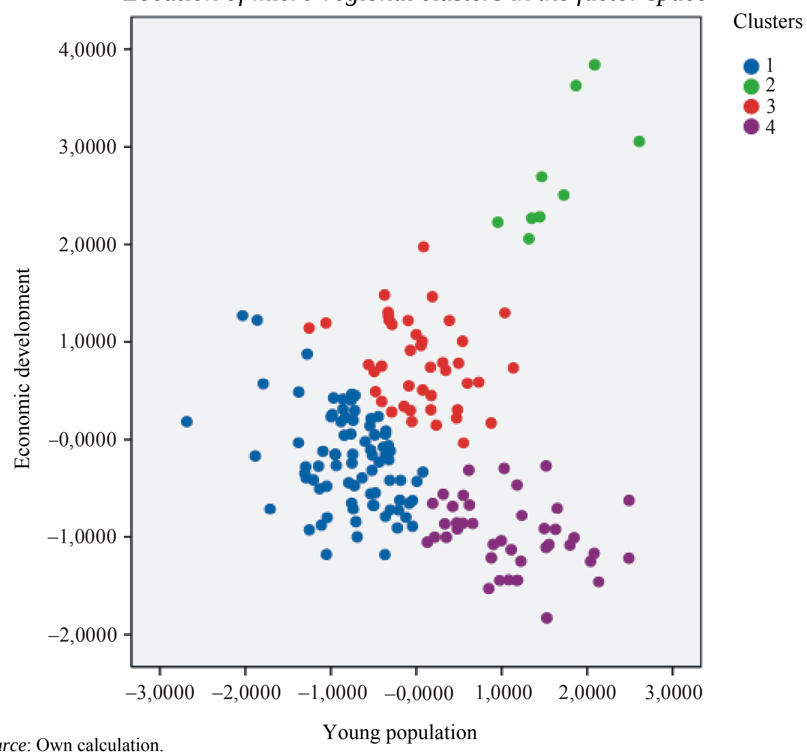
Cluster centres

Factors	Cluster			
	1	2	3	4
Economic development	–0,212	2,730	0,777	–0,978
Young population	–0,770	1,647	0,050	1,110
Number of micro-regions	81	9	42	41

Source: Own calculation.

Figure 9

Location of micro-regional clusters in the factor space



Source: Own calculation.

The aim of the cluster analysis[9] is to group the micro-regions by their economic force and age-structure. As a first step, a hierarchical cluster analysis was carried out, followed by the application of the K-mean method. Finally, after comparing the results, I accepted the cluster result of the K-mean method as final.

9 For more details about cluster analysis see Obádovics–Popovics (2011).

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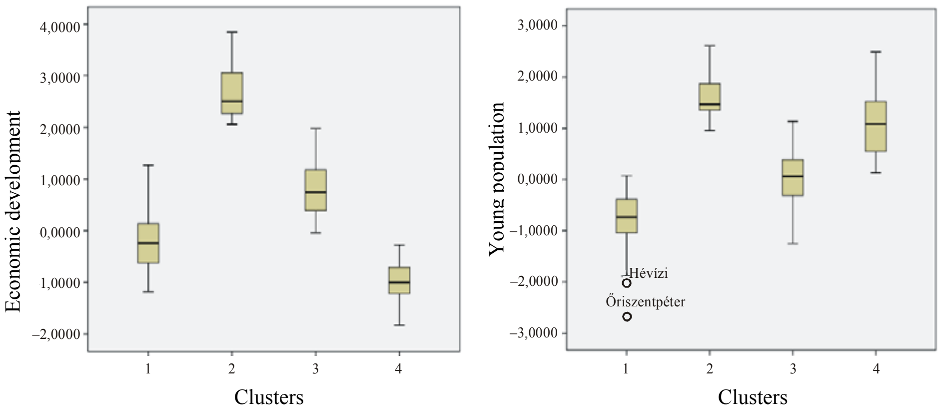
Based on the cluster centres, the groups can be characterised. It is clearly shown in the table that the fourth cluster is characterized by a favourable age-structure and young population, but it is comprised of micro-regions with the most underdeveloped economy. At the same time, in the second cluster, the favourable age-structure is accompanied by the strongest economic development. The poor, ageing micro-regions belong to the first cluster, while the ones slightly more developed than the average and having medium-level age-structure are in the third cluster.

The differences in the features of the clusters are shown by their spatial locality along the cluster axis (Figure 10).

As it shown in Figure 10, there are large differences among the clusters in respect of both age-structure and economic development. The situation is the best in the second cluster; these micro-regions are located in the agglomeration around Budapest. They are dynamically developing micro-regions with high population density, low unemployment rate, strong economy and favourable demographic characteristics.

Figure 10

Location of the clusters along the factors



Source: Own calculation.

The fourth cluster is the other special group of micro-regions with a highly underdeveloped economy and very young age-structure. This group comprises the most problematic micro-regions: there are no job opportunities, the level of educational attainment is low while the unemployment rate and the proportion of long-term unemployed are high. The birth rate is especially high, and the fertility rate is much higher than in the other regions. However, while the fertility and birth rates are outstandingly high, life expectancy at birth is lower than in the other parts of the country (Hablicsek 2009).

The geographical location of the clusters is shown in Figure 11.

Micro-regions with the youngest population are located in four parts of the country. The largest contiguous areas are in the northeastern part of the country, mainly micro-regions in Borsod-Abaúj-Zemplén and Szabolcs-Szatmár-Bereg counties as well as in the agglomeration around the capital city are here. There are two other areas that are characterized by young population: one in Baranya county, along the Dráva and the other

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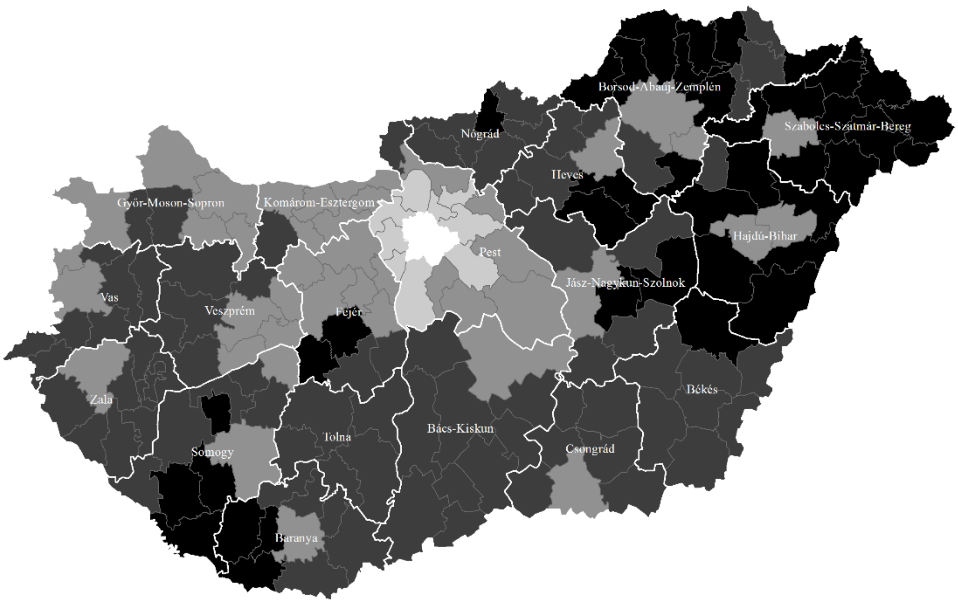
in the middle part of Northern Great Plain. However, the favourable age-structure is not always accompanied with economic development. In some micro-regions, the relation between the age-structure and the economic performance is positive, while in others, it is negative. Economic development is the strongest in the central part of the country and in the northern part of Transdanubia.

Figure 11

Geographical location of clusters



4. cluster: Economically underdeveloped with very young population
1. cluster: Unfavorable economic situation with aging population
3. cluster: Favorable economic situation with average age composition
2. cluster: Economically developed with very young age structure

Source: Own calculation.

Micro-regions in an unfavourable economic situation and with a young population are located in Southern Transdanubia and Northern and Eastern Hungary.

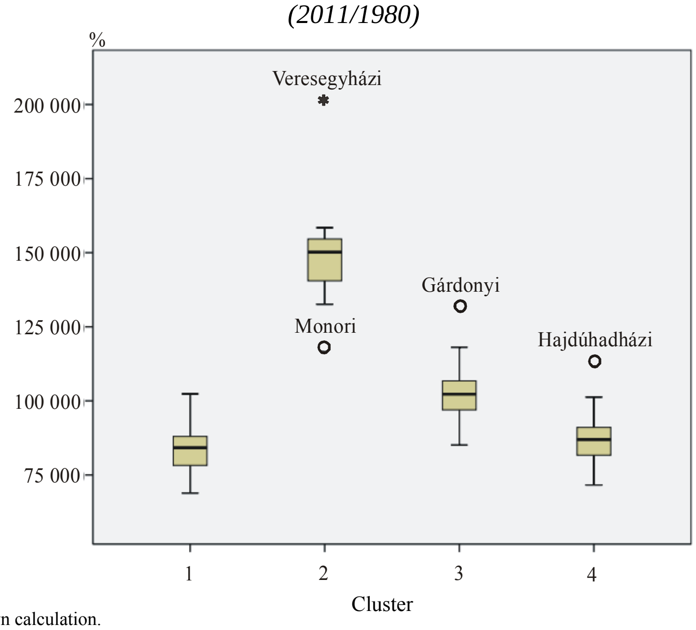
Population dynamics and projection of clusters

The population dynamics of the four established homogeneous groups also show considerable differences. When examining the period between 1980 and 2011, we can see that, among the four groups, population dynamics is by far the strongest in the economically developed micro-regions around Budapest, having favourable socio-economic characteristics and young age-structure. Overall, considerable population loss is characteristic of the first and the fourth group, with the exception of some micro-regions, such as the Hajdúhadház micro-region in the economically underdeveloped group having a young age-structure.

The socio-economic situation of the third cluster can be considered good, since its population loss equals or is less than the national average, and some micro-regions (e.g. Gárdony) have a considerably positive population balance. It can be seen in Figure 12 that, in respect of population dynamics, the situation is the same in the first and the fourth cluster while it is significantly better in the third and the second one. The population is decreasing in the first and fourth cluster; it is stagnant in the third one – having a better value than the country average – while the population of the second cluster comprising only nine micro-regions is dynamically increasing.

Figure 12

Population dynamics in the micro-regions of the clusters (2011/1980)



Source: Own calculation.

Figure 13 shows how the real population dynamics data differ from the projections in each cluster.

The first cluster is the economically underdeveloped group with an ageing population. The projection predicted a higher population number than the actual number. This cluster is characterized by a strong population decrease exceeding the projected one.

The second cluster includes the most developed micro-regions around Budapest with a very young age-structure. In this group, the actual population number is higher than the projected value, i.e. the population concentration is stronger than could be deduced from the projection, the higher level of migration from the country, immigration from abroad and the outstanding fertility rate surpassed expectations. In 2011, this cluster could record significant population surplus compared to 1980.

The third cluster comprises the moderately developed micro-regions with average age-structure. In 2006, the projection was entirely accurate, but by 2011, the population number was higher than projected. The population of the micro-regions comprising the cluster is

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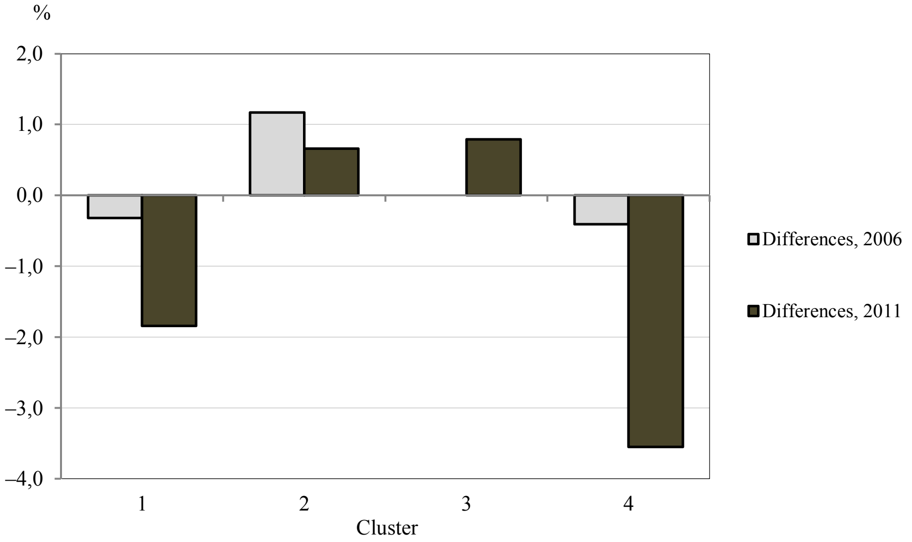
essentially stagnant, so it is characterized by positive demographic trends compared to the national trend.

The population of the fourth cluster is decreasing except for the Hajdúhadház micro-region. The population projection predicted a considerably larger population for this group with very underdeveloped economy but with outstandingly high fertility rate. This also shows indirectly that the population increase moderates among groups with high fertility.

Figure 13

Differences between actual population number and projected population data in the clusters



Source: Own calculation.

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