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Regional inequalities, backwardness and peripheralization in Hungary:

an attempt to reconstruct historical HDI at settlement level, 1880-2022

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Assessing the role of border changes and structural transformations in regional processes

Previous research has shown[1] that Hungary's contemporary peripheries are not homogeneous and even show significant local diversity in their socio-economic characteristics. Not only does this means that there is no universal remedy to improve their situation, but also that their fate has probably been shaped by different historical processes. As a result, in order to unravel the historical roots of the current disparities we need to look back before 1945. Even though there is a consensus that the location and the relative position of peripheries remained unchanged since 1990,[2] irrespective of political regimes, and regardless of methods and variables used to delimit them, their origin is unclear. There is no consensus, though, which political or economic system is responsible for the present pattern. The socialist era, the postponed agricultural reforms in Interwar Hungary, an even the border changes of 1920 are possible candidates.

It is known that the present pattern of peripheries differs from the picture observed during state-socialism.[3] It has also been found that Williamson's hypothesis on the reversed U-curve of inequality can be confirmed in the 1990s,[4] in this case an initial increase in spatial inequalities was followed by a decline.[5] A description of pattern stability (i.e. despite the changing depth of inequalities the location of peripheries remained surprisingly stable in the last 20 years) using post-1945 datasets was given by Zoltán Egri, claiming that at least 30 years are required for the spatial correlations to change remarkably[6] – regardless of whether there are sudden changes in economy or political system or not. Present peripheries thus can be traced back to the 80s, before the regime change. Then, most settlements classified as underdeveloped were agricultural municipalities (with a few exceptions such as mining settlements in Borsod

[1] János Pénzes and Gábor Demeter, "Peripheral areas and their distinctive characteristics: The case of Hungary," *Moravian Geographical Reports* 29, no. 3 (2021): 217–30.

[2] János Pénzes, "Periferikus térségek lehatárolása Magyarországon – módszertani és területi sajátosságok" [Delimiting Peripheral Regions in Hungary – Spatial and Methodological Characteristics], in *Polarizáció - függőség - krízis: Eltérő térbeli válaszok* [Polarization, Crises, Different Regional Responses], eds. Erika Nagy and Gábor Nagy (Budapest – Békéscsaba: MTA KRTK, 2014): 170–71, esp. figure 3.

[3] Róbert Győri, and György Mikle, "A fejlettség területi különbségeinek változása Magyarországon, 1910–2011" [Transformation of Regional Development Disparities in Hungary, 1910–2011], *Tér és társadalom* 31, no. 3 (2017): 144–64. doi: 10.17649/TET.31.3.2866

[4] Nemes Nagy József: Fordulatra várva – a regionális egyenlőtlenségek hullámai. In: Dövényi Zoltán – Schweitzer Ferenc (szerk.): *A földrajz dimenziói*. MTA FKI, Budapest, 141–158

[5] Pénzes J. – Kiss J. P. 2024: A területi egyenlőtlenségek trendjei Kelet-Közép-Európában és Magyarországon az uniós tagság első két évtizedében. – In: Társadalmi Riport 2024 (szerk. Gábos, A.- Medgyesi M.- Tóth I. Gy.). TÁRKI Társadalomkutatási Intézet Zrt., Budapest. pp. 69-93.
DOI: 10.61501/TRIP.2024.3 https://topap.hu/cms/uploads/069_093_TRIP_2024_Penzes_Kiss_ca5a6e6da5.pdf

[6] Egri Zoltán: Mobilitás és perzisztencia a hazai települési szintű jövedelemegyenlőtlenségi folyamatokban, 2012–2019. *Területi Statisztika* 63 (1): 3–37. For correlations measured by us between HDI from different decades see table 3 and table 4.

County). A significant number of these areas had limited agroeconomic potential, leading to the assumption that their underdevelopment stemmed from long-standing structural issues.[7] In the 1990s, economist Endre Miklóssy argued that the origins of modern peripheral backwardness lay in the historical development of large-scale agriculture, which sidelined livestock farming. This structural transformation, he claimed, did not align with the ecological and land-use characteristics of many affected settlements. Though this transformation sped up after 1945, its roots can be traced back the 1900s. [8] Geographers, by contrast, often pointed to socialist-era development policy—particularly the 1971 National Spatial Development Concept (abbreviated as OTK)—as a principal cause of spatial marginalization today.

Yet, there has been only one attempt by geographers (and none from historians up to the 2020s) to carry out a longitudinal investigation to trace peripheries of Hungary in the historical past and to search for the permanent and quickly changing mosaics of space that can be connected to theories of path dependency or reversal of fortune,[9] though there is a growing interest to investigate the role of history in the stability of regional patterns,[10] not only at country or interregional scale.[11] And this implies several problems to resolve, like measuring local outputs instead of country aggregates (substituting GDP unavailable at fine resolution),[12] or interpreting historical terms according to modern concepts in order to utilize them. While using GIS to analyze

[7] Endre Miklóssy, "A területi elmaradottság társadalmi és gazdasági összetevői" [Socio-economic Components of Regional Underdevelopment], *Magyar Tudomány* 97 [35], no. 8 (1990): 889.

[8] Miklóssy, 1990: 890. This hypothesis was examined and approved in: Gábor Demeter–Zsolt Szilágyi and Zsolt Pinke "Sártenger és búzatenger. Mérlegen az alföldi gabonakonjunktúra és a vízszabályozások regionális következményei (1720–2020)" [Mud sea and wheat sea. The regional consequences of water regulations and the cereal boom in the Great Plains (1720–2020)], *Századok* 156, no. 5 (2022): 963–99.

[9] Daron Acemoglu, Simon Johnson and James A. Robinson, "Reversal of Fortune: Geography and Institutions in the Making of the Modern World Income Distribution," *The Quarterly Journal of Economics* 117, no. 4 (2002): 1231–94.

[10] Carlo Ciccarelli and Torben Dall Schmidt, "The Impact of History on Regional Development," *Review of Regional Research* 42, no. 3 (2022): 219–25

[11] For interregional approach see: François Bourguignon, and Christian Morrisson, "Inequality Among World Citizens: 1820–1992," *American Economic Review* 92, no. 4 (2002): 727–44. Allen, Robert C. 2001. „The Great Divergence in European Wages and Prices from the Middle Ages to the First World War." *Explorations in Economic History 38,* 38: 411-447, Alam, M. Shahid. 2006. „Global Disparities Since 1800: Trends and Regional Patterns." *Journal of World-Systems Research* XII, 2: 37-59. Joan Ramón Rosés and Nikolaus Wolf, *The Economic Development of Europe's Regions: A Quantitative History Since 1900* (Routledge, 2019), or Jan Luiten van Zanden, Joerg Baten, Peter Foldvari, and Bas van Leeuwen, „The Changing Shape of Global Inequality 1820-2000; Exploring a New Dataset,". *Review of Income and Wealth* 60, no. 2 (2014): 279–97.
For the great divergence see: O'Rourke, Kevin H. – Williamson, Jeffrey G.: *Globalization and History: The Evolution of a Nineteenth-Century Atlantic Economy*. The MIT Press, Michigan.

[12] Anna Missiaia, "Regional GDP before GDP: A Methodological Survey of Historical Regional Accounts," in *Regional Economic Development and History*, ed. Marijn Molema and Sara Svensson (Routledge: 2019), 82–97.

spatiality has not been a problem for long for non-historians,[13] the interpretation of 18th or 19th c. terms is challenging.

Győri and Mikle used 6 variables at district level going back to 1910 (we use here only 3 indicators, but at municipal level)[14] - because they were not able to trace the same variables back in time and did not undertake the risk to approximate them by other indicators. Going further to the past was left to historians with skills to interpret sources, but usually not familiar with quantitative methods or GIS as regional aspect of history has been underrated in Hungarian curriculum.[15]

The settlement-level socio-economic-demographic databases of Hungary has been under construction for 10 years now. For the first time, this study unites three major historical databases: GISta Hungarorum (covering the years 1720, 1780, 1828, 1880, and 1910),[16] the TMTA (1920, 1931, and 1941), and more recent datasets used primarily by geographers (spanning 1980 to 2020). Together, these databases comprise over 10 million records, providing an unprecedented opportunity to identify long-term indicators and trace the historical roots of contemporary peripheral regions. This, in turn, offers valuable insights into the origins of modern peripheries and enhances the potential for more effective spatial planning. Nevertheless, the differences in territorial coverage and data structure across the three sources present certain technical challenges that must be carefully addressed.

Another key problem (beside accessibility and reliability of historical data) is the definition and measurement of development, essential for the identification of peripheries and backwardness. GDP is not measurable at fine-scale and its reconstruction possibilities are limited before the 20th c. Furthermore, Maddison's GDP-oriented approach can be criticized for ignoring the political-economic role of

[13] In history see the reevaluation of Fogel's thesis on the contribution of railways to economic development, based on GIS-aided approach by Jeremy Atack, "On the Use of Geographic Information Systems in Economic History: The American Transportation Revolution Revisited," *Journal of Economic History* 73 no. 2 (2013): 313–38.

[14] Győri and Mikle did not try to calculate incomes at district level but used mortality and literacy rates.

[15] There was some progress in Hungary in recent years considering longitudinal quantitative investigation, but these targeted one sector, and focused on the last century, regional aspects were not of primary character and were realized abroad. See: Klein, Alexander – Schulze, Max-Stephan – Vonyó, Tamás: How peripheral was the periphery? Industrialization in East Central Europe since 1870. In: O'Rourke, K. H. – Williamson, J. G. (eds.): *The spread of modern industry to the periphery since 1871*, Oxford University Press, 63–90. Or Venyige, Robert: *The Road From Serfdom: Essays in Economic Development and Property Rights*. University of Michigan. Menyhért, Bálint: *History as agent of Growth. Natural Experiments from Central Europe*. PhD-dissertation, CEU, Budapest.
The forthcoming issue of the Hungarian Studies Review in the US will account on the development of the last decade including quantitative research on regional patterns of medieval and early modern (Ottoman and 18th c.) periods through four quantitative and GIS-aided studies.

[16] http://gistahungarorum.abtk.hu (webmap-server)

inequalities,[17] but also for the flaws in the methodology applied to Eastern Europe[18] and for its one-dimensional, economic growth-oriented nature.

For this reason, we searched for an index that allows us fine resolution and at the same time longitudinal reconstruction, provides multidimensional approach to development. Our multidimensional "welfare" index applied for 1780-1910 using SEM neither allows international comparisons, nor can be linked to measured modern data and was developed to allow the comparison of time-horizons with different number and type of available indicators, was neither appropriate selection.[19] We decided to calculate historical HDI (Human Development Index) instead, which can be calculated for several time horizons even at settlement level for Hungary (1880, 1910, 1920, 1930, 1941, 1960, 1980, 2000, and 2020 - representing the last prewar years, the effect of border changes, the great economic crisis, prewar economic upswing, consolidation of socialism, collapse of socialism, EU-accession, etc. respectively)

The calculation of settlement level HDI values allowed us both to trace long-term patterns of peripheralization and to carry out statistical analysis at country level to inquire into l*ongue durée* tendencies. The mean and standard deviation of HDI can be calculated for different grouping variables too with the aid of GIS and our database structure, thus investigations can target urban-rural relations, statistical regions, closeness to borders, and ethnicity/denominations, etc., or can be aggregated to higher administrative levels (district, county)

The long-run temporal changes of national HDI were also calculated, as well as the degree of inequality to trace U-curves of Williamson. We also compared the calculated national HDI of Hungary to older estimations and to the HDI values of neighboring countries, analyzing whether divergence or convergence took place on the long run, thus evaluating the economic and social policies of the different political regimes from this perspective.

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[17] Jeffrey, G. Williamson, "Regional Inequality and the Process of National Development: A Description of the Patterns", *Economic Development & Cultural Change* 13, no. 4 (1965): 1–84. Thomas Piketty, *The Economics of Inequality* (Harvard Univ. Press, 1997); Thomas Piketty, *Nature, Culture and Inequality: A Comparative and Historical Perspective* (Other Press, 2024). Daron Acemoglu and James A. Robinson, 2012. *Why Nations Fail: The Origins of Power, Prosperity and Poverty* (New York: Crown, 2012); Branko Milanovic, *Visions of Inequality: From the French Revolution to the End of the Cold War* (Belknap Press: An Imprint of Harvard University Press: 2023); Branko Milanovic, "Income Level and Income Inequality in the Euro-Mediterranean Region, C. 14–700," *Review of Income and Wealth* 65 no. 1 (2017): 1–20; Branko Milanovic, Peter H. Lindert and Jeffrey G. Williamson, "Measuring Ancient Inequality," *Working Paper 13550,* National Bureau of Economic Research. (Cambridge: MA, 2007) http://www.nber.org/papers/w13550

[18] Angus Maddison, *The World Economy. A Millennial Perspective.* (Paris: OECD: 2001) vs. Martin Ivanov and Adam Tooze, "Convergence or Decline on Europe's Southeastern Periphery? Agriculture, Population, and GNP in Bulgaria, 1892–1945," *The Journal of Economic History* 67, no. 3 (2007): 672–703. https://doi.org/10.1017/S0022050707000277 . See growth rates for the southeast European region by: Morys, Matthias 2006: South-Eastern European Growth Experience in European Perspective, 19th and 20th Centuries. In: Avramov, R.–Pamuk, Ş. (eds.): *Monetary and Fiscal Policies in South-East Europe*. Bulgarian National Bank.

[19] Demeter – Földvári 2025, Regional disparities in Hungary in the era of absolutism and the dualistic period (1720 – 1914): a statistical analysis to assess inequalities and the driving forces of development forthcoming in American Studies Review

However, the investigation also has limitations. Since the components of HDI—material welfare, education, and longevity—are based on very different (proxy) indicators in historical contexts, these historical HDI values are not directly comparable with contemporary ones and sometimes not even across (synchronous) economies. Another drawback is that they inherit an arbitrary choice of weights from the modern HDI. However, historical HDI estimates are very useful for tracing long-term changes in development within a single region across decades.

The question why (historical) HDI was chosen as our indicator referring to development, despite the above mentioned limitations, can be reasoned beside its multidimensional/composite character and general use in modern investigations, by another important fact, that, in Hungary its reliability has already been validated on historical datasets too – comparing it with the results of other methods targeting the assessment and visualization of development trends and patterns. A linear correlation coefficient of 0.60 was observed between the historical Human Development Index (HDI)—constructed using only three indicators—and a composite development index based on 15 indicators, both calculated for the years 1880 and 1910. A similar degree of correlation was found when comparing the historical HDI with a latent welfare index constructed using the SEM-MIMIC (Structural Equation Modeling – Multiple Indicators Multiple Causes) approach. This method distinguishes between variables that cause and those that reflect development, handles both ordinal and metric data, and incorporated over 25 variables for the year 1910. Interestingly, the correlation between the SEM-MIMIC index and the composite development index based on 15 indicators was even higher than that observed with the historical HDI.

Despite the limited number of indicators required to calculate HDI, our initial experience made it clear[20] that conducting a continuous longitudinal study using the same variables over a 150-year period would be nearly impossible. This is due to

- changes of statistical preferences of the state, which have led to changes in the availability and consistency of key indicators over time;
- and the changing explanatory power of some indicators, even in cases where continuous data collection would be theoretically possible.

[20] Szilágyi, Zsolt 2019: Regional Differences in Development and Quality of Life in Hungary during the First Third of the Twentieth Century. *Hungarian Historical Review* 8 (1): 121–152.
Demeter, Gábor 2020: Estimating Regional Inequalities in the Carpathian Basin – Historical Origins and Recent Outcomes (1880–2010). *Regional Statistics* 10 (1): 23–59.
Pénzes János 2020: The impact of the Trianon Peace Treaty on the border zones – an attempt to analyse the historic territorial development pattern and its changes in Hungary. *Regional Statistics* 10 (1): 60–81. Demeter, Gábor – Horbulák, Zsolt: Regional socio-economic inequalities before and after the collapse of the Hungarian Kingdom: modernization, "magyarization" and economic exploitation from a different perspective. *Historicky časopis* 69 (5): 889–919.

For example, the proportion of persons with university degree was not recorded before 1941, neither have we GDP or income data, especially not in the required regional level of aggregation prior to WWI. Neither was life expectancy estimated and reported throughout the 20th c. Therefore, in accordance with the suggestion of Prados de La Escosura,[21] we had to rely on proxy variables to overcome this obstacle.

Life expectancy was substituted with (reversed) mortality rate, GDP per capita was substituted by income (based a proportional income tax) after 1980, and by the cumulative value of state direct taxes per capita prior to 1945, which comprised incomes from agriculture, industry and enterprises, representing all sectors of the economy (all proportional). Though the taxation system was modified twice between 1880 and 1941, the limited number of changes allow us to consider the cumulative data comparable in time. For 1960, the first sample after WWII assessing income was difficult, as published sources contained salaries differentiated at economic sectors and counties, but did not publish settlement level incomes. Therefore we had to approximate this by using county level data combined by settlement level social stratification of earners, and the estimated salaries were transformed into per capita values (**Figure 1**). Values were calculated at current prices and the problems of changes in currency, inflation, etc. were eliminated during normalization. Note, that income always refers to official incomes: incomes from household farming were not included as in certain periods of socialism earnings from outside the state-controlled economy were not allowed. Neither do post-1980 incomes include grey economy as income tax did not contain this) (for sources see: **Table 1 and 2**).

However, neither of the above indicators allow for a continuous sampling, or even if they did, such as literacy rate, their explanatory power of wellbeing changed over the 20th century. Consequently, we decided to segment our timeline into two smaller periods, one comprising 1880, 1910, 1920, 1930 and 1941, the other comprising 1960, 1980, 2000, 2020. While the territorial changes were significant in the first period influencing the economic performance and social stratification of the country, the set of available variables remained constant. This offers us an opportunity to observe the development trends and patterns during the dualistic period, and we may even compare the HDI values of the Kingdom of Hungary before and after 1920 while controlling for the border changes (**Figure 4, 5 and Figure 6**). We can assess the effect of WWI both in terms of trends and spatial patterns; 1930 can be considered as the last year before the great crisis, finally 1941 represents the last year of peace making it possible to assess the impact of the great economic crisis and the rate of recovery

[21] Prados de la Escosura, Leandro: *Improving the Human Development Index. New Estimates for Europe and its Offshoots, 1850–1990*. Manuscript.
http://www.aehe.es/wp-content/uploads/2005/10/a1_prados_de_la_escosura.pdf
Prados de la Escosura, Leandro: World Human Development: 1870–2007. *Review of Income and Wealth* 61 (2): 220–227.

(within the 1920-borders). For the period between 1880-1941 literacy rate, mortality rate and state taxes per capita were the input variables at settlement level. We used a more complex educational indicator instead of the literacy rate from 1960 on, as widely used indicator of average finished school years per person was not available for each observed census year at settlement level. [22]

Table 1. Sources and variables for settlement level HDI calculations between 1880 and 1941

Indicator	Year	Component indicator for HDI	Source (Abbreviation)
m1	1880	Halálozások átlagszáma helyett proxy: beszélni nem tudók száma (BNT) Population number (1880), towns and villages separately	KSH 1880b KSH 1880a, 1880b
	1910	Average number of deaths (1901–10) Population number (1910)	MSK Ús. 46. MSK Ús. 42.
	1920	Average number of deaths (1911–20), yearly decomposition Population number (1920)	KSH 1969. MSK Ús. 69.
	1930	Average number of deaths (1921–30), yearly decomposition Population number (1930)	KSH 1969. MSK Ús. 83.
	1941	Average number of deaths (1932–41), yearly decomposition Population number (1941)	KSH 1969. KSH 1947, 1976
m2	1880	Population able to read and write (1880) population over 6 yrs (1880), county level averages and towns Population number (1880), towns and villages separately	KSH 1880b KSH 1880b KSH 1880a, 1880b
	1910	Population able to read and write (1910) population over 6 yrs (1910) Population number (1910)	MSK Ús. 42. MSK Ús. 42. MSK Ús. 42.
	1920	Population able to read and write (1920) population over 6 yrs (1920) Population number (1920)	MSK Ús. 69. MSK Ús. 69. MSK Ús. 69.
	1930	Population able to read and write (1930) population over 6 yrs (1930) Population number (1930)	MSK Ús. 83. MSK Ús. 83. MSK Ús. 83.
	1941	Population able to read and write (1941) population over 6 yrs (1941) Population number (1941)	KSH 1976. KSH 1976. KSH 1947, 1976
m3	1881	State direct taxes (1881, o. é. Ft) Population number (1880), towns and villages separately	HSK 1881 KSH 1880a, 1880b
	1908/10	State direct taxes (AK) State direct taxes for towns (1910, AK) Population number (1910)	MSK Ús. 39. MSK Ús. 58. MSK Ús. 42.
	1924/26	State direct taxes of villages (1924/25, AK vagy inflated K) *Estimations for taxes in towns (ld. 1933/34):* Population number (1920)	NM EADS KTL 1925 MSÉ Úf. 34. Szőnyi 1940. AS 1934, MSK Ús. 86. és 99. MSK Ús. 69.
	1933/34	State direct taxes for villages (1934, P)	MSK Ús. 93.

[22] A so-called complex educational attainment index was introduced, based on the number of persons with at most high school degree and the weighted number of persons with higher education compared to the number of population aged 20 and more. Source: PÉNZES, J. - PAPP, I.- APÁTI, N.- KISS, J. P. 2023: Border areas and educational attainment – Long-term analysis of Hungary for the period between 1960 and 2022. – DETUROPE, 15 (2): 109–128. DOI: 10.32725/det.2023.015

Indicator	Year	Component indicator for HDI	Source (Abbreviation)
		Data for towns:	
		· Landtax on towns (1933/34, P)	AS 1934: 51.
		· Tax on household rentals in towns (1933/34, P)	AS 1934: 77.
		· tantième tax and tax on profit rate of enterprises in towns (1933/34, P)	AS 1934: 149.
		· Total landtax (1933/34, P)	AS 1934: 51.
		· Net cadastral income of towns (1935, AK)	MSK Ús. 99.
		· Values of houses (1933/34, P)	AS 1934: 82.
		· Raw values of household rentals in towns (1933/34, P)	AS 1934: 83.
		· tantième tax and tax on profit rate of enterprises in towns (1933/34, P)	AS 1934: 149.
		· Earners in industry, trade and transports (1930)	MSK Ús. 86.
		Population number (1930)	MSK Ús. 83.
	1940/41	State direct taxes (1940, P)	MSK Ús. 115.
		Taxes paid by towns:	
		· Landtax paid by towns (P)	AS 1941: 28.
		· Tax on household rentals paid by towns (P)	AS 1941: 42–43.
		· tantième tax and tax on profit rate of enterprises in towns (P)	AS 1941: 172–173.
		Population number (1941)	KSH 1947, 1976

Table 2. Sources and variables for settlement level HDI calculations (1960 – 2020)

Indicator	1960	1980	2001	2022
Death rate at settlement level	Klinger A. – Acsádi G. – Salamon L. –Varga L. (1969): A népmozgalom főbb adatai községenként 1901-1968. Statisztikai Kiadó Vállalat, Budapest	KSH census https://statinfo.ksh.hu/Statinfo/QueryServlet?ha=TB2022	KSH census https://statinfo.ksh.hu/Statinfo/QueryServlet?ha=TB2022	KSH census https://statinfo.ksh.hu/Statinfo/QueryServlet?ha=TB2022
M2a – population above 20 yrs M2b population with degree or matriculation at settlement level	KSH census TeIR historical database	KSH népszámlálás https://statinfo.ksh.hu/Statinfo/QueryServlet?ha=TB2022	KSH népszámlálás https://statinfo.ksh.hu/Statinfo/QueryServlet?ha=TB2022	KSH népszámlálás https://statinfo.ksh.hu/Statinfo/QueryServlet?ha=TB2022
M3 – income tax per capita at settlement level (for 1960, calculated)	Bács-Kiskun megye fontosabb statisztikai adatai (1962): Központi Statisztikai Hivatal, Kecskemét (minden megyére) + Budapest statisztikai zsebkönyve (1962)	PM-APEH, + NAV base data KSH	PM-APEH, + NAV base data KSH	PM-APEH, + NAV base data KSH

Some methodological results (byproducts of research):

Table 3. Correlation between HDI values as evidence for the speed of transformation patterns decreasing after 1960 and that spatial patterns significantly change after 30 years (a confirmation of Egri's hypothesis on postwar pattern stability using different postwar data):

	HDI-1960	HDI-1980	HDI_2001	HDI_2022
HDI-1960	1	0.650**	0.590**	0.473**
HDI-1980	0.650**	1	0.876**	0.633**
HDI_2001	0.590**	0.876**	1	0.806**
HDI_2022	0.473**	0.633**	0.806**	1

Table 4. Correlation between HDI values as evidence for the speed of transformation patterns decreasing after 1910 and that spatial patterns significantly change after 30 years (a confirmation of Egri's hypothesis after 1945 on data prior to 1945)

	HDI 1880	HDI 1910	HDI 1920	HDI 1930	HDI 1941
HDI 1880	1	0.589**	0.468**	0.477**	0.351**
30 yrs					
HDI 1910	0.589**	1	0.728**	0.757**	0.643**
HDI 1920	0.468**	0.728**	1	0.704**	0.593**
HDI 1930	0.477**	0.757**	0.704**	1	0.763**
HDI 1941	0.351**	0.643**	0.593**	0.763**	1

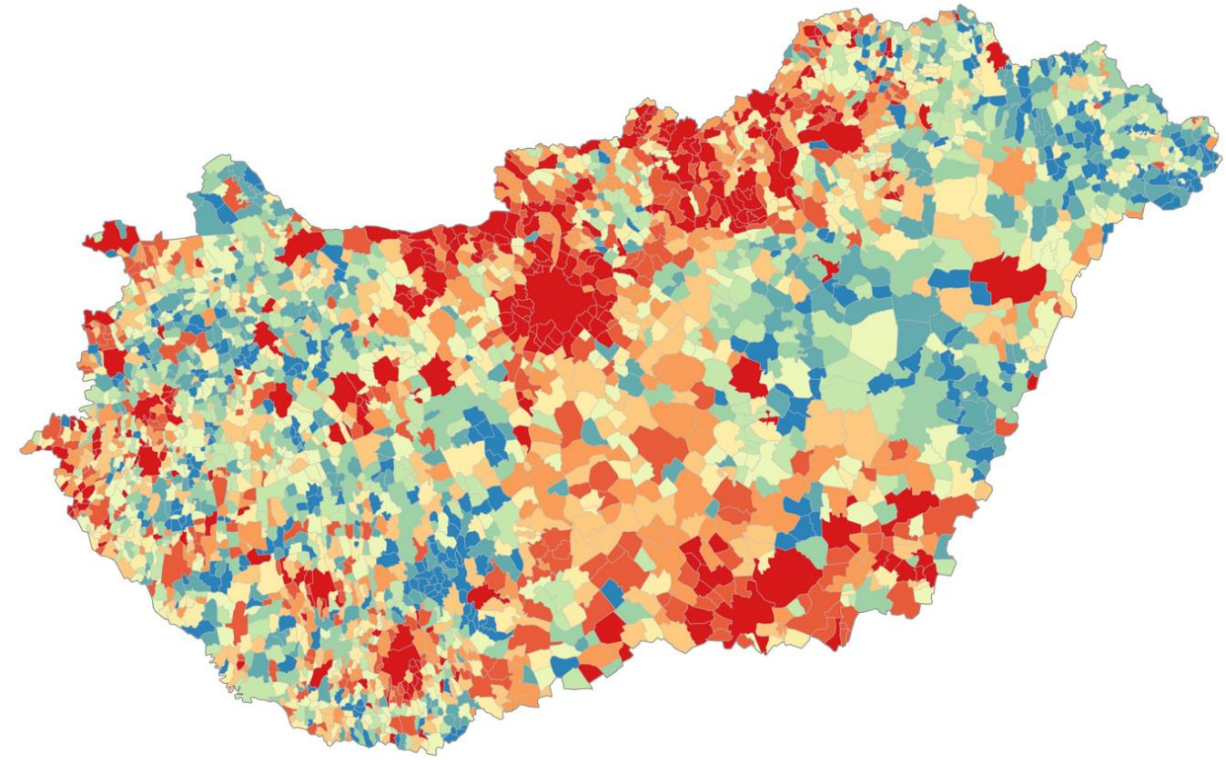


Figure 1. Estimated settlement level income data per capita in 1960, calculated from settlement level sectoral stratification and county level average salaries compared to the present population of settlements (decile value)

The second segment included the consolidation of the Kádár-regime (represented by 1960), the last years of the new economic mechanism just before the state entered into the spiral of indebtedness (1980 – with income data from 1988, just before the collapse of the regime). 2000 represents the transition to market economy, an early recovery stage of the economy, while 2020 symbolizes Hungary as an integrated market economy in EU after the crisis in 2008,[23] but before experiencing the economic effect

[23] We may add 2010 in future research.

of the COVID epidemics. For these two periods, each ranging to 60 years, income per capita, mortality rates and the proportion of persons with degree or certificate from secondary schools were adjusted to assess historical HDI.

In the end of the study, we also offer a possible solution how to connect the two periods as not only the indicators are different, but simple merging causes unexpected fall in the national average of HDI by 1960 compared to 1941, the reality of which is implausible.

To calculate HDI for each time horizon the three variables were normalized for each settlement, then unweighted average was calculated.[24] HDI was analyzed from spatial and temporal aspects too. The analysis of spatial patterns caused some inconvenience as many settlements were attached to another, or detached from the original during this 150 years, and we even had settlements with no data for one or more time horizons For temporal comparisons and calculations therefore we used the largest common set of settlements for all time horizons, ranging altogether to 2500 entities between 1880 and 1941, whereas for static visualization on maps, to trace patterns, data on all settlement from the given time horizon was used (this could go up to 3200). For the visualizations of dynamism (to trace shifts in cores and peripheries or analyze the stability/transformation of patterns) again the common set of settlements was used.

Discussion 1. Positioning Hungary's HDI according to former, country-level aggregates (Figure 2 and 3).

Former literature estimated the Hungarian HDI between 0.43 and 0.46 for 1913, arriving at an extremely low value for 1870, the beginning of the dualistic period. The latter estimates must have been based on secondary data, as there are no settlement level data series for literacy and mortality in 1870. Béla Tomka puts the national average HDI below 0.5, slightly worse than estimated for Austria and Italy, but overtaking Finland (0.45).[25] Prados de la Escosura (2005)[26] reports an 0.7 value for 1950 – again based on aggregated data, since the 1949 census in Hungary does not allow us to calculate district, or settlement level incomes. Long term trends suggested that Hungary was catching up Austria by then, however, the gap between the two countries were increasing in the Interwar period, whereas the gap between Hungary and the western world was decreasing. Looking at a third calculation in hiHD a continuous rise is indicated with seemingly no effect of the world economic crisis or WWI and the

[24] We also tried weighting by the population of the settlement.
[25] Tomka Béla 2023 (2010): Életminőség és történelem. In: Tomka, Béla *Korszakok és korszakhatárok*. Budapest, 62–74.
[26] Prados de la Escosura, Leandro 2005: *Improving the Human Development Index. New Estimates for Europe and its Offshoots, 1850–1990*. Manuscript.
http://www.aehe.es/wp-content/uploads/2005/10/a1_prados_de_la_escosura.pdf

border changes. Hungary's values in 1870 were similar to that of the Balkans reaching only half of West Europe's values. By 1938 the gap slightly decreased, and Hungarian HIHD value reached 80% of the western score, while there was a remarkable divergence between Balkan and Hungarian values.

While these calculations and estimations evaluate Hungarian performance in an international context, these cannot reflect on intraregional diversity. Furthermore, we had a presumption that the consequences of great world crises should somehow appear on the timeline contrary to the monotonous trends suggested by Figure 2 (lacking comparative date) and Figure 3.

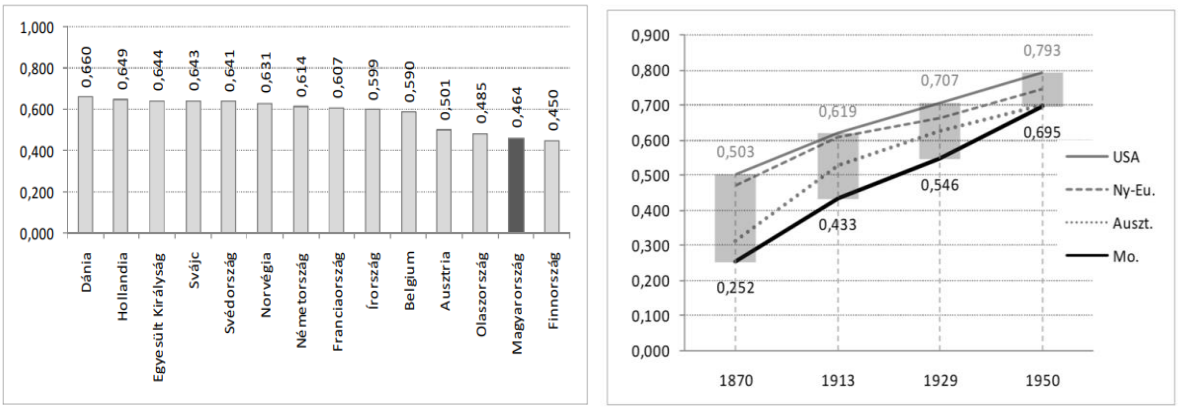


Figure 2. Former HDI estimations, based on national averages (Tomka, 2011: 191; Prados 2005: 25.)

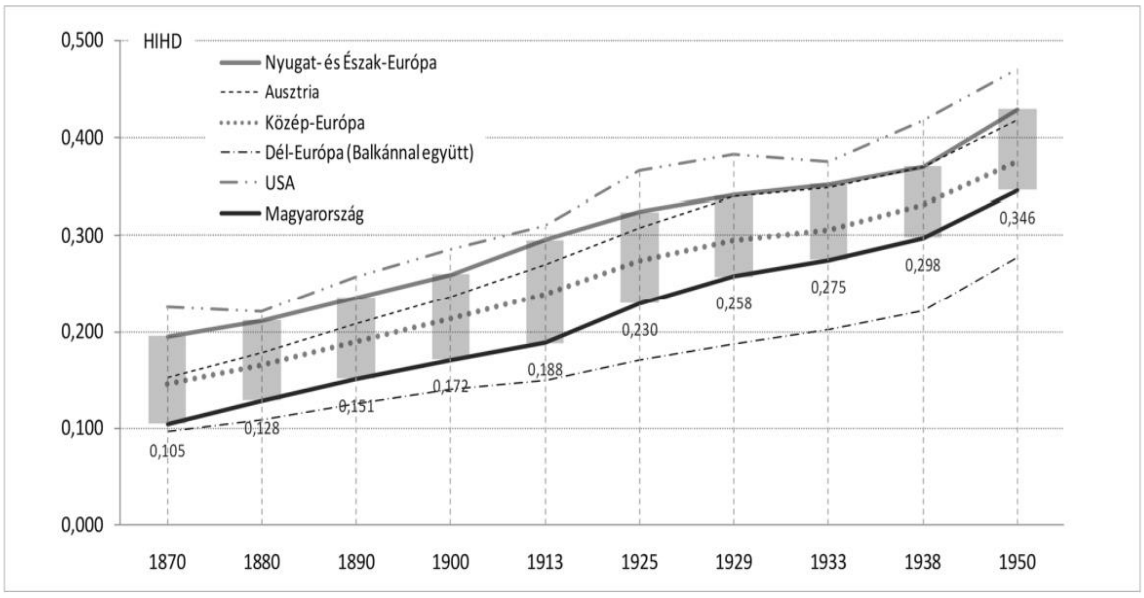
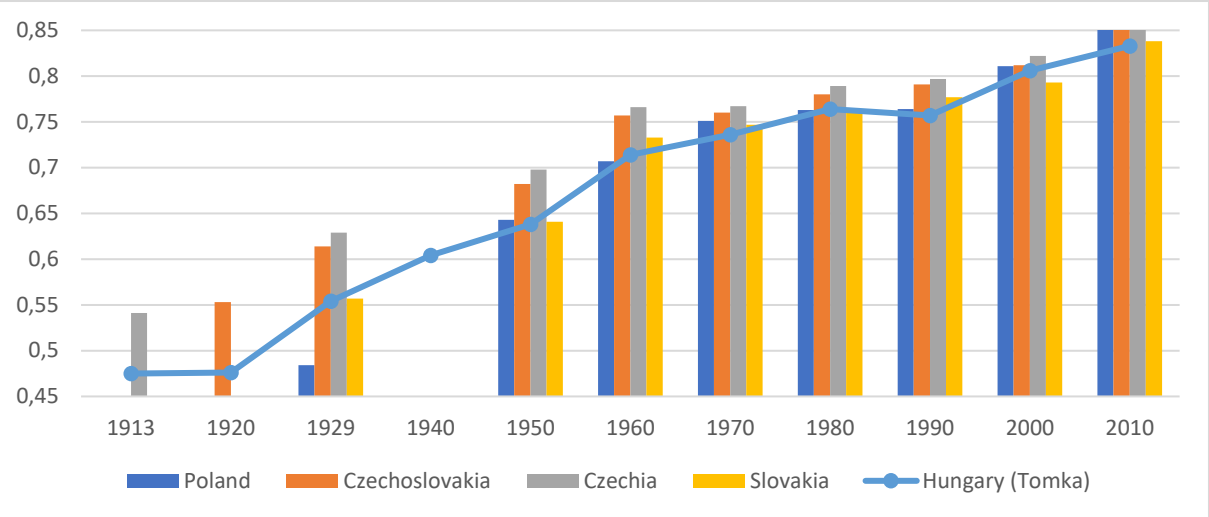


Figure 3. Trends of historical HDI in Hungary in international comparison (WHD 1870-2015)



Country level aggregated HDI for Hungary and its neighbors by Holubec and Tomka 2023

Discussion 2: Regional inequalities and development trends in the Dualist State. The Kingdom of Hungary compared with the area of post-1920 Hungary between 1880-1910 (Figure 4, 5 and 6)

The historical HDI for 1910 that we calculated at the settlement level closely aligns with Tomka's estimates, allowing us to be reasonably confident in the quality of our data — both for assessing regional variation and for analyzing temporal trends (**Figure 4**). Our 1880 estimates are notably lower, but not as low as those reported by Prados de la Escosura (2005). The data enable us to compare the trajectory of the entire Kingdom of Hungary with that of the territory within its post-1920 borders. This breakdown for 1880 and 1910 is especially important because subsequent analyses are confined to the post-1920 area, and the HDI can be sensitive to the size of the dataset. Furthermore, by comparing these "two Hungaries"—the Kingdom as a whole and its post-1920 territory—we can draw general inferences about the respective levels of development in the geographical core and periphery (**Figures 5 and 6**).

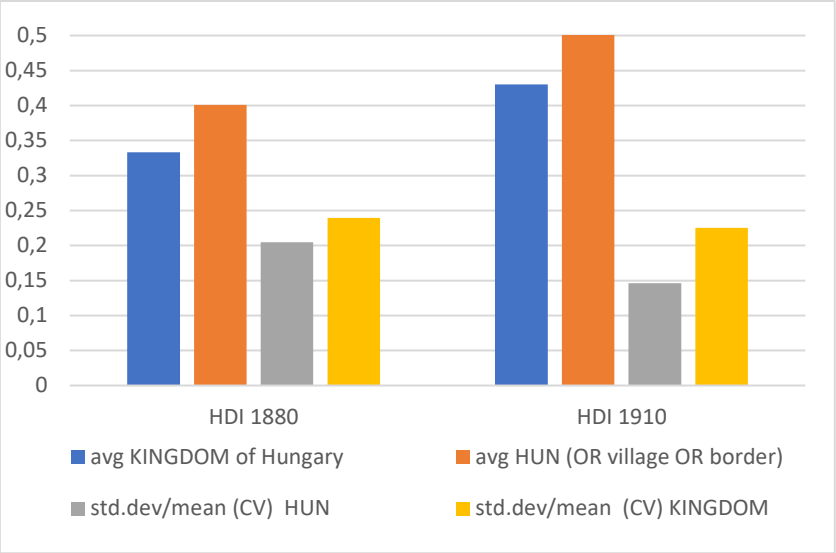


Figure 4. A comparison of HDI and the relative standard deviation (coefficient of variation) for the whole territory of the Kingdom and on the area with post 1920-borders (1880 and 1910)

It is evident that both in 1880 and 1910 the area of Hungary within the post 1920 borders was more developed than the area of the whole country. Despite the general growth of 29%, the HDI in the post-1920 area also grew by 27% thus the rest of the country could not catch up with the economic (and physical) core. In fact, the territorial pattern shows that some of the peripheries in 1880 even faced a further decline by 1910 (Zakarpattya, West-Transylvania), despite the overall increase in HDI in the peripheries. This invoked that while the coefficient of variation (std.dev./mean) in the core (in the post-1920 territories) were not only smaller, compared to the Kingdom's average, but decreased further, which resulted in decreasing inequalities there, the whole Kingdom showed stagnation in this respect, which means that inequalities outside the 1920-borders even grew. In other words, the areas detached from the country were peripheral and not only in physical geographical sense but were backward in fact both in 1880 and 1910. These thirty years represented a dynamic and positive era compared to next 30 years with its oscillations (**Figure 5 and 6**).

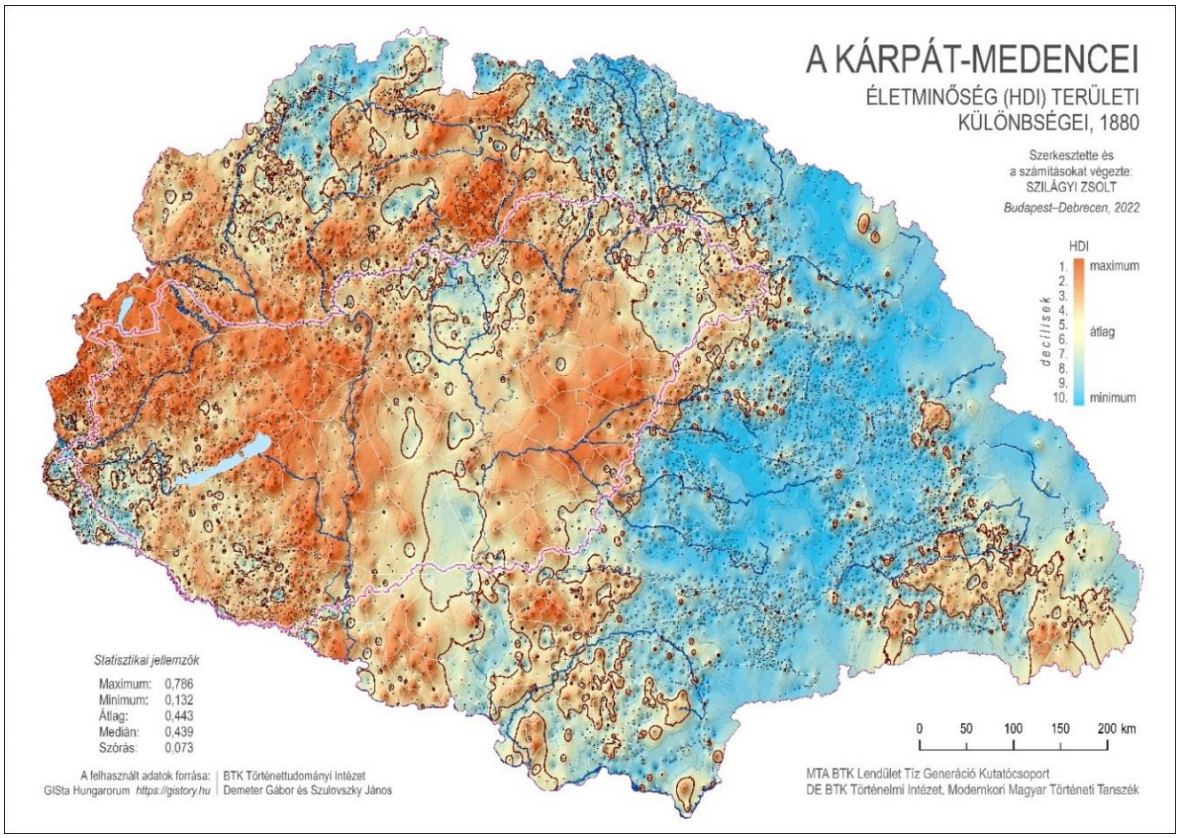


Figure 5. Regional differences in historical HDI values in the Kingdom of Hungary in 1880 (interpolated model)

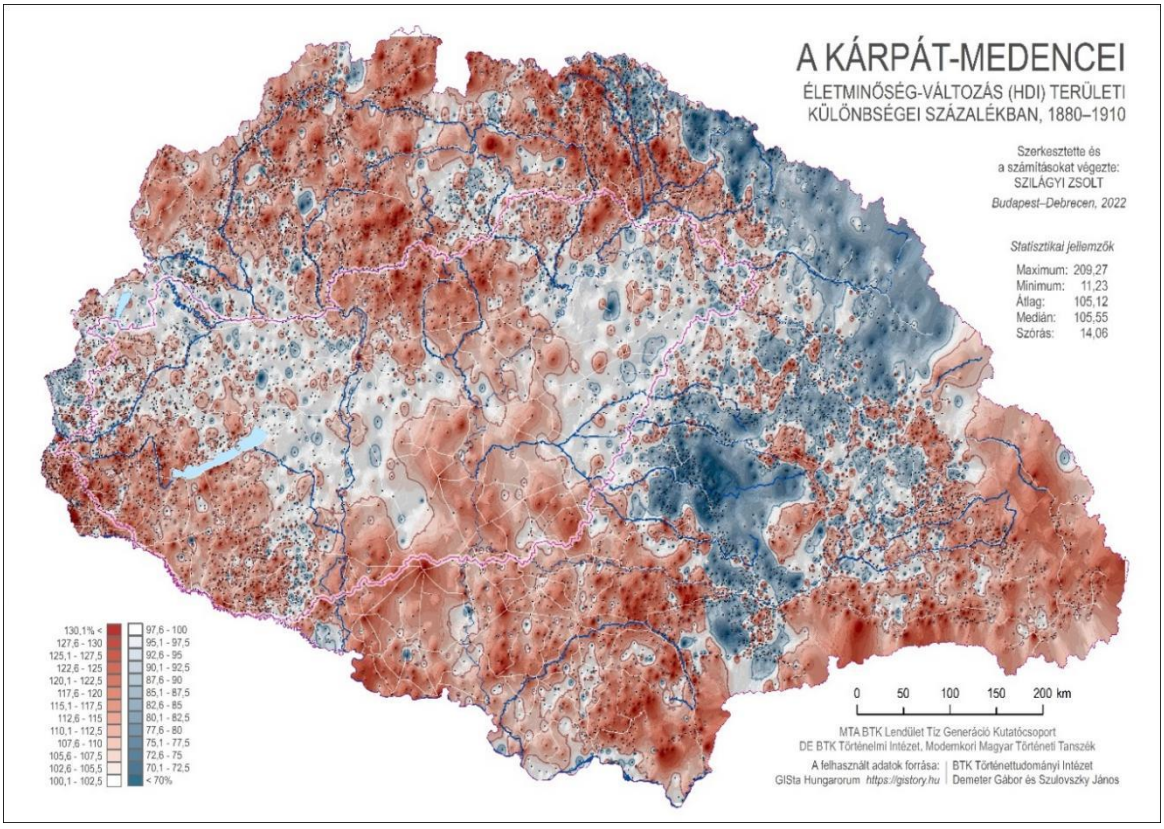


Figure 6. Regional differences in historical HDI values in the Kingdom of Hungary illustrating the changes of HDI values expressed in % (interpolated model)

Discussion 3: Trends between 1880 and 1940 (post-1920 borders) (Figure 7 and 8)

Contrary to the former results in literature our data – aggregated from settlement level data (we even controlled the findings with HDI weighted by population number) – suggest that there was a drop back in the 1920s, which affected towns the most. The ratio between the highest and lowest 500 (20% of settlements)[27] settlement-level values did not change remarkably between 1910 and 1920, however there was a closing up between the most and least developed between 1880 and 1910. The latter can be observed in towns and villages too and the drop back by 1920 was general in all subsets, not only in the border regions. The values of the border regions (a 30 kms wide stripe containing 1300 settlements, half of the total) were not different from that of the national average or of the villages, therefore we did not indicate the latter two separately on charts. By 1930 we experienced a convergence between the most developed 20% of the settlements and the most backward 500, which was turning into divergence between 1930 and 1941, probably reflecting the effect of the great economic crisis. HDI increased in the 45 larger towns more than the national average, however due to their relatively small number, this did not cause divergence between the top 500 and bottom 500 settlements in the unweighted model. The average HDI of the bottom 500 was increasing quickly between 1920 and 1930 referring to recovery phenomena, frequent after cataclysms. By 1941 the HDI of the bottom 500 fell back (this decline was larger expressed in % compared to the fall in urban HDI values), but was still a bit higher than in 1910, while urban HDI or the values of the top 500 did not reach the 1910 values in 1941 (while they even exceeded them in 1930). The country-level HDI was thus similar to the 1910 values, and this contradicts to previous findings **in Figure 2 and 3**).

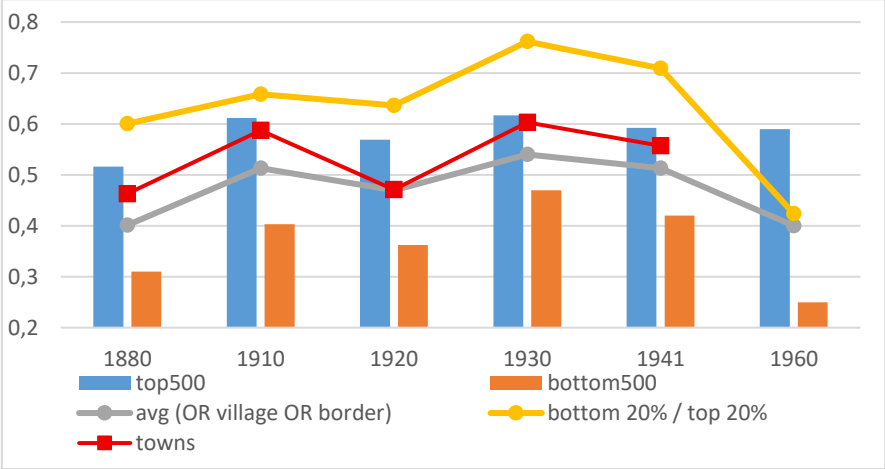


Figure 7. Average historical HDI in different sets of settlements aggregated from settlement level values (1880-1941)

[27] We used 600 settlements after 1960 to estimate HDI for the lowest and highest 20%.

The last column also draws the attention to a methodological problem partially resolved later, that data from 1960 cannot be linked directly to prewar data due to the change in measuring education and incomes. (And we were unable to calculate HDI for 1949)

In order to check the internal heterogeneity of the different subsets, std. dev. values were divided by the average. Relative deviation decreased between 1880 and 1910 for the full sample of settlements (using post-1920 boundaries), this even decreased between 1920 and 1930 and heterogeneity began to grow after the great economic crisis. This is true for the border regions and villages as subsets too. In the case of towns there was no remarkable homogenization during the dualist era, but after then, the relative deviation began to decrease, even by 1920 (while the st.dev/mean value even increased in the country). Trends reversed and inequalities increased after 1930 in the towns similarly to the villages. (The shift of the national average is not due to the effect of towns as samples were not weighted by population number, thus the 45 urban centres here were unable to influence the total values).

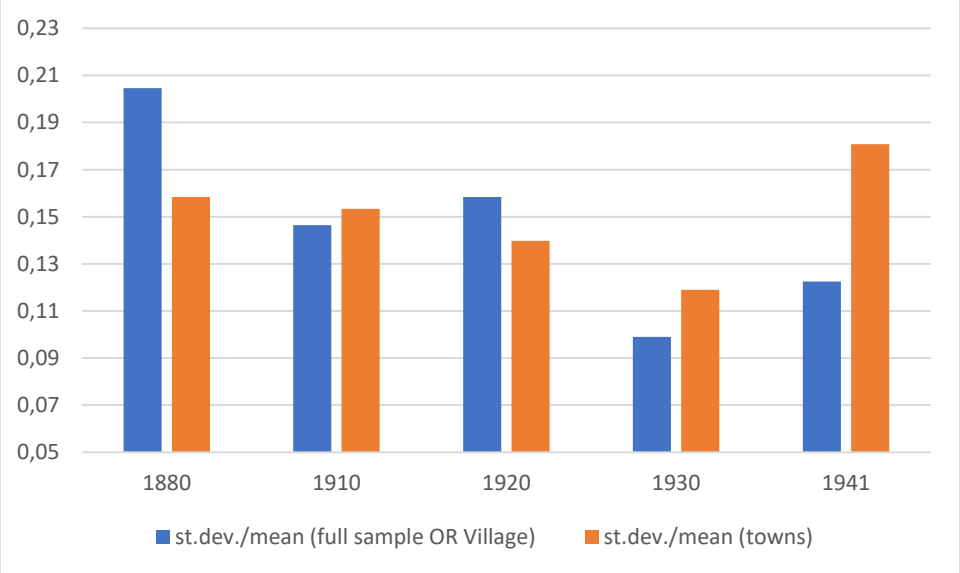


Figure 8. Relative deviation values (1880-1941) for different subsets

Discussion 4: Trends of components of HDI (Figure 9 and 10)

The general global phenomena (such as WWI or the great economic crisis) can explain the fluctuating trends, but which components of the HDI were affected the most? This subchapter tries to follow up the changes of the three constituents of HDI between 1880 and 1941.

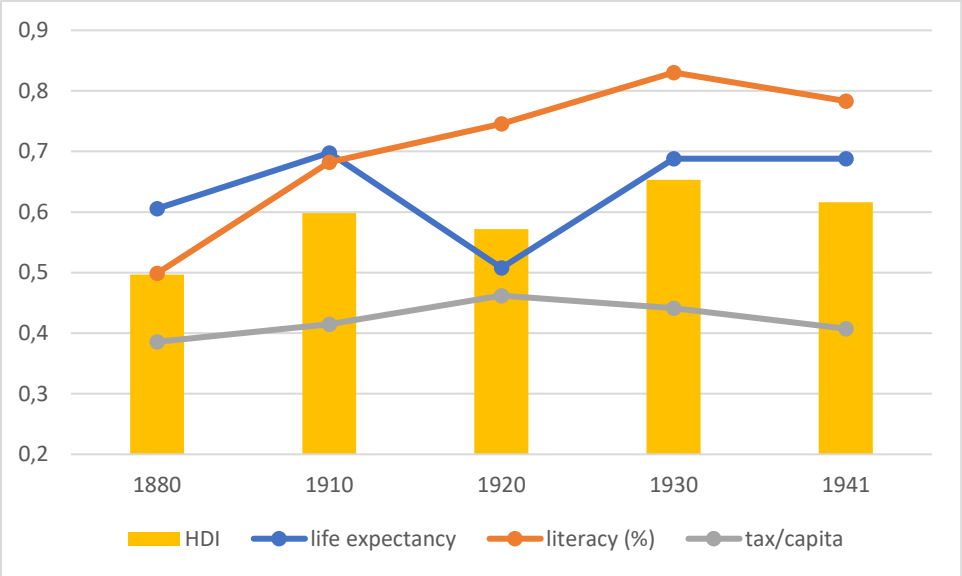


Figure 9. Trends of HDI-components (1880-1941)

Normalized average income values were the lowest throughout the period (in fact, checking their histogram would suggest that it showed the greatest inequalities too), whereas life expectancy fluctuated the most, falling back by 1920 (increased mortality due to Spanish flu) then recovering again. The great increase in HDI between 1880 and 1930 was mainly owing to the increase in literacy rates, secondly to increasing health conditions and least to slowly rising material welfare. Contrary to our expectations normalized average values of tax/capita values did not fall back right after WW1, continued to increase. Whereas the relative level of incomes decreased in 1930 and it lasted even to 1941, as a consequence of the crisis, increasing life expectancy and educational levels compensated for this in 1930. The growth rate of overall HDI between 1920 and 1930 was even higher than the yearly rate in 1880-1910, when 30 years resulted in a 30% increase (this was almost 20%. However, this was due to the dropback and recovery in 1920 – the rate of increase between 1910 and 1930 was only 10% in 20years.

Although life expectancy in 1880 was slightly higher across the entire Kingdom of Hungary compared to the postwar territory in 1880, this trend reversed by 1910. Literacy rates were consistently higher in the country's central regions from 1880 onwards; however, the overall average literacy for the entire kingdom increased at a faster pace than in the core, leading to a reduction in regional disparities in this regard. A notable shift is observed in average income: while incomes were nearly equal in 1880, by 1910 settlements located within the post-1920 borders outperformed those outside these borders.

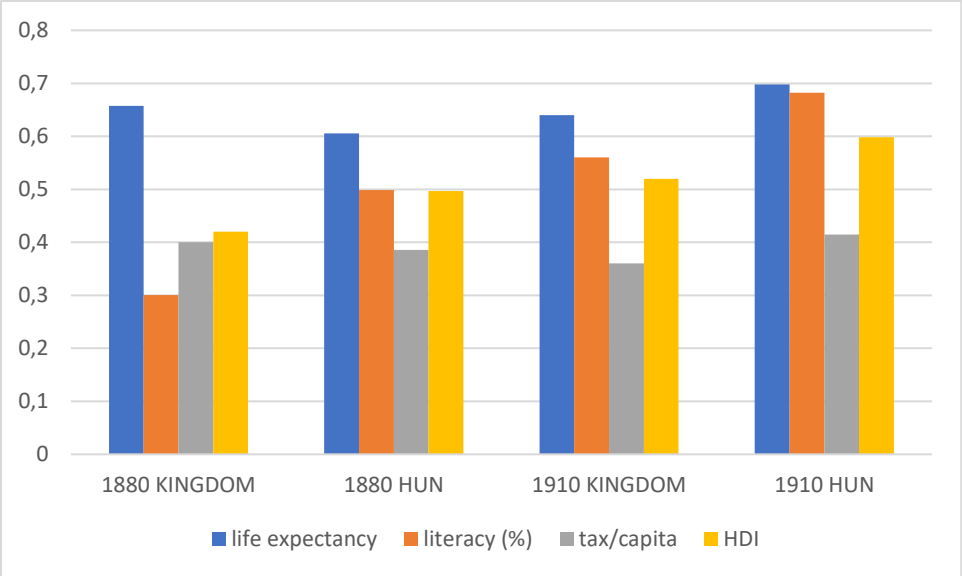


Figure 10. A comparison of the three constituents of HDI in the territory of the Kingdom and the within post-1920 borders (1880-1910)

Discussion 5: Spatial patterns between 1880 and 1940 (post-1920 borders) (Table 5 and 6, Figures 11-17)

Some further thoughts should be addressed to the question of regional differences and the general situation of the border regions focusing on the Interwar period. It was Transdanubia where the urban HDI decreased the most between 1910 and 1941, though, among towns, still the Transdanubian towns were the most developed. The 19 urban settlements of the Northern Mts. were catching them up. Contrary to the situation in the towns, Transdanubian villages were characterized by increase in HDI as well as all other villages, but the latter were unable to catch up with Transdanubian villages. These were characterized by better HDI values even in 1910 and in 1941 too, than towns in the plains, and the gap between Transdanubian villages and towns was shrinking. Villages of the Plains remained the least developed despite their greater rate of increase in terms of HDI (compared to the HDI growth in Transdanubian villages). Villages in the Northern Mts. produced the greatest advance in HDI values in these years. Within group differences among villages were diminishing (st. dev. decreased), while in the case of towns a regionally diverse situation was observable in this respect (Table 5.).

While there was a significant difference between border regions and core regions regarding the state direct tax per capita values in towns, already in 1910, with a gap even increased by 1941, the difference between the villages in border and non-border regions was less explicit. However, the difference between towns and villages increased remarkably in both areas (Table 6).

Table 5. Territorial (regional) breakdown of urban and rural HDI values, 1910 and 1941

Category	settlements	Avg. HDI		St.dev.		Coefficient of variation (x100)		difference in CV, %)
		1910	1941	1910	1941	1910	1941	1941–10
Towns according to 3 major regions								
Plains (without Budapest)	*75*	*0.518*	*0.525*	*0.06*	*0.062*	*11.653*	*11.844*	***1.6***
Transdanubia	58	0.588	0.567	0.068	0.054	11.622	9.55	**–17.8**
Northern Mts.	19	0.544	0.560	0.059	0.061	10.803	10.975	**1.6**
Villages according to 3 major regions								
Plains	693	0.471	0.495	0.079	0.059	16.773	11.895	**–29.1**
Transdanubia	1 707	0.542	0.548	0.066	0.047	12.107	8.596	**–29.0**
Northern Mts.	537	0.489	0.519	0.064	0.05	13.097	9.708	**–25.9**
Settlements together								
Towns (without Budapest)	*152*	*0.548*	*0.546*	*0.071*	*0.063*	*13.01*	*11.473*	***–11.8***
Villages	2 937	0.515	0.531	0.076	0.055	14.671	10.456	**–28.7**

Considering HDI, the situation was different. The development level of towns and villages along the border did not increase by 1941 and the same was true for the towns and villages in rest of the country. The HDI values in the geographic center were better, but this was not the consequence of the new borders in 1920, as already in 1910 there was a significant difference especially between (future) border towns and the rest. The difference also existed in 1910 in the case of state taxes, and both towns along the border region and towns in the center showed a 30% increase in state taxes per capita between 1910 and 1941, while villages stagnated. Thus a divergence between towns and villages was about to evolve both in the border region and in the core zone, whereas considering HDI there was a convergence observable in both regions. This points to a great increase of literacy rates and longevity in rural environments (Table 6).

Table 6. Territorial breakdown of urban and rural HDI values in 1910 and 1941 in birder regions and the central area

Settlement type	Along the border max. 25 kms depth				Rest of the country more than 25 kms from border			
	1910	1941	difference		1910	1941	difference	
			value	1910=100			value	1910=100
State tax in P								
Towns	*11.63*	*15.15*	***3.52***	***130.3***	*16.12*	*22.07*	***5.95***	***136.9***
Villages	7.24	6.93	**–0.30**	**95.8**	7.65	7.5	**–0.15**	**98.1**
HDI								
Towns	*0.569*	*0.577*	***0.009***	***101.5***	*0.625*	*0.609*	***–0.016***	***97.4***
Villages	0.507	0.524	**0.017**	**103.3**	0.523	0.537	**0.013**	**102.6**

Spatial patterns on maps

Nonetheless, the main idea to use settlement level data was not only to make distinction between different subsets of settlements, but to trace the above mentioned phenomena on maps illustrating territorial patterns. First a series of maps illustrating the situation for 1910, 1920, 1930 and 1940 are introduced (Figure 11), which allow us to demonstrate regional differences, then, to highlight the dynamics of territorial processes, these static maps (more properly, the settlement level HDI values) were divided by each other.

Let's see the patterns first. Between 1880 and 1910 there were two significant changes: southern Transdanubia, characterized by low HDI values (especially to northern Transdanubia) was catching up quickly by 1910. The same process took place in the southern part of the Plains also characterized by low values in 1880. These regions showed the greatest dynamics, but the whole territory of (future) Hungary was characterized by general increase regarding HDI values. The reason, which indicator of the three composing the HDI is responsible for the growth is not analyzed here, but the structure of the database would allow us to visualize this too.

It is important to emphasize regarding the debate on the origin of todays' peripheries in Hungary, that the dropback in N-Borsod or in Szatmár already began between 1880 and 1910, so it is not the consequence of the border changes in 1920 (Košice)! Other regions, like the Central-Tisza area, also considered peripheral nowadays, did really originate their birth from the 1920s, but this has nothing to do with border changes, as it was located in the middle of the country. And certainly we have some constant peripheries like southern Zala (from 1330 on!!)[28] or the Nyírség. The Danube-Tisza Interfluve was constantly among the backward regions, despite the closeness of Kecskemét and even of Budapest. The effect of the latter was significant on its close surroundings including the region of the Danube Bend from 1930 on, which became a touristic destination in the Interwar period (painters). The impact of new centers of heavy industry, Salgótarján and Ózd also be traced from 1930 on.

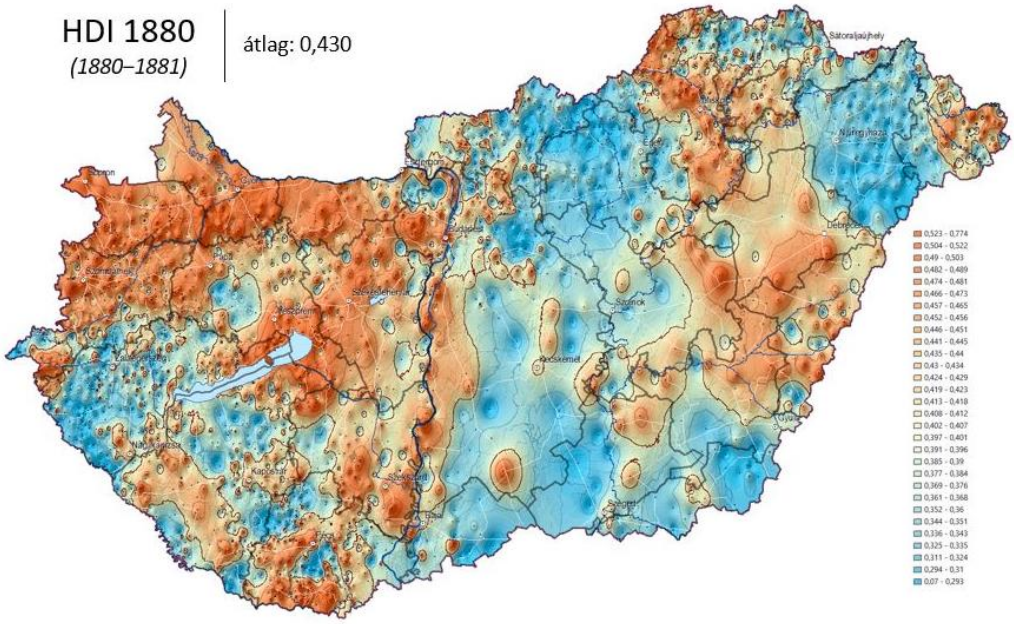
While between 1880 and 1910 there was a general growth of HDI in the whole country, though regional rates were different (it was Győr in the west and Szatmár and southern Bihar in the east with the smallest rate of increase well before the establishment of the new borders!), between 1910 and 1920 a general dropback was characteristic in the whole country. The central plains were affected the most – especially Hajdú and the

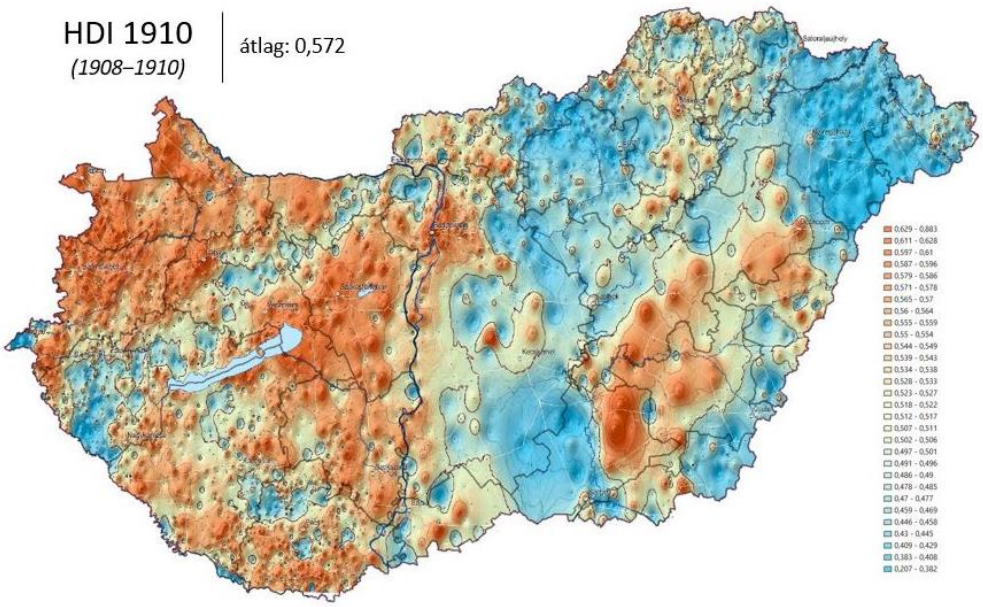
[28] See the papal tithe values per area calculated by Romhányi Beatrix: A Historical Geographical Atlas of the Medieval Kingdom of Hungary (11th-16th century). Budapest, Martin Opitz, 2023;
Demeter, Gábor–Papp, István–F. Romhányi, Beatrix–Pénzes, János 2023: Long-term study of territorial inequalities at settlement level in the territory of the historical Hungary and its successor states, 1330–2010 (I.), A területi egyenlőtlenségek településszintű vizsgálata a történeti Magyarország és utódállamai területén, 1330–2010 (I.) *Területi Statisztika*, 63(3): 271–299; DOI: 10.15196/TS630301

Nagykunság. Together with Moson (the gate to Vienna) and Szigetköz in the west (all leading crop producers) we may assume the collapse of the joint market as a driving process behind this. However, the tax income per capita did not suffer from a large dropback at country scale (Figure 9), contrary to life expectancy, as we mentioned, but a regional, settlement level breakdown of this confirms our theory – tax incomes contracted in the mentioned regions (Figure 16). It is also not surprising that the HDI of western borderland fell – partly because of the unsettled borders (Lajtabánság) and partly because of the loss of communication lines towards Vienna and the local small markets. Despite the dropback, this region was still developed enough to keep its relatively good position within the country. The southern border zone along the Drava also began to decline, but it is not the consequence of losing neighbouring urban centres. Croatian towns of the other side of the Drava river did not exert attraction on Hungarian agrarian villages located there, however after 1920 daily wage agrarian labor on large estates in Croatia also became impossible, which had negative effect on the population. However, these changes in the southernmost regions can be traced back before 1910, and this may be reasoned by the collapse of wine-producing in Villány Mts. caused by phylloxera.

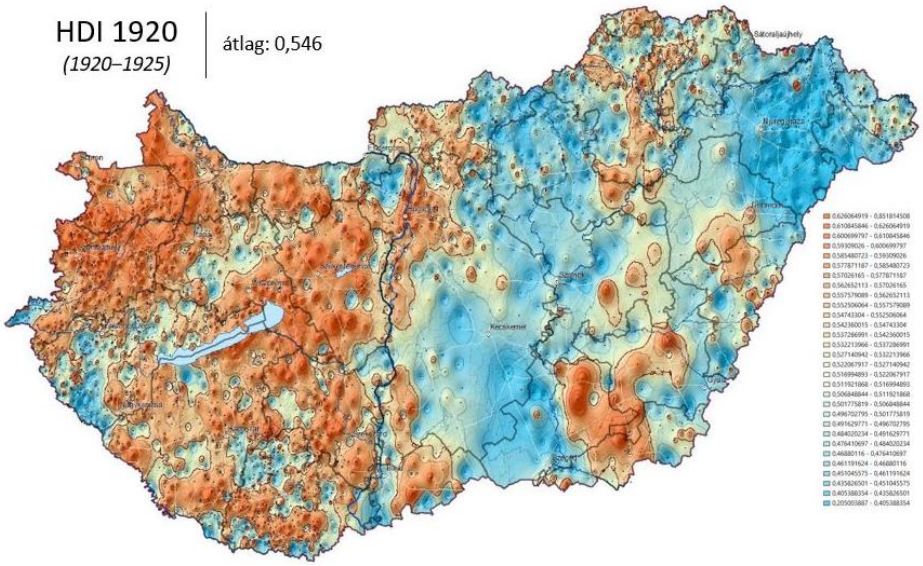
Between 1920 and 1930 general increase was observable in the country, however the map reveals, that in Transdanubia most of the settlements stagnated or declined. The Plains, suffering between 1910 and 1920, on the contrary, gained impetus again, and a significant recovery can be observed not only in the very regions of the dropback in the previous decade (partly driven by incomes increasing again – Figure 17), but the values of the formerly backward Nyírség also began to increase due to modernization in the agriculture increasing life expectancies and better education implemented in the scattered „tanya" by Klebelsberg. In the northern mountainous region one might easily locate the new industrial centers on the map based on their dynamics. However, their attraction to their larger surrounding is barely traceable then. Ózd (a village that time) can be good example of deconcentrated industrial developments with considerable spatial effect on HDI (see the iron factory in Borsodnádasd). Finally, the last map illustrating the changes between 1930 and 1941 refers to a general decrease in the HDI covering the whole area of the country despite that the national average showed only a moderate decline. The uniform pattern of this last map refers to a general, (not internal) problem: as the map illustrating the changes between 1910 and 1920 can be driven back largely to the effect of the WWI itself, this one illustrate the omnipresence of the great economic crisis. The HDI in the central parts of the plains declined, while other regions with lands of better quality or dominated by large estates managed to overcome the crisis with smaller losses compared to the declining region along the Tisza river. The central, radial structure of the railways and roads and all communication lines (incl. markets and exports) did not help (and does not help even now) the recovery of this SW-NE stripe without internal connections far from Budapest and larges towns

that could attract them (Szolnok was insignificant then, a result of socialist urban planning). Shrinking grain prices (income per capita) again might be the cause of the sad picture, but figure 17b reveals that changes in state income per capita explain the decline only partially. There is a decrease in southern Transdanubia (see Zala), which means that its closing to the developed regions between 1880 and 1910 was finally eliminated. Even the Sajó-axis in the north with its heavy industrial complex showed a remarkable decrease (Rudabánya, Diósgyőr), which highlights why the Cserehát area (in northern Borsod-Abaúj), losing Košice as urban center and turning towards Miskolc was losing ground too.

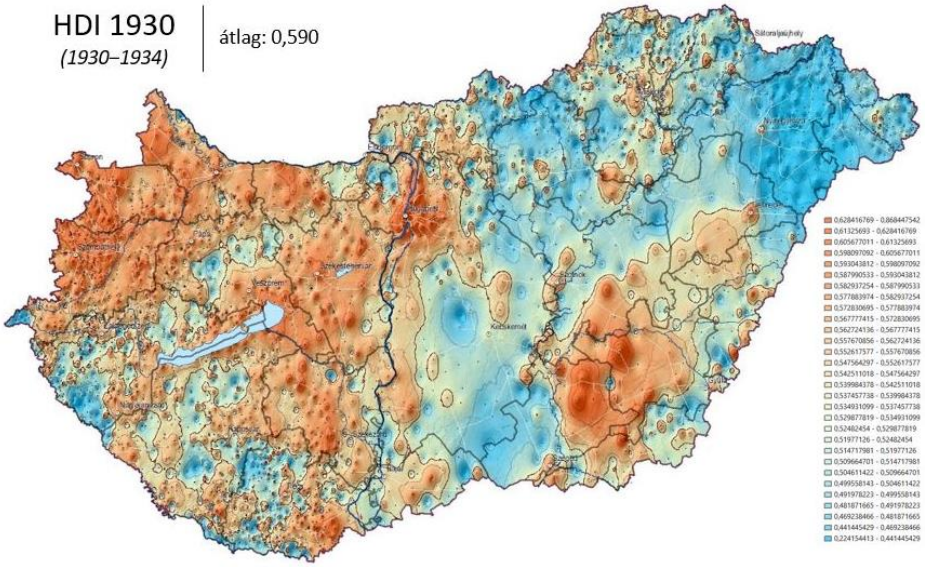




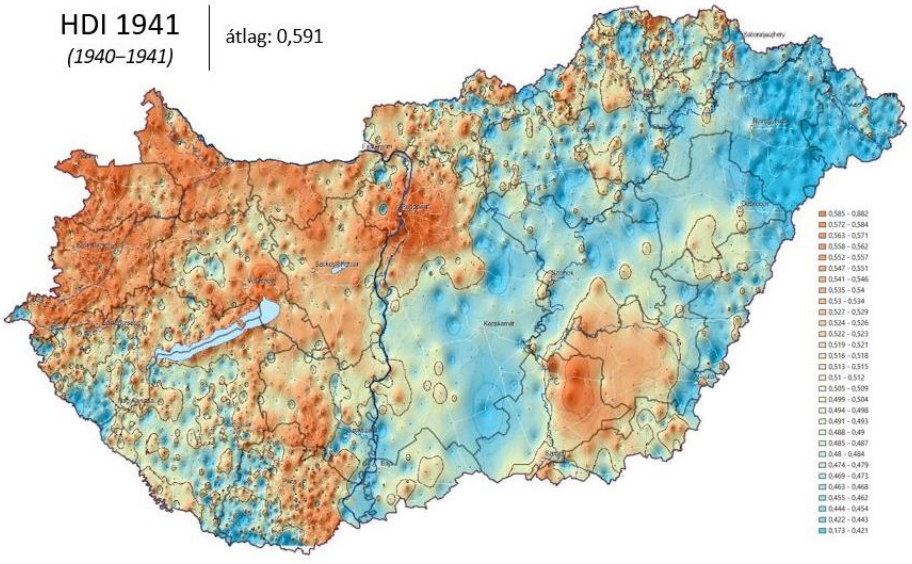
HDI 1920
(1920–1925)
átlag: 0,546



HDI 1930
(1930–1934)
átlag: 0,590



HDI 1941
(1940–1941)
átlag: 0,591



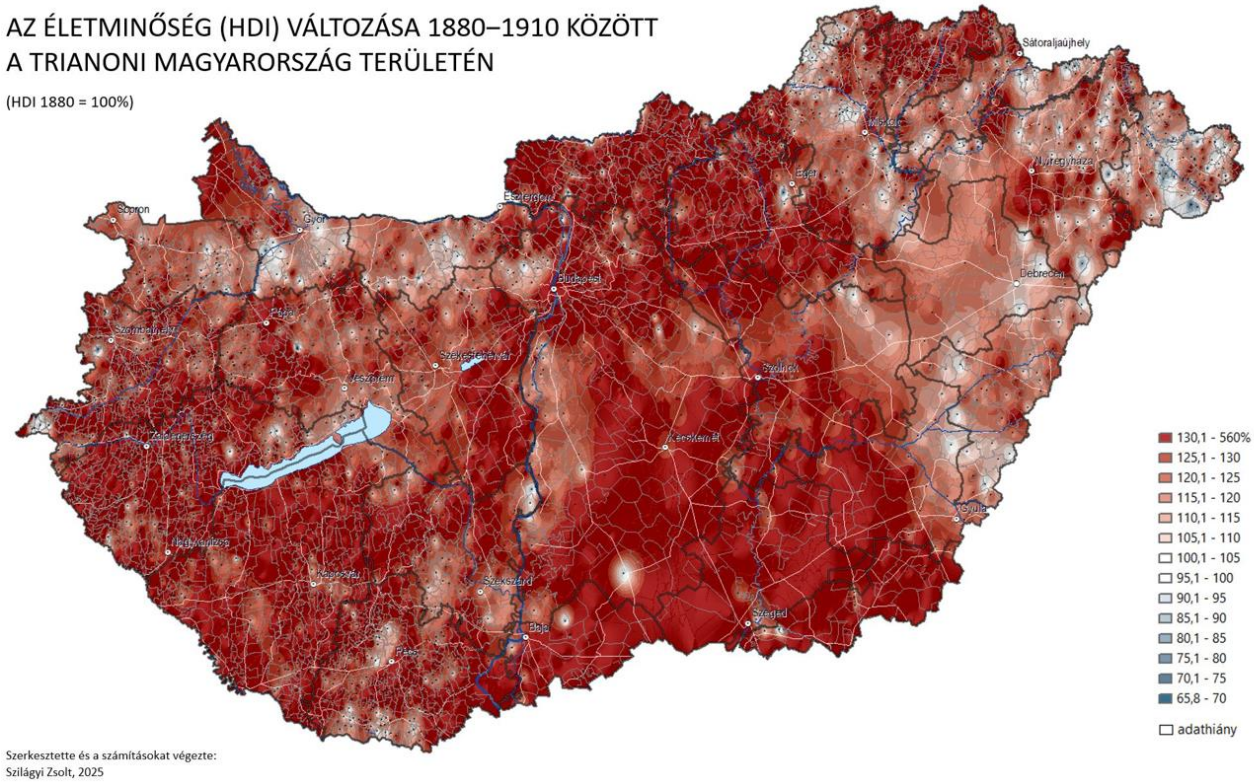


Figure 12. Change in HDI values 1910/1880

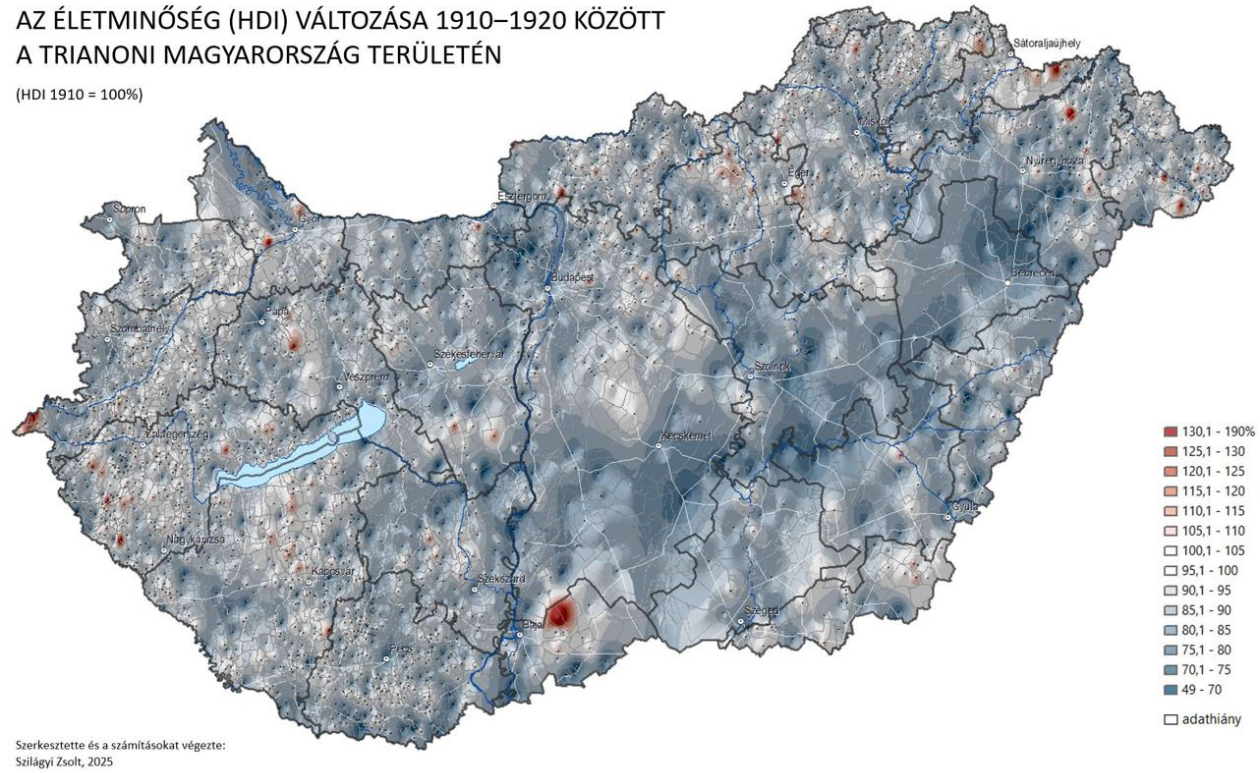


Figure 13. Change in HDI values 1920/1910

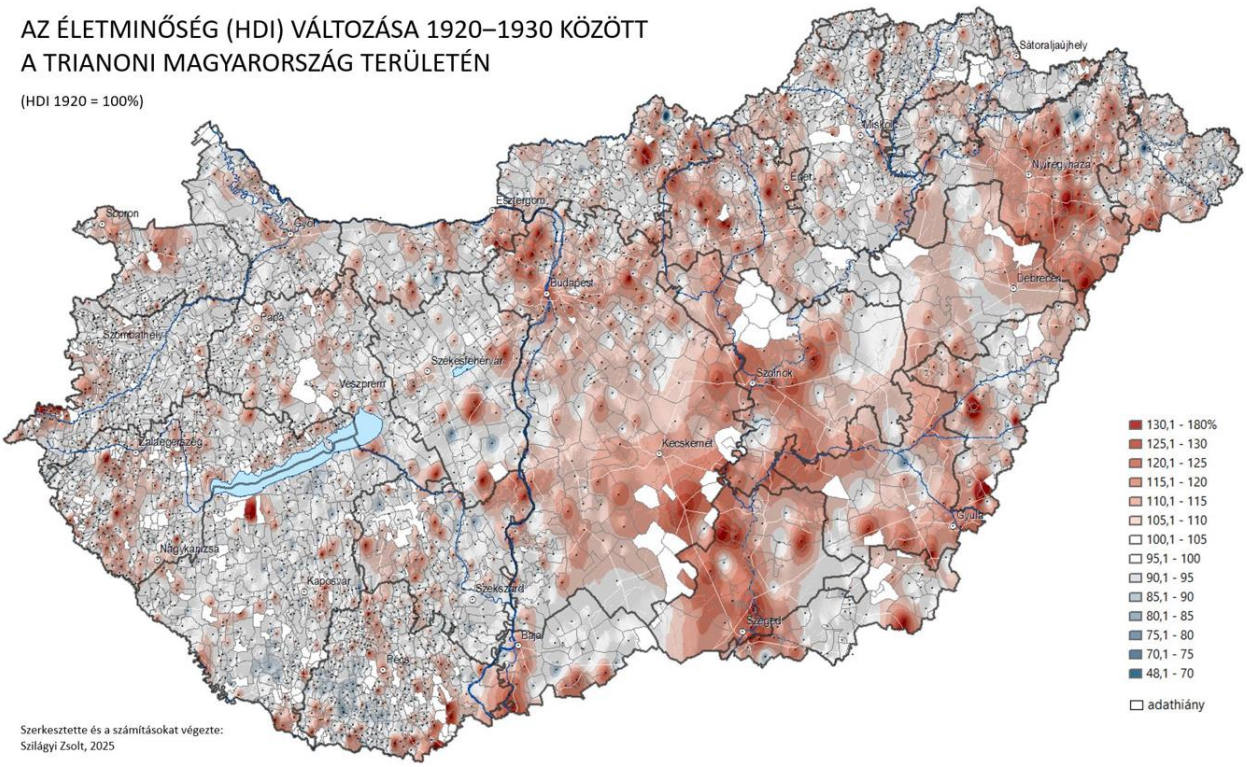


Figure 14. Change in HDI values 1930/1920

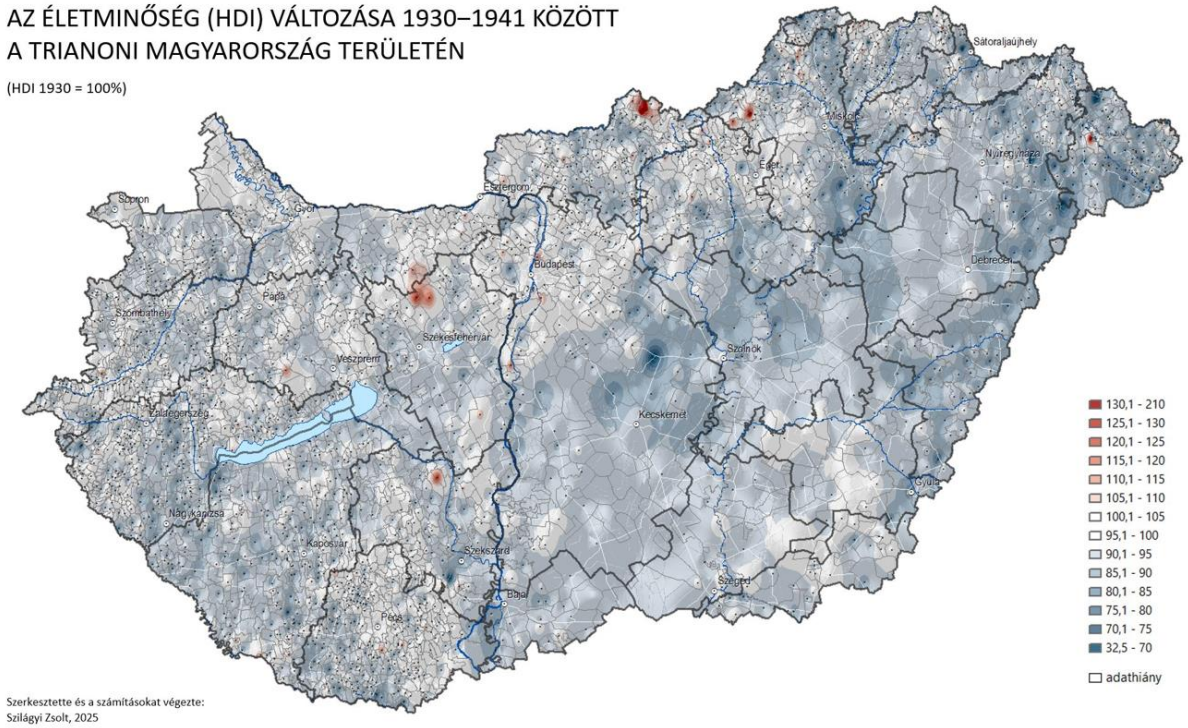


Figure 15. Change in HDI values 1940/1930

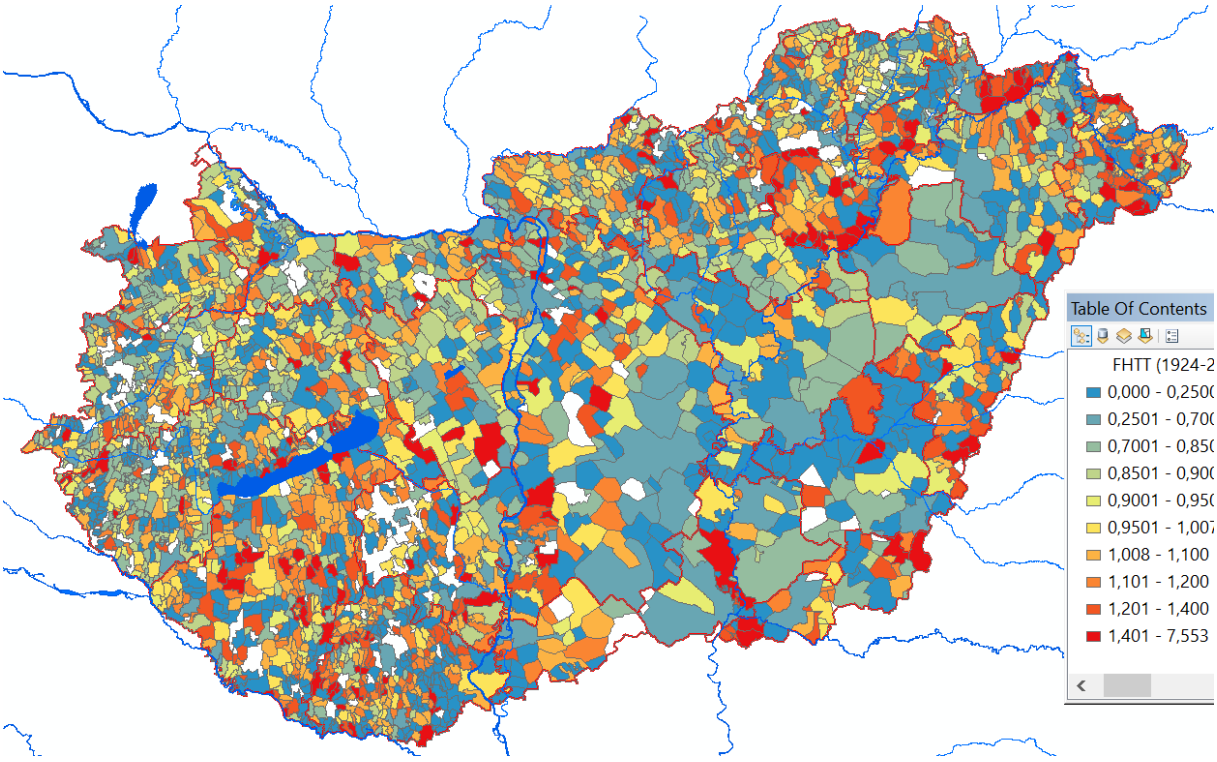


Figure 16. Change in tax income per capita 1924/1910

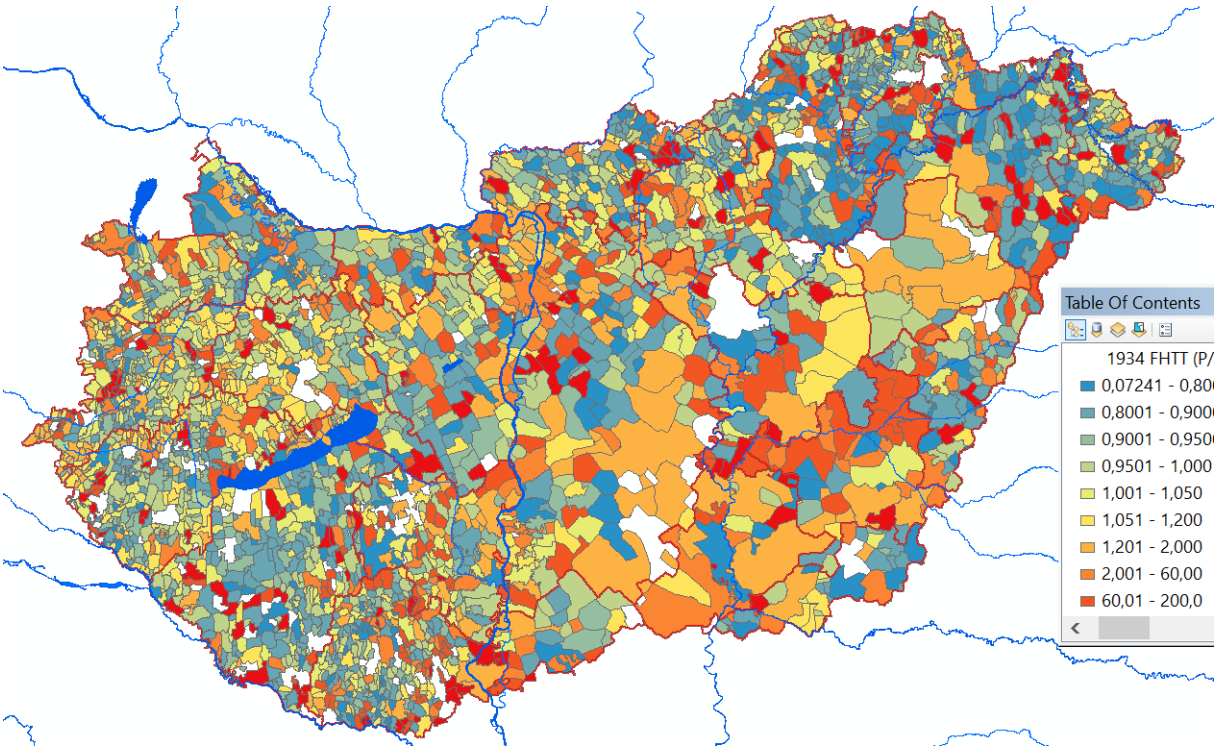


Figure 17. Changes in tax income per capita 1930/1924

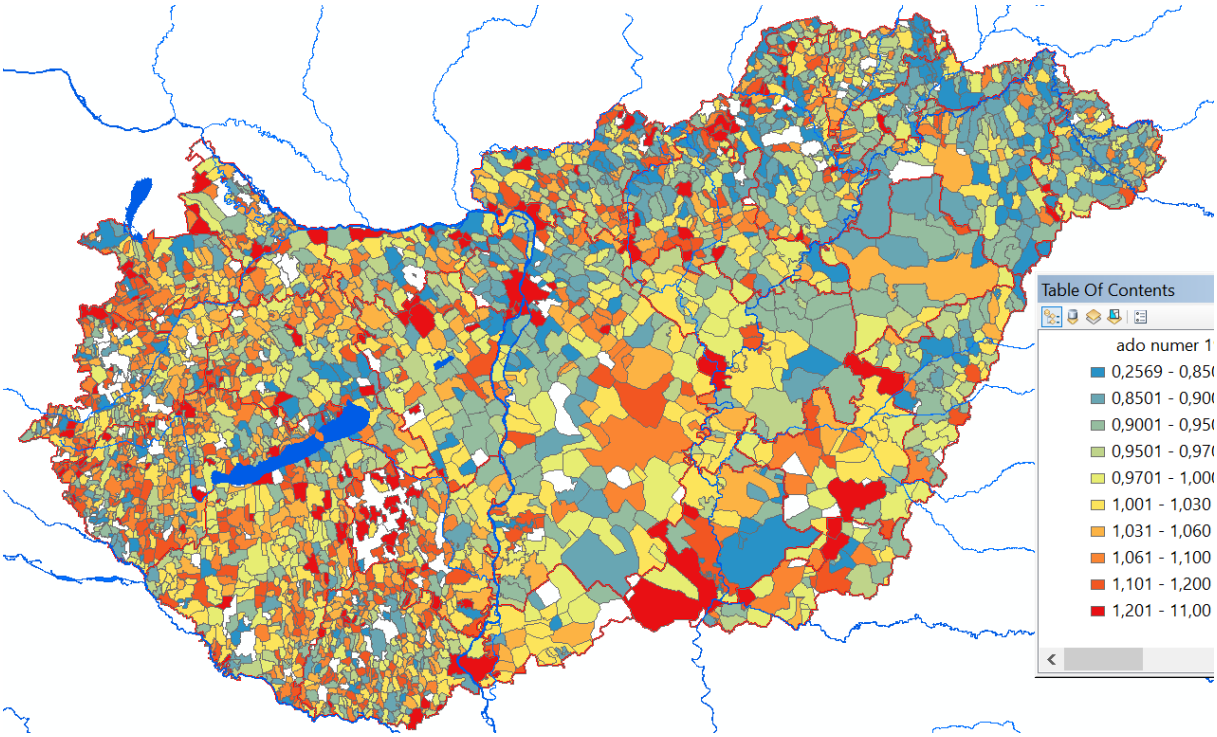


Figure 17b. Changes in tax income per capita 1941/1930

Discussion 6. Persistence and concentration of patterns (Figure 18-22)

A cartogram of the most and least developed 500 municipalities at different time sections may highlight regional differences further. Indeed, this showed a strong spatial concentration in both 1910 and 1940. So, we are not simply talking about settlements, but whole regions. The question is how stable this pattern was. On the basis of the three pictures drawn here (Figure 18), the backward and developed regions seem to be quite stable. But to explore this question in detail, we have examined the location of the municipalities that are consistently in the top, as well as those that are in the bottom. We used a similar visualization method as applied by Pénzes to analyze the persistence of peripheries between 1990 and 2010.[29]

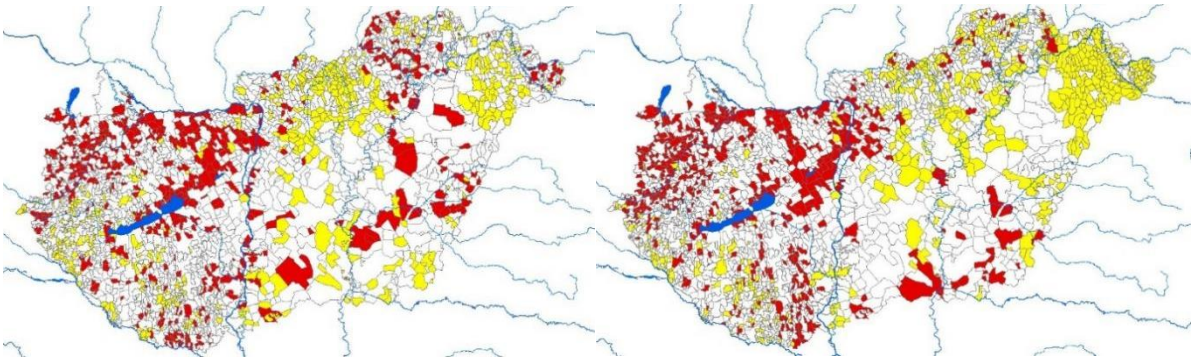


Figure 18. The location of the most and least developed 500 settlements in 1941

[29] See Pénzes 2014.

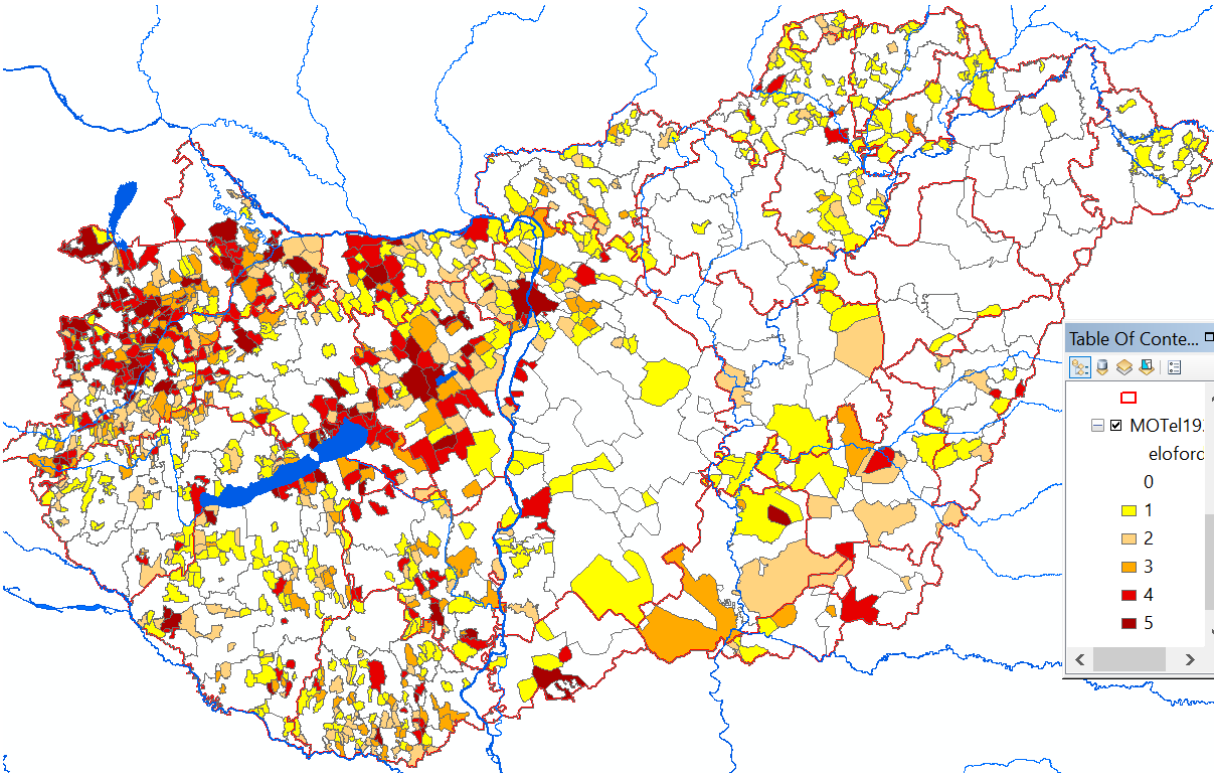


Figure 19. Number of occurence in top 500 – most developed settlements (1880-1941) (note that some towns are missing due to lack of data for 1 time interval – see Debrecen, Mosonmagyaróvár)

The municipalities most often ranked in the top 500 (top 20%) were concentrated in the northern part of Transdanubia, with the exception of a few northeastern cities (Putnok, Miskolc) and the developed urban zone of the southern part of the Great Plains (Figure 19). The massive north-western recurrence draws out the Rába-Danube axis as a unified region, as shown by Róbert Győri on the basis of settlement data for 1910. This is joined by the much narrower ribbon of the Budapest-Székesfehérvár-Balaton zone, which also existed in 1780.[30] The Komárom-Székesfehérvár axis is the result not only of physical geographical endowments but also of the increased exploitation of its raw materials after 1920.

The worst five hundred settlements showed a high degree of regional stability in two regions (Figure 20): one was the Nyírség in the northeast, already mentioned several times, and the other was the hilly area between Heves-Gömör-Borsod-Nógrád and its southern foothills, the Gyöngyös-Hevesi plain. Neither Eger, nor Miskolc, nor Salgótarján and Ózd were able to pull up the region: a positive shift in the region took place only after 1930 (but this only represents one date). Settlements in southern Zala in the southwest, the Cserehát in the north, or in the hilly region between Baranya and Somogy occurred in 2 or 3 cases among the 500 settlements with the lowest HDI. The

[30] See Demeter – Földvári 2025 in press.

settlements in the southeastern corner of the country, the so-called Viharsarok showed the same pattern.

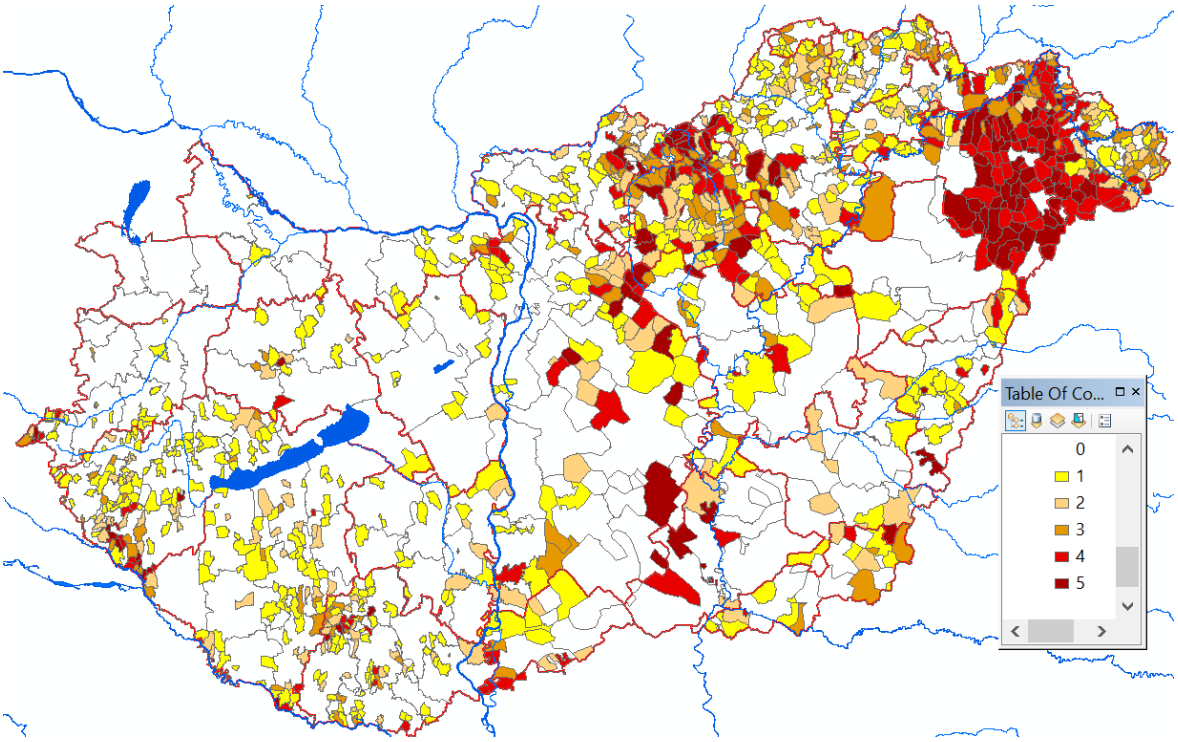


Figure 20. Recurrence in most backward 500 based on HDI values (1880-1941). (note that some towns are missing due to lack of data for 1 time interval – see Debrecen, Mosonmagyaróvár)

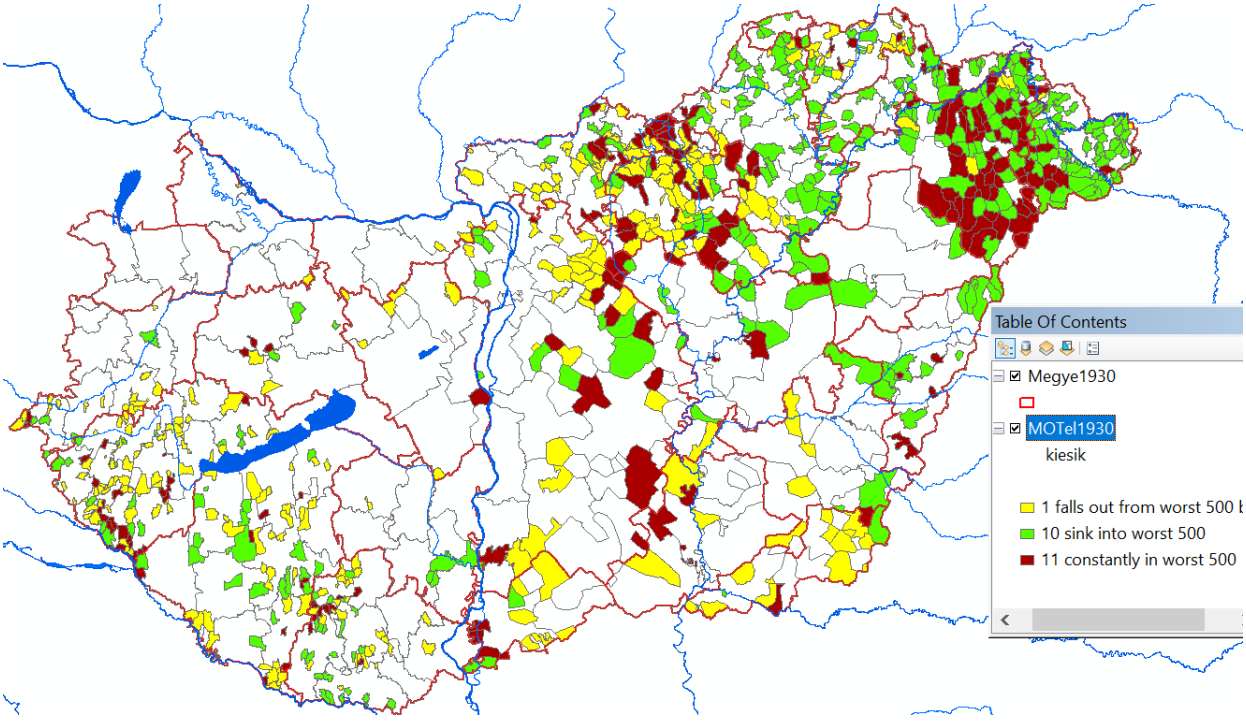


Figure 21. Location of settlements emerging from and sinking back to the most backward 500 between 1880 and 1941

Finally, our last two figures (Figure 21-22) apply a dynamic approach and show which of the settlements considered peripheral in 1880 were able to move out of the backward position and which settlements were sinking down to the worst 500. We illustrated the same dynamics for the top 500. In other words, we complement the perspective of the previous two graphs with the directions of change and their historical context.

It is perhaps clear from figure 21 that the previously mentioned backward block of settlements in Heves-Borsod-Nógrád began to break up by 1941, just as the high concentration of backward settlements in Zala was vanishing, while block of backward settlements in the Nyírség had expanded, and an almost compact area along the Tisza had appeared in its neighborhood. The backward settlements around Pest disappeared, but new ones appeared in the south. The density of settlements with low HDI in Somogy increased. The disappearance of the settlements with unfavorable HDI from the southern lowlands was counterbalanced in the south-east by the emergence of a new, continuous undeveloped zone.

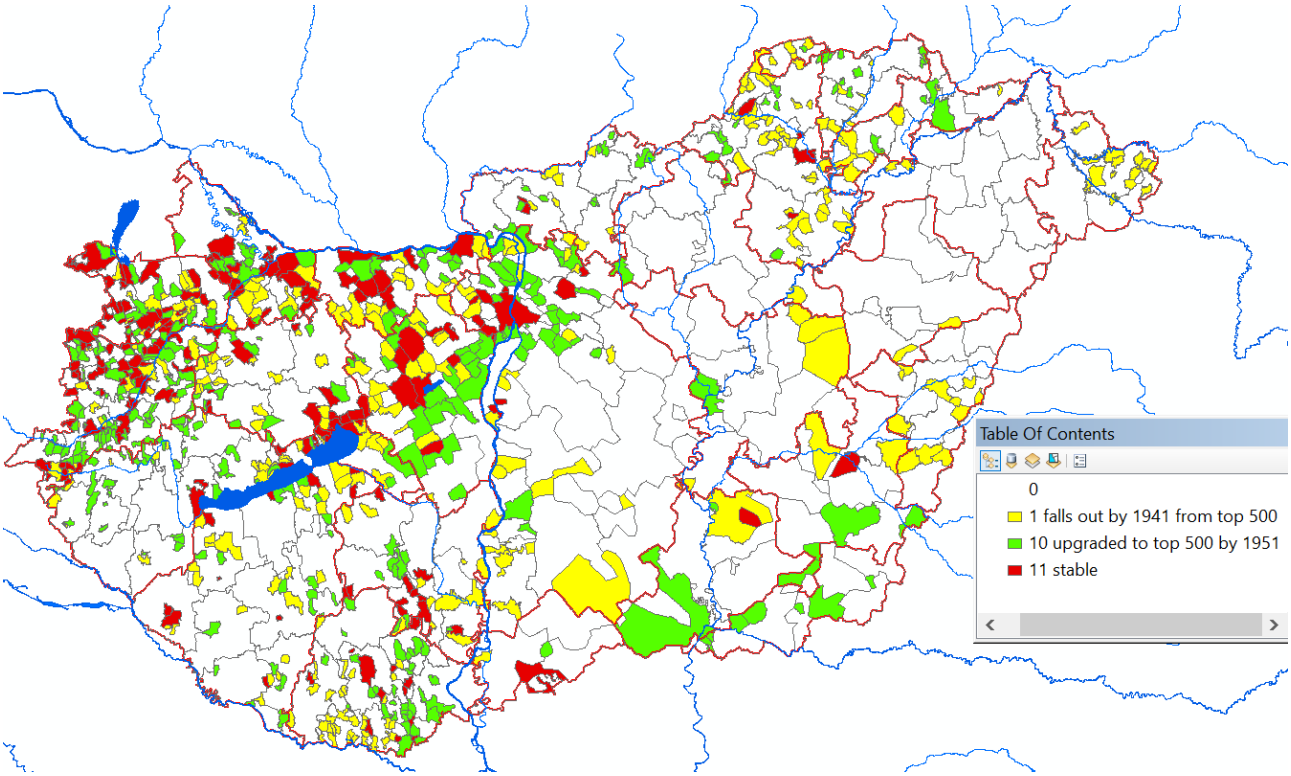


Figure 22. Location of settlements falling out from and emerging to the most developed 500 settlements between 1880 and 1941 (note that some towns are missing due to lack of data for 1 time interval – see Debrecen, Mosonmagyaróvár)

As regards the dynamics over time of the 500 most developed settlements (Figure 21), there had been a significant densification in the already developed North Transdanubia, not only in the region west of the Rába river, forming there an extensive, developed rural-urban region, but also in the southern part of Fejér and the surroundings of

Budapest. In Baranya, the emergence of the Swabian settlement area is evident, as is the subsidence of the Tolna area. Villány and Ormánság were in decline, Szeged and the urban settlements of the Viharsarok (but not those that were established by daily wage earners on large estates) were ascending, as were the industrial villages of Borsod (not yet towns) and the traditional cultural center of protestants, Sárospatak. The settlements of Szatmár, Nagykunság and South Bihar fell out of the top 500 - in the case of the latter this could be seen as a consequence of the border demarcation, but on the one hand we already saw signs of this in 1910, and on the other hand being out of the top 500 does not mean peripheralization - as the previous figure confirms.

Discussion 7. Country level HDI after 1960 (Figure 23)

For the period 1960-2000, the average development of the 600 settlements with the lowest HDI (lowest 20%) generally stagnates until 2000, and only starts to rise after the change of regime (the latter has tangible political consequences for the present), while the HDI of the most developed 20% (including, of course, many villages) increases continuously, and even soars between 1960 and 1980 (the golden age of the Kádár regime). Overall, this represents a steadily improving national average of HDI, which even the change of regime cannot change - at least not when using data sampling by 10 or 20 years. However, while until 2000 this is due to the performance of the already leading cities, the improvement between 2000 and 2020 is explaned by the convergence. The ratio of HDI of the backward 600 to the most developed 600 decreases after 1960, i.e. divergence (manifesting in U-shaped Kuznets/Williamson curve) can be observed, peaking around 2000. Thus, the economic shock of the regime change manifest in divergence rather than a decline in average HDI. But using a finer temporal scale, it also became clear that the catching-up of the countryside stopped in 2018 and since then there has been a continuous divergence observed.[31]

[31] Pénzes J. – Kiss J. P. 2024: A területi egyenlőtlenségek trendjei
The calculated HDI values are significantly lower than those given by Prados de la Escosura for 1950 (fo this year a reconstruction on municipality level is not possible). It is the average HDI of the top 600 municipalities that shows similarity to the average calculated by Prados.
Between 1960 and 2020, the correlation between the change in HDI and the change in population showed an r value of 0.65, not characteristic for the previous era between 1880 and 1941. This leads us to the question of whether it is worth calculating a population-weighted HDI.

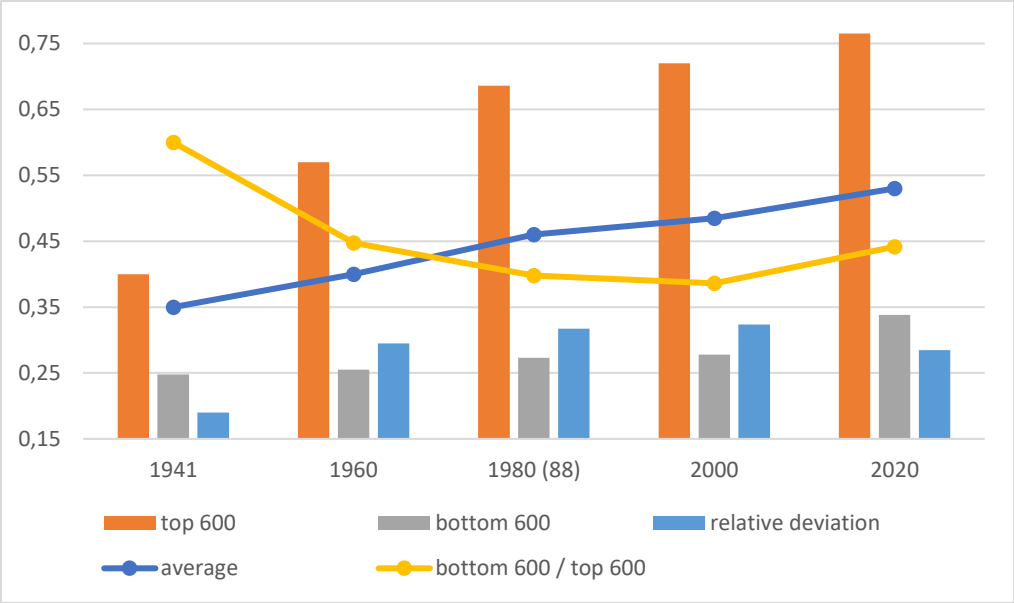


Figure 23. Temporal changes of average HDI and inequalities between 1960 and 2020

Discussion 8. Transforming and stable spatial patterns of HDI after 1960 (Figure 24-36)

The spatial patterns show that significant changes took place between 1941 and 1960 (Figure 24). Southern Transdanubia clearly shifted towards the backward regions, and with the improvement of the position of the Southern Great Plain, a coherent backward zone emerged between Bihar and Heves, which already existed, but was fragmented in 1941. The biggest loser of the WWII and the subsequent socialist transformations was not the western border zone, but the Rába region, which lay between the Budapest-Komárom industrial axis and the Austrian border, whose dozens of municipalities fell back from the top 500 (first two deciles) to the bottom five deciles, forming an internal periphery similar to that of evolving in the Somogy and Tolna regions south of Lake Balaton and the mentioned lowland periphery from Bihar to Lake Tisza. As a result of socialist economic development focusing on raw materials and heavy industry, the Gyöngyös-Salgótarján-Ózd-Eger (lignite, bentonite) mountainous quadrangle suddenly upgraded from being a periphery to one of the best, and a similar process took place in the Bakony Mts, in Transdanubia (bauxite, lignite). The southern half of the Nyírség region was broken up, the northern half and Szatmár became a border periphery, while the Cserehát and Bodrogköz remained backward, while the Budapest agglomeration zone widened. The former Danube axis, was stretching towards Szeged, creating a coherent development zone, so that neither West-East nor North-South slope was observable in the 1960s: the Budapest-centric radial structure determined the development picture.

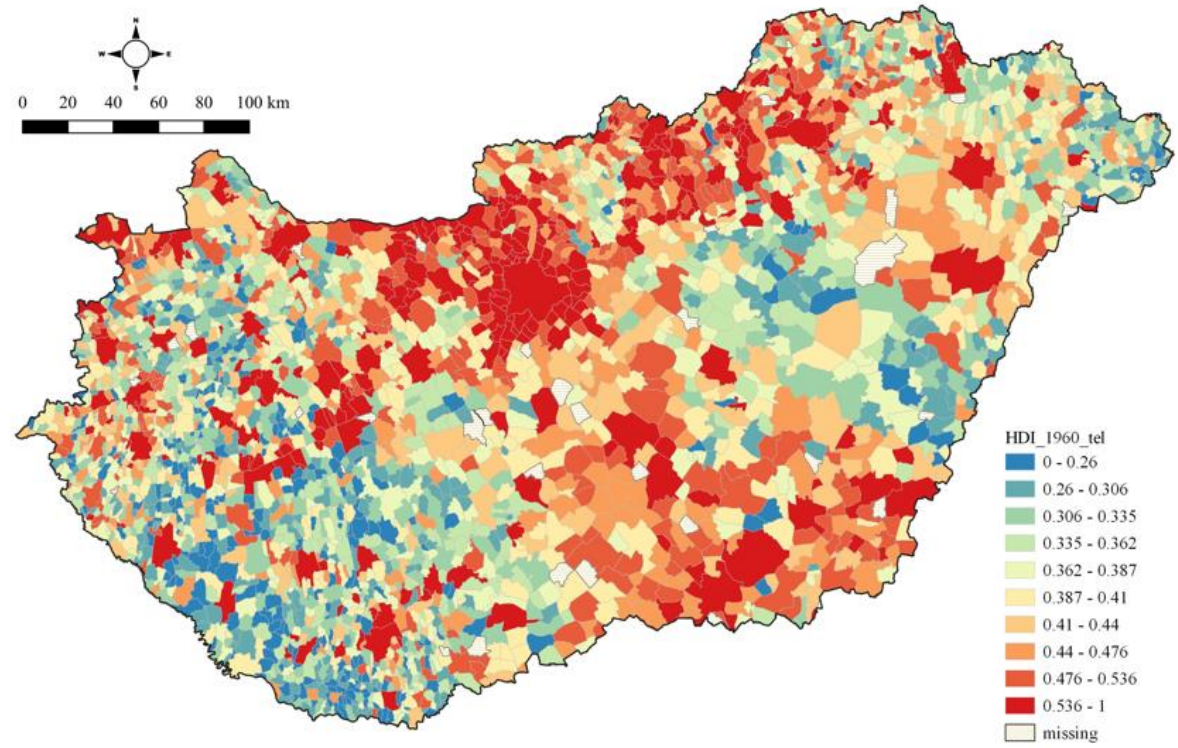


Figure 24. Spatial pattern of HDI in 1960 (decile rankings)

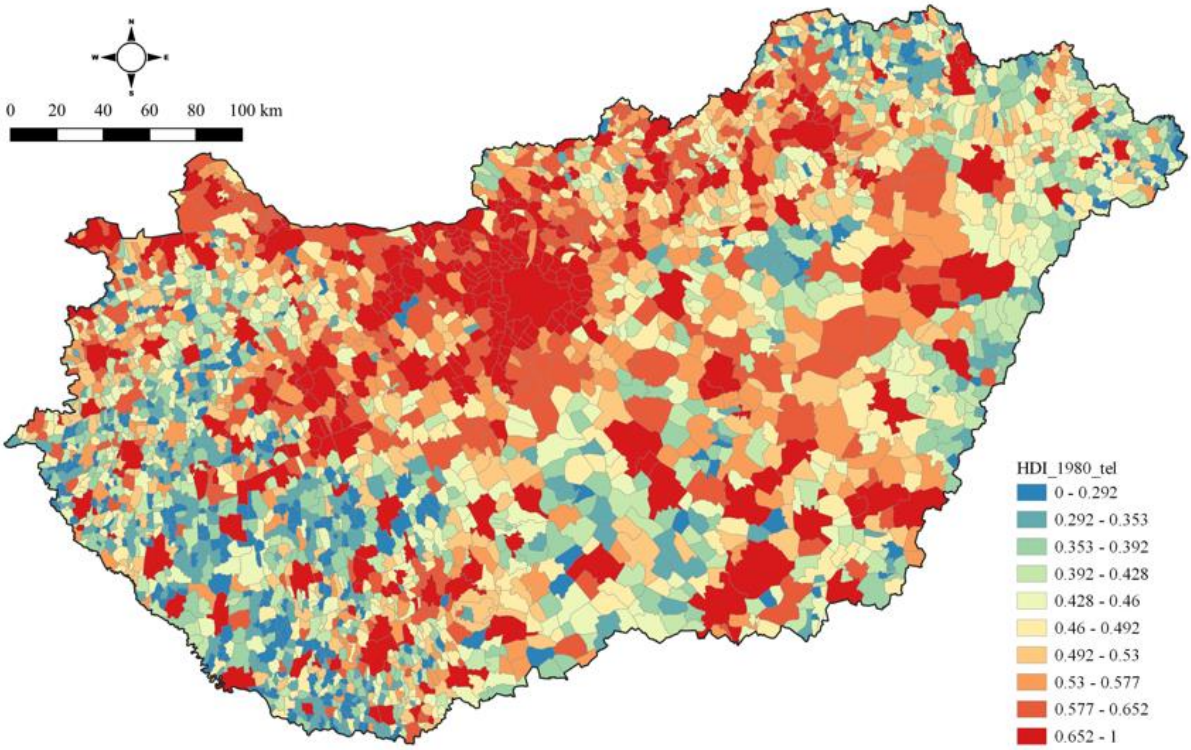


Figure 25. Spatial pattern of HDI in 1980 (decile rankings)

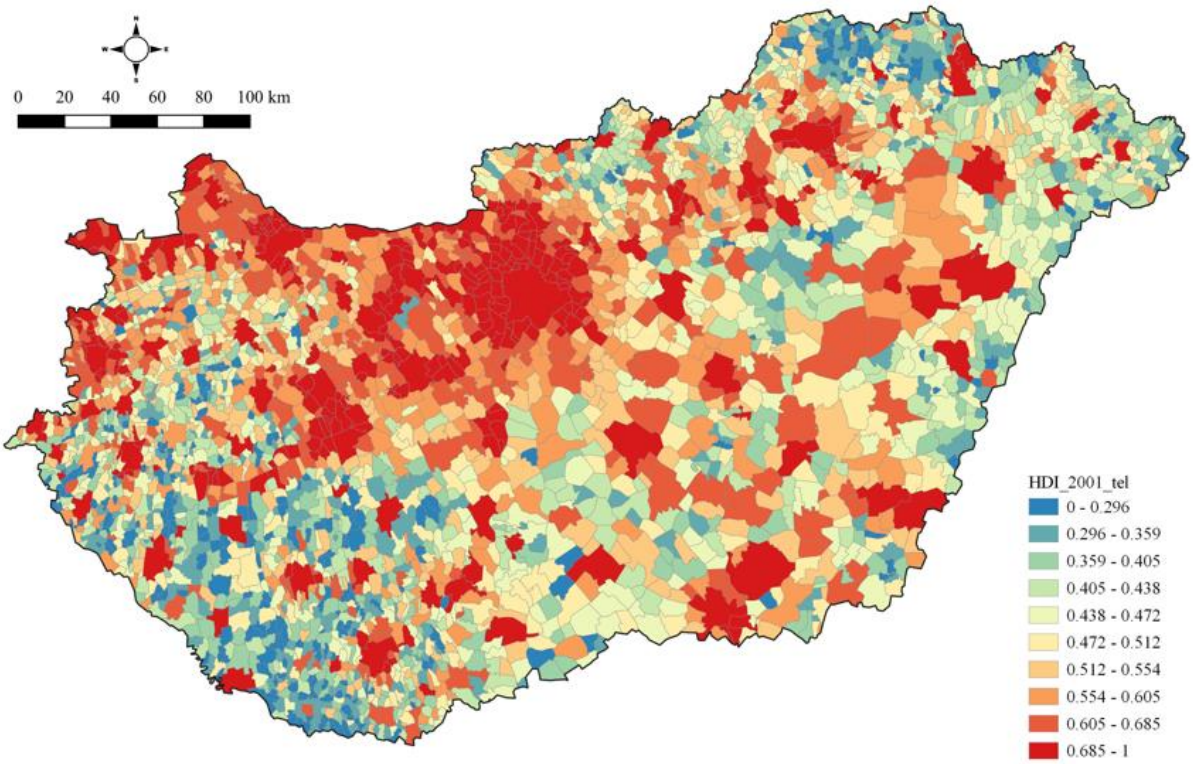


Figure 26. Spatial pattern of HDI in 2001 (decile rankings)

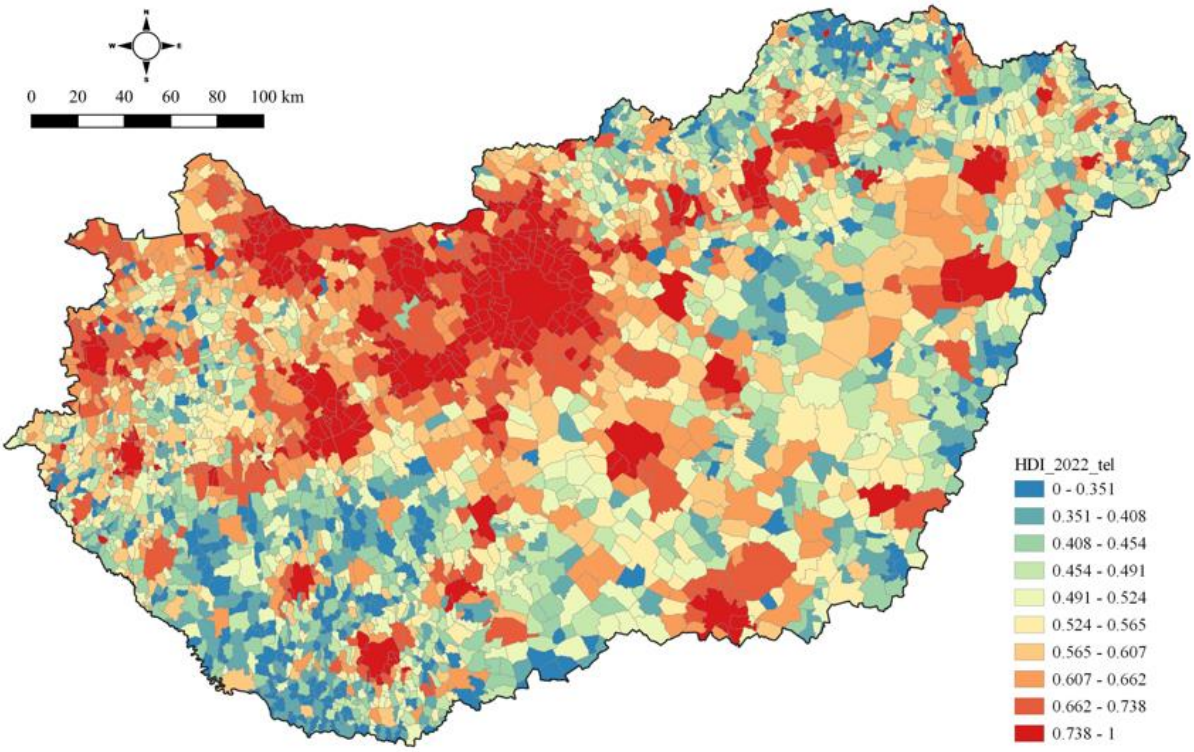


Figure 27. Spatial pattern of HDI in 2022 (decile rankings) compared to population growth (for agglomerating effect of welfare – see figure 28 below)

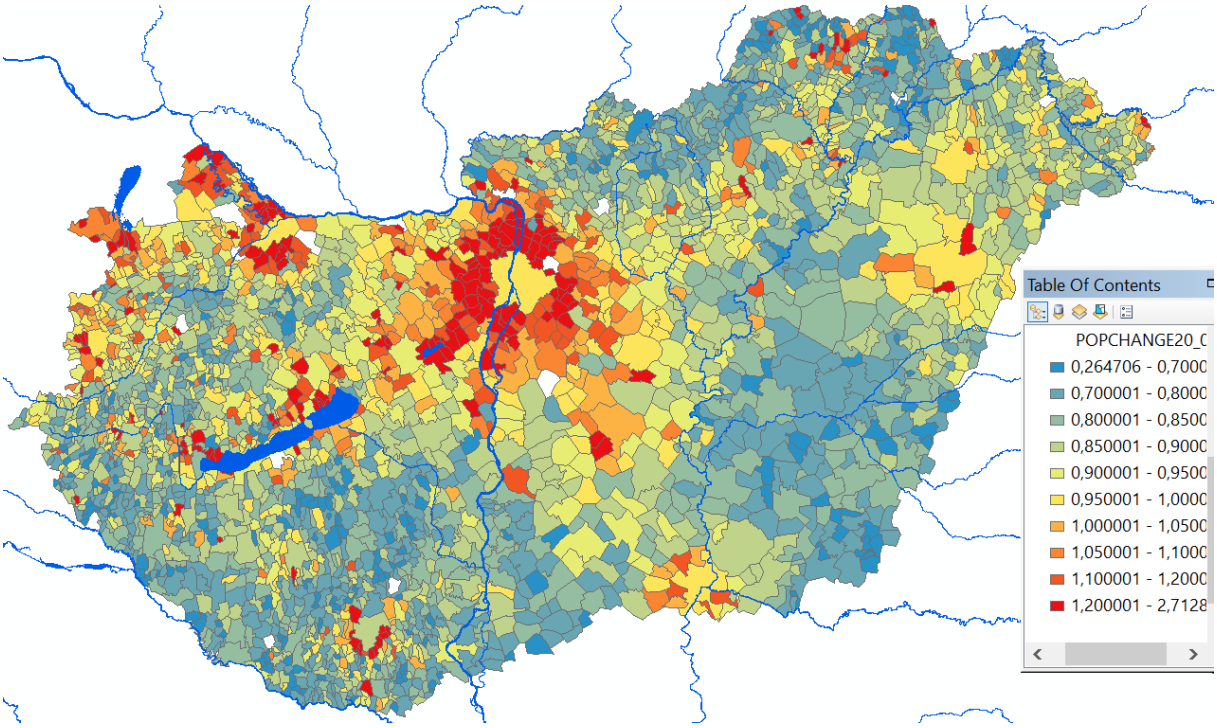


Figure 28. Population growth 2020/2000

By 1980, the Komárom-Budapest-Balaton triangle had become an almost coherently developed area (Figure 25), while the mining and industrial region of Heves-Borsod, which was a homogeneous and developed block in 1960, began to differentiate. Likewise, the Budapest-Szeged band was also broken up, and the eastern half of Kiskunság (Danube Tisza Interfluve) declined spectacularly (while it was a periphery between 1880 and 1930 too). In contrast, further north a homogeneous developed band emerged along the Budapest-Szolnok-Debrecen-Nyíregyháza railway line. Nagykunság recovered (probably the large canal construction works and the rationalization of agriculture (abandonment of rice and cotton cultivation) also played a role in this. Thus, the Lake Tisza became a nicely isolated inner periphery (again): the part of Bihar County that remained in Hungary was still underdeveloped, but this peripheral zone was no longer linked to the Lake Tisza area. The Nagykanizsa-Balaton-Pécs triangle held its backward position steadily - only Kaposvár stood out, but this did not seem to have any impact on the quality of life in the area.

Between 1980 and 2000, the patterns did not change (Figure 30), the processes just described above continued, but the differences became more and more exlicite in the southern part of the Danube-Tisza Interfluve, in the Cserehát (N-Hungary) and in the historical Bihar along the Romanian border With the collapse of heavy industry and mining, the area of Bujak in permanent depression began to grow and now extended to the whole of eastern Nógrád. The district of Ózd, also behaving as a single block, dropped down to the level of the Aggtelek area, thus a continuous and long

undeveloped frontier strip from Balassagyarmat to Fehérgyarmat evolved. Towns located within this stripe, Szécsény, Salgótarján and even Nyíregyháza were unable to have a positive impact on their surroundings.

By 2022, the segmentation and contraction of the developed areas in the east became even more pronounced (Figure 27), and the coherent developed stripe along the M4 motorway (still under construction) became also fragmented. Meanwhile, in the west, the Komárom-Győr-Veszprém triangle has seen the emergence of settlements. Between 1980 and 2000, the region from the Rába river to the Austrian border in the west showed an almost uniform upswing (Figure 30), except for Mosonmagyaróvár (agrarian industry + metallurgy), where HDI grew only in the previous period (1960-1980). Contrary to this, Kemenes region, after a decline between 1960 and 1980 (while Sopron was characterized by stagnation), also showed an increase in HDI values up to 2000. For the above reasons, however, by 2000 the areas west of the Rába did not show such a uniform picture as, for example, the Komárom-Fehérvár-Budapest block. The northern part of this area (Almásfüzitő, Nyergesújfalu) showed a significant decline, and stagnation had already been a feature of the area between 1960 and 1980 (this area was still a periphery in 1930, then it became part of the attraction zone of Budapest).

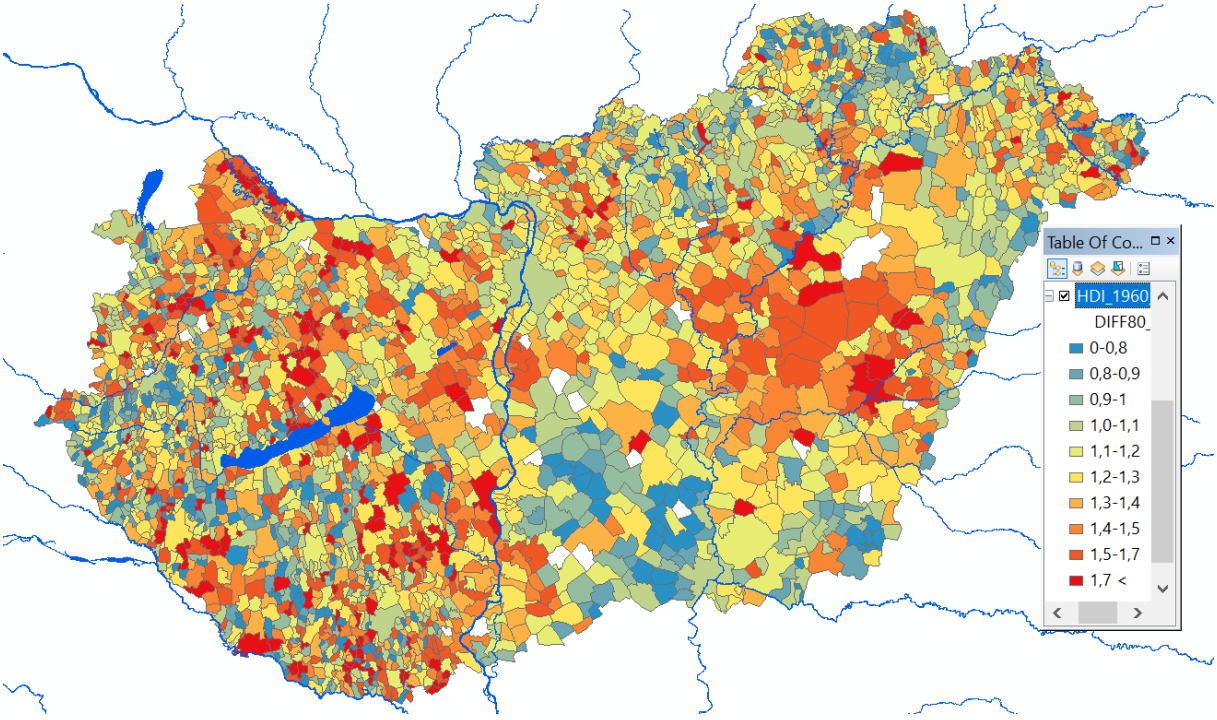


Figure 29. Change in HDI values 1980/1960

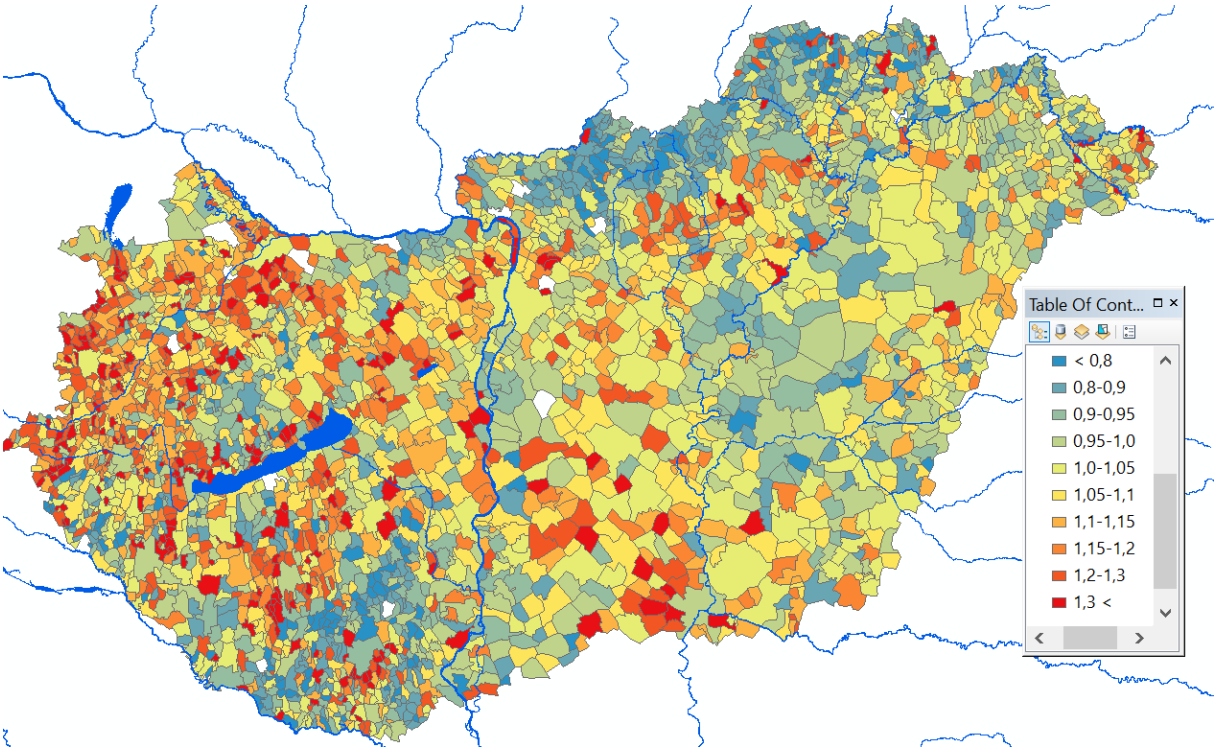


Figure 30. Change in HDI values 2000/1980

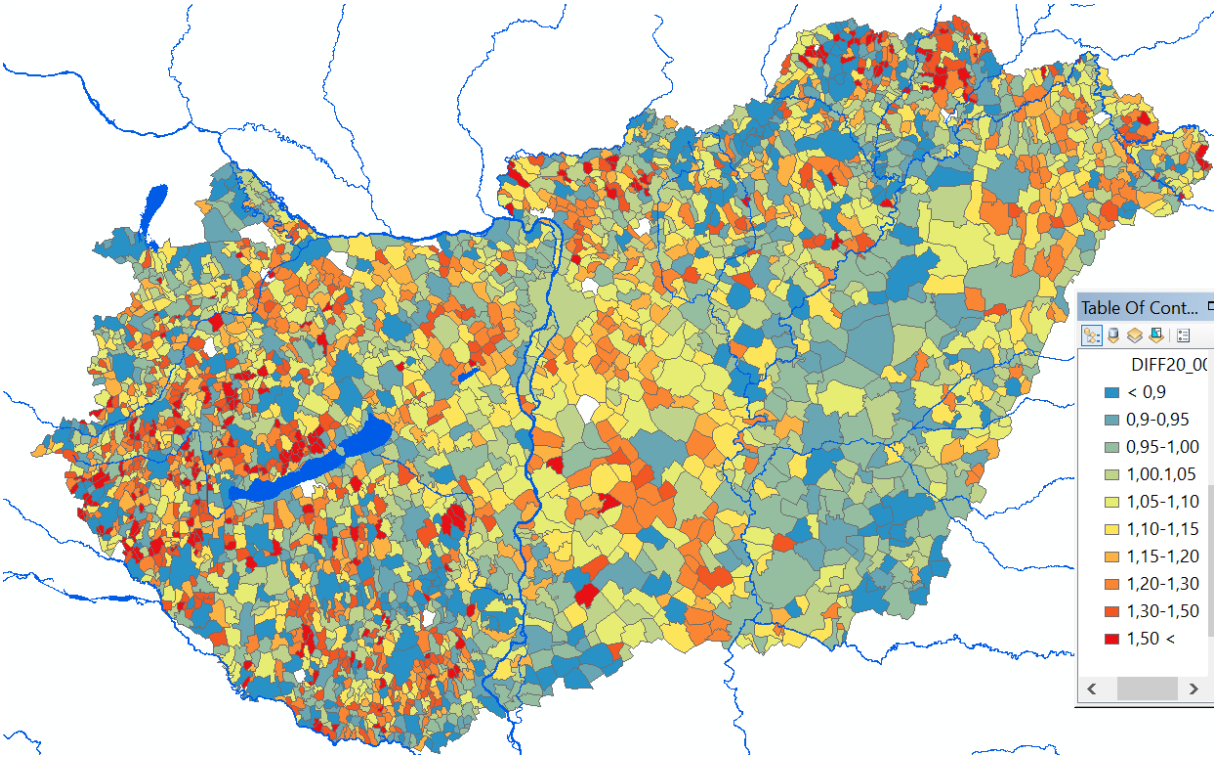


Figure 31. Change in HDI values 2020/2000

In the 2000-2020 period, the development of smaller settlements was obviously characteristic (Figure 31), whether we look at Nógrád, Abaúj or Zemplén. The settlement reconstructions after the Tisza flood disaster in 2001 also left positive mark on the Bereg region, the Balaton uplands were uniformly renewed, while the

settlements of Zala and Vas, but even the Ormánság and Villány-Mecsekalja was characterized by increasing HDI values, although here very mosaic patterns and extremities next to each other occurred. After the decline between 1960 and 1980, the central part of Kiskunság showed a significant development between 1980 and 2000 and even after 2000 (despite the statistics did not include the significant illegal incomes). By 2020, the situation had become so polarized that several towns in South Transdanubia, which were still in the top 20% in 2000, disappeared: only Pécs, Kaposvár, Nagykanizsa and Szekszárd, remained in the top 600. The same is true for Tiszántúl (Figure 32). This is even worse than the situation in 1960: the middle of the Tiszántúl was „empty" then too, but at least in the south one could find many urban settlements in the top 20%. By 2020, however, only Szeged and Hódmezővásárhely, Gyula and Békéscsaba, 2-2 neighboring towns that reinforce each other remained in the top 600 regarding HDI, while Szarvas, Szentes, etc. have disappeared.

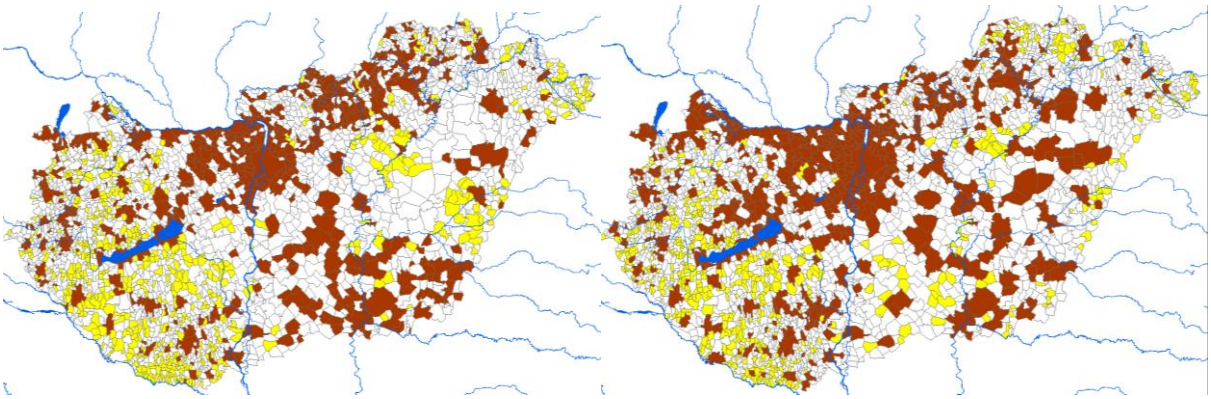


Figure 32. Top and bottom 20% (600) in 1960 and in 1980

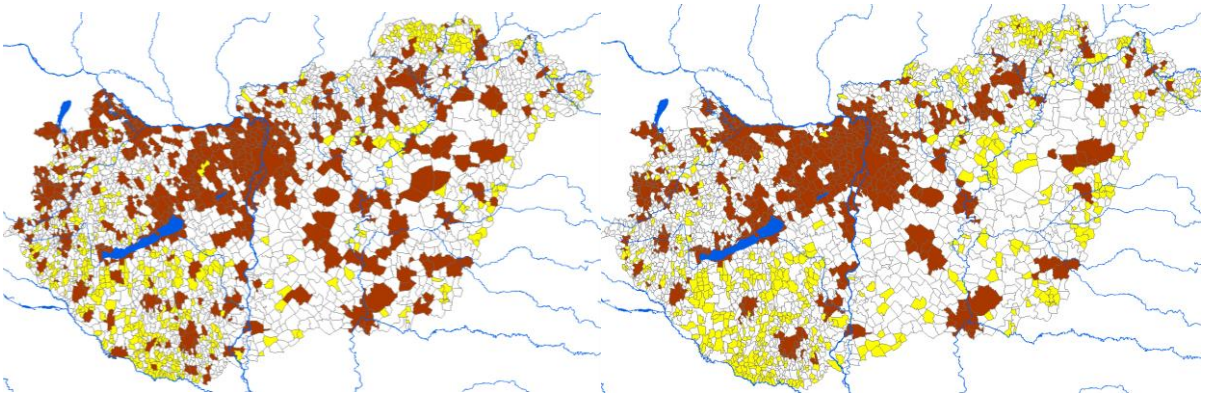


Figure 32. Top and bottom 20% (600) in 2000 and in 2020

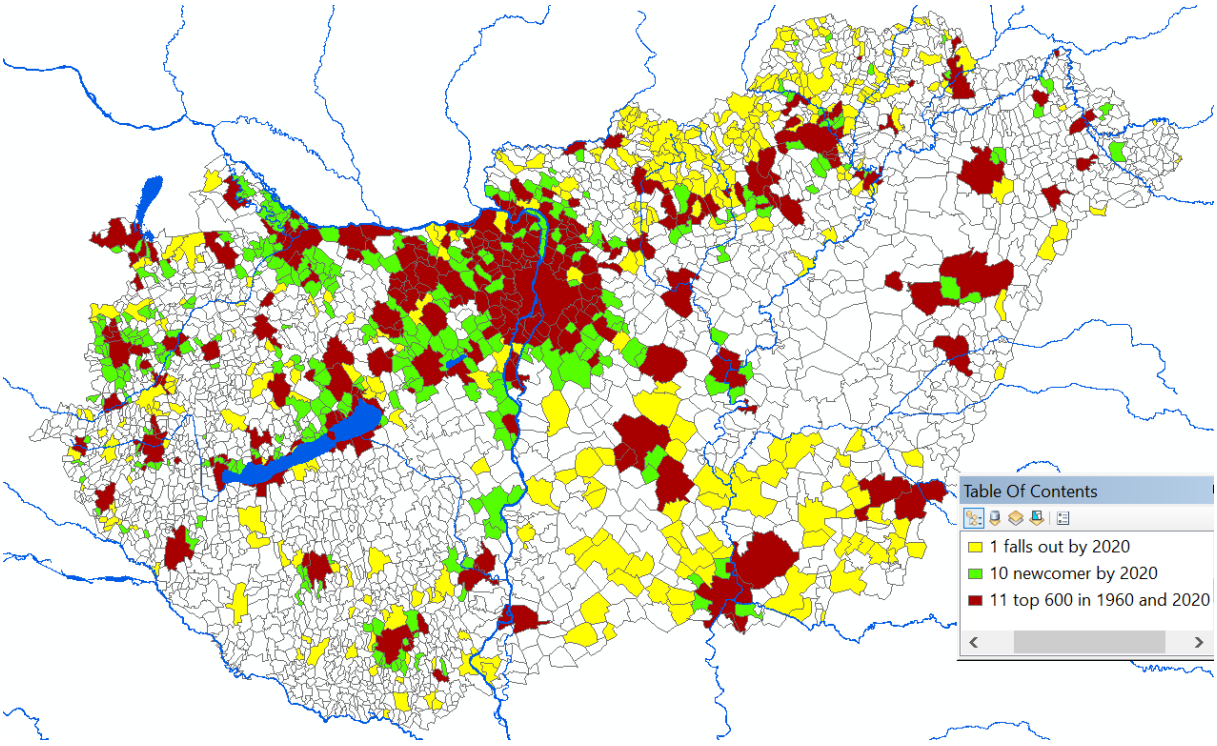


Figure 33. Settlements emerging to the top 600 and fall out between 1960 and 2010

If we analyze the spatial patterns of upward and downward movements in the top 600 (Figure 33-34), the strengthening of Budapest and the shrinking of the developed region in the Southern Great Plain to the major cities is clearly visible. In the West, the elite has been "replaced". The areas around Győr and Szombathely emerged, and the small villages around Sopron and Fertő-Hanság have fallen out from the top 20% - technically.[32] But the collapse of Northern Hungary after socialism is even more spectacular and realistic. The mining districts disappeared completely, leaving only the core of the region's developed - the historical towns of the market line, Eger and Gyöngyös. Mátraverebély has even fallen from the top 600 in 1960 to the bottom 600 in 2010, but this is not common, the region was not completely peripheralized. This is illustrated by the following figure, which, in addition to showing the descending and constantly backward settlements, also documents the attempts to record the successful breakouts between 1960 and 2020.

While the inner periphery around Lake Tisza was a characteristic factor of todays' landscape since the 1940s, its shape has changed over time, with some settlements moving up and others declining in terms of HDI. The situation of the settlements stuck in the bottom 20% is much more stable in South Transdanubia, furthermore, a significant number of new settlements have sunk in the last sixty years, while in the north, around Zala County and Lake Balaton, there has been a successful mass escape

[32] This does not reflect a real process. Due to cross-border employment, income levels have fallen spectacularly, as these wages earned abroad are invisible for Hungarian statistics. See: Pénzes, J. – Kiss J. P. 2024: A területi egyenlőtlenségek trendjei..

of settlements from the backward zone. The situation of Sárrét and Szatmár along the eastern borders also improved slightly marking the end of the extremely low HDI values and rankings, while the decline of Cserehát accelerated spectacularly after 1960, as did the decline of the shadow zone of Nógrád-Heves-Borsod-Gömör (with the closure of the Egercseh coal mine, copper mine in Recsk, the bentonite mine in Istenmezeje and the cement factory in Bélapátfalva).

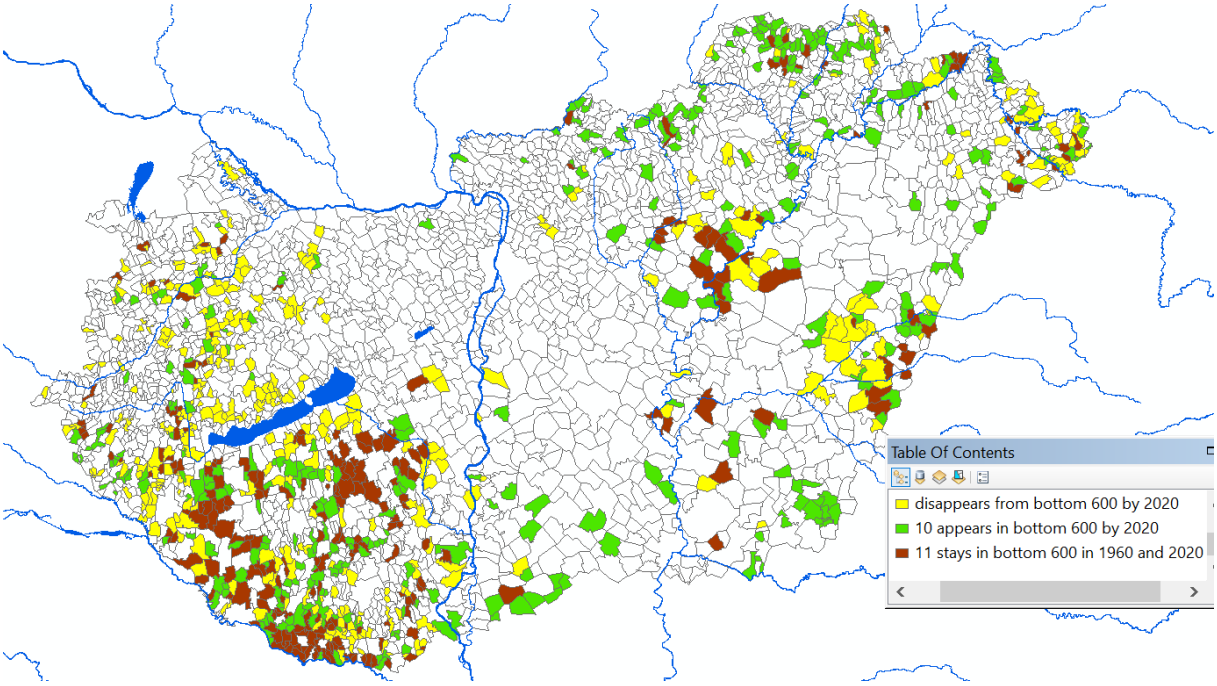


Figure 34. Settlements emerging from and sink into the bottom 600 settlements between 1960 and 2010

It is also worth to look at the persistence of peripheral settlements – how many times they occur among the most backward 600 settlements out of a possible maximum of four (Figure 35-36).

It is true that the persistence of backward positions is more frequent along the border, but this was often originally not caused by the border, it only contributed to the conservation of the backward situation. In addition, the inner periphery around Lake Tisza, in the shadow zone between Szolnok, Miskolc and Eger towns, as well as Tolna and North Somogy are also characterized by permanently backward settlements.

It is also evident from the figure that the band along the Danube to Lake Balaton and along the Danube towards Vienna/Bratislava can only be considered as permanently developed locations (M1 and M7 motorways). The routes of the M3, M5, M6 motorways and main road 4 can also be traced through the HDI values, but the towns along the motorways (Szeged, Hódmezővásárhely) are no longer able to rise their wider, rural areas. Elsewhere, however, the position of settlements close to large cities has improved thanks to suburbanization (Győr, Veszprém, Székesfehérvár, Miskolc,

Pécs). In Southern Transdanubia, or the Great Plain and Northern Hungary, it is not typical that villages have been able to stay in the top 20% (either become towns or sank back).

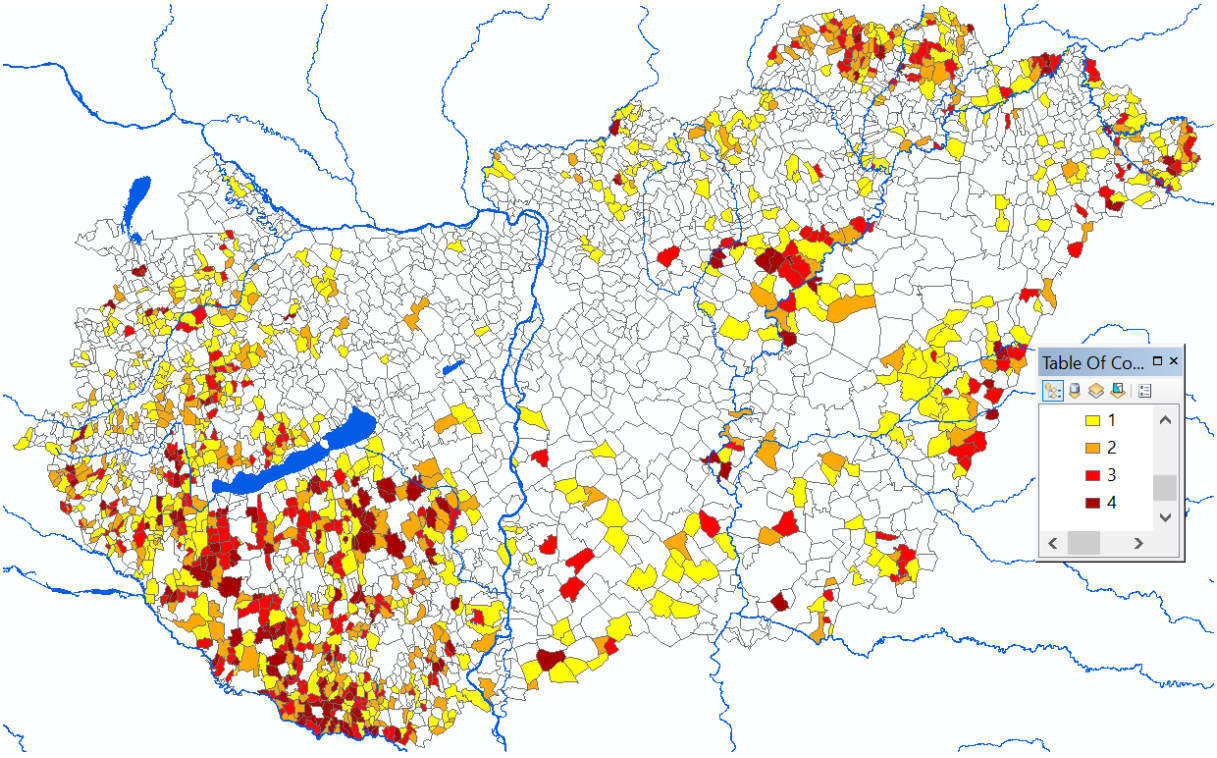


Figure 35. Number of recurrences among the worst 600 (20%), 1960 – 2020

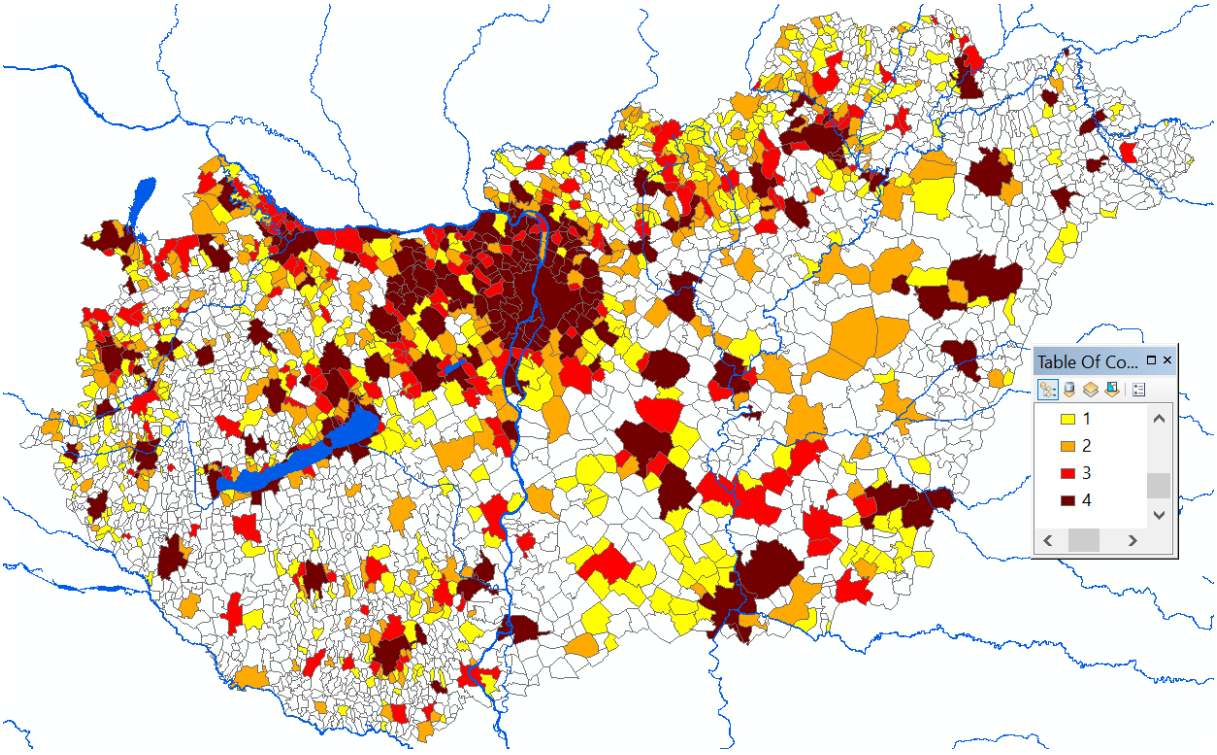


Figure 36. Number of recurrences among the best 600 settlements (20%) between 1960 and 2020

Discussion 9. Connecting prewar and postwar data (Figure 37)

Though the primary variables used for the reconstruction of HDI prior to and after 1945 differed, it is possible to attempt the connection of 1941 and 1960, since we data on matriculation and degrees were registered in 1941 even at settlement-level breakdown thus we do not solely rely on literacy as prior to 1941. However, this still does not mean the total integration of the two time-series, because for 1930 and before, we lack such data. But at least we can estimate the effect of WWII on HDI-levels and patterns too, even if we cannot compare the extent of this effect with that of the great economic crisis or WWI. From technical aspect this means the geocoding of two datasets (settlement names were changing thus they cannot function as ID to link the database from 1941 and 1960). The second problem is the treatment of income which not only differs in terms of their basis (tax-based, vs. salary-based), but since we did not have settlement level breakdowns for this in 1960, a special method using social stratification of settlements was used to estimate settlement level averages.

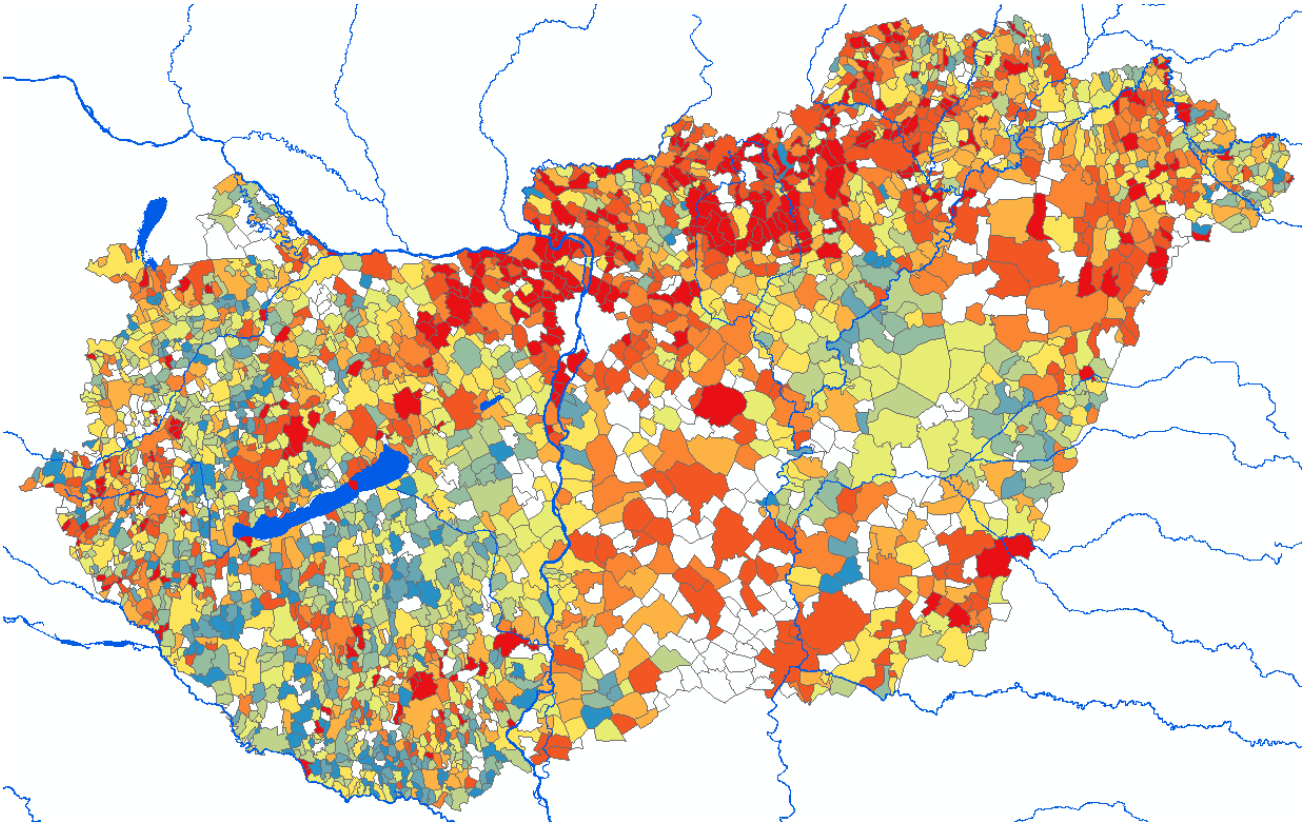


Figure 37. Pattern of change in HDI 1960/1941 (warm: increase)

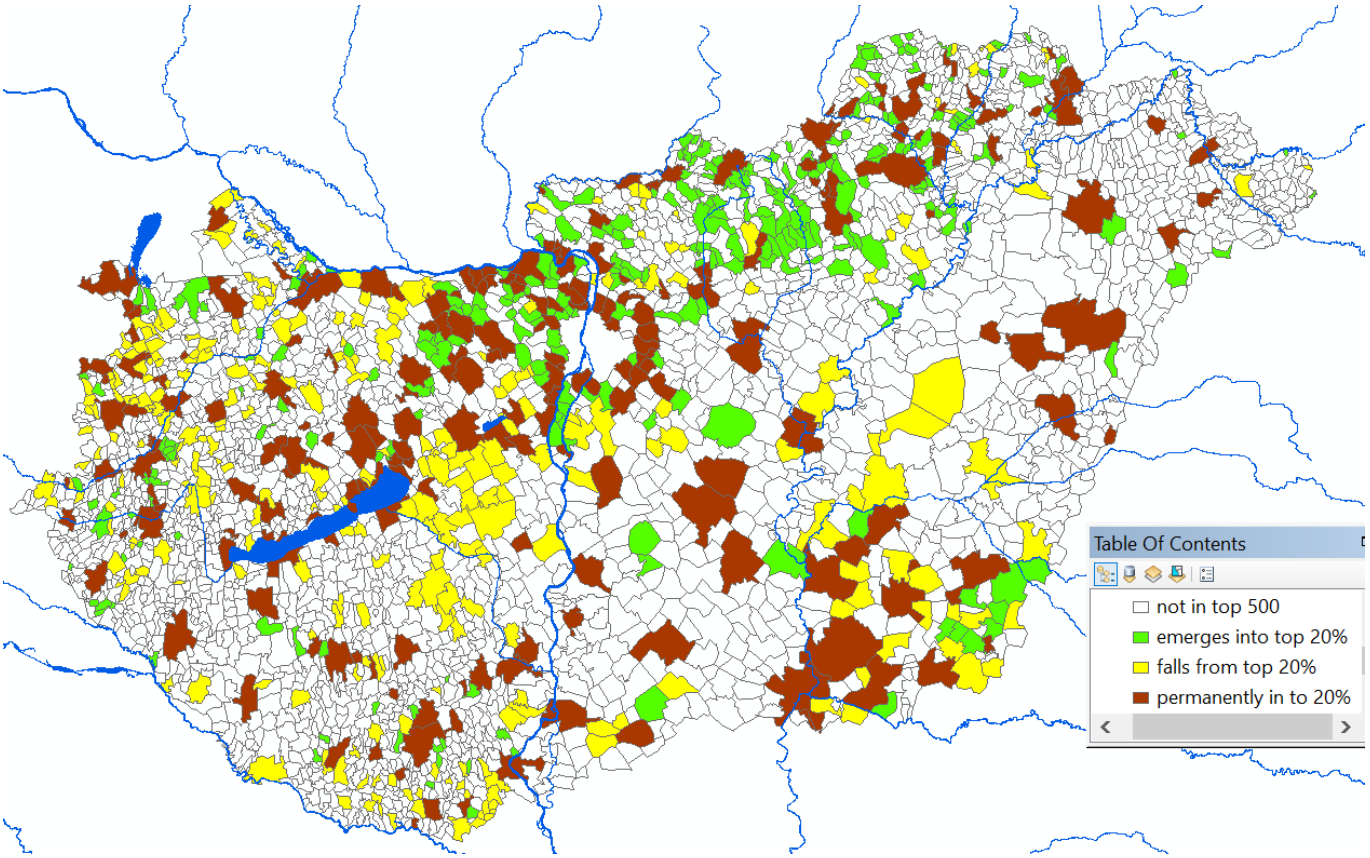


Figure 38. Changes in positions within the top 500 after WW2

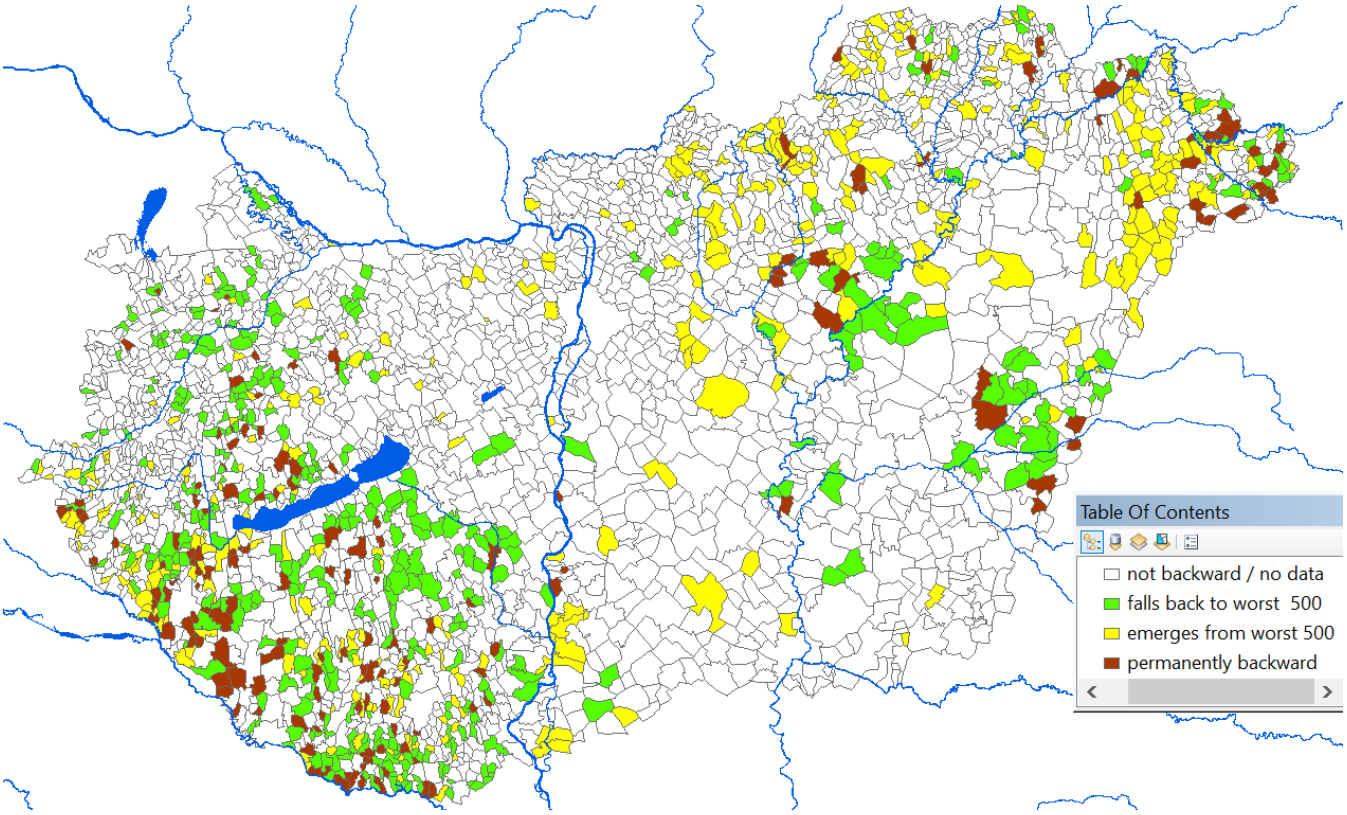


Figure 39. Changes in positions within the most backward 500 after WW2

Conclusions

Contrary to the previous literature claiming that HDI was very low in the 1880s, we managed to adjust this value higher (both for the whole kingdom and the post-1920 territory) using settlement level calculations.

We also proved that contrary to the previous claims in the literature the HDI in Hungary was not increasing constantly, but fluctuated.

We assessed HDI after 1940 a bit smaller compared to Prados de la Escosura's calculation using different time-horizons, methods and resolution (these all may explain a part of the difference).

We managed to prove that between 1910 and 1920 HDI decreased reflecting the effect of WWI and the collapse of the free market for agrarian producers in Hungary.

We also managed to trace the effect of the great economic crisis in the trends of average HDI between 1930 and 1941.

We also managed to prove that regions of the country reacted and behaved differently to global challenges (see the double collapse of incomes – grain prices – in the interwar period in the Great plains).

We confirmed Egri's hypothesis (who examined the stability of spatial patterns after 1945 claiming that these change remarkably only after 30 years), on historical datasets prior to 1945. MORAN I values show an increase in spatial autocorrelations between 1910 and 1941, that is, settlements with high and low HDI seems to become more aggregated spatially.

We proved that the area of post-1920 Hungary was more developed even in 1880 and 1910 than most of the regions detached from in 1920. Thus the geographical periphery was peripheral in terms of backwardness too.

We calculated that during the dualistic period the periphery developed quickly, but could not decrease the gap.

HDI values indicate that the recovery period in 1920-1930 showed greater yearly increase than the 30 years of the dualistic period (30% increase in 30 years).

We challenged the statement that interwar peripheralization was caused mainly by the new borders. Some peripheries along the new borders often had their roots in the dualistic period, some peripheries originating after 1920 were not located along the border. On the other hand it is true that borderland regions' HDI was smaller, but this was already observable in 1910. Interwar policies did not decrease the difference between borderland and center significantly. Socialist attempt did so in the north, but failed to handle the borderland peripheries in the east and even contributed to the

creation of new borderland peripheries (and the amalgamation of borderland and inner peripheries too).

Though after 1945 the average HDI was increasing monotonously, this does not imply stable territorial patterns. Following up the settlement-level HDI allows us to explain territorial consequences of socialist policies (Iron Curtain, heavy industry, agrarian products that do not fit to natural endowments).

Though after 1945 the HDI was increasing monotonously this does not mean that trends of inequalities were monotonous too. In fact the occurrence of U-curve between 1980 and 2000 refers to the economic transformations after the regime change and underlines that the problems of adaptation were reflected differently, both regionally and in the settlement hierarchy.

Though we cannot state generally, it is highly probable that a decrease in country-level average HDI is influenced more by external (global) phenomena in Hungary (WWI, world economic crisis of 1929), whereas growing inequality in HDI refers to internal or regional challenges.

There is a parallel move between the trends of the Kondratieff-cycle and the HDI-levels in Hungary between 1880 and 1960. After this in the socialist regime only the increase of inequalities (decrease of convergence on Figure 40) reminds us to parallelism with global market processes.

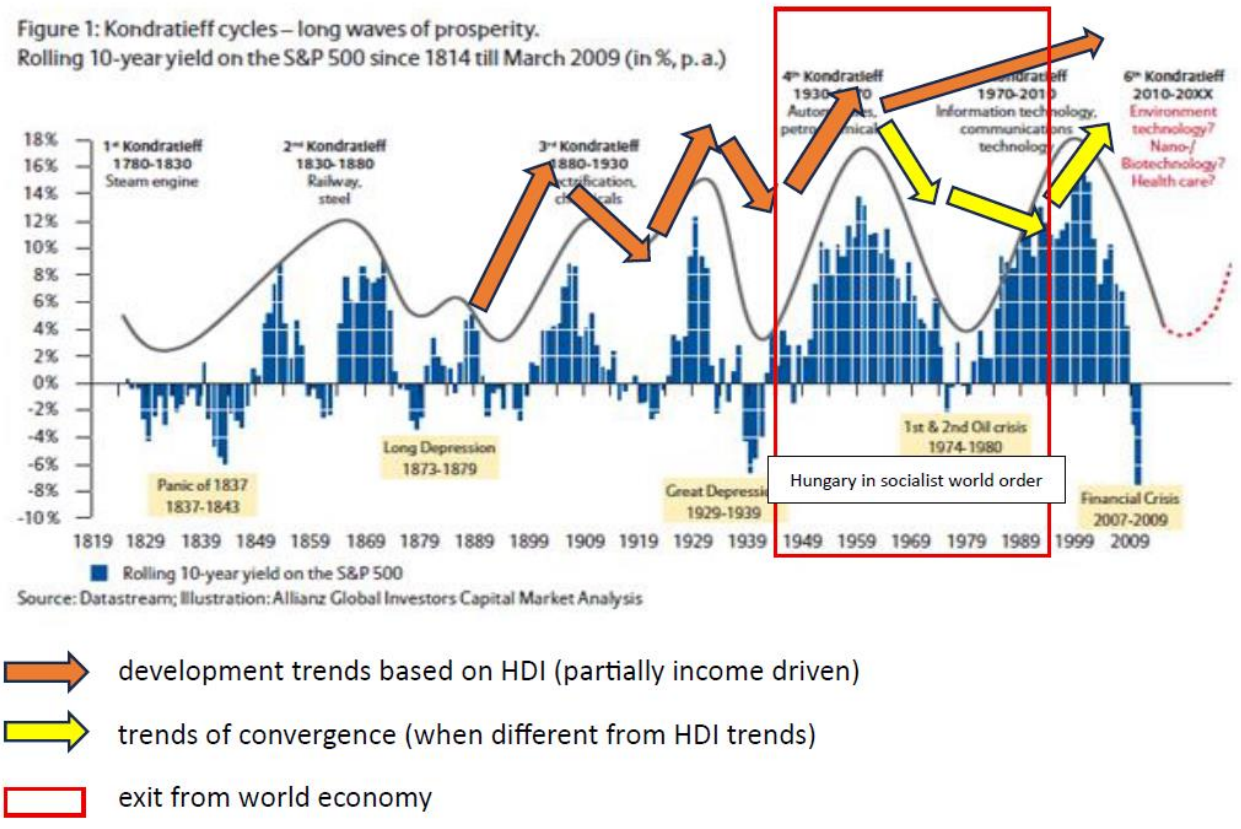


Figure 40. Kondratieff-cycles vs HDI and inequalities in Hungary (1880-2020)

After 2000, the decrease of spatial inequalities, the closing up of rural regions (ended in 2018) had political consequences too.

Core areas also underwent changes, with the exception of the outstanding values of Budapest, the core of growth in fact, representing stability in each era. Strengthening radiation of Budapest was accelerated by the suburbanization after the regime change in 1989.

A more favourable situation of northwestern Hungary was also observed during most of the studied time horizon. The spectacular weakening values after 2000 are resulted by the massive cross-border commuting causing statistical distortions in the national taxation datasets.

Appendix

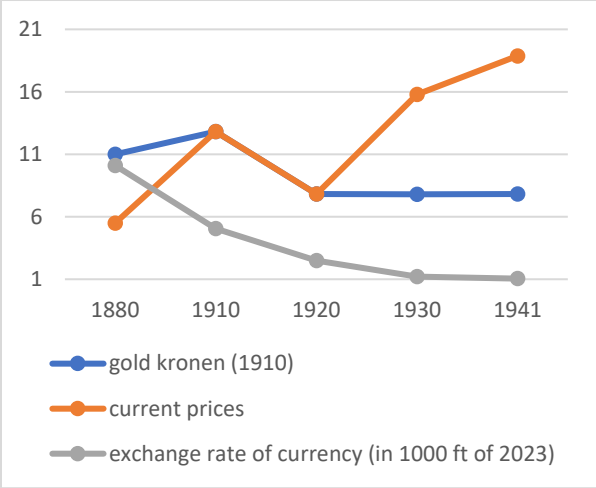
In the table below we report the spatial autocorrelation of the estimated HDIs in two ways. First, we report Moran's I, then we also report the spatial autocorrelation coefficient using a spatial error regression, without control variables. The patterns indicates an increase in spatial autocorrelation, that is, settlements with high and low HDI seems to become more aggregated spatially between 1910 and 1941.

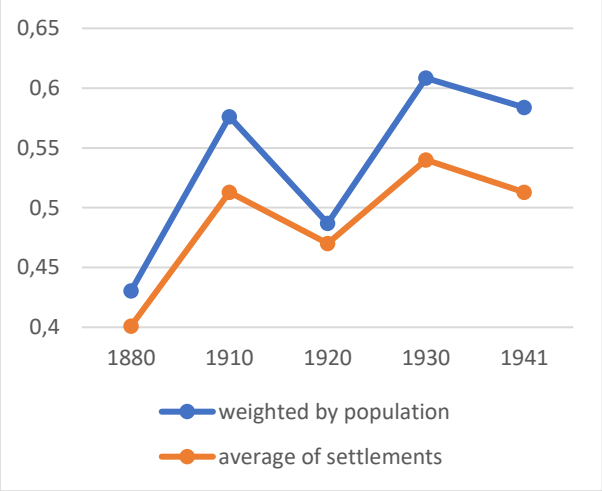
Year	Moran's I	Spatial error coefficient
1910	2.64***	0.075*** (0.027)
1920	1.95*	0.056** (0.027)
1930	3.21***	0.086*** (0.026)
1941	3.26***	0.090*** (0.026)

Note: Standard errors in parentheses. *, **, *** refers to significance at 10, 5 and 1% respectively. The above statistics are based on a row-normalized spatial contiguity matrix. The estimates are based on the post 1920 borders.

Relationship between HDI and population growth

	HDI-1960	HDI-1980	HDI_2001	HDI_2022
POP 80_60	0.447**	0.656**	0.620**	0.452**
Pop 00_80	0.254**	0.449**	0.648**	0.501**
pop20_00	0.202**	0.274**	0.466**	0.590**





Direct tax per capita values (at current prices and adjusted to gold Kronen of 1910)

Difference between HDI, aggregated at settlement level and HDI weighted by population