

A Fine-Scale Longue Durée Investigation on Regional Inequalities in the Kingdom of Hungary (1330–1910)

1. Introduction – sources

As the Carpathian Basin belonged to one political formation prior to 1920, economic processes were characterized by monocentric development in most of the second millennium (with the exception of the Ottoman era). By digitising serial sources and involving other scientific disciplines, it has become possible to analyse the longue durée trends and patterns of economic processes in the historical Kingdom of Hungary (without Croatia) – in other words to identify the cores and peripheries and their shift between 1330 and 1920.

Tracing both longue durée trends and patterns of development requires a systematic collection and harmonization of digitized datasets derived from archival serial sources and a special, inter- or multidisciplinary approach that involves historical statistics, methods of regional sciences such as multivariate statistics, spatial data processing and GIS-aided geographical approach to visualize data beyond the traditional philological and paleogeographical skills that help to read out and interpret the sources.

Our analysis is based on data derived from settlement level serial sources from four historical periods. The last (and most detailed) census of the Kingdom of Hungary was concluded in 1910 and the retrieved socio-demographic data are organised into a huge GIS database of the GIS_{ta} Hungarorum project.¹ Beyond the official volumes of the Statistical Bureau from the 1910s²

¹ Research was supported by the HAS RCH Lendület “Ten Generations” project (Gábor Demeter), the Bolyai János Research Scholarship of the Hungarian Academy of Sciences (János Pénzes) and the National Research, Development and Innovation Fund of Hungary K 145924 (Beatrix F. Romhányi).

² A Magyar Szent Korona országainak 1910. évi népszámlálása. Első rész. A népesség főbb adatai községek és népesebb puszták, telepek szerint. Magyar Statisztikai Közlemények, új sorozat. Vol. 42. Budapest 1912, 883pp. A Magyar Szent Korona országainak 1901–1910. évi népmozgalma községeinkint. Magyar statisztikai közlemények, új sorozat. Vol. 46. Budapest 1913, 727pp.

A Magyar Szent Korona országainak 1910. évi népszámlálása. Második rész. A népesség foglalkozása és a nagyipari vállalatok községeinkint. Magyar Statisztikai Közlemények, új sorozat. Vol. 48. Budapest 1913, 883pp.

other works focusing on settlement taxes and agrarian incomes were used too, to derive variables seen on table 1.³ The database was recently extended to the eighteenth century (see <http://gistahungarorum.abtk.hu> as an interactive version), by integrating the settlement level data of the Josephinian census from 1785-1787 (published in 3 volumes);⁴ the first Regnicolaris conscription after the Ottoman era from 1715/1720 covering more or less the whole county (inc. Transylvania) as published by Acsády in 1896 (without ethnic data which are absolutely unreliable);⁵ the so-called Lexicon locorum from the 1770s containing much reliable data on religion and spoken language for each settlement,⁶ the settlement-level conscription of tenants, including their legal status (*colonus*, *inquilinus*, *subinquilinus*, tax-payer freeholder, noble settling on peasant plot), their landsize, meadows, direct state taxes paid and their duties (compulsory workdays: *corvée*) and gifts in kind to the landlord in 1786 (without Transylvania), a source still unpublished.⁷ In order to substitute the data for the missing 2000 settlements of

A Magyar Szent Korona országainak 1910. évi népszámlálása. Harmadik rész. A népesség foglalkozása részletesen és a vállalati statisztika. Magyar Statisztikai Közlemények, új sorozat. Vol. 52. Budapest 1914, 1312pp.
A Magyar Szent Korona országainak 1910. évi népszámlálása. 4. rész. A népesség foglalkozása a főbb demográfiai adatokkal egybevetve és a népesség ház- és földbirtokviszonyai. Magyar Statisztikai Közlemények, új sorozat. Vol. 56. Budapest 1915, 377pp.

³ Magyarország művelési ágak szerinti területe és földjövödelme. Buda 1865, 545pp.

Abaúj...Zólyom vármegye adóközségeinek területe és kataszteri tisztajövödelme művelési áganként és osztályonként az 1909. évi V. t.-c. alapján (in 64 separate volumes). Budapest 1914, xxx

A debreczeni/ kassai/ kolozsvári/ budapesti/ besztecebányai/ nagy-szebeni/ pécsi/ pozsonyi/ szatmári/ szegedi / temesvári kataszteri kerület összes becselőjárásainak osztályozási vidékenkénti előleges tisztajövödelmi fokozatai és sommás osztálykivonatainak összeállítása. Budapest, 1882–1883.

JEKELFALUSSY József (ed.). A községek háztartása és pótdójuk. Az 1881. évi jóváhagyott költségvetések alapján. Országos Magyar Királyi Statisztikai Hivatal (Hivatalos Statisztikai közlemények 21). Budapest 1883, 529pp.

Magyarország községeinek háztartása az 1908. évben. Magyar Statisztikai Közlemények, új sorozat. Vol. 39. Budapest, 1913, 949pp.

Current spatial data published in the 2010s from the 8 successor-states of the Kingdom of Hungary were also collected, harmonised and processed for a spatio-temporal comparison.

⁴ Az első magyarországi népszámlálás (1784–1787) Budapest 1960, 389pp.

Pótlás az első magyarországi népszámláláshoz 1786–87. Budapest 1975, 91pp.

DÁNYI, Dezső – FARAGÓ, Tamás – LÁSZLÓ, Géza. II. József népszámlálásának községi adatai. A [KSH Népességtudományi Kutató Intézetének Történeti Demográfiai Füzetek 15. Budapest 1996, 122pp.

⁵ ACSÁDY Ignác. Magyarország népessége a pragmática sanctio korában 1720–21. Budapest, 1896, 496pp.

⁶ ILLÉS, József (ed.). Lexicon locorum Regni Hungariae populosorum anno 1773 officiose confectum. Budapest, 1920, 335pp.

⁷ Magyar Nemzeti Levéltár [National Archives of Hungary] Országos Levéltára (MNL OL), Magyar Kancelláriai Levéltár (1770–1848) [Hungarian Chancery Archives (1770–1848)]. 1785/86-i úrbéri összeírás (1785–1786) [Urbanial conscription (1785–1786)]. A 39, 3688/1786. Fónagy published data for 1767: FÓNAGY, Zoltán. A nemesi birtokviszonyok az úrbérrendezés korában. Adattár. Vol. I-II. Budapest 2013, 1536pp.

Transylvania we used the settlement-level conscription from 1750 published by Ladislau Gyémánt);⁸ furthermore the standardized and reorganized data of the three volumes of Vályi (1797)⁹ were also integrated into our database to identify constraints of agrarian production. Thus, beside data on 1910 (and on 2010 for the eight successor countries, which we do not analyse here) we have two more sets of socio-economic and demographic indicators in 1720 and 1786, mostly on the rural population and agriculture. Finally, we processed and integrated the papal tithe register from the 1330s, using the work of Fejérpataky (1887) and Croatian data published by Buturac (1984) and some other variables (table 1). This constituted the earliest time horizon of our investigations.¹⁰ Of course, it is possible to extend the database for other time horizons,¹¹ but this requires more time.¹²

It is evident that not all medieval-early modern terms and variables can be interpreted according to modern schemes. It is also not surprising that the number of “valid” indicators decrease as we go back in time. The harmonization of data of different kind, referring to different features and to correspond them with modern terms requires special skills (furthermore, handling unpublished and published works also require different skills) and a thorough knowledge on literature on the topic of creating indicators from raw data and measuring development.

2. Literature and methods

As the result of the dynamically broadening spatial datasets and improving processing methods, the possibilities of *longue durée* investigations and regional analysis in history have

⁸ GYÉMÁNT, Ladislaus et al. (eds.). *Conscripția fiscală a Transilvaniei din anul 1750. I–II*. București; Cluj-Napoca 2009–2016, 1272pp.; 1276pp.; 671pp.; 1056pp.; 733pp.

⁹ VÁLYI, András. *Magyar országnak leírása...* Vols. I–III. Buda 1796, 704pp.; 736pp.; 688pp.

¹⁰ FEJÉRPATAKY, Ladislaus (ed.). *Rationes collectorum pontificorum in Hungaria. Pápai tizedszedők számadásai. Monumenta Vaticana Hungariae* vol. I/1. 1281–1375. Budapest 1887, 524pp.

BUTURAC, Josip. *Popis župa zagrebačke biskupije 1334 i 1501 godine*. In *Starine*, 1984, vol. 59, p. 43–107.

¹¹ The conscription of 1828 just published online at the *AdatbázisokOnline* of the Hungarian National Archives were not used, as these are still under processing.

¹² Processing cca 10 variables for 10,000 settlements may take one year according to our experience, if done only by 1 person. Reading out Ottoman defters is even more slower, after 8 years of work we only processed 50% of the data on tax units and taxes in the 16th c. available for Hungary.

broadened substantially since the first attempts of Braudel.¹³ Historical research using GIS have become widespread allowing a shift in focus from vertical (societal) to horizontal (regional) structures. However, despite the general interest towards spatial historical analyses and the broadening of its geographical scope¹⁴ there are still numerous obstacles to overcome.

First, many studies focus on a single indicator, such as the reconstruction of historical GDP,¹⁵ which is difficult and the indicator itself is biased. Though its substitution has been attempted through hHDI¹⁶ or historical inequalities¹⁷ as a new dimension of measuring development levels, but these attempts rarely offer the fine-scale mapping of these regional inequalities. So, optimal scaling is the second obstacle. The third is the time-scale of studies, which remains often limited in case of using multiple (composite) indicators. Fourth, altering administrative boundaries and the changing focus of available conscriptions, or the lack of data covering extensive areas are also obstacles.¹⁸

¹³ CLOUT, Hugh. D. *The Land of France 1815-1914*. Routledge Library Editions: Rural History 3. London 1983, 2018, 186pp.

¹⁴ SCARGILL, Ian. Regional Inequality in France: Persistence and Change. In *Geography*, 1991, vol. 76, no. 4, p. 343–357; DORMARD, Serge. Economic development and regional disparities in France. In KARL, Helmut – ROLLET, Philippe. *Employment and regional development policy: Market efficiency versus policy intervention*. Hannover 2004, p. 50–67.; COMBES, Pierre-Philippe et al. The rise and fall of spatial inequalities in France: A long-run perspective. In *Explorations in Economic History*, 2011, vol. 48, no. 2, p. 243–271; da SILVA, Simone. A. Regional Inequalities in Brazil: Divergent Readings on Their Origin and Public Policy Design. In *EchoGéo*, 2017, vol. 41, p. 1–17; DíEZ-MINGUELA, Alfonso – MARTÍNEZ-GALARRAGA, Julio – TIRADO-FABREGAT, Daniel, A. Regional inequality and economic development in Spain, 1860–2015. *Palgrave Studies in Economic History*. Springer, 2018, 302pp.

¹⁵ CARUANA-GALIZIA, Paul. Indian regional income inequality: estimates of provincial GDP, 1875–1911. In *Economic History of Developing Regions*, 2013, vol. 28, no. 1, p. 1–27.; BUKOWSKI, Maciej et al. Urbanization and GDP per capita: New data and results for the Polish lands, 1790–1910. In *Historical Methods*, 2019, vol. 52, no. 4, p. 212–227; ENFLO, Kerstin – MISSIAIA, Anna. Regional GDP estimates for Sweden, 1571–1850. In *Historical Methods*, 2018, vol. 51, no. 2, p. 115–137.

¹⁶ For Hungary see: SZILÁGYI, Zsolt. Regional Differences in Development and Quality of Life in Hungary During the First Third of the Twentieth Century. In *The Hungarian Historical Review*, 2019, vol. 8, no. 1, p. 121–152. In general: PRADOS DE LA ESCOSURA, Leandro. *World Human Development: 1870–2007*. In *Review of Income and Wealth*, 2015, vol. 61, no. 2, p. 220–227.

¹⁷ MILANOVIC, Branko – LINDERT, Peter – WILLIAMSON, Jeffrey, G. Pre-Industrial Inequality. In *The Economic Journal*, 2010, vol. 121, no. 551, p. 255–272; REIS, Eustáquio. Historical Perspectives on Regional Income Inequality in Brazil, 1872–2000. In BÉRTOLA, L. – WILLIAMSON, Jeffrey. *Has Latin American Inequality Changed Direction?* Cham 2017, p. 143–170.

¹⁸ See for example, RUMPLER, Helmut – URBANITSCH, Peter – SEGER, Martin (ed.). *Die Habsburgermonarchie IX. Soziale Strukturen 2. Teilband: Die Gesellschaft der Habsburgermonarchie im Kartenbild. Verwaltungs-, Sozial- und Infrastrukturen. Nach dem Zensus von 1910*. Wien 2010, 362pp. Their maps use territorial entities of different size for Hungary and Cisleithania.

Compared to the investigations relying on late nineteenth century data, datasets from the eighteenth centuries or earlier were created with the purpose of taxation of land,¹⁹ therefore they are not ideal either for estimating regional inequalities, development levels or GDP and require special paleogeographical skills.

This article aims at addressing the problems outlined above by executing a fine-scale (municipal level) longitudinal investigation on the regional inequalities in the Kingdom of Hungary spanning over seven hundred years, using a GIS-aided quantitative approach. Beyond tracing and visualizing the *longue durée* shift of peripheries in Hungary between the 1330s and 1910, never attempted before. Győri & Mikle²⁰ focus on the present territory of Hungary in their investigation between 1910 and 2010, whereas Beluszky & Győri²¹ did not go back to the nineteenth century, Máténé and Ritzlné²² focused on urban settlements, Mariann Nagy on agriculture²³). The present study also has a methodological focus, when seeking to visualise temporal changes and differences for three time horizons. Studies analyzing historical regional inequalities in Austria-Hungary focus on GDP, not on overall development, therefore these are not fine-scale investigations.²⁴ Studies on the early regional development trends and patterns of

¹⁹ SCHNEIDER, Ute. Inquiries or statistics? Agricultural surveys and methodological considerations in the nineteenth century. In VIVIER, Nadine. *Golden Age of the State Enquiries. Rural Enquiries in the Nineteenth Century. Rural History in Europe 14*. Brepols 2014, p. 43–59.

²⁰ GYŐRI, Róbert – MIKLE, György. A fejlettség területi különbségeinek változása Magyarországon, 1910–2011. In *Tér és társadalom*, 2017, vol. 31, no. 3, p. 144–164.

²¹ BELUSZKY, Pál – GYŐRI, Róbert. Magyar városhálózat a 20. századelején. Budapest; Pécs 2005, 232pp.

²² MÁTÉNÉ BELLA, Klaudia – RITZLNÉ KAZIMIR Ildikó. 2022. A Trianon előtti magyar városok relatív fejlettségének vizsgálata strukturális egyenletek modelljével. In *Területi Statisztika*, 2022, vol. 62 no. 1, p. 3–34.

²³ NAGY, Mariann. *Regional Structure of the Hungarian Agriculture at the Beginning of the 20th Century*. Budapest 2017. 472pp.

²⁴ KLAPKA, Pavel – ERLEBACH, Martin. The contribution of spatial interaction modelling to spatial history: The case of central places and their hinterlands in the territory of the Austro-Hungarian Empire. In *Moravian Geographical Reports*, 2021, vol. 29, no. 4, p. 266–277; SCHULZE, Max-Stephan: *Regional Income Dispersion and Market Potential in the Late Nineteenth Century Habsburg Empire*. [Online]. LSE Working Papers no. 106/07, 2007. Department of Economic History, London School of Economics, London. Available online: <https://eprints.lse.ac.uk/22311/1/WP106schulze.pdf>.

Recently two new studies deal with regional inequalities in Austria-Hungary and their short-term trends: STÖLLINGER, Roman. *Economic Growth in the Habsburg Monarchy 1870-1910: Convergence, Catching-up, Confusion*. [online] Conference, Falling Behind and Catching Up Southeast Europe and East Central Europe in Comparison. Vienna, 23 June 2016. Available online: <https://wiiw.ac.at/roman-stoellinger-economic-growth-in-the-habsburg-monarchy-1870-1910-convergence-catching-up-confusion-dlp-3961.pdf>; ERFURTH, Philipp E.: *Is the European Union More Unequal Than the Habsburg Empire? Examining Regional Inequalities in Habsburg Regions. From 1870 to 2018*. [online] Stone Center On Socio-Economic Inequality. Working Paper Series. No.

new-born states after 1920 are also sporadic especially those using statistical analysis as method.²⁵ Similar complex and at the same time fine resolution research is rare in Europe. Historical decentralization of Italy and the Holy Roman Empire makes it impossible to execute research on large territory. In eastern Europe the lack of data hinders similar investigations, whereas in western Europe the problem is with the too much data still unprocessed.²⁶ A recent conference in Valencia pointed out that though in Portugal and Spain²⁷ similar frameworks do exist, but they do not go before the 19th c, thus data processing in Hungary is outstanding.²⁸ In Poland historical GIS produced remarkable efforts for the 16-18th c.²⁹ but the dismemberment of the state makes reconstruction difficult between 1795 and 1920, and neither the Portugal, nor the Polish database was evaluated yet.

Investigations using similar interdisciplinary methods in Slovakia targeting the early history of the region are rare (despite the possibilities in ecclesiastic conscriptions):³⁰ one may mention the statistical analysis of the conscription of 1720,³¹ the GIS-based historical atlas of

50. 2022. Available online: <https://stonecenter.gc.cuny.edu/research/is-the-european-union-more-unequal-than-the-habsburg-empire/>

²⁵ GYÖRI – MIKLE, A fejlettség; MAREK, Martin Václav. Souvislosti rozmístění socioekonomických charakteristik obyvatelstva a hospodářství ve vztahu k železniční síti v Československu v letech 1921 a 1930. Diploma thesis, Praha: Charles University, 2015. 134pp.; DEMETER, Gábor. Trends in regional inequalities between 1910 and 1930 in Hungary and the successor states. In *Wschodnioznawstwo*, 2020, vol. 14, p. 95–115.

²⁶ In Britain the Taxatio was processed in digital database, 20th c. data also, but a data prior to 1800 are not.

²⁷ The Spanish municipal population dataset (ESPOP) 1860-1930.

²⁸ Reconciling the irreconcilable: methods and techniques towards a European historical local population database. Valencia (Spain), 24-25 October 2024. ADEIT - Fundación Universidad-Empresa de la Universitat de València. Program available online at: https://aecr.org/wp-content/uploads/2024/10/Diptico-workshop-UV-2024_DEF.pdf

²⁹ See Atlas Fontium, available online at: <https://atlasfontium.pl/language/en/polish-lands-of-the-crown/>. SŁOMSKA-PRZECHA Katarzyna et al. Historical Atlas of Poland 2.0 – over 140 years of joint work of historians and cartographers. [online] 2021. Available online: https://atlas.icaci.org/wp-content/uploads/2021/icc_slomska_historical_atlas_of_poland_abstract.pdf

³⁰ VAVRINEC, Žeňuch. A Munkácsi Eparchia 1775-ben készített sematizmusa / Schematizmus Mukačevskej diecézy z roku 1775. Nyíregyháza 2022. 284pp.

³¹ KOHÚTOVÁ, Mária. K hodnote daňových súpisov z rokov 1715, 1720 a ich údajom o počte obyvateľstva. In *Historický časopis*, 1984, vol. 32, no. 1, p. 83–100; KOHÚTOVÁ, Mária. Štatistiky obyvateľstva v Uhorsku v 18. storočí. [online], 2016. Available online: <http://www.infostat.sk/vdc/pdf/doc/kohutova.pdf> TIŠLIAR, Pavol – ŠPROCHA, Branislav. Premeny vybraných charakteristík obyvateľstva Slovenska v 18. – 1. pol. 20. storočia. Bratislava 2017, 167pp.

Čéplö et al³² for the 18-20th c. Situation of 18th c. towns was compared by Žudel,³³ but still, most GIS-aided studies (like of Tišliar and Šprocha) focus on the territory of Slovakia and limit their timescale to late 19th or early 20th c.³⁴

By tracing the historical origins of present inequalities and analysing the location and features of backward areas as well as their shift in time, historical research of this kind can reveal path dependency, thus contribute to present territorial planning³⁵ and can also contribute to (re)assess different political systems in the past from a different perspective, by focusing on the spatial dimension of inequalities instead of the more common approach targeting income levels and social differentiation. In short, the Williamson-hypothesis³⁶ can be tested in extended timescale (back in historical past).

So the key questions we investigate are:

- how can administrative changes and *data harmonization* of eight countries be handled when visualizing fine-scale investigations and comparing several time-horizons;

³² ČÉPLÖ, Slavomir et al. Historický atlas obyvateľstva Slovenska. (18. - 1. pol. 20. storočia). Bratislava 2017, 250pp.

ČÉPLÖ, Slavomir et al. Vybrané populačné štruktúry na Slovensku (18. - 1. pol. 20. storočia). Bratislava 2016, 3305pp.

³³ ŽUDEL, Juraj. Obyvateľstvo slobodných kráľovských miest na Slovensku v 2. polovici 18. storočia. In Geografický časopis, 1987, vol. 39, no. 2, p. 148–168; KOLLAI, István: Patterns of Vernacular Conflicts in Medieval And Early-Modern Towns Of Historical Upper Hungary. In Studia Historica Nitriensia, 2022, vol. 26, no. 2, p. 305–322.

³⁴ TIŠLIAR, Pavol – ŠPROCHA, Branislav. Zaznávaný a nepoznaný Cenzus 1919 či len kuriozita? In Historický časopis, 2015, vol. 63, no. 2, s. 253–274; TIŠLIAR, Pavol – ŠPROCHA, Branislav. Malé dejiny veľkých akcií: sčítanie ľudu z roku 1919. In Studia Historica Nitriensia, 2021, vol. 25, no. 1, p. 113–130; TIŠLIAR, Pavol – ŠPROCHA, Branislav. Sťahovanie obyvateľstva vo výsledkoch sčítaní ľudu 1921 a 1930 na Slovensku. In Studia Historica Nitriensia, 2024, vol. 28, no. 1, p. 21–43; PRŮCHA, Václav et al. Hospodárske dejiny Československa v 19. a 20. storočí. Bratislava, 1974, 609pp.; SRB, Vladimír. Obyvateľstvo Slovenska 1918 – 1938. Bratislava 2002, 28pp.

³⁵ ACEMOGLU, Daron – ROBINSON, James. Why Nations Fail: The Origins of Power, Prosperity, and Poverty. New York 2012, 544pp.

³⁶ WILLIAMSON, Jeffrey, G. Regional inequality and the process of national development: a description of the patterns. In Economic Development and Cultural Change, 1965, vol. 13, no. 4, p. 3–84.

- *which indicators* are adequate to assess the long-run levels of development in case of changing variable structure (due to the temporal differences in available historical sources) and lacking fine-resolution historical GDP-data
- what *patterns* of regional development are observable in the long run in the Kingdom of Hungary: where were the main core and peripheral areas located, and how did their location change throughout the centuries;
- what *trends* of regional development are observable in the long run in the Kingdom of Hungary; under which political regime can we observe the deepening of inequalities and how can it be measured; can the Williamson-hypothesis be applied on long-durée historical datasets ?

Variables derived from the available historical sources that may have relevance in explaining development are listed in Table 1.

Table 1: Indicators derived from historical sources and used in the composite development indices in the different periods³⁷

1330	1720	1786	1910 (and 1880)	2010
• paid tithe, categorised; • number of parishes; • markets, fairs, tolls; • presence of fiscal administration; • presence of church hierarchy; • place of authentication, categorised; • number of mendicant friaries; • number of Pauline monasteries;	• ratio of tenants (<i>colonus</i>); • ratio of lodgers (<i>inquilinus</i>); • ratio of burghers and freemen (<i>civilis, libertinus</i>); • area of ploughland per peasant; • area of meadow per peasant; • change in the ratio of tenants up to 1786	• soil quality, 1786; cultural infrastructure, 1775; • ratio of tenants, 1786; • ratio of the poor living in other's house (<i>subinquilinus</i>) 1786; • area of vineyard per peasant; • area of ploughland per tenant, 1786; • number of days of corvée (<i>angaria</i>) per peasant;	• selected from 48 original variables using PCA; • average rate of infant mortality in 1901-1910 measured to total death, %; • non-earners measured to 100 earners in 1910*; • share of industrial earners to all earners in 1910, %*; • net cadastral income per	• selected from 12 variables reconstructed for the 8 successor state of the Kingdom of Hungary using PCA; • average migration rate in 2001-2011 measured to 1000 prs; • average death rate in 2001-2011 measured to 1000 prs; • share of population with maximum elementary school measured to the

³⁷ See sources above in introduction.

• urban privilege received before 1340; • correction index (when there was more than one parish church in a settlement and the cumulated sum of the tithe exceeded 20 grossi)	• grain production • technological level of cultivation (number of <i>calcatura</i> and <i>oxen</i>) (not visualised here)³⁸	• total sum of taxes per peasant, 1786; • ratio of strangers (<i>extraneus</i>) compared to the conscripted, 1785; • ratio of the absent compared to the conscripted, 1785; • number of families per house, 1785; • closeness the market (4 intervals); • ratio of the burghers compared to the number of families, 1785; • value of services in kind per peasant, 1786	• capita in 1910-ben, Kronen*; • settlement income per capita in Kronen in 1908*; • state direct tax per capita per one person in 1909*; *available for 1880 too	• population above 7 yrs, %; • share of population with degree measured to total population, %; • registered unemployed from all inhabitants in 2010, %; • gross income per capita in 2010 calculated in Ft³⁹
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In order to compare the development levels of the settlements for the four time-horizons, the above mentioned sets of indicators were converted into a composite indicator reflecting overall development for each periods (as we lacked municipal GDP data). Since in our case there are hardly any overlaps between the variables of the 1330s, 1786 and the 1910 datasets (whereas there is a great overlap between variables for 1910 and 2010, though the explanatory power of single indicators in explaining overall development level changed substantially, the use of the matching-persisting variables would have resulted in a massive loss of information. Therefore, we decided to focus on methodological consistency by applying Principal

³⁸ Situation in 1720 is analyzed by DEMETER – HORBULÁK, Regional socio-economic inequalities, p. 889–919.

³⁹ Situation in 2010 is analyzed by DEMETER, Gábor. Estimating regional inequalities in the Carpathian Basin – Historical origins and recent outcomes (1880–2010). In Regional Statistics, 2020, vol. 10, no. 1, p. 23–59.

Component Analysis (PCA) for each time horizon to reduce the numbers of interdependent indicators.⁴⁰

After this the values of the chosen indicators were normalised,⁴¹ and then a composite index of development (CDI) was created by aggregating the normalised values of the selected single variables. This procedure was repeated for all time horizons.⁴²

Historical Hungary certainly had a huge advantage in providing a unified statistical framework, while in 2010 its territory was divided between eight countries. However, the numerous administrative changes between 1330 (4400 entities) and 1910 (12500 entities) made a direct comparison of the different time-sections virtually impossible. In order to make our snapshots from different time horizons comparable (to overcome the obstacles caused by the superposition of two different administrative divisions) we decided to fit a uniform grid network instead of administrative boundaries.⁴³

The 5×5 km size of grid cells was calculated as based on the optimization method developed by Netrdová et al.⁴⁴ Thus we had more than 11,000 cells very similar to the real

⁴⁰ PCA allows the systematic narrowing of correlating variables, at the same time maintaining the variance of the original database. Instead of using the factor score values of the first or all derived principal components for further processing, we have selected one-one indicator from each group that showed the greatest correlation with the derived components. For the reliability of PCA, KMO and variance values were used. PCA results for 1786: KMO=0,71, variance explained 77%, 14 variables grouped into 6 components. PCA results for 1910: KMO=0,65, variance explained, 74%, Nr. of factors=3. PCA results for 2010: KMO=0,64, variance explained, 61%. Nr. of factors=3

Finally we omitted natural population increase/decrease, which in our opinion is an ambivalent indicator of spatial development. (Földvári proves that population growth shows strong correlation with welfare only until 1900, after this a “random walk” process occurs. FÖLDVÁRI, Péter. A magyarországi demográfiai átmenet nemlineáris időszerelemzése. In *Demográfia*, 2008, vol. 51, no. 2–3, p. 244–258.)

⁴¹ Rescaled between 0 and 1. The ranking was reversed for the ratio of the poor living in other's house, ratio of the absent compared to the conscripted, extent of corvée and value of in-kind services per peasant in case of the 18th c. investigations, mortality rates in case of 1910, etc.

⁴² Temporal comparison of the maps illustrating aggregated development levels of municipalities, i.e. the problem of changing administrative boundaries, was solved using a weighted grid network. Missing settlement boundaries for the 1330s were substituted by Voronoi-polygons before gridding, after the localisation of 4000 medieval parishes.

⁴³ JAKOBI, Ákos. A grid: aggregált és dezaggregált rácsmodellek a területi egyenlőtlenségek vizsgálatában. In *Területi Statisztika*, 2015, vol. 55, no. 4, p. 322–338. Another important feature of the grid models is that, due to their raster nature, raster analysis techniques can be performed, while they retain their vector data storage format.

⁴⁴ NETRDOVÁ, Pavlina – NOSEK, Vojtěch – P. HURBÁNEK, Pavol. Using Areal Interpolation to Deal with Differing Regional Structures in International Research. In *International Journal of Geo-Information*, 2020, vol. 9, no. 126, p. 1–14.

number of administrative entities in 1780-1910. However such a good resolution was not applicable for the 1330s due to missing data, therefore when comparing the development map for the 1330s with the 1780s we used a 10×10 km grid cell resolution. This reduced the number of cell entities to 4000, which was very similar to the number of medieval parishes.

One methodological problem with gridding techniques has to be mentioned, as certain distortions can appear. If the administrative territory of a settlement is too large, for example, containing many grid cells (Debrecen, Szeged, Subotica), the development of their peripheral villages is indicated higher than in the reality, as the core city's values are extrapolated to them.

To perform the composite development maps for the four time sections, the CDI values of the 5x5 km cells were ranked in deciles from 1 (best 10%) to 10 (lowest 10%) for each time horizon and visualized using a continuous cold-hot scale. These rankings also served as basic values for the overlay maps used for temporal comparisons: the dynamism of changes was illustrated by subtracting the decile values of each cell of the two comparable static maps.⁴⁵

However, composite development does not reflect on the strengths and weaknesses – even a settlement with low composite development value might have outstanding values regarding one or two indicators. Furthermore, the concept of development changes in time: the mercantilist idea considered the (simplificed) equation: more people = more money as valid, however, by the end of the 18th c. physiocratism put emphasis on more land = more production = more money, since they recognized that many people with small parcels is an unfavourable outcome from the point of view of taxation – thus relative overpopulation (demographic pressure in fact) can be harmful. On the other hand, we expect that our composite indicators illustrating more than one aspect of welfare is still better than GDP, which is one-dimensional, focuses on the economic aspect only, does not allow fine-resolution reconstructions, thus tracing internal inequalities, and it cannot be calculated for the past. To substitute GDP, we

⁴⁵ As rescaled CDI values range from 1 to 10, the maps illustrating the differences between two time horizons show values between -9 and +9.

decided to rely on proxy indicators of economic welfare, like tax/area (available for the middle ages and 16-17th centuries), representing the purely economic aspects. These were accompanied by several other indicators representing education, health, etc. It is evident that the composite indicator of development is composed of different set of indicators for each time horizon prior to 1880 (see Table 1), because common variables are simply missing due to the different nature of protostatistical (tax) conscriptions. On the other hand, it is also important to note, that having the same set of variables for each time horizon is not a necessity, since the weight of factors explaining development might change over time (see e.g. literacy, gradually losing its significance between 1880 and 1950). Before analyzing the picture obtained by the composite indicator, some of the single indicators are also illustrated here on maps, to see the different patterns.

3. Discussion

3.1. Patterns of development after the expulsion of the Ottomans (late 18th c.)

Using twelve variables referring to socio-economic and demographic features of the agrarian class (Table 1) the Composite Development Index (CDI) for 1786 was created too (Map 1). (Unfortunately, data were not available for Transylvania). According to the results, surprisingly, just hundred years after the expulsion of the Ottomans the long-harassed Great Plains seemed to be the most developed compared to the north-western areas, that were falling back (apart from the Danube-axis around Bratislava and the ore mining towns in the North, which were prosperous and developed) though these were not harassed by the Ottomans in the seventeenth century! But, since this latter north-western stripe served as refuge area for the population, it became overloaded and crowded by 1700. This was accompanied by low soil

quality and small parcels.⁴⁶ On the other hand, the relatively empty plains offered greater parcels and better soils (not to mention tax exemptions), thus attracted the population from the North (and from abroad) after the expulsion of Ottomans in 1699.

Focusing on the area of future Slovakia, the ore-mining central, mountainous parts, furthermore Spiš and Orava in the north beside Bazin, Modor, Szentgyörgy around Bratislava were the most developed (as compared to the entire kingdom). Eastern Slovakia (Zemplín, Šariš) and the valley of the Hron and Váh were underdeveloped.

Map 1. Composite development (agrarian) level of settlements 100 years after the expulsion of Ottomans (1780s) based on 12 variables (table 1), reclassified into deciles, calculated at 10×10 km grid cells. Source: author's own edition

3.2 Measuring regional development in the Middle Ages – creating grid-map for entities with no exact boundaries

The above example illustrate a situation with good data supply and explicit (traceable) administrative boundaries, which enabled us to perform gridding without resulting in many “empty spaces”. But can we extend the time horizon of our investigation, if settlement boundaries are unknown or unconsolidated, or the settlement density is much smaller? The question is not purely of methodological character, but has practical significance too, as it may help solve some of the historical problems of the region. Namely, it would allow the comparison of socio-economic-demographic situation before and after the Ottoman era. The Ottoman conquest (1541-1699) had deep impact on the settlement structure and development of the Hungarian Kingdom, but yet no country-scale and at the same time fine-resolution investigation

⁴⁶ DEMETER, Gábor. Területi egyenlőtlenségek a történeti Magyarország területén a reformkor előtt (1773–1796). In Magyar Gazdaságtörténeti Évkönyv, 2022, vol. 6, p. 143–188.

could quantify these changes. To execute such an investigation three problems have to cope with:

- (1) is there a historical source that can help reproduce the settlement structure of the country for the pre-Ottoman era,
- (2) does any of the medieval sources provide quantifiable data series to identify centres and peripheries, and
- (3) how can the lack of definite settlement boundaries be handled to make a pre-Ottoman map comparable with a post-Ottoman map? The simple gridding of points (identified medieval settlements) would result in numerous empty grid cells, thus subtracting the two maps (the pre- and post-Ottoman) would also inherit this unfavourable feature.

For the entire Kingdom of Hungary, the only more or less comprehensive source of the medieval settlement network is the papal tithe list set up between 1332 and 1337. Supplemented with additional parish registers from the same period, like the parish register of the Zagreb Diocese from 1334⁴⁷ we are able to reconstruct 97 per cent of the parish network of the era comprising altogether 4417 parishes in 4049 localizable settlements, while 187 parishes (c. 4 percent) remained unidentified.

This dataset offered a unique possibility to investigate regional differences of the Carpathian Basin in medieval times. Furthermore, the results may be comparable with other European kingdoms of the time, especially with England and France where similar lists subsist from the late-thirteenth and early-fourteenth century.⁴⁸ Thus, the place and weight of the Hungarian kingdom in fourteenth-century Europe can be better assessed.

⁴⁷ F. ROMHÁNYI, Beatrix. Plébániák és a dóporták – a Magyar Királyság változásai a 13–14. század fordulóján. In *Századok*, 2022, vol. 156, no. 5, p. 907–939.

⁴⁸ KÜMIN, Beat. The English Parish in a European Perspective. In FRENCH, K. et al. *The Parish in English Life 1400–1600*, Manchester 1997, p. 15–32; POUNDS, Norman J. G. *A History of the English Parish: The Culture of Religion from Augustine to Victoria*. Cambridge 2000; LOT, Ferdinand. *L'état des paroisses et des feux de 1328*. In *Bibliothèque de l'École des chartes*, 1929, vol. 90, p. 51–107. p. 256–315.

The economic capacity of the settlements could not be estimated in any other way as tax registers covering the whole kingdom hardly survived, and their interpretation is often problematic. The royal tax levied on the peasant hides did not depend on the plots' income, the paid sum was equal all over the kingdom. Contrary to this, both the tithe and the papal tithe were levied proportionally (10 per cent of the income), therefore the papal tithe list is a better source for our purposes – measuring differences in production (development) (Map 2). As the taxable goods were grain and wine (husbandry is not included!), this tax mainly represents the volume of agrarian production, therefore the CDI calculated for the fourteenth century has to be calibrated further by using additional indicators e.g., the presence of higher administrative and economic functions, of mendicant friaries etc.⁴⁹ Nonetheless, since in pre-modern times the primary sector was predominant in the economy, and CDI is based dominantly on agricultural data even in the eighteenth century too (Table 1), the results from the pre- and post-Ottoman era are comparable and thus long-term changes are detectable.

The comparability of visualised data, however, was challenged by the fact that the fourteenth-century parish boundaries are unknown, and for the comparison with the post-Ottoman period they needed to be substituted somehow. To overcome this obstacle and to approximate missing settlement boundaries for the fourteenth century, “geometrically calculated” (Voronoi) polygons were calculated for the whole territory (Map 3). These polygons are created based on equal distance from the parish centers and using the well-known boundaries of the dioceses (a higher hierarchic level above the level of parishes).⁵⁰ Tithe per parish area was also recalculated using these Voronoi-polygons as supposed boundaries of the parishes for 1330 (Map 2b), thus we were able to obtain data similar to the 18th-19th c. “income/hectare”-type data. This is a great step forward to approximate output/unit- type variables (like GDP/capita): since data on population is missing from the 14th c., we are unable

⁴⁹ However, these are not measured on a continuous scale, just as existing or non-existing (0-1 values).

⁵⁰ Cells along the kingdom's border need to be handled with caution as these regions were very sparsely populated.

to calculate output/capita or output/economic unit. (For the latter, the number of *porta* are available for the entire area of the country only from a later period, 1494, and the tax-system changed significantly during this period, therefore we cannot merge these two datasets on papal tithe and porta numbers). So, output/area remains the only solution for the 14th c. to measure economic intensity, and since tithe is a proportional tax on agrarian production, we may estimate the regional differences in the pattern of agrarian intensity.

The generated map indicates a better situation for Western Transdanubia and Southern Slovakia as compared to the map based on absolute, not-weighted tithe/parish values (Map 2a, 2b), while the Danube-axis performs a bit weaker. This means that in the Medieval Ages settlements (parishes) with smaller administrative area were not necessarily poorer than settlements with greater area. This would change dramatically after the Ottoman era. For example, Northwestern Slovakia or Burgenland performed better based on this indicator in 1330 as it did in the 18th c. after the Ottoman wars, or even in 1910 (based on direct tax/hectare or agrarian income/hectare or composite indicators created from indicators recorded in table 1).

Map 2a. The location of identified parishes and the tithe paid around 1330. Source: author's own edition based on literature in footnote 9.

Map 2b. Tithe per parish values in 1330 – weighted by the supposed area of the parish (Voronoi polygons used to substitute unknown administrative boundaries). Source: author's own edition based on literature in footnote 9.

Map 3. Voronoi polygons (used to substitute unknown administrative boundaries), based on the identified parishes – and hierarchic rankings of parishes according to the indicators given in table 1. Source: author's own edition based on variables in table 1 and literature in footnote 9.

Map 4. Patterns of deciles of the development indicator around 1330 calculated to 10×10 km grid network, based on the Voronoi polygons replacing the unknown parish and settlement boundaries. Source: author's own edition based on sources in footnote 9.

Aggregating other indicators to the tithe/area we created a Composite Development Index for medieval times too. Map 4. confirm that mining had a key role in producing (central) incomes in medieval times. Maramureş (salt), Southern Transylvania, Central Slovakian towns (ores), Börzsöny Mts. were among the most developed regions based on CDI together with other territories the development of which were determined by other sectors: Sopron-Ödenburg and Srijem (wine), Buda-Visegrád-Esztergom, Kalocsa, Szeged, Eger, Oradea (central functions) and Debrecen towns, Saxon Lands in Transylvania (economic productivity), Danube-axis between Bratislava and Buda (trade and commerce). The Szeklerland, the southern Plains and southern Transdanubia were lagging behind (however the old Roman routes along the Drava were still flourishing). To understand the situation of these backward regions one should add among the possible explanations, that the southern plains were devastated the most by the Mongol invasion of 1241 and probably could not recover; that the income from husbandry is not included in the tax values that were used up in our investigation, while it is well known – as the inscription on the map of Lazarus clearly indicates – that the southern plains, the Danube-Tisza Interfluvium were focusing on husbandry even before the Ottoman attack and not on grain production. Neither climatic explanations – the effect of Little Ice Age on precipitation and ground water levels in the plains – can be neglected. Considering CDI values (multidimensional approach to development), the southern flow of Hron and Váh (the homeland of Matúš Čák) are more developed in the 1330s compared to the picture in the 1780s! (It was in favourable also in 2010: it seems that decentralized, multipolar systems – that is the age of oligarchs in the 14th c., and the establishment of new states on the ruins of the Kingdom of Hungary after 1920 – show similar patterns for Slovakia despite the 700 years difference). Southern Slovakia in the 1330s was less developed compared to 1910 (however by 2010 it fell back to the 1330 levels regarding rankings, decile values). Central Slovakia in 1330 was very

developed, what is more interesting it managed to maintain its relative position in the 1780s, despite the decreasing significance of gold and silver production. Westernmost Slovakia was also developed both in the 1330s and in the 1780s, whereas the northwestern parts remained backward in the 1330s in the 1780s – and even in 1910.

It is important to emphasize that there is 400 years between the 14th and 18th c. snapshots, which is large. Illustration of patterns before and after the Ottoman conquest is therefore limited due to social and structural changes and the differences in the conscription methods. Research is in progress to introduce new time horizons for 1500 and for 1570s. An atlas to study Medieval Hungary has just been published containing hundreds of maps to illustrate socio-economic phenomena.⁵¹ In the meantime, for 10 years now we have been processing Ottoman tax conscriptions too.⁵² The subject of tax census is very similar to that of the 1330s – both are proportional taxes, measuring agrarian output, thus are similar indeed. In other words, we are able to calculate output/area after adjusting Ottoman currency to denarius. This allows us to connect late Medieval and Ottoman data and trace changes in patterns. However, the Ottoman database is still under construction, therefore our reconstruction on tax burdens and agrarian outputs are limited right now to some counties (see data in Table 2), showing tax burdens / area and agrarian output before and during the Ottoman rule.⁵³

Table 2. The size and types of taxes in six counties of South Transdanubia and Slavonia before the Ottoman period and at the beginning of the Ottoman conquest

⁵¹ F. ROMHÁNYI, Beatrix. *Kisatlasza a középkori Magyar Királyság történeti földrajzának tanulmányozásához (11-16. század) - A Historical Geographical Atlas of the Medieval Kingdom of Hungary (11th-16th century)*. Budapest 2024, 176pp.

⁵² See atlas at: <https://mnl.gov.hu/mnl/ol/terkepek>

⁵³ For comparison we abandoned Ottoman territorial units, reconstruction was made for medieval counties.

Medieval county	area (km ²)	Medieval parishes (1330s)	Total tithe in 1330 (den.)	Tithe/area (1330)	war subsidy /area (similar to the tithe, 10% in 1495)	supposed value of ninth (<i>nona</i>) / area (1495)	total tax / area (=30% of production)	total grain+wine production in denarius per area	Pre-Ottoman tax/area without <i>decima to church</i> (tithe) in denarius ⁵⁴	Tax/area in akce in the 1570s (at 1:1 akce:denarius rate) ⁵⁵	Tax/area value in 1579 calculated by 1:1.66 akce:denarius rate (data given in denarius)
Baranya	5718	203	10857.3	304	262.6	300	866.6	2888	566.6	711.3	1180
Somogy	6339	243	9360.6	236	173.7	230	639.7	2132	409.7	430.1	713
Tolna	4503	144	4666.3	166	220.4	170	556.4	1854	386.4	712	1181
Pozsega	1935	67	2261.3	187	188.5	190	565.5	1885	375.5	558.1	926

Data comparable are indicated the same.

3.3. The analysis of regional development patterns in 1910

The spatial pattern of development levels (CDI) obtained for 1910 (Map 5) based on the indicators seen in table 1 shows a mosaic spatial structure, with urban zones in focus of the developed areas. Besides these, the historical Spiš County and the northern mining towns in today's Slovakia were outstandingly developed, and the stripe ranging from Levice to Rožňava represented another developed region. Another axis of developed settlements stretched from Braşov through the Transylvanian Saxon territories to Banat's ore and coal mines. This region is divided from the northern axis by the underdeveloped Transcarpathia and Maramureş regions. The almost contiguous Nyírség-Szatmár-Bihar (Satu Mare – Bihor) area conspicuously separate the more mosaic-like Inner Transylvanian areas from the quite developed areas of the Hungarian Great Plains. From the Mátra Mountains region to Bačka (or to Szeged), there is a significant underdeveloped zone (of which only major towns stand out), which blends into the developed zone of South Transdanubia. The undeveloped areas of SW-Transdanubia in 1910 were followed by a largely coherent, more developed area to the north (Burgenland-Bratislava). Instead of the East-West or North-South slope, so characteristic in present geographical literature, in 1910 a concentric pattern along the Bratislava-Budapest-Debrecen axis was observable.

⁵⁴ Calculated value for comparative purposes, as Ottomans did not collect it and local people abandoning Roman Catholic faith (90% of Hungary) also did not pay that.

⁵⁵ Taxation rate cannot be higher than 25%, thus agrarian output can be estimated.

As for the Slovak regions, Central Slovakia maintained its relative good position, as well as the westernmost edge around Bratislava and the Spiš region. However the southern valley of the Hron and Váh lost their significance, whereas the areas around the Nové Zámky – Košice line gained importance (partly because of the transversal railway line). Much has been discussed about the reasons of the situation seen here, and we do not go into details here as we put emphasis on changes (trends).⁵⁶

Map 5. Patterns of deciles of the complex development indicator in 1910 calculated to 5×5 km grid network. Source: authors' own edition based on literature in footnote 1-2

3.4 Longue durée comparison of medieval, post-Ottoman and late nineteenth-century development patterns

In order to illustrate changes caused by the Ottoman period and the subsequent reconstruction, the grid cell maps created for 1330 and 1786 were compared using the CDI values ranked in deciles. Though we have data for 1720 too, to illustrate the patterns of inequalities prior to the reconstruction of the country, the data from 1780s are more diverse and illustrate development levels better. 1330 might be far from the Ottoman era, but we do not have taxation or other data covering the whole country that could represent differences in development levels for the 15th c. and neither Ottoman, nor Hungarian taxation was able to cover the whole country for the 16th c., not to mention that due to their different basis (*hane* vs. *porta*), we cannot combine them to substitute missing data, thus they are incomparable. Therefore 1330 and 1786 was used to symbolize pre-Ottoman acme and post-Ottoman reconstruction.

⁵⁶ 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. In *Historický časopis*, 2021, vol. 69, no. 5, p. 889–919.

To execute the comparison a 10×10 km grid was created from the Voronoi polygons (and not from settlement-points), as finer resolution was not applicable for the situation in the 1330s due to the empty cell values (missing data), (Map 1, and Map 4). The difference of the map from 1330 and 1780s, illustrating the changes of these four hundred years, was created with the same resolution (Map 6).

The pattern of changes suggests that areas ruined by the Ottomans recovered quicker, while those territories where the original settlement structure persisted (small villages with 500 inhabitants and an administrative area of 4-5 km radius) – and financed the wars against the Ottomans for 150 years through their high taxes – stagnated, while they also served as a refuge area with increasing demographic pressure on low quality soils and spall peasant plots. In the center of the country where the original settlement network was destroyed by the Ottomans in the Great Plains, brand new structures of cooperation emerged ('tanya'-farms, husbandry, townlets of 5-10,000 people) during the Ottoman occupation, which proved to be competitive. In other words, in this case "tabula rasa" offered better chances for growth than the survival of old structures. This puts the adaptivity of local people and Ottoman conquest into a different light at least from economic aspect, whereas it is also a good example of path dependency, i.e., when existing structures hinder development.

Map 6. Difference of development levels measured in 1786 and 1330 based on decile values at 10×10 km grid size. Source: author's own edition based on literature given in footnote 3-9.

Map 7. Difference between regional development levels in 1910 and 1786 using a decile classification at 5×5 km grid resolution (for input variables see Table 1). Source: author's own edition based on literature given in footnote 1-2 and 3-7.

As a next step we compared the situation in 1786 to that in 1910 using now again the finer resolution of 5×5 km cell size in order to illustrate the regional inequalities (uneven development, shift of backward areas) generated by the transition from preindustrial to

industrial societies. The differences of decile values (Map 7) from the two time horizons suggest that in this period the Great Plains, booming in the 18th c. began to stagnate, while Southern Transdanubia and present-day Slovakia, lagging behind in the eighteenth century, gained new impetus and produced a rapid increase, similarly to Northern Burgenland, the development of which was fuelled by the closeness of the increasing Viennese consumption markets.⁵⁷ Similar dynamism and amelioration in positions can be produced even without the closeness of such a huge consumption centre – the rise of Slovakia was based on raw material and industrial products. In Southern Transdanubia (which was devastated by the Ottomans and not recovered by 1786, unlike the Great Plains) growth was based on agriculture – largely on latifundia and not on peasant smallholdings (contrary to the surroundings of Vienna, where both types of economies flourished). However, Map 5 (as compared to Map 4 and Map 1) indicates that the rise of future Slovakia did not mean that the region was able to overcome its earlier backwardness – the northern and eastern parts of the region were still among the underdeveloped areas in 1910 together with large parts of Transylvania, which explains the dissatisfaction of the local people with Hungarian centralism, nationalism and liberal economic policies, all constituting a part of the “modernization scheme”. Some of the minority regions in the peripheries met only with one by-product of this “modernization” – “Magyarization” through schooling.⁵⁸

The above mentioned confirm our hypothesis, that beside the language question, land question and debates on broadening the suffrage,⁵⁹ regional differences also contributed to the growing tensions that became ethnicized by 1910 resulting in the collapse of the state (1920).

⁵⁷ HORVÁTH, Gergely K. Bécs vonzásában. Az agrárpiaicosodás feltételrendszere Moson vármegyében a 19. század első felében. Budapest 2013, 695pp.

⁵⁸ KÖVÉR György. „Statistikai asszimiláció” Magyarországon 1880–1910. In Századok, 2016, vol. 150, no. 5, p. 1221–1258.

⁵⁹ KÖVÉR, György. Magyarország társadalomtörténete a reformkortól az első világháborúig. In GYÁNI, Gábor – KÖVÉR, György. Magyarország társadalomtörténete a reformkortól a második világháborúig. Budapest 2003, p. 9–186.

This dissatisfaction also explains the changing patterns of development levels by 2010, as some of the formerly backward minority regions in the Northwest managed to emerge in Slovakia, whereas some regions dominated by ethnic Hungarians fell back either in Slovakia (Southern Slovakia) and Serbia/Yugoslavia (Vojvodina). However, Romania was unable to raise the level of development in the acquired Transylvania.

3.5. Permanent cores and peripheries

The visualisation of the medieval dataset and its comparison with the maps illustrating CDI values in 1780s, 1910 and 2010 led to several findings. It became clear that the highly developed region between Vienna and Budapest in 1910 or 2010 existed even in 1330; Maramureş (salt mines) and southern Transylvania were more developed in the 1330s than in 1910, etc.

This drove us to outline regions that can be identified as permanent peripheries (regardless of political regimes, socio-economic structures) and persisting cores. The investigation was limited between 1720 and 2010 (because the involvement of the medieval dataset would produce too many blank areas) and was carried out simply by aggregating the decile rankings of each grid cells for the four investigated time horizons.⁶⁰ The results are illustrated on Map 8. The region Bratislava-Sopron around Vienna, the southern Great Plains, towns of Central Slovakia, the Győr (Raab) – Budapest axis were the key permanent cores, and Zala, Western Transylvania, Zakarpattia, Northwestern and Northeastern Slovakia were the backward regions in the long-run.

Map 8. Aggregated decile values for four time horizons: 1720, 1786, 1910 and 2010 – identifying continuously developed and backward regions of the Kingdom of Hungary and its successor states. Warmer colours represent continuous cores, colder colours represent

⁶⁰ As for each time horizon cell values of CDI range from 1 to 10, four time horizons produce an interval between 4 and 40.

continuously underdeveloped areas. Source: author's own edition based on sources in footnote 1-9.

3.6 Long-run trends in regional inequalities – testing the Williamson-hypothesis

Though the dynamics of development and the changes in territorial patterns of inequalities can be assessed based on the visualized patterns, but this method do not allow temporal changes to be adequately quantified. In other words, the method used for identifying the peripheries does not give information on the general deepening or diminishing of inequalities.

However, this can be assessed by calculating the average of normalized CDI values for the most developed and least developed 20% of the settlements for each time horizon (without giving a territorial dimension to the investigation), or by comparing the average levels of development for each time horizon (Fig. 1).⁶¹ The rate of divergence/convergence can also be assessed using the quotient of the normalized average CDI values for the most developed and least developed 20%. This method offers a possibility to test the relevance of the Williamson-hypothesis, that is used to measure the extent of inequalities, in the historical past on fine-scale data for a large region. The increase in spatial inequalities is evident after the expulsion of the Ottomans as figure 1 suggests: the trends during the reorganization (1720–1786) of the country confirm the Williamson-hypothesis. The subsequent development into capitalism (1786–1910) causes stagnation in terms of inequalities (but not in HDI or in GDP between 1880 and 1910),⁶² while the era of globalization (1910–2010) shows a decrease in inequalities, (as Williamson suggested for the twentieth century in general), even despite the numerous border changes, decentralisation and economic restructurations followed by economic integration to the EU.

⁶¹ CDI values were rescaled between 0 and 1 for each time horizon to make them comparable.

⁶² SCHULZE, Regional Income Dispersion; SZILÁGYI, Regional Differences in Development.

If we add a brand new time horizon for 1880, splitting the era between 1786 and 1910 more or less referring to the political courses of enlightened absolutism and reforms, and the era of the dualist Austria-Hungary, as a dozen of variables available for 1910 were also recorded in 1880, then it becomes evident that the average normalized level of development decreases after 1880, while the most developed 20% continues to progress, the least developed 20% falls back. Thus the distance between the most and least developed 20% increases after 1880. Compared to this, between 1786 and 1880, the increase in average normalized level of development took place hand in hand with the decrease of inequalities, as the development of the leading 20% halted, while the least developed 20% began to catch up. All in all, the post-Ottoman reconstruction period (1720-1786) and the „national liberalism” of the first stage of capitalism (1880-1910) was characterized by increasing inequalities. The disintegration of the economic space (after 1920) not only led to a change in the territorial pattern of peripheries, but inequalities also decreased, while normalized mean development stagnated: the development level of the top 20% decreased, that of the bottom 20% increased.

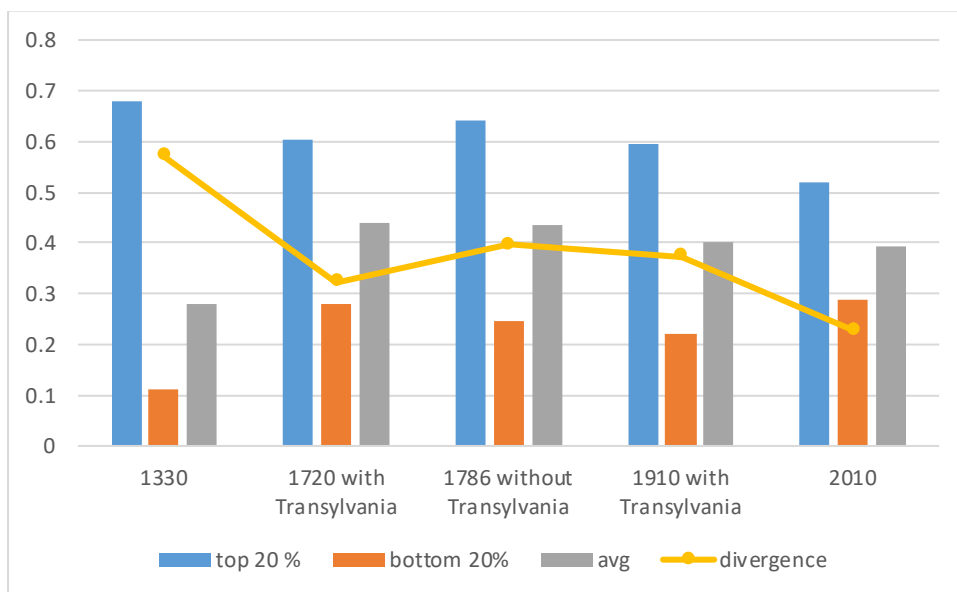


Figure 1. Trends in regional inequalities in historical Hungary and its successor states based on the rescaled composite development levels for the settlements (1330–2010)

4. Conclusions

Our study can primarily be interpreted as an experiment on the utilization of an enormous database containing approximately 9 million settlement level data from the 1330s to 1910 offering the *longue-durée* analysis of the history of cca. 300,000 sq kms from a different perspective. Beyond illustrating the regional patterns and shifts of cores and peripheries for several time horizons, and testing the Williamson-hypothesis on historical data of the past, our experiment was also targeted to resolve the methodological problems of visualizing the results emerging during a *longue durée* comparative investigation, such as

- (1) changing administrative areas
- (2) lack of exact boundaries for the investigated entities,
- (3) the changing accessibility and relevance of indicators in time (that makes comparison difficult),

We proved that our visualization methods (gridding, development maps) can be adapted both to a medieval dataset and to modern or contemporary ones. The *longue durée* regional approach enabled us to discuss some new ideas and explanations regarding structural changes, path dependency and regional trends of development for the Kingdom of Hungary and its successor states, that way contributing to the better understanding of East Central Europe's history. Former conclusions based on "average values" of GDP/capita,⁶³ or results of local investigations extended to the whole area of the kingdom (which is methodologically problematic) can be probed and compared to our results.

In order to select indicators that express the level of development adequately for the comparison of numerous time horizons, multivariate statistical analysis (PCA) was applied instead of the common set of indicators (because their number was very low), securing

⁶³ MADDISON, Angus. The World Economy. A Millennial Perspective. Paris 2001, 653pp.

methodological consistency. The use of gridding and decile-values also served the purpose of comparability. The creation of a composite development index (CDI) based on differing variable sets can be reasoned by the fact that historical HDI can be calculated only for time horizons in 1880, 1910 and 1940⁶⁴ while GDP at municipal or district level is completely missing (only a provincial level reconstruction was given by Schulze in 2007).

The methodology outlined above also offers the possibility to insert and evaluate new time horizons (1500s, 1720, 1828, 1880, 1930), making sampling denser, thus reaching more established results. As the snapshots on development levels and inequalities presented here do not rely on cause-consequence modelling, in other words, in the present investigation we did not make distinction between variables indicating/reflecting development and variables causing development. So, beside inserting new time horizons the application of Structural Equation Modelling can be a future step for a better understanding of relationship between variables, that way providing more reliable outputs for regional development patterns. However, even this short study relying on the comparison of four time horizons revealed that

- (1) detecting long-term temporal changes of peripheries is not impossible;
- (2) inequalities grew after 1720, stagnated between 1786 and 1910 and decreased by 2010 after the collapse of the Kingdom of Hungary – confirming the Williamson-hypothesis on historical datasets;
- (3) the Great Plains devastated by Ottomans overtook the unharrassed areas regarding development levels by the 1780s until 1910. This means that not only population agglomerations but also new economic structures were able to create prosperity.
- (4) among the least developed areas in 1910 many minority regions can be observed (Zakarpattia, Western Transylvania), thus regional inequalities could be easily ethnicized,

⁶⁴ SZILÁGYI, Zsolt. *Az ismeretlen Alföld*. Budapest 2022, 476pp.

(5) after 1920 there has been a great change in the location of peripheries and cores in Slovakia, for example, the Danube-axis, one of the most (and more or less permanently) developed region regained its primordial importance after the fall of the Great Plains in the 1920s, Western Slovakia rose and Southeastern Slovakia fell back.

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