Regional GDP disparities in the interwar and restored independent Baltic States

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Zenonas Norkus (Vilnius University, Faculty of Philosophy),
Jurgita Markevičiūtė (Vilnius University, Faculty of Mathematics and Informatics)

Abstract

This paper presents for the first time estimates of the regional GDP (RGDP) for Baltic countries during the interwar period (1918-1940), applying the methodology of Frank Geary and Tom Stark (2002) and expanding the set of countries covered in Roses and Wolf (2019). Our research questions: How large were cross-regional disparities in economic productivity in interwar Baltic countries? What are the similarities and differences in the patterns of cross-regional inequalities in interwar and restored independent Baltic countries? For the restoration period, our analysis covers the period since 2001 and is based on Eurostat RGDP data at the NUTS3 level. Because of their small size, the Baltic countries are not divided into NUTS2 regions, except for Lithuania, which, since 2018, has been divided into two NUTS2 regions (the Capital City Vilnius and Central and Western Lithuania). Therefore, unlike most work published in Roses and Wolf (2019), we use NUTS3 as the spatial units of analysis. Spatial cross-time harmonization problems are most formidable in Lithuania's case because of the instability of its interwar time borders. We use Coefficient of Variation (CV), Mean Logarithmic Deviation (MLD), Gini and Theil indexes to explore sigma convergence/divergence and also look for beta convergence/divergence. However, the application of the last tool is limited by a small N for two countries: Latvia is divided into 7, and Estonia into only 5 NUTS3. For the interwar period, we provide RGDP estimates for years with sufficient data on employment by sectors, which are population census years: 1925, 1930, and 1935 for Latvia, 1922 and 1934 for Estonia, and 1923 for Lithuania. Unavailability of wages data prevented us from including the Soviet period in our analysis when four population censuses (1959, 1970, 1979, 1989) took place. The main finding about Latvia is that sigma divergence was mainly stable over both periods. Direct comparisons of regional growth rates indicate that economically more advanced regions were more sensitive to business cycles than less advanced regions. Hence, sigma divergence seems to prevail in times of high growth and convergence in times of low growth. About Lithuania, the main finding is that overall levels of economic disparities in the territory of contemporary Lithuania are significantly higher than in Lithuania within interwar borders. However, in the contemporary NUTS2 Central and Western region, which rather closely corresponds territorially to that of the Republic of Lithuania in 1923-1938, they remained on the same level as in 1923. However, there were important changes in the rankings of particular regions within this territory. In 1923 Klaipėda ranked first, Šiauliai second, and Kaunas (provisional capital city of interwar Lithuania) only the third. In the Restoration era, Kaunas did take the first rank from Klaipėda (but only since 2017), remaining second to Vilnius, which was outside Lithuania during the interwar period and probably was poorer by its end. Rather differently, the predominance of Riga and Tallinn (capital city regions) remained uncontested during both periods under comparison. In restored Estonia, sigma divergence is also much above the interwar level.

Introduction

This paper contributes to the research on the long-run trends in the comparative regional development of European countries, focusing on the changes in the disparities in regional productivity, measured by regional GDP (rGDP). The research on economic cross-regional inequalities in European countries thrives in social sciences, monitoring and providing information on European Union (EU) cohesion policy, which is the EU strategy to promote and support the overall harmonious development of its member states and regions.[1]

Knowledge of the history of long-term evolution of territorial inequality is necessary to understand contemporary economic reality because it is the result of a long and complex process, strongly influenced by technological and institutional change, geography, and policies. Therefore, the research on current patterns of cross-regional inequality has recently been enlarged by quantitative research, focusing on the long-run (recent hundred or more years) trends in the changes in cross-regional inequalities.[2]

Such enlargement helps to gauge the efficacy limits of cohesion policy and to test competing theoretical approaches, providing contradictory pictures and forecasts of the temporal dynamics of cross-regional inequalities. However, currently, long-run perspective quantitative historical research is limited to older EU member countries, with only a partial exception for Poland.[3] In this paper, we

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[1] E.g., M. Boldrin, F. Canova, J.S. Pischke, D. Puga, 'Inequality and Convergence in Europe's Regions: Reconsidering European Regional Policies', *Economic Policy*, vol. 16(32) (2001), pp. 205–253; M. Borsi, T. and N. Metiu, 'The evolution of economic convergence in the European Union', *Empirical Economics*, vol. 48 (2015), pp. 657–681; M. Butkus, D. Cibulskiene, A. Maciulyte-Sniukiene, K. Matuzeviciute, 'What Is the Evolution of Convergence in the EU? Decomposing EU Disparities up to NUTS 3 Level', *Sustainability*, vol. 10(5) (2018), pp. 1–37.

[2] J.R. Rosés, N. Wolf (Eds.), *The Economic Development of Europe's Regions. A Quantitative History since 1900* (London, 2019); M. Badia-Miró, J. Guilera, P. Lains, 'Regional Incomes in Portugal: Industrialisation, Integration and Inequality, 1890–1980', *Revista de Historia Económica*, vol. 30(2) (2012), pp. 225–244; M. Badia-Miró, J. Guilera, P. Lains, 'Reconstruction of the Regional GDP of Portugal, 1890–1980', *Documents de Treball. Facultat Economia i Empresa* (Barcelona, 2012), pp. 12–280; E. Buyst, 'Reversal of Fortune in a Small Open Economy: Regional GDP in Belgium, 1896–2000', *Rivista di Storia Economica* 26(1) (2010), pp. 75–92; P. Caruana-Galizia, C. Hanes, S. Wolcott (Ed.), 'Estimating French Regional Income: Departmental Per Capita Gross Value Added, 1872–1911', *Research in Economic History*, vol. 29 (2013), pp. 71–95; N. Crafts, 'Regional GDP in Britain: Some Estimates', *Scottish Journal of Political Economy*, vol. 52(1) (2005), pp. 54–64; A. Díez-Minguela, M.T. Sanchis-Llopis, 'Regional income inequality in France 1860–1954: Methods and findings', *Historical Methods: A Journal of Quantitative and Interdisciplinary History*, vol. 52(1) (2019), pp. 1–14; K. Enflo' Finland's regional GDPs 1880-2010: estimates, sources and interpretations', *Lund Papers in Economic History. General Issues*, No. 135 (2014); K. Enflo, M. Henning, L. Schön, 'Swedish regional GDP 1855–2000: estimations and general trends in the Swedish regional system', *Research in Economic History*, vol. 30 (2010), pp. 47–89; K. Enflo, A. Missiaia, 'Regional GDP estimates for Sweden, 1571–1850', *Historical Methods: A Journal of Quantitative and Interdisciplinary History*, vol. 51(2) (2018), pp. 115–137; E. Felice, 'Regional value added in Italy, 1891–2001, and the foundation of a long-term picture', *The Economic History Review*, vol. 64(3) (2011), pp. 929–950; F. Geary, T. Stark, 'What happened to regional inequality in Britain in the twentieth century?', *The Economic History Review*, vol. 69(1) (2016), pp. 215–228; M. Henning, K. Enflo, F.N.G. Andersson, 'Trends and cycles in regional economic growth: How spatial differences shaped the Swedish growth experience from 1860–2009', *Explorations in Economic History*, vol. 48(4) (2011), pp. 538–555; J. Martínez-Galarraga, J.R. Rosés, D.A. Tirado, 'The Long-Term Patterns of Regional Income Inequality in Spain, 1860–2000', *Regional Studies*, vol. 49:4 (2015), pp. 502–517; D.A. Tirado, A. Díez-Minguela, J. Martinez-Galarraga, 'Regional inequality and economic development in Spain, 1860–2010', *Journal of Historical Geography*, vol. 54 (2016), pp. 87–98; D.A. Tirado-Fabregat, M. Badia-Miró, 'New Evidence on Regional Inequality in Iberia (1900–2000)', *Historical Methods: A Journal of Quantitative and Interdisciplinary History*, vol. 47(4) (2014), pp. 180–189.

[3] M. Bukowski, P. Koryś, C. Leszczyńska, M. Tymiński, 'Rozwój regionalny ziem polskich pod zaborami. Porównanie poziomu produktu brutto per capita na dzisiejszych terenach Polski na przełomie XIX i XX w. (wyniki pierwszych estymacji)', *Roczniki Dziejów Społecznych i Gospodarczych*, no 77 (2017), pp. 163–198; M. Bukowski, P. Koryś,

pioneer this line of research for Baltic States measuring their regional GDP disparities during the interwar period and them with those during restored independence period. These are our research questions: how large were cross-regional disparities in economic productivity in Baltic countries? What are the similarities and differences in the patterns of cross-regional inequalities in interwar and restored independent Baltic countries?

For contemporary Baltic countries, we are using ready-made rGDP figures, published since since 2001 by Eurostat.[4] Our original contribution is the estimation of the rGDP of Lithuania during interwar period. Because state of research and data on Estonia, Latvia and Lithuania differ very much, we proceed on country-by-country basis. Therefore, our contribution is divided into five parts. In the first part, we present our methodology, common for three next parts, which examine Latvian, Lithuanian and Estonian cases. Last part should contain concluding cross-country comparisons (taking into consideration also broader European context) and discuss obstacles to extending our contribution to the 1940-2000 period, which are common with those facing researchers interested in the cross-regional inequalities in the countries which called themselves socialist.

0. Methodology

Regional GDP estimates for contemporary Lithuania, which are published by its national statistical office and Eurostat, are derived by constructing subnational accounts according to System of National Accounts (SNA) 2008 rules. These are regional production (added value), income, and expenditure (or at least one account of such type). However, because of the lack of sufficient primary data, this is not possible for the more distant past. Thus, for the estimation of regional output of interwar Lithuania we use the methodology of indirect estimation, which recently became the standard approach in the quantitative research on the economic development of European regions.

Most recently this method was applied to calculate the GDP of the NUTS II regions of the older EU member countries by the international team of researchers under Joan Ramon Roses and Nikolaus Wolf (2019). The complete list of countries covered includes Austria (1870–2014), Belgium (1896–2010), Denmark (1850–2010), Finland (1880–2010), France (1860–2010), Germany (1895–2010), Italy (1871–2010), Netherlands (1820–2010), Norway (1900–2010), Portugal (1890–2010), Spain (1860–2010), Sweden (1860–2010). Our application is different only in that we will do this at the NUTS3 region level.

Frank Geary and Tom Stark (2002) are inventors of the method. The basic principle is that a country's GDP is equal to the sum of all regional GDPs. More specifically, the total GDP of any country (Y_i) is the sum of n regional GDPs (Y_j):

$$Y_i = \sum_{j}^{n} Y_j.$$

Next, regional GDP (Y_j) can be decomposed into contribution from all sectors in the economy:

$$Y_j = \sum_{k}^{K} y_{jk} L_{jk},$$

C. Leszczyńska, M. Tymiński, N. Wolf, 'Urbanization and GDP per capita: New data and results for the Polish lands, 1790–1910', *Historical Methods: A Journal of Quantitative and Interdisciplinary History*, vol. 52:4 (2019), pp. 213–227.

[4] Eurostat 2023. Gross domestic product (GDP) at current market prices by NUTS3 regions, https://ec.europa.eu/eurostat/databrowser/view/nama_10r_3gdp/default/table?lang=en (accessed 26.10.2024).

y_{jk} being the output, or the average value, per worker in each region j, in sector k, and L_{jk} the number of workers in each region j and sector k. As we have no direct data for y_{jk}, its value is approximated by assuming that regional differences in labor productivity in each sector are reflected in the regional industry wage level relative to the national sector wage level $w_{jk}/w_{k.}$

Therefore, regional GDP can be computed by:

$$Y_j = \sum_{k}^{K} \left[y_k \beta_k \left(\frac{w_{jk}}{w_k} \right) \right] L_{jk}.$$

Here, y_k is value added per worker in sector k at the national level, w_{jk} is the wage paid in region j in sector k, w_k is the country average wage in each sector k, and β_k is a scalar that preserves the relative region differences but scales the absolute values so that the regional total for each sector adds up to the country total:

$$\beta_k = \frac{Y_k}{\sum_j^K \left[y_k \left(\frac{w_{jk}}{w_k} \right) \right] L_{jk}},$$

where Y_k – total value added in a sector K.

This is a framework for indirect estimation of regional output figures, based on variation in employment and wages, which allows for an approximation of GDP by region at country factor cost. The basic data necessary for the application of this estimation procedure are national-level estimates of GDP, value added per worker by sector, and nominal wages and employment by sector.

After estimating total rGDP values for Lithuania's territories within contemporary NUTS3 limits in 1923, we calculate rGDP per capita values and apply to them standard measures of inequality: coefficient of variation (CV), Gini index, mean logarithmic deviation (MLD), Theil index. Following the mainstream approach, going back to Williamson (1965), we weight these values by the shares of the population of regions in total population.

All these statistical tools are measures of sigma (σ) convergence, defined by variation of values around sample or population mean (in statistics, σ is the designation of standard deviation, referring to the amount of variability in a given set of data: whether the data points are all clustered together, or very spread out). All measures of inequality presented above, are derivates of σ, sharing its properties: the lower σ is, the higher the level of convergence that has been reached. In theory, full equality is reached when the standard deviation is zero, while high values of σ reflect a very low degree of equality.

There is another concept of convergence referring to the necessary (but not sufficient) condition of sigma convergence.[5] This is beta (β) convergence: it occurs when poor economies grow faster than rich ones. In statistics, β is the designation of the coefficient at the independent variable in the regression equation. Its size indicates the degree of change in the outcome (dependent) variable for every 1 unit of change in the independent (predictor) variable. Its sign indicates the direction of change: the positive coefficient indicates that as the value of the independent variable increases, the mean of the dependent variable also tends to increase. A negative coefficient suggests that as the independent variable increases, the dependent variable tends to decrease.

In the analysis of cross-regional economic disparities, the independent variable is the level of GDPpc at the start of a period of interest, and the dependent variable is the annual growth rate during this

[5] See e.g. Sala-i-Martin, X. 'The Classical Approach to Convergence Analysis', *The Economic Journal*, vol. 106(437), pp. 1019–1036 (1996).

period. Thus, negative β coefficients indicate convergence: GDPpc in regions with lower levels of GDPpc at the start of the period increases more rapidly (or decreases less rapidly in the case of negative growth) than those with higher initial levels. Positive β coefficients indicate divergence: GDPpc in regions with higher levels of GDPpc at the start of the period increase more rapidly than in those with lower levels or decrease less rapidly in cases of negative GDPpc growth.
Measures of sigma convergence directly describe the distribution of annually created wealth across regions, and so the reliability of results depends only on data quality. Measuring beta convergence involves model estimation, and so the reliability of results depends on the N of the population sample. Since we have rGDP estimate for one year only for interwar Lithuania, application of the concept is not possible. Running regressions for2001–2020 we received only a few statistically significant results because of small N of cases. Hence, we only measure sigma convergence for Lithuania. We explored its applicability for Latvia, and received some statistically significant results, presented below. However, we received no such results for Estonia, where we are measuring only sigma convergence too.

1. Latvia

1.1 Contextual information and state of research

Due to their small size, the Baltic countries may be considered irrelevant for cross-regional economic disparities. However, Latvia is an exception to this assumption, due to extreme polarization between Riga and the rest of the country. In Estonia, the dominance of Tallinn is balanced to some degree by the growth of Tartu, while Lithuania has even two non-metropolitan economically successful cities (Kaunas and Klaipėda). Thus, Estonia ranks ninth and Lithuania fourteenth in the OECD (2022) ranking according to cross-regional economic disparities.

At the same time, Latvia is the only Baltic State which has a regional division inscribed into its constitution. The list of Latvian regions is provided in Article 3 of the Constitution (*Satversme*) of Latvia, accepted in 1922 and reinstated in 1991: “The territory of the State of Latvia, within the borders established by international agreements, consists of Vidzeme, Latgale, Kurzeme and Zemgale”. This provides a potential legal basis for regionalist politics and claims for equal consideration. However, the list does not include the capital city of Riga, which usually is singled as a separate unit on par with the four “constitutional regions”. It is placed at the juncture of three relatively advanced regions, i.e., Vidzeme, Kurzeme, and Zemgale, and it has status as their common gravitation centre (Fig.1).

Another distinctive feature of Latvia is the special position of the eastern part, Latgale. It has a significantly lower level of productivity and is known for a conspicuous regional identity, i.e., “Latvians of Latgale”, commonly called Latgalians. They are distinguished by the dominant Catholic and Orthodox churches, contrary to the dominant Lutheran faith in the rest of the country, Latgale also holds cultural and linguistic peculiarities. The ability of mainland Latvians to understand Latgalian without learning makes it akin to dialect. However, differently from other dialects in the Baltic languages, there is an old and still alive tradition of literature written in Latgalian. For Latgalian regionalists, this provides a reason to describe Latgalian as a separate Baltic language (Plakans 2011; Bukšs 2012, 1976). This makes the situation of Latvia unique in comparison with the other Baltic countries.

Fig.1 Historical ethnographic regions of Latvia (Provinces of the independent Republic of Latvia 1918-1940). Source: Šķiņķis, Pēteris. Administratīvi teritoriālais iedalījums Latvijā. https://enciklopedija.lv/skirklis/22981-administrat%C4%ABvi-teritori%C4%81lais-iedal%C4%ABjums-Latvij%C4%81
https://enciklopedija.lv/api/image/original?name=b22842116c16-6392855a-4633-42d8-86fb-c7c56a853485.jpg

The regional disparities acquired salience in geopolitical tensions after the outbreak of the hybrid Russian-Ukrainian war in 2014. Among new EU and NATO members, Latvia is sometimes perceived as the "weakest link" due to its high share of the Russian-speaking population (Pridham 2018). Besides Riga, Latgale holds a huge Russian concentration. As of 2022, the share of ethnic Latvians in the population of Latvia was 63%. However, in Latgale the share was 46%, and in the largest city of Latgale Daugavpils only 21%. Among the non-Latvian population of Latgale, 36% were Russians, 6% Poles, and 5% Belarussians (Central Statistical Bureau of Latvia. 2023b). The resentment against the "Riga elite", fueled by Latgale's socio-economic problems, like unemployment, poverty, and social exclusion finds its expression in the protest vote in support of Latvia's Russophile Harmony Center party and populist parties.

There is significant research on economic and social inequalities within and across regions of the restored independent state of Latvia (Auers et al. 2019; Kebza et al. 2019; Krastiņš, O. and Vanags 2005; Keišs and Kazinovskis 2014; Račko and Voronovs 2014; Vanags J. et al. 2012). Since 2000, Latvia's national statistical office has published annual estimates of regional GDP, based on Eurostat templates. However, nearly all cross-regional studies on interwar Latvia are qualitative or focus on cultural history (Zeile 2006; Bukšs 1957; 2012, 1976; Malahovskis 2014).

The only but important exception is the work of the Latvian pioneer of national accounting Alfreds Ceichners (1929a; 1929b), who presented estimates of the Latvian national income for 1925, 1929-1930, and 1932 (Norkus and Markevičiūtė 2021; Grytten et al. 2022). The estimation of Latvia's national income for 1929-1930 was the topic of his habilitation thesis (Ceichners 1931), including the attempt to estimate the share of Latgale of the total national income. Ceichners' main results for 1925 at current prices are presented in table 1.

Employment branch	Vidzeme	Kurzeme	Zemgale	Latgale	Latvia (total)
Agriculture	163.8	84.5	110.2	113.0	471.0
Manufacturing	106.9	27.7	18.7	16.7	170.7
Trade	63.0	13.9	8.7	16.7	100.0
Communications and transport	21.4	5.3	3.4	3.5	34.0
Public administration	13.0	3.0	2.2	3.6	22.0
Intellectual work occupations	35.4	6.8	4.6	7.0	54.0
Servants, including domestic servants	14.0	3.5	2.0	2.3	22.0
Other and unknown occupations	27.9	10.9	7.8	7.2	54.0
Total	445.0	155.0	158.0	168.0	926.0
For 1 employed person, Ls	1 005.0	904.0	890.0	505.0	825.0
For 1 inhabitant, Ls	600.0	541.0	571.0	311.0	502.0

Table 1. Latvian regional and national income in 1925. Source: Ceichners 1929b.

Unpublished Ceichners estimate refers to 1929-1930 and provides only national income figures (also at current prices) for Latgale along with totals for Latvia (table 2).

Employment branch	Latgale	Latvia
Agriculture	103	493
Forestry	2	18
Sea fishing	-	3.5
Manufacturing	17	270
Trade and credit	16	177
Transport and communication	5	47
Real estate in the towns	2	40
Other income (salaries of officials etc.)	10	103
Total	155	1151
The income of Latgalian workers earned in other regions of Latvia	10	-
Total	165	1151
Per capita, Lats	300	600

Table 2. Latgalian regional and Latvian national income (millions Ls) in 1929-1930. Source: LSHA 1308, 11, 18920. [6]

According to the first estimate, national income per capita in Latgale was 62 percent of Latvia's mean value. According to the second, it was 50 percent of the Latvian mean. Grytten et al. 2022 (see also Norkus 2018) provide the discussion of Ceichners work on the national income of interwar Latvia. The main finding is that his accounting methodology was unstable, being marked by ad hoc changes in the calculation rules. Thus, for 1929-1930 alone he provides three different national income estimates. For the same reason, his estimates for different years are not comparable and cannot be used for output growth assessment. Therefore, it is not possible to know whether the difference in his estimates of Latgale's standing in comparison with the national mean for 1925 and 1929-1930 reflects his opinion that in 1925-1930 the lag between Latgale and mainland Latvia increased.

[6] The text found in the archive (LSHA 1308, 11, 18920) does not have a date. However, its content suggests that it could be written in 1933-1934.

In addition, we find Ceichners' pioneering estimates of the regional shares conceptually flawed. From the contemporary systems of national accounts (SNA) perspective, gross domestic product (GDP) is the value of finished domestic goods and services produced within a specific territory (United Nations 2009). On the other hand, national income is the value of the final production of goods and services owned by a country's citizens, whether those goods are produced in that country, and it excludes income repatriated by foreigners. Hence, national income is calculable only on the national level, as there is no possibility to trace the income flows across regional limits. Nevertheless, Ceichners' figures are of interest for control purposes.

2.2 Data and issues of spatial cross-time data harmonization

To make cross-time comparisons of the new figures with the restored independence period possible, we calculate rGDP twice. First for the Latvian regions (*apgabals*) according to the interwar administrative regional division (Kurland, Latgale, Vidzeme, Zemgale, Riga city). However, the limits of these units only approximately correspond to those for NUTS 3, which in 2009-2021 were also "planning regions" (*Latvijas plānošanas reģioni*), (figures 1 and 2).

Fig.2 NUTS 3 statistical regions of contemporary Latvia by the Central Statistical Bureau of Latvia, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=18527500

While the territory of the interwar Kurzeme region perfectly coincides with that of the contemporary NUTS3 region (LV003), this does apply to the other regions. In interwar Latvia, there was no Pierīga region, which includes the territories of interwar Riga and Tukums. Accordingly, the contemporary Vidzeme (LV008) region was diminished by Riga County, while Zemgale (now LV009) "lost" Tukums county. Another "loss" is Ilukste county, which now belongs to Latgale (LV005). However, the territory of the Latgale region itself was diminished by the transfer of one-third (1300 km^2) of the territory of interwar Jaunlatgale (renamed in 1938 to Abrene) county to the Russian Federation in 1945 (Nacionālā Enciklopēdija 2018, 37).

Interwar Latvian regions (Composition by interwar counties)	Contemporary (NUTS 3) statistical regions (Composition by interwar counties)
Riga City	Riga city (LV06)
Na	Pierīga (LV007): Riga and Tukums counties
Vidzeme: Riga, Valmiera, Cesis, Valka, Madonna counties	Vidzeme (LV008): Valmiera, Cesis, Valka, Madonna (Riga to Pieriga)
Kurzeme: Liepaja, Aizpute, Kuldiga, Ventspils, Talsi counties	Kurzeme (LV003): Liepaja, Aizpute, Kuldiga, Ventspils, Talsi counties (no changes)
Zemgale: Tukums, Jelgava, Bauska, Jekabpils, Ilukste counties	Zemgale (LV009): Jelgava, Bauska, Jekabpils (Tukums to Pieriga, Ilukste to Latgale)
Latgale: Daugavpils. Rezekne, Ludza, Jaunlatgale (Abrene) counties	Latgale (LV005): Daugavpils. Rezekne, Ludza, Jaunlatgale (Ilukste from Zemgale, part of Jaunlatgale (Abrene) county to Russian Federation)

Table 3. Spatial synchronization scheme for Latvian interwar and contemporary (2009-2019) regions.

To ensure maximal comparability, we calculate rGDP also for territories enclosed within the contemporary limits. For this aim, we reorganize the data according to the spatial harmonization scheme presented in table 1. Because our aim is a cross-time comparison and space is limited, we present rGDP figures for territories within contemporary NUTS3 only. However, comparing our findings with Ceichners' estimates, we use rGDP for regions according to interwar time definitions.

The data necessary for application of Geary Stark method procedure are national-level estimates of GDP, value added per worker, nominal wages, and employment by sector. We follow the same procedure as Roses and Wolf 2019, i.e., the Geary-Stark method for census years only, since they provide the most reliable data on employment by sector. Four inter-war censuses were taken: 1920, 1925, 1930, and 1935. However, the 1920 census data were only partly published, and they do not include employment statistics.

The 1930 census data was also incompletely published, probably because of austerity policies imposed by the Latvian government during the Great Depression. However, we were able to locate relevant data in the archives. Importantly, original data exist with breakdowns by regions and counties, making it possible to regroup the data according to borders for contemporary NUTS III regions, i.e., Kurland, Latgale, Pieriga, Riga, Vidzeme, Zemgale, according to spatial harmonisation scheme in table 1. Our regional employment data is available in Annex 1.

The Latvian statistical office published the annual "Statistics of Labor" (*Darba statistika*), containing data on manufacturing by major cities, regions, and professions. We draw from this source, using means of daily wages of skilled and unskilled workers for regions. For agriculture, we found necessary data in the accounts of expenditures and revenues, collected from a sample of farms, covering all four regions. The real challenge is data on wages in the service sector, as "Statistics of Labor" provides them for a limited number of occupations and locations only. Following the established practice in the application of the Geary-Stark method, we use the weighted means of wages in agriculture and manufacturing, using the number of persons employed in agriculture and manufacturing in the different regions as weights.

Almost all authors applying the Geary-Stark method, use nominal wages (Roses and Wolf 2019). However, cross-regional differences in nominal wages reflect not only differences in labor

productivity, but also those of living cost. This could be important for Latvia, where retail prices for most food products were higher in Riga. Therefore, we deflated nominal wages by using regional rye prices and following the examples by Wolf (2019) and Lust (2007). Then we do our calculations twice: using nominal and real wages data (this data is in Annexes 2 and 3). Because of space limits, we present only the findings on rGDP based on real wages in the main text, placing estimates based on nominal wages into Annex 4.

Calculating rGDP for the the Pieriga region (LV07), which was non-existent in the interwar time, we use employment data for the Riga and Tukums counties, and agricultural wage data for interwar Vidzeme, which included the Riga County. Manufacturing wages for the Pieriga region are computed as the weighted average of Vidzeme and Zemgale wages. We use the number of employed persons in Riga and Tukums counties as weights. The last data necessary for the estimation of the rGDP are national-level GDP at base prices by sectors. These data were recently provided by Norkus et al. (2022) and Klimantas et al. (2023).

Year	GDP at basic prices, mil.Ls, total	GVA of agriculture, forestry, and fishing, mil. Ls	GVA of manufacturing and construction, mil. Ls	GVA of services, mil.Ls
1920	485.5	169.9	51.5	264
1921	561.2	212.8	74.6	273.9
1922	578.5	207.7	89.5	281.3
1923	674.7	240.3	117	317.4
1924	698.1	238.2	125.5	334.3
1925	**755.3**	**262.00**	**136.9**	**356.4**
1926	764.2	257	139.7	367.4
1927	789.7	261.8	149.5	378.5
1928	795.3	245.0	158.8	391.5
1929	872.9	273.7	178.9	420.4
1930	**946.6**	**294.9**	**207.4**	**444.2**
1931	868.3	288.3	175.0	405.0
1932	862.8	322.4	156.2	384.2
1933	947.3	339.5	197.7	410.0
1934	1037.6	375.1	228.8	433.7
1935	**1061.8**	**383.4**	**240.1**	**438.3**
1936	1073.6	364.4	255.8	453.6
1937	1167.7	390.7	291.8	485.3
1938	1203.1	399.9	308.2	495.0
1939	1209.7	409.7	314.5	485.6

Table 4. Real GDP at 1935 base prices in Latvia 1920-1939. The GDP values used for rGDP estimation are in bold. Source: Klimantas et al. 2023; Norkus et al. 2022.

After estimating total rGDP values for the interwar regions and territories within contemporary NUTS3 limits, we calculate rGDP per capita values and use standard measures of inequality, i.e., coefficient of variation (CV), the Gini index, mean logarithmic deviation (MLD), and the Theil index. Following the mainstream approach, going back to Williamson (1965), we weigh the values by the shares of the population of the regions to the total population.

All these statistical tools are measures of sigma convergence (σ), defined by variation of values around a sample or population mean. In statistics, σ is a designation of standard deviation, referring to the amount of variability in each set of data: if the data are clustered. All measures of inequality presented here are derivatives of σ. The lower σ is the higher convergence. Full equality is reached when the standard deviation is zero, while high values of σ reflect a very low degree of equality.

There is another concept of growth convergence, i.e., β-convergence: it occurs when initially poorer economies grow faster than initially richer ones. In statistics, β is the designation of the coefficient of the independent variable in a regression equation. Its sign indicates the direction of change. A positive coefficient indicates divergence, and a negative coefficient indicates convergence. In an analysis of cross-regional economic disparities, the independent variable is the level of GDPpc at the start of a period of interest, and the dependent variable is the annual growth rate during this period.

2.3 Findings: cross-time comparison of disparities in regional productivity

Table 5 provides a summary of our findings at constant 1935 prices. We report Eurostat (2023) data on Latvian rGDP, 2001-2016, recalculated at constant 2010 prices in table 6. As the output figures for these periods are in different monetary units, comparison of rGDP volumes are impossible. However, as they are at constant prices, a comparison of growth rates is sensible.

Importantly, the two periods of rGDP punctuate substantively different eras of economic development. For interwar Latvia, 1930 was the last year when its economy displayed growth before it contracted in 1931-1932, related to the Great Depression, which hit Latvia during the autumn of 1930. In 1935, the economy was firmly on the track of recovery, which according to recent findings started in 1933 (Klimantas et al. 2023).

For the restored independent Latvia, 2006 was the last year of the two-digit growth rates. The following year, it slowed down, and in 2008-2010 the economy contracted severely, affected by the Global Financial Crisis (GFC) 2007-2008. 2011 is the first year when it displayed growth again, continuing the next five years. The available data do not allow us to estimate rGDP for the last years of the interwar independence,1935-1939. Thus, one cannot compare them with the next period of strong growth of the restored independent Latvia, 2011-2016. However, national growth rates for this period can be compared with those for 1935-1939, provided in Klimantas et al. (2023).

Hence, we find that the growth rates in restored independent Latvia were significantly higher in comparison to the interwar time. The cross-time difference in growth rates can be explained by period effects, as the interwar years are known as an era of weak growth (Feinstein et. al. 1997). The main cause was the breakdown of international trade during and after the Great Depression, including a temporary reversal of globalization. Differently, the GFC did not have such an effect. However, there were important similarities in the economic policies of the Latvian governments during both periods. During the GFC, the Latvian government embraced extremely strict austerity policies, to uphold the peg of the national currency to the Euro. Also, an aim of the economic policy of the Latvian government 1930-1936 was to avoid devaluation of the Lat. This policy delayed the recovery. The austerity policies during the GFC helped Latvia to preserve the image of a safe haven for foreign investments.

Indeed, the huge inflow of foreign investments on the eve of the Latvian entry to the EU in 2004 and during its first membership years probably was a main driver for its two-digits growth. Foreign investments were an important driver of the interwar growth until 1930, when more than 50 percent of its manufacturing was foreign-owned (Ceichners 1933: 58). However, during the next decade outflows surpassed inflows, making Latvia rely on domestic capital accumulation.

		1925		1930		1925-1930, annual growth GDPpc %	1935		1930-1935, annual growth GDPpc %	1925-1935, annual growth GDPpc%
		Total, mil. Ls	Per capita, Ls	Total, mil. Ls	Per capita Ls		Total, mil. Ls	Per capita. Ls		
	Contemporary Latvian NUTS regions									
LV06	Riga	284.16	841.46	414.68	1097.27	5.45	433.99	1127.05	0.54	2.97
LV07	Pierīga	53.44	378.44	61.25	406.04	1.42	75.08	482.63	3.52	2.46
LV08	Vidzeme	113.80	373.56	116.72	392.47	0.99	141.49	477.48	4.00	2.48
LV03	Kurzeme	122.25	426.46	139.80	485.25	2.62	148.03	505.82	0.83	1.72
LV09	Zemgale	75.35	411.23	84.20	443.55	1.52	102.61	520.64	3.26	2.39
LV05	Latgale	161.71	273.44	199.14	334.16	4.09	238.40	382.17	2.72	3.40
LV000	Latvia	810.70	439.45	1015.79	534.62	4.00	1139.60	584.26	1.79	2.89
	Interwar Latvian regions									
Na	Riga	283.74	840.22	414.52	1096.85	5.48	433.66	1126.20	0.53	2.97
Na	Vidzeme	151.31	373.77	160.21	395.76	1.15	194.39	478.50	3.87	2.50
Na	Kurzeme	121.76	424.76	139.66	484.78	2.68	147.59	504.30	0.79	1.73
Na	Zemgale	106.35	385.40	119.09	413.39	1.41	146.94	490.84	3.49	2.45
Na	Latgale	147.54	273.38	182.31	336.91	4.27	217.02	382.64	2.58	3.42
Na	Latvia	810.70	439.45	1015.79	534.62	4.00	1139.60	584.26	1.79	2.89

Table 5. Regional GDP of interwar Latvia, 1925-1935, within contemporary NUTS3 and interwar region borders at constant 1935 prices (estimates based on cross-regional differences in real wages). Own calculation.

		2001		2006		2001-2006. annual growth GDPpc %	2011		2006-2011. annual growth GDPpc %	2016		2011-2016 annual growth GDPpc %	2001-2011 annual growth GDPpc %	2001-2016. annual growth GDPpc%	2006-2016. annual growth GDPpc%
		Total, mil. Eur	Per capita, Eur	Total, mil. Eur	Per capita Eur		Total, mil. Eur	Per capita. Eur		Total, mil. Eur	Per capita. Eur				
	Contemporary Latvian NUTS regions														
LV06	Riga	5089	6800	9763	13900	15.37	9934	15200	1.80	13767	21500	7.18	8.38	7.98	4.46
LV07	Pierīga	1098	3100	2160	5900	13.74	2897	7800	5.74	3847	10500	6.13	9.67	8.47	5.93

LV08	Vidzeme	622	2500	1107	4700	13.46	1291	6100	5.35	1644	8500	6.86	9.33	8.50	6.10
LV03	Kurzeme	1118	3500	1779	6000	11.38	2236	8300	6.71	2376	9600	2.95	9.02	6.96	4.81
LV09	Zemgale	703	2400	1311	4800	14.87	1624	6400	5.92	1919	8100	4.82	10.31	8.45	5.37
LV05	Latgale	735	2000	1227	3600	12.47	1654	5500	8.85	1784	6500	3.40	10.65	8.17	6.09
LV000	Latvia	9374	4000	17363	7800	14.29	19666	9500	4.02	25371	12900	6.31	9.04	8.12	5.16

Table 6. Regional GDP of contemporary Latvia, 2001-2016, at constant 2010 prices. Source: Eurostat 2023.

Another important similarity between the periods is that Riga was by far the most attractive location for these investments, due to its permanent productivity edge over other Latvian regions. Return migration from Soviet Union continued until 1925, with most returnees, formerly workers in the Riga industry. Creating excess supply of highly qualified workforce, return migration depressed by 1925 real wages in Riga below the national mean, making it even a more attractive place for foreign investments. Table 7 compares the economic productivity of the Latvian regions, expressing their rGDPpc in percentages of the national GDPpc value. This is the simplest way to let transpire trends in change of disparities (convergence or divergence) during both periods as well as continuities and differences. To provide possibility t assess the sensitivity our findings to use of nominal or real wages as basis for rGDP assessment, 1925-1935, we provide ratios of rGDP to national GDP mean.

	1925	1930	1935	1925	1930	1935	2001	2006	2011	2016
	rGDP calculated basing on cross-regional differences in nominal wages			rGDP calculated basing on cross-regional differences in real wages			Eurostat data on GDP and rGDP			
Kurzeme	89	88	84	97	91	87	88	77	87	74
Latgale	61	57	61	62	63	65	50	46	58	50
Riga	203	210	208	191	205	193	170	178	160	167
Pieriga	86	80	80	86	76	83	78	76	82	81
Vidzeme	88	80	81	85	73	82	63	60	64	66
Zemgale	86	81	81	94	83	89	60	62	67	63

Table 7. Regional GDPpc of Latvian regions, 1925-1935 and 2001-2016, in percent of country mean GDPpc.

Figures 3 and 4 visualize table 7 for the interwar and the restored independence periods correspondingly.

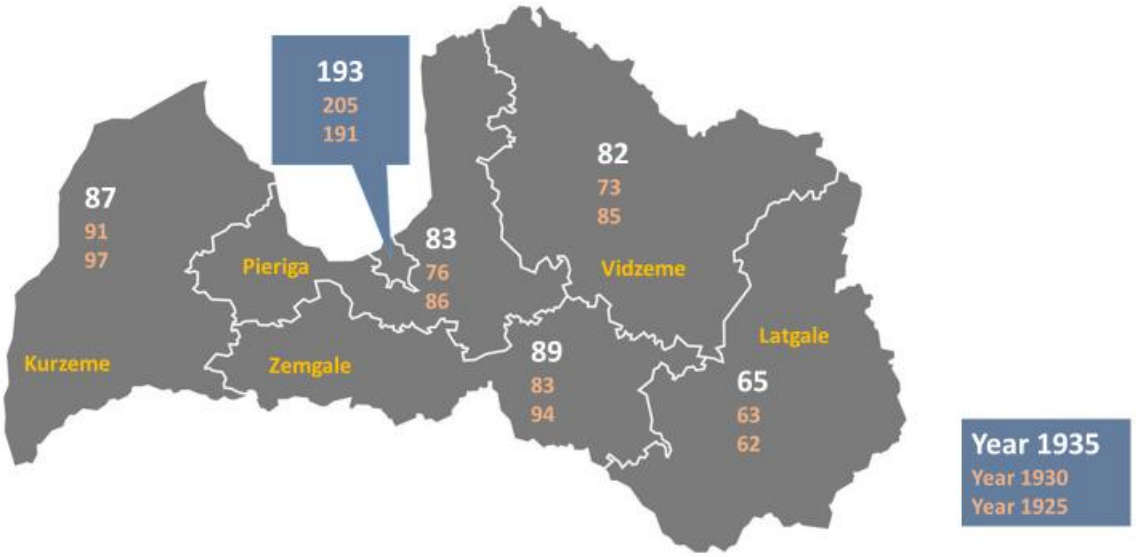

Figure 3. Cross-regional differences of regional GDP (estimates based in cross-regional differences in real wages) in interwar Latvia (territories within contemporary NUTS3 borders). Source: Own.

During both the interwar and restored independence periods, Riga was considerably ahead of the remaining regions. Our results completely new evidence that during the interwar period, the

productivity gap separating the Latvian metropolis from all other regions was even larger than in the early 2000s. GDPpc in Riga surpassed the mean more than twice in 1930, while during the second and third independence decades, its edge over country mean was 60-78%. Using nominal wages data, interwar Riga always surpassed the national mean more than twice.

Another common feature for both periods is the wide lag of Latgale. If the positive outlier position of Riga with respect to the mean decreased a bit after 60-70 years separating the periods of comparison, the Latgale as a negative outlier became even more conspicuous. In 1925-1935, the rGDPpc of Latgale was 62-65% of the national mean, against 46-58% 2001-2016. Comparing rGDP values for the interwar period derived using nominal wages, Latgale's standing appears slightly worse. In both cases, the use of nominal wage data may distort the real situation, since the costs of living were higher in Riga, while in Latgale the purchasing power of the Lats was higher. When assessing the ranking of regions for the interwar period we should rely on the rGDP values derived from real wages data.

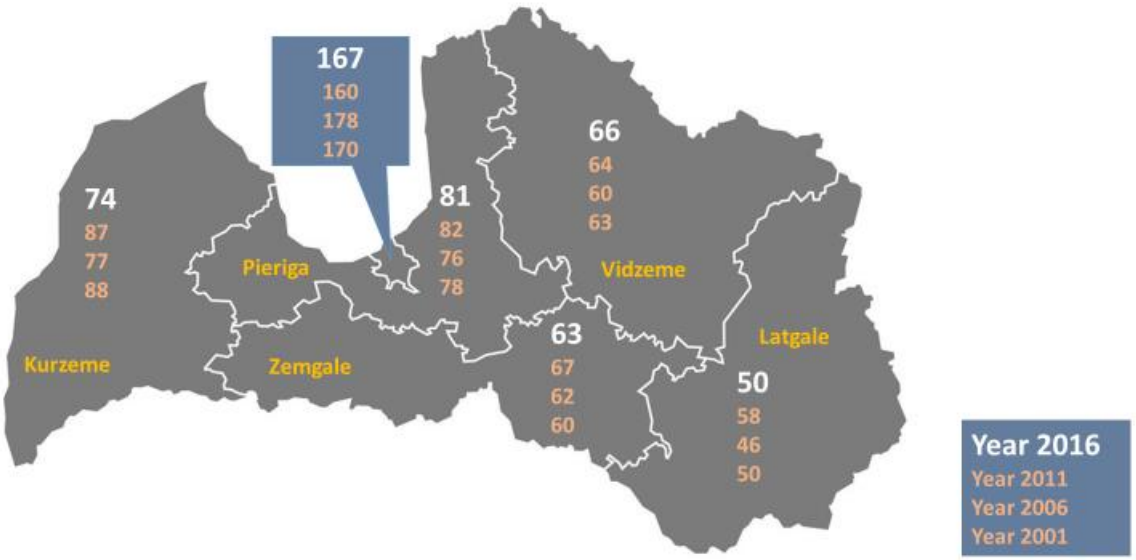

Figure 4. Cross-regional differences of regional GDP in restored independent Latvia. Source: Own calculations using Eurostat data.

According to data visualised in the Figure 3, Riga was by far the wealthiest in the interwar period, followed by Kurzeme and Zemgale, which were pretty even. Thereafter Pieriga and Vidzeme were at similar levels and Latgale at a clear bottom. For the period 2001-2016, Riga was still significantly above the others followed by Kurzeme and Pieriga. After these two Vidzeme and Zemgale performed at similar levels, when Latgale still lagged considerably behind, significantly less than a third of Riga.

Importantly, Pieriga did not become the richest non-metropolitan region of the post-communist era before more than a decade into the 21st century. Pieriga surpassed Kurzeme in 2016. This may be explained by the sprawling of contemporary Riga across its administrative limits into the surrounding Pieriga region. It involved the suburbanisation of Riga and the relocation of economic activities from the city to its surroundings, facilitated by the automobilization of its population taking place during the same time. Riga was growing in interwar times. However, by 1935 its number (385 000) still was below its size in 1914 (520 000) (Norkus et al. 2021). At that time available infrastructure could

accommodate both influx of population and new economic activities within the city limits, contrary to the situation during the first decades of the 21st century.

Despite Pieriga was replacing Kurzeme as Latvia's second richest region, the overall scale of cross-regional inequalities in the restored independent state remains at nearly the same levels as during the interwar time. This is in line with the sigma divergence measures presented in table 8 and figures 5-6. According to these measures, cross-regional productivity disparities during both periods of independence remained at similar levels. Hence, during both periods, no clear sigma convergence or divergence trend is discernible.

	1925	1930	1935	1925	1930	1935	2001	2006	2011	2016
	rGDP calculated basing on cross-regional differences in nominal wages			rGDP calculated basing on cross-regional differences in real wages			Eurostat data on GDP and rGDP			
CV	0.5024	0.5591	0.5429	0.4524	0.5332	0.4691	0.4943	0.5350	0.4241	0.4706
MLD	0.0977	0.1209	0.1112	0.0827	0.1079	0.0852	0.1160	0.1344	0.0846	0.1049
Gini	0.2330	0.2620	0.2472	0.2197	0.2473	0.2173	0.2592	0.2749	0.2221	0.2449
Theil	0.1079	0.1331	0.1244	0.0897	0.1205	0.0947	0.1161	0.1347	0.0856	0.1054

Table 8. Sigma convergence measures for Latvia, 1925-2016.

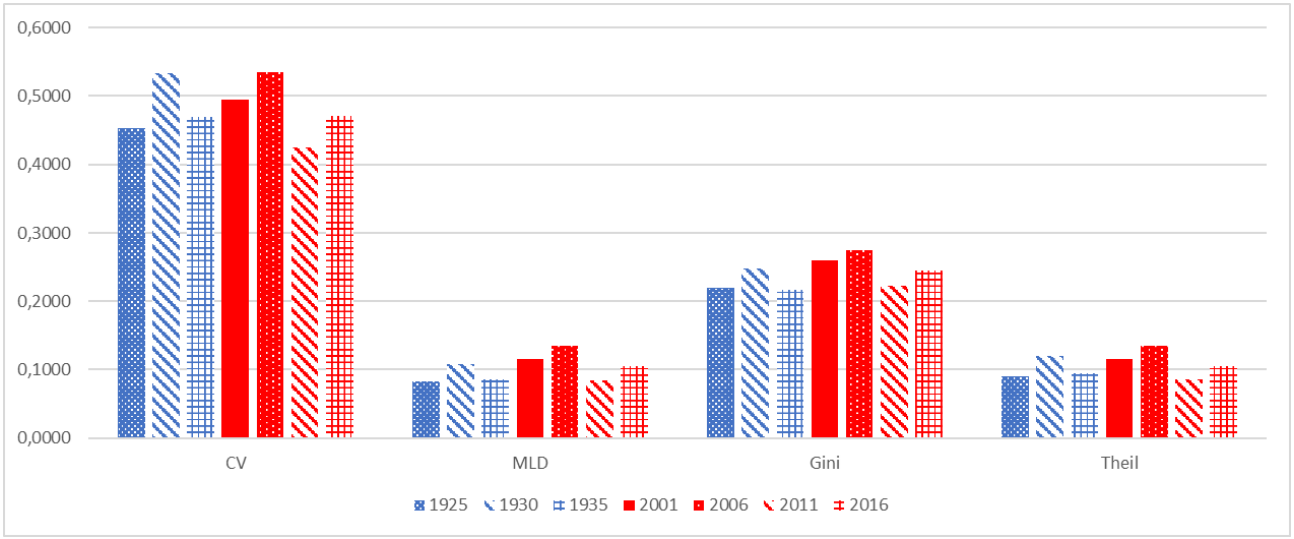

Figure 5. Sigma convergence measures for Latvia, 1925-2016. Regional GDP values, 1925-1935, were estimated using regional real wages data.

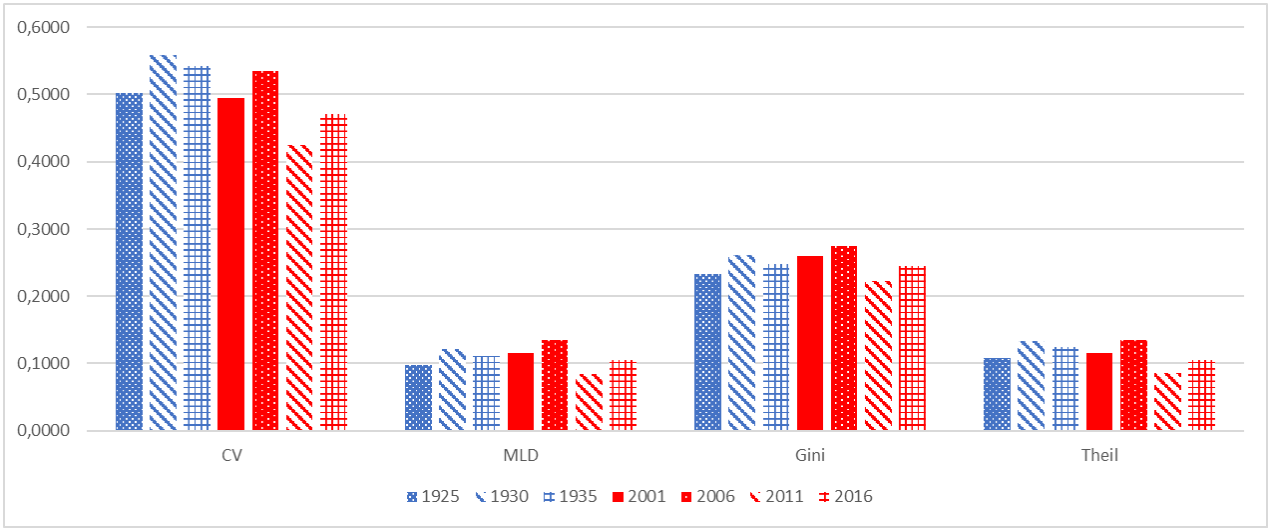

Figure 6. Sigma convergence measures for Latvia, 1925-2016. Regional GDP values, 1925-1935, were estimated using real wages data.

The measures of sigma convergence describe the distribution of wealth creation across regions. The reliability depends on data quality. Measuring beta convergence involves model estimation. Thus, the reliability also depends on the size of the sample. Because of the limited sample, one hardly expects reliable results from a quantitative beta convergence analysis of our data. Nevertheless, running linear regressions for all possible subperiods in 1925-1935 and 2001-2016 provides some information. Due to the small population, we use $p \leq 0.1$ as a critical statistical significance value. Four models, for 1930-1935, 2001-2011, 2006-2011, and 2006-2016 were statistically significant (table 9).

	1925-1930 model	1925-1935 model	1930-1935 model	2001-2006 model	2001-2011 model	2001-2016 model	2006-2011 model	2006-2016 model	2011-2016 model
β_0	-12.8459	3.1774	18.5121(*)	2.1972	23.4156(***)	11.8597(*)	44.9168(***)	16.0228(**)	-14.5335
β_1	5.5648	-0.2177	-5.8255(*)	3.2514	-3.9687(**)	-1.0803	-10.4033(**)	-2.8041(*)	5.0822

Table 9. Estimations of beta convergence for Latvia's NUTS3 regions, using (1925-1935) rGDP data based on real wages data. (*) – significant with a level less than 0.1; (**) – significant with a level less than 0.05; (***) – significant with a level less than 0.01.

During both independence periods, the cross-regional GDPpc disparity displays the same pattern. The years of booms are marked by cross-regional divergence, shown in increasing values of all four measures, indicating an increase in inequality. For the periods 1925-1930 and 2001-2006 rapid growth took place with easy access to capital. It seems that metropolitan regions profit more from those than the peripheral regions, leading to an increase in cross-regional disparities.

During the recessions during the 1930s and 2007-2011, the cross-regional disparities decreased when the metropolitan region suffered relatively more. For 2006-2011 Riga's growth rate was the lowest among the regions (1.8 percent) and significantly below the over all-Latvian rate (4.0 percent) (table 6). The pattern observed for the interwar period is very similar (table 5). This is the main reason for the decrease in the sigma values during 1930-1935, and 2006-2011. This interpretation is vindicated by the only statistically significant regression of beta convergence (1930-1935) for the interwar period when the model predicts convergence during the crisis (figure 6). The same picture is provided by the regression for 2006-2011, encompassing the GFC (figure 7).

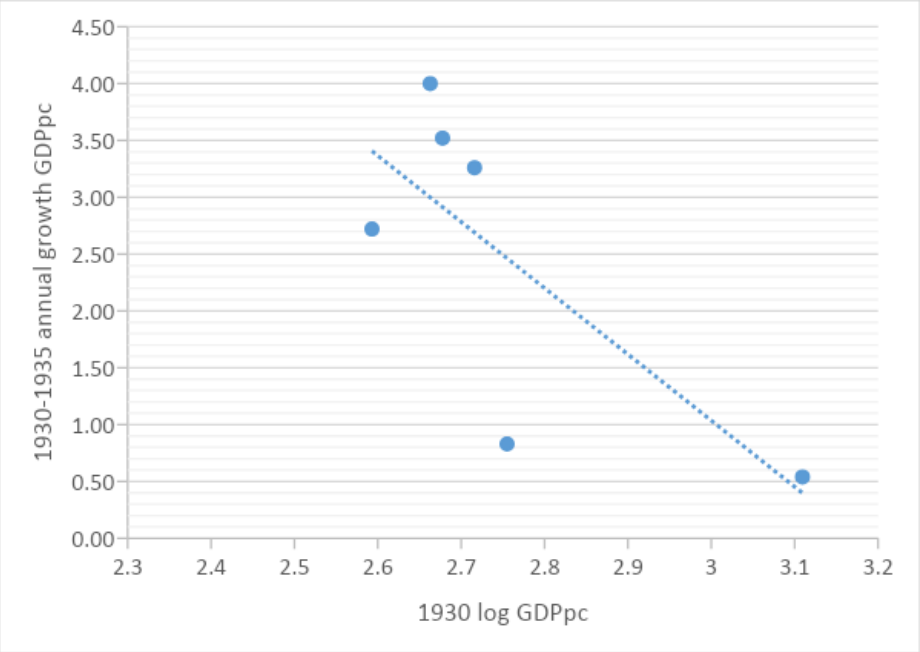

Figure 6. Beta-convergence of Latvian regions, 1930-1935. Source: See table 5.

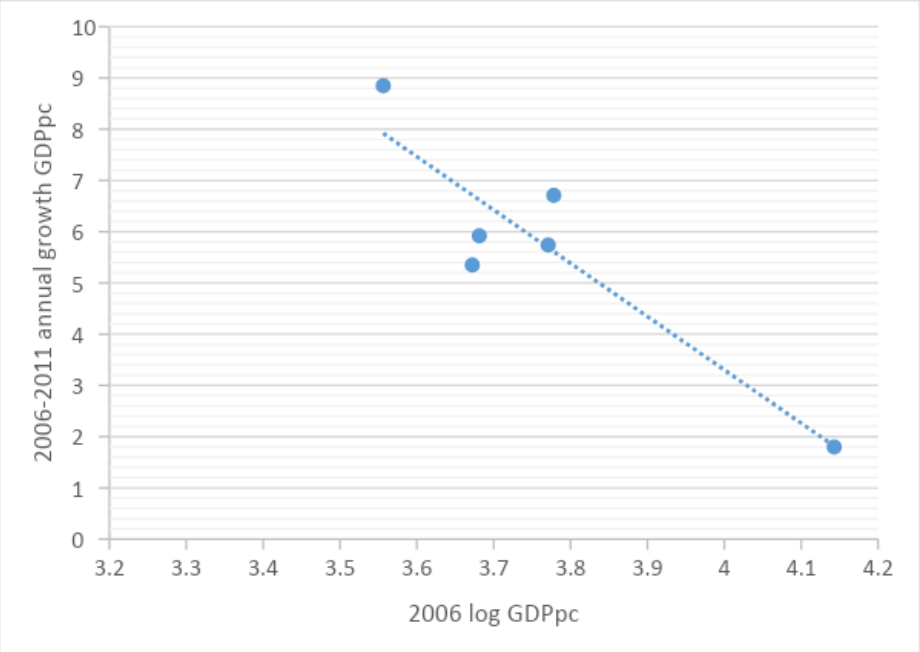

Figure 7. Beta-convergence of Latvian regions, 2006-2011. Source: See table 6.

The poorest region, Latgale, was not the worst performer in terms of GDP growth during the interwar period. For 1925-1935, its growth rate was above the Latvian aggregate and its rGDPpc ratio to the national increased from 62 to 65 percent (figure 3). For 2001-2011 it increased from 50 to 58 percent (figure 4). During the next five years, 2011-2016, Latgale's growth (3.40 percent) was relatively weak, surpassing only that of Kurzeme (2.95 percent). Latgale's rGDPpc was back to 50 percent of the national in 2016, significantly lower than the bottom in the interwar period of 62 percent.

For 1925, our findings for Latgale coincides with Ceichners (1929b) results (table 1). His calculations imply that the national income per capita in Latgale was 62 percent of Latvian national income. His figures for Kurzeme (108 percent) and Zemgale (114 percent) are higher than our findings (97 and 88 percent correspondingly).[7] He also claimed Latgale made up 50 percent of the overall-Latvian value in 1929-1930, against our 63 percent (table 2 and table 5). Ceichners considered Riga as part of Vidzeme. His findings imply that the national income per capita of Vidzeme was 120 percent of the Latvian average. Reshuffling our findings for Vidzeme enlarged by Riga, we get 134 percent.

2.4 Concluding Discussion of Latvian Case

Less productive regions must grow faster than more productive regions to obtain catching-up convergence. However, such beta convergence is only a necessary condition of sigma convergence. Thus, there can be sigma divergence despite beta convergence. Beta convergence without sigma convergence may take place when growth rates change rank between regions. During beta divergence, productivity growth is faster in the more productive regions or when productivity in the more productive regions decreases slower than in the less productive regions. This may be the case during recessions affecting less productive regions more severely than less productive regions.

It looks like the last scenario materialized in Latvia both in 1930-1935 and in 2006-2011. In 1925-1930, Riga's growth record was the best and in 1925-1930 the worst with 5.45 and 0.54 percent respectively. For the restored independence period, we find the same picture. During the "golden" period 2001-2006, it was the best performer with 15.37 percent annual growth. During the crisis 2006-2011 the capital was the worst performer with 1.80 percent annual growth. During both the

[7] To ensure comparability, we use our findings about Zemgale in its interwar limits.

interwar and restored independence eras, there were dramatic changes in the growth rates of the non-metropolitan regions.

During the interwar years, they include the acceleration of Vidzeme (LV008)[8] from an annual growth of 0.99 in 1925-1930 to 4.00 percent in 1930-1935. How can this acceleration of growth of the peripheric (agrarian) regions despite the crisis be accounted? Riga's industry suffered most from the crisis. However, Ceichners (1933) found that real output of agriculture increased during the crisis (this finding is corroborated in Klimantas et al. 2023). The reason was not just a coincidence of good harvests (1930, 1933-1934) and crisis in the general economy, but peculiarities of the economy of family farms, which were the dominant economic units in interwar Latvia. They reacted to falling prices by expanding production to pay taxes and debts during deflation. The ways to reduce production cost included reducing personal consumption.

Under the restored independence, agriculture was not the leading sector anymore, technological conditions of production changed even for extant family farms. Therefore, none of the regions could accelerate during the crisis-ridden period 2006-2011 in comparison with the early 2000s. However, in these years Latgale displayed a top growth performance (8.85 percent), which was more than two times higher than the Latvian aggregate (4.02 percent). However, during the subsequent boom, 2011-2016, its growth slowed down to 3.40 percent, making it remain at the same low relative level in 2016 as in 2001 despite regional cohesion policy.

From 2006-2011 to 2011-2016, the growth rates improved most in Riga, from 1.80 to 7.18 percent. Kurzeme showed a slowdown from 6.71 to 2.95 percent and Zemgale from 5.92 to 4.82 percent. Pieriga surpassed Kurzeme in the position as the second-richest region, explained by the "sprawling" or suburbanization of Riga proper. This is the only important difference when it comes to spatial distribution during the independence restoration years compared to the interwar years.

Lithuania

1.2 Contextual information and state of research

A key part of European integration is the European Union (EU) cohesion policy, which is the European Union's strategy to promote and support the "overall harmonious development" of its Member States and regions. The Cohesion Policy funding is concentrated on less developed European countries and regions in order to help them catch up and reduce the economic, social, and territorial disparities that still exist in the EU. The EU Cohesion Policy funding assisted the Baltic countries to boost their economic growth and human development and stand to the challenges of the economic crisis in 2008–2011.

However, the EU cohesion policy is focused on the disparities between NUTS2 regions. The NUTS (*Nomenclature des Unités Territoriales Statistiques*; Nomenclature of Territorial Units for Statistics) classification is the key tool used to implement EU cohesion policy. Regions eligible for support from cohesion policy are defined at the NUTS2 level, and the regular cohesion reports are also mainly prepared on this level, which is in-between major socio-economic regions (NUTS1) and lowest level regions (NUTS3), that divide themselves into local administrative units. Disparities between NUTS2 are also the focus of most research on regional disparities. Meanwhile, until 2018 Estonia, Latvia, and Lithuania were the only countries in the European Union where the whole country is treated as a

[8] Not including Riga.

NUTS2 region, and there were microstates Cyprus and Malta, each treated as a single NUTS3 region. According to actual EU rules, GDP levels in the NUTS2 regions are used for distributing Cohesion Policy funds, while handling the cross-regional differences at the lower NUTS3 level and at the local administrative unit (LAU) level is the national prerogative.

Since 01.01.2018, Lithuania became the first Baltic country divided into two NUTS2 regions, improving its participation conditions in the EU Cohesion Policy: Capital City (LT01), embracing Vilnius County and Central and Western Lithuania (LT02), including the remaining nine counties. Lithuanian counties (*apskritis*) have the status of NUTS3 regions. The list of counties belonging to NUTS2 Central and Western Lithuania (LT02) includes Alytus (LT021), Kaunas (LT022), Klaipėda (LT023), Marijampolė (LT024), Panevėžys (LT025), Šiauliai (LT026), Tauragė (LT027), Telšiai (LT028), Utena (LT029). Vilnius county (LT011) coincides with NUTS2 region Capital City.

The contemporary Lithuanian counties were established in 1994. In 1995–2010, they were the largest administrative units of Lithuania. They did not stand in the unambiguous relation to five ethno-cultural or historical regions, officially distinguished since 1999: Aukštaitija, Dainava (Dzūkija), Lithuania Minor (Klaipėda region), Žemaitija, and Sūduva (Suvalkija). In 2010, county administrations were abolished. However, counties did remain reporting units in databases and publications of the Lithuanian national statistical office.[9] Since 1995, these sources have also estimates of gross value added (GVA), which is gross domestic product, calculated by the production approach. Since 2001, these estimates are calculated using methodology approved by the statistical agency of the EU (Eurostat) and are published in its databases.

This provides for broad cross-national comparability of the Lithuanian data on regional productivity with those of other EU countries, making them the standard source for experts in Lithuanian regional studies. These experts can broadly be divided into two groups. One of them, including mainly scholars from ethnology, cultural anthropology, and linguistics disciplines, is interested in the cultural and linguistic diversity within Lithuania. These scholars are mainly using ethnocultural or historical regions as units to collect and analyze data.[10] Scholars from social and economic geography, economics, sociology, and other social sciences are interested in the social and economic disparities across Lithuanian regions.[11] As far as their main source are databases and publications of the Lithuanian national office, where data are structured by NUTS, they mainly define regions according

[9] Statistical Department of Lithuania (*Lietuvos statistikos departamentas*), renamed in 2023 into State Data Agency (*Valstybės duomenų agentūra*).

[10] E.g. R. Paukštytė-Šaknienė, V. Savoniakaitė, Ž.B. Šaknys, I. Šidiškienė, *Lietuvos kultūra: Aukštaitijos papročiai* (Vilnius, 2007); R. Paukštytė-Šaknienė, V. Savoniakaitė, Ž.B. Šaknys, I. Šidiškienė, *Lietuvos kultūra: Dzūkijos ir Suvalkijos papročiai* (Vilnius, 2009). R. Paukštytė-Šaknienė, V. Savoniakaitė, Ž.B. Šaknys, I. Šidiškienė, *Lietuvos kultūra: Mažosios Lietuvos ir Žemaitijos papročiai* (Vilnius, 2012).

[11] See e.g., M. Butkus, *Regionų konvergencijos vertinimas ES šalyse nacionalinės ekonomikos išsivystymo lygio ir ekonominių pokyčių kontekste*. Daktaro disertacija (Kaunas, 2012); M. Butkus, D. Cibulskiene, A. Maciulyte-Sniukiene, K. Matuzeviciute, 'What Is the Evolution of Convergence in the EU? Decomposing EU Disparities up to NUTS 3 Level', *Sustainability*, vol. 10(5) (2018), pp. 1–37; D. Cibulskienė, M. Butkus, 'Estimation of Uneven Development of Lithuanian Regions in the Aspect of Economic Growth', *Osteuropa-Wirtschaft*, vol. 51 (2006), pp. 160–181; D. Cibulskienė, M. Butkus, 'The Influence of Cumulative Causation Process on Regional Divergence in Lithuania during 1995–2003', *Jahrbuch für Regionalwissenschaft*, vol. 27(1) (2007), pp. 59–87; R. Čiegis, J. Ramanauskienė, L. Šimanskienė, *Lietuvos regionų darnaus vystymosi vertinimas* (Klaipėda: 2010); N. Maknickienė, I. Lapinskaitė, A. Miečinskienė, I. Skačkauskienė, 'Patterns of Inequality of Lithuanian Regions', *Journal of Business Economics and Management*, vol. 19(2) (2018), pp. 323–342; O. Palekienė, *Regionų atsparumo ekonominiams šokams vertinimas*. Doctoral dissertation (Kaunas, 2016); S. Šabanovas, *Šiuolaikinės Lietuvos teritorijų socialinė raida*. Doctoral dissertation (Vilnius, 2016); G. Pociūtė-Sereikienė, *Periferingumo teritorinė raiška Lietuvoje.* Doctoral dissertation (Vilnius, 2014); R. Ubarevičienė, *Socio-spatial change in Lithuania: Depopulation and increasing spatial inequalities* (Delft, 2017).

to NUTS3 or counties.[12] So in the bulk of the social scientific regional studies cross-regional differences or disparities across Lithuanian regions mean disparities between counties or NUTS3. For the restored independence period we can only use the rGDP data on NUTS3 from the publications of the Lithuanian national statistical office and Eurostat. Our estimates for the interwar period provide a long-term retrospective better understanding of actual disparities due to better knowledge of their historical origins. Therefore, for our estimations of rGDP in interwar Lithuania we must accept the actual regional division of Lithuania, grounding social scientific research on cross-regional disparities in contemporary Lithuania. Hence, for 1923, we are estimating rGDP for territories, approximately corresponding to contemporary NUTS3.

In this work, we have few predecessors, whose work can provide benchmarks or at the very least serve as a source of inspiration. There is important research on the socio-economic history of particular regions, including that of cities together with surrounding areas.[13] However, only Zigmas Kiaupa recently tried to provide an encompassing picture of the economic disparities between regions of the Grand Duchy of Lithuania (GDL) in 1775 and 1784–87.[14] Based on the territorial differentiation of the land tax rates in a new law, drawn up in 1775, Kiaupa argued that the richest region in the whole GDL (within its borders after the first partition of the Polish-Lithuanian Commonwealth in 1772, comprising not only lands of contemporary Lithuania but also those of Belarus) was the area, including Žemaitija eldership (*seniūnija*), Upytė and larger part of Ukmergė counties (*pavietas*).

The second richest was a territory, enclosing Kaunas County and part of Trakai county on the left bank of Nemunas. The third richest was the territory comprising Breslauja county and northern part of Vilnius County. Brest county and the remaining part of Trakai county ranked fourth, while a larger part of Vilnius County together with Ašmena, Slanimas, Gardinas, Lyda, Minsk, Naugardukas, Orša, Valkaviskas counties and part of Pinskas county were fifth. They were followed by parts of Polockas and Rečyca counties, which did remain within the post-partition GDL limits. The ranking was closed by the territory comprising Mozyrius county and part of Pinskas county (ranked seventh) as the poorest lands of GDL.

For 1784–87, Kiaupa draws on land price data, provided by Polish historian Tadeusz Korzon[15]. This data allow for more fine-grained picture, allowing to rank counties of the GDL in the following order, from richest to poorest: (1) Upytė, (2) Kaunas, (3) Trakai, (4) Ukmergė, (5) Vilnius, (6) Lyda, (7) Gardinas, (8) Brestas, (9) Žemaitija eldership, (10) Breslauja, (11) Ašmena, (12) Valkaviskas, (13) Polockas, (14) Naugardukas, (15) Orša, (16) Minskas, (17) Slanimas, (18) Rečyca, (19) Pinskas, (20) Mozyrius. Both rankings broadly correspond, including the top position of Upytė county and the standing of Mozyrius as the poorest county. However, there is inconsistency about Žemaitija, which according to the first ranking belonged (together with Upytė) to the richest part of the GDL, but ranked only ninth according to Korzon data. Another important inconsistency is about the standing of Breslauja, which ranked third in the first ranking, but was only tenth in the second.

[12] On some issues, databases of Lithuaniuan statistical office provide data on municipalities (savivaldybė) or LAU1 (*Local administrative unit 1*) and eldership (seniūnija) or LAU2 (*Local administrative unit 2*) levels. In particular, this applies to census data. However, data about economic productivity are not available below the NUTS3 level.

[13] E.g., J. Kiaupienė, *Kaimas ir dvaras Žemaitijoje XVI–XVIII a.* (Vilnius. 1988); A. Kuncevičius, R. Laužikas, R. Jankauskas, R. Augustinavičius, R. Šmigelskas, *Dubingių mikroregionas ir Lietuvos valstybės ištakos* (Vilnius, 2015); R. Ragauskienė, D. Karvelis, A. Ragauskas, *Lietuvos Didžiosios Kunigaikštystės mikropasaulis: Radvilų Kėdainių visuomenė (XV–XVIII a.)* (Vilnius, 2022).

[14] Z. Kiaupa, Trumpasis XVIII amžius (1733–1795 m.), *Lietuvos istorija*, t. 7, d. 2 (Vilnius, 2018).

[15] T. Korzon, *Wewnętrzne dzieje Polski za Stanisława Augusta, 1764–94*, t. 1–7, 2nd ed. (Kraków, 1897–1899).

Both inconsistencies are important because they undermine Kiaupa's putative explanation of cross-regional economic disparities in the GDL. According to this explanation, the most important factor was the closeness to sea ports as destination points of main export goods (flax, grain, and wood) or the availability of waterways (navigable rivers) allowing to transport of these bulk goods over long distances. The advantage of Žemaitija was its closeness to three sea ports at once (Klaipėda, Liepaja, and Riga), and that of Breslauja county access to Daugava river, providing a connection to Riga. Among counties in the territory of contemporary Belarus, Brest was the richest, because by the Bug and Wisla rivers, it was connected to Gdansk. Korzon's data contradict this explanation, so Kiaupa hesitates between questioning the reliability of this data, and suggesting that the economic standing of particular regions could change during the decade between two time points. However, he does not provide any evidence of so rapid economic decline of Žemaitija and Breslauja areas in 1775–1787.

We will propose a tentative solution to Kiaupa's puzzle in the fourth section. Further research is needed to find more evidence about the economic situation in particular regions and to test Kiaupa's explanation of cross-regional disparities. Arguably, this explanation is less relevant for the XXth century, which is our focus of interest. While closeness to sea ports remains an important advantage to regions, lack of access to navigable rivers ceased to be a crucial disadvantage due to the construction of the railway network (since the second half of the XIXth century), supplemented and partly outcompeted by the advancement of motor vehicle and air transportation (since the middle of XXth century).

However, before looking for the best explanation of the cross-regional economic differences in the XXth century Lithuania, we first need to measure them, using the standard tool accepted in contemporary economic history. This tool is regional GDP as the most encompassing measure of economic productivity. Before 1995, such information is totally missing. For interwar Lithuania, only Gediminas Vaskela[16] attempted to estimate the output disparity between mainland Lithuania (called also Greater Lithuania) and the Klaipėda region (Minor Lithuania) in 1938. He applied the estimate of national income of mainland Lithuania (without Vilnius and Klaipėda areas) in 1938, published during Nazi occupation[17], and calculation of total "private income" of residents of Klaipėda region by Rudolfas Valsonokas[18] in 1926–1935. After amending Valsonokas calculations, Vaskela guestimated that the total national income in Lithuania in 1938 borders was 1,275–1,285 mil. Litas (Lt) or circa 500 Lt per capita at current prices. The contribution of the Klaipėda region was 110–120 mil. Lt, or circa 750 Lt per capita. This means that output per capita in Klaipėda region by 50% did exceed country mean.

3.2 Data and issues of of cross-time spatial harmonization

Our estimation of the rGDP of interwar Lithuania is limited to the 1923 year, because only for this year we able to collect all data necessary for the application of Geary-Stark method. Most importantly, this was the year of the only interwar census in Lithuania (on 17–23.09.1923), providing data on employment by economy sectors on the local level. We use data on total employment by counties and employment by economy sectors published in the first volume of the Lithuanian statistical yearbook[19], because in this publication the data of 1923 population census are amended with those of the population census in Klaipėda region on 20.01.1925, which was not covered by 1923 census.[20]

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[16] G. Vaskela, *Tautiniai aspektai*, p. 86–89.
[17] *Reichskommissar für das Ostland*. *Strukturbericht über das Ostland, 1: Ostland In Zahlen* (Riga, 1942), p. 120.
[18] R. Valsonokas, 'Privatinės Klaipėdos krašto tautinės pajamos', *Tautos ūkis*, Nr. 35 (1938), p. 684–686.
[19] *Lietuvos statistikos metraštis 1924–1926* (Kaunas, 1927), p. 27–28.
[20] Publishers of data do not provide information how data of both censuses, taken on different points of time, were harmonised.

Data on wages in agriculture by counties were published only since 1924. So, we use data on annual wages of male agricultural workers for 1924, published in LSM[21], and republished in Norkus[22], providing data series for the complete interwar period. This source provides only data about the monetary part of annual wages. Taking into consideration the non-monetary part of wages, including the cost of food, lodging, clothing, and part paid in kind, we assumed that the monetary part of wages did make out 50 percent of total wages. This assumption is based on a survey of the Latvian statistical office on the composition of agricultural wages in Latgale, which was part of Latvia, most similar to Lithuania by its socioeconomic conditions[23]. Sources provide annual wage data. To apply the Geary-Stark method, data on daily wages are needed. We converted annual wages into daily wages, assuming 190 working day-long agricultural season, beginning on April 1 and closing on November 11 (St. Martin's Day). This period includes 225 calendar days. Calculating the number of working days, we subtracted 33 Sundays and 2 religious' holidays (second Easter day and All Saints day). In Catholic mainland Lithuania St. George's day (23 April) also used to be a holiday. Thus, we assumed 189 days long agricultural season for Catholic mainland Lithuania and 190 working days for Protestant Klaipėda region.

Data on wages in manufacturing in interwar Lithuania are published only for 1930s, providing information on the daily earnings of skilled and unskilled workers in Kaunas, Klaipėda, and Lithuania's mean values.[24] For the early twenties, such data are available only for Kaunas.[25] So, we assumed that wages of unskilled workers could not be lower than the minimal cost of living in Lithuanian county centers. Lithuanian statistical office published this information since late 1923 in its monthly publication *Statistikos biuletenis*. However, the data for 1923 still do not include the Klaipėda region. So, we used annual minimal cost of living for 1924 as proxy for annual earnings of unskilled workers, converting them to daily wages. In this conversion, we assumed 8 hours working day (according to work legislation of the interwar Republic of Lithuania) and 250 working days following established practice going back to Allen.[26]

For wages of skilled workers in Lithuanian provincial towns and cities, we used findings of archive research, drawing on various sources for 1923–1926.[27] For the Klaipėda region, we used data

[21] *Lietuvos statistikos metraštis 1927–1928* (Kaunas, 1929), p. 189–191.

[22] Z. Norkus, A. Ambrulevičiūtė, J. Markevičiūtė, V. Morkevičius, G. Žvaliauskas, 'Annual Salary of Agricultural Workers in Lithuania, 1919–1939', *Lithuanian Data Archive for SSH* (2022).

[23] A. Frīdbergs, J. Skuja, *Lauksaimniecības rentabilitāte 1935./36., 1936./37. un 1927./37. saimniecības gadā* (Riga, 1939), p. 57.

[24] Z. Norkus, A. Ambrulevičiūtė, J. Markevičiūtė, V. Morkevičius, G. Žvaliauskas, 'Annual Average Hourly Earnings of Industrial Workers by Industry in Lithuania, 1919–1939', *Lithuanian Data Archive for SSH* (2022).

[25] Z. Norkus, A. Ambrulevičiūtė, J. Markevičiūtė, V. Morkevičius, G. Žvaliauskas, 'Annual Average Hourly Earnings of Industrial Workers by Profession in Kaunas (Lithuania), 1913–1939', *Lithuanian Data Archive for SSH* (2022).

[26] R.C. Allen, 'The Great Divergence in European Wages and Prices from the Middle Ages to the First World War', *Explorations in Economic History*, vol. 38(4) (2001), pp. 411–447.

[27] Alytus (1924): Amatų įmonių ir darbininkų skaičius. Vidutinis meistro darbo dienos mokesnis, LCVA, f. 928, ap. 1, b. 1173, l. 6; Marijampolė (1923): Marijampolės apygardos inspekcijos pranešimas VRM vyriausiam darbo inspektoriui dėl darbo valandų darbininkams mažinimo spirito ir mielių varyklos bendrovėje "Ruckof", LCVA, f. 377, ap. 5, b. 98, l. 273; Vilkaviškis (1925): Vilkaviškio apygardos amatų įmonių ir samdomų darbininkų skaičius, LCVA, f. 928, ap. 1, b. 1179, l. 9v.; Rokiškis (1926): Pirmas Lietuvo gelumbių fabrikas (Juodupėje, Rokiškio stotis), atsakymas Prekybos ir pramonės rūmams dėl mokamų algų, LCVA, f. 938, ap. 1, b. 502, l. 18; Šiauliai (1926): Prekybos bendrovės ir linų išdirbimo dirbtuvės "Semlin" Šiauliuose atsakymas Prekybos ir pramonės rūmams dėl mokamų algų, LCVA, f. 987, ap. 1, b. 502, l. 11; Raseiniai (1924): Amatų įmonių ir darbininkų skaičius. Vidutinis meistro darbo dienos mokesnis, LCVA, f. 928, ap. 1, b. 1168, l. 8v.; Kretinga (1924): Statistinės žinos darbo srityje. Telšių apygarda (Kretingos apskr., I pasmetis), LCVA, b. 928, ap. 1, b. 949, l. 36; Telšiai (1924): Telšių apygardos amatų įmonių ir darbininkų skaičius. Vidutinis meistro darbo dienos mokesnis, LCVA, f. 928, ap. 1, b. 1167, l. 11; Utena (1924): Utenos apygardos amatų įmonių ir darbininkų skaičius. Vidutinis meistro darbo dienos mokesnis, LCVA, f. 948, ap. 1, b. 1182, l. 5.

provided by Valsonokas.[28] The final daily wage values in manufacturing were calculated as weighted means of skilled and unskilled wages, using as weights shares of skilled (20%) and unskilled (80%) workers in total employment in manufacturing and construction, based on analysis of 1923 census data.[29]

The usual difficulty in applying the Geary-Stark method is the lack of reliable data on wages in the services sector. This difficulty is related to its heterogeneity because it includes such different categories as top officials in public services, "free professions", and home servants, largely differing in their earnings. Therefore, the inventors of our method recommend and apply themselves to use as proxy weighted mean of manufacturing and industrial employment.[30] We accept this recommendation.

The last piece of information to apply our method is national-level GDP values, derived using the production or gross added value (GVA) estimation method. Only this method allows us to estimate the contribution of main sectors to GDP. Until the very last time, there were only estimates of the national income of interwar Lithuania for 1924[31], 1930[32], and 1938–1939[33] available. Based on an outdated, undisclosed, or idiosyncratic methodology, they are of limited comparability. Norkus and Markevičiūtė[34] published new GDP estimates, allowing for a cross-national comparison of Lithuania's productivity international standing in 1913, 1922, 1929, and 1938. However, they do not allow to estimate the contribution of different sectors.

An adequate basis for the estimation of Lithuania's rGDP is provided by the recently published estimates of Lithuania's GDP in 1919–1940 by Adomas Klimantas[35]. According to this publication, Lithuania's total GDP in 1923 at market prices (at constant 1937 prices) was 1,387.2 mil Lt, or 651.7 Lt per capita (or 1725 international 1990 Geary Khamis $). GDP at market prices includes taxes less subsidies on products. Subtracting them, we get total gross value-added (GVA) at basic prices, which was in 1923 1,338.4 mil. Lt, or 628.7 Lt per capita. Table 10 presents the breakdown of total GDP or GVA by sectors together with sectoral distribution.

	Gross added value (GVA) total	Employment	GVA per employed person
Agriculture	658,400,000	1,129,870	582.72
Manufacturing and construction	230,771,000	94,731	2436.07
Services	449,203,000	248,344	1808.79
Total economy	1,338,374,000	1,472,945	908.55

[28] R. Valsonokas, Privatinės, p. 684–686.
[29] Z. Norkus, *Du nepriklausomybės dvidešimtmečiai: kapitalizmas, klasės ir demokratija Pirmojoje ir Antrojoje Lietuvos Respublikoje lyginamosios istorinės sociologijos požiūriu* (Vilnius, 2014), p. 441.
[30] See F. Geary, T. Stark, What happened, pp. 215–228.
[31] A. Rimka, 'Tautos pelnas ir metodai jam surasti', *Lietuvos ūkis*, Nr. 3(42) (1926), p. 70–74; Nr. 4(43), p. 105–110; Nr. 5(44), p. 141–146.
[32] S. Šimanauskas, *Tautos pajamos ir jų perkamoji galia Lietuvoje* (Kaunas, 1932).
[33] *Reichskommissar für das Ostland*, p. 120.
[34] Z. Norkus, J. Markevičiūtė, 'New Estimation' (2021).
[35] A. Klimantas, 'Lithuanian economy, 1919–1940: stagnant but resilient. The first inter-war GDP time-series estimates and their implications', *Scandinavian Economic History Review* (2023).

Table 10. GDP of Lithuania by main sectors of the economy in 1923 (in Litas at constant 1937 prices). Sources: A. Klimantas, 'Lithuanian economy, 1919–1940; *Lietuvos statistikos metraštis* 1924–1926, p. 27–28.

Cross-temporal comparison of cross-regional economic disparities has to cope with the problem of instability of delimitations between administrative units. This constitutes a problem of cross-time harmonization of local-level data, collected for territorial units with limits that are not congruent over time. To solve this problem, we took examples from researchers who contributed to Roses and Wolf 2019. We did take notice that "losses" of territory by a specific territorial unit are usually compensated by "gains", making the total area of the territory of this unit unaffected or without considerable change.

We confront this situation, attempting to compare economic disparities in interwar Lithuania with those in restored independent Lithuania. The borders of interwar Lithuania were unstable. Lithuania insisted on the international recognition of its Eastern borders, established by the 12.07.1920 Peace Treaty between Soviet Russia and Lithuania. However, Poland seized Vilnius by force in 1920–1939. Lithuania was compensated in 1923 by the Klaipėda (Memel) region, detached from Germany since 1920 according to Versailles Peace Treaty. In March 1939, Germany did recapture Klaipėda, but in October 1939 Lithuania regained Vilnius. In 1940 Lithuania did become another Soviet republic. Further changes of its Eastern delimitations with neighbor Soviet Belorussia were made, and they were inherited by the restored independent Lithuania. So, the area of contemporary Lithuania is 65,300 km^2, while in 1923, after the annexation of the Klaipėda region, it was 55,670 km^2.[36]

There is no congruence between the administrative limits of contemporary Vilnius County (or LT01 as NUTS2 region) and the demarcation line, which did separate in the interwar time Lithuanian territory under Lithuanian and under Polish rule (see Fig. 1). The Northern part of the interwar time Vilnius region (with Turmantas, Dūkštas, Ignalina) belongs now to Utena county (LT029), and the Southern part (with Varėna, Marcinkonys, Druskininkai) belongs to contemporary Alytus County (LT012). However, the contemporary Vilnius County (LT011), coinciding with the Capital City region (LT01), was "compensated" by parts of contemporary Trakai and Širvintos municipalities and the complete Ukmergė municipality, which during interwar time were under the control of the government of the Republic of Lithuania.

[36] *Lietuvos statistikos metraštis* 1938 (Kaunas, 1939), p. 3.

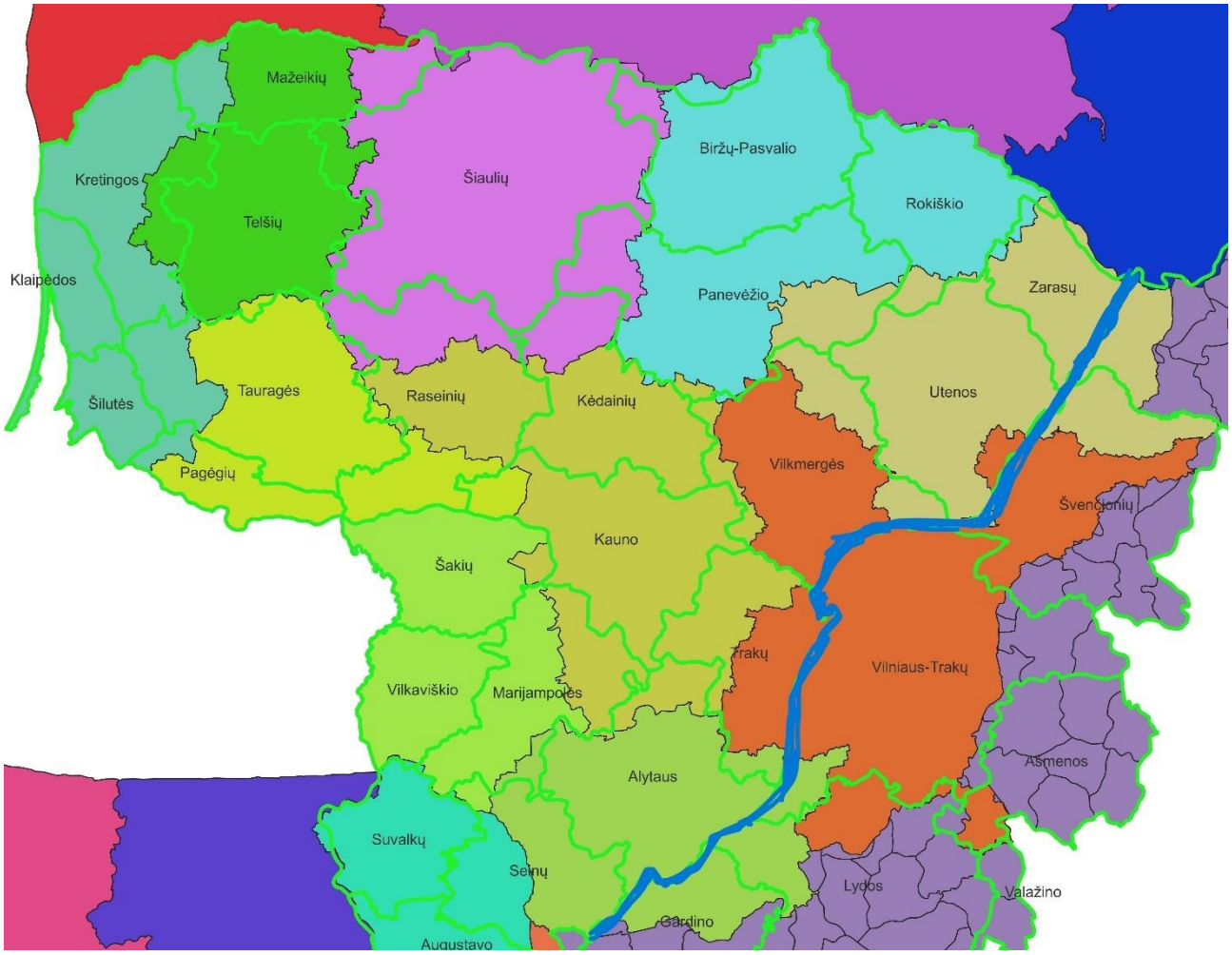

Fig.8 NUTS3 of contemporary Lithuania (areas of diffent color) and counties of interwar Lithuania (delimitated by green colored lines). The thick blue line is the demarcation line between Lithuania and Poland in 1920–1939. Own production using QGIS software.

As a result, there is a nearly perfect coincidence of the size of the territory of metropolitan NUTS2 region LT01 (9,730 km²) and that part of the territory of contemporary Lithuania, which was under Polish rule in 1920–1939 (9,630 km^2). The last area makes out 14.74%, while that of the contemporary Vilnius region (county) sits on 14.90% of the total territory of contemporary Lithuania. Correspondingly, the area of the contemporary NUTS2 region Central and Western Lithuania, 55,570 km^2, is nearly identical to that of the Republic of Lithuania (55,670 km^2). Thus, while contemporary Lithuania is not strictly comparable to interwar Lithuania, the contemporary NUTS2 region Central and Western Lithuania very closely corresponds to interwar Lithuania despite the incongruencies between administrative delimitations between contemporary Vilnius County and municipalities, belonging to the "rest" of Lithuania.

We can observe the same phenomenon by exploring correspondences between contemporary NUTS3 regions, which are our observation and analysis units, and administrative divisions of interwar Lithuania. In many cases, these correspondences are close. So, the territory of contemporary Telšiai county LT028 rather closely corresponds to that of interwar Telšiai and Mažeikiai counties taken together. The same applies to interwar Šiauliai and contemporary Šiauliai (LT026) counties, while contemporary Panevėžys county (LT025) comprises three interwar counties: Panevėžys, Biržai/Pasvalys, and Rokiškis.

Surely, only exceptionally we can detect the exact coincidence of historical and contemporary administrative delimitations. However, summing up "losses" and "gains" according to the principle of compensation, illustrated above by the example of the Vilnius region, we find close correspondence between areas of the contemporary NUTS3 and those for the interwar counties. This correspondence is sufficiently close to validate a cross-time comparison of regional disparities in Lithuania as of 1923 with those in the contemporary NUTS2 region Central and Western Lithuania. Table 11 presents the spatial harmonisation scheme which we used re-arranging the interwar time county-level statistical data according to contemporary division into NUTS3 units.

Contemporary NUTS3 regions	Interwar Lithuania's counties	Municipalities of restored independent Lithuania (as of 2023)
LT01 Capital City		
LT011 Vilnius County	Ukmergė / Vilkmergė	Vilnius city, Elektrėnai municipality, Šalčininkai district (*rajonas*), Širvintai district, Švenčionys district, Trakai district, Ukmergė district, Vilnius district
LT02 Central and Western Lithuania		
LT021 Alytus County	Alytus, Seinai/Lazdijai	Alytus city, Alytus district, Druskininkai municipality, Lazdijai district, Varėna district
LT022 Kaunas County	Kaunas, Raseiniai, Trakai, Kėdainiai	Kaunas city, Birštonas municipality, Jonava district, Kaišiadorys district, Kaunas district, Kėdainiai district, Prienai district, Raseiniai district
LT023 Klaipėda County	Klaipėda, Šilutė, Kretinga	Klaipėda city, Klaipėda district, Kretinga district, Neringa city, Palanga city, Skuodas district, Šilutė district
LT024 Marijampolė County	Šakiai, Vilkaviškis, Marijampolė	Marijampolė municipality, Kalvarija municipality, Kazlų Rūda municipality, Šakiai district, Vilkaviškis district
LT025 Panevėžys County	Panevėžys, Biržai/Pasvalis, Rokiškis	Panevėžys city, Biržai district, Kupiškis district, Panevėžys district, Pasvalys district, Rokiškis district
LT026 Šiauliai County	Šiauliai	Šiauliai city, Akmenė district, Joniškis district, Kelmė district, Pakruojis district, Radviliškis district, Šiauliai district
LT027 Tauragė County	Tauragė, Pagėgiai	Tauragė district, Jurbarkas district, Pagėgiai municipality, Šilalė district
LT028 Telšiai County	Telšiai, Mažeikiai	Telšiai district, Mažeikiai district, Plungė district, Rietavas municipality
LT029 Utena County	Utena, Zarasai	Utena district, Anykščiai district, Ignalina district, Molėtai district, Visaginas city, Zarasai district

Table 11. The scheme of cross-time spatial harmonization between administrative division of Republic of Lithuania (1918–1940) and restored independent Lithuania.

3.3 Findings I: regional GDP of Lithuania in 1923

Table 12 provides the summary of our main findings about GVA (or regional GDP) at current 1923 prices received applying to the data described in the previous section Geary-Stark formulas (see

Section 2). To provide complete data (with rGDP of NUTS3, located in the territory of contemporary Lithuania summing up to 100% or total national GDP at basic prices), we included also the residual Ukmergė county, now belonging to Vilnius region (NUTS2 LT01). The table provides totals of rGDP for all territorial units and their breakdown by three main sectors. It also contains the data on the size of the population of these units, used to calculate the values of the rGDP per capita (rGDPpc). This standardization allows to ranking of regions by their productivity. The bottom row contains information about the size of rGDPpc in comparison with the national mean GDPpc value. It also can be used to rank regions, helping to gauge the extent of productivity of particular regions, before measuring the overall productivity variation by summarizing quantitative measures in the next section.[37]

[37] To enhance the comparability of our quantitative productivity disparity measures for 1923 with those for NUTS2 Central and Western Lithuania, we also applied a slightly different procedure o rGDP estimation for 1923: after computing regional GDP for all regions, we excluded the estimates of Ukmergė county and reestimated the regional GDP for rest of the Lithuania. Note, that in this case finally the sum of regional GDP is smaller than total country's GVA. In such a way, we can compare the interwar Lithuania with modern Lithuanian NUTS2 LT02 region in more precise way. The ratios of regional GDPpc to mean per capita GDP for Lithuania without Ukmergė county are as follows: Alytus 82.03; Kaunas 102.76%; Klaipėda 135.66%; Marijampolė 96.05%; Panevėžys 96.46%; Šiauliai 126.77%; Tauragė 80.97%; Telšiai 88.65%; Utena 72.41% (see also Table 6). The rank ord between regions is the same under both calculation procedures.

	Alytus	Kaunas	Klaipėda	Marijampolė	Panevėžys	Šiauliai	Tauragė	Telšiai	Utena	Ukmergė	Lithuania, total
GVA in agriculture	93,569,027	206,779,666	93,240,336	150,192,636	234,108,991	142,917,839	84,086,170	91,980,067	80,363,801	60,553,465	1,237,792,000
GVA in manufacturing and construction	19,668,379	113,281,831	64,436,680	52,848,788	66,280,787	42,658,847	14,987,209	20,664,029	21,717,981	17,304,944	433,849,480
GVA in services	29,924,273	242,538,923	156,796,131	77,225,627	83,574,757	110,588,410	44,190,096	45,885,751	27,468,647	26,309,027	844,501,640
Regional GDP at basic prices	143,161,679	562,600,425	314,473,147	280,267,051	383,964,536	296,165,097	143,263,475	158,529,847	129,550,429	104,167,436	2,516,143,120
Population	147,885	464,123	196,533	247,303	337,323	198,015	149,952	151,556	151,617	126,309	2,170,616
GDP per capita	968	1,212	1,600	1,133	1,138	1,496	955	1,046	854	825	1,159
In % of national GDPpc (=100%)	83.51	104.57	138.04	97.77	98.20	129.03	82.42	90.24	73.71	71.15	100.00

Table 12 Regional GDP in Lithuania (by sectors, total, per capita, and per capita in % of national GDPpc) in 1923 at current prices in national currency Litas. Sources: Klimantas 2023, LSM 1924–1926, own calculations.

By 1923 regions within the interwar borders of Lithuania ranked this way (from richest to poorest): (1) Klaipėda; (2) Šiauliai; (3) Kaunas; (4) Panevėžys; (5) Marijampolė; (6) Telšiai; (7) Alytus; (8) Tauragė; (9) Utena. The leading position of Klaipėda, which was annexed to Lithuania this year, is not a surprise, given its former belonging to Germany, which was one of the most advanced countries at this time. Although in Germany Klaipėda region was a deep periphery, it was a paragon of socio-economic modernity in comparison with mainland Lithuania, which for more than a hundred years was handicapped in its economic development by the inclusion into the economic space of Russian empire.

It may appear that our finding that the rGDPpc of the Klaipėda region in 1923 surpassed the national mean by some 40% contradicts the 50 percent suggestion of Vaskela for 1938.[38] However, it should be taken into consideration that the contemporary NUTS3 region LT023 (Klaipėda county) includes also the territory of the interwar Kretinga county (see Table 11), which dilutes the productivity values of the Klaipėda region downwardly.

In terms of the share of the total GDP, metropolitan Kaunas region (NUTS LT022) was number one. Its contribution to added value in manufacturing was 26 percent, and to services 29 percent which is in line with the status of Kaunas as the provisional capital of Lithuania according to its interwar constitutions. However, the share of Kaunas in the total added value of agriculture was only 17percent.[39] Panevėžys region (LT025) made the largest contribution (19 percent) to this sector. The leadership of the Kaunas region is accounted by its largest share (464 123 persons or 22 percent) in the total population (2 170 616) of interwar Lithuania. In terms of rGDPpc, it was the second in mainland (or Greater) Lithuania, or the third in the overall ranking.

Somewhat unexpectedly, the Šiauliai region (LT026) turned out as the richest in Greater Lithuania, taking overall second rank. This may be a most important and interesting finding of our study. We call it unexpected because of the broadly shared perception of the part of Greater Lithuania on the left bank of the Nemunas river, called Suvalkija, as its richest part. However, according to our findings, it takes only fifth rank, lagging behind Klaipėda, Šiauliai, Kaunas, and Panevėžys regions[40], and it is separated from Šiauliai by rather a wide gap.

Our finding may qualify as unexpected also because metropolitan regions, hosting central administration, usually are richer than peripheric regions. However, by 1923 Kaunas could profit from the advantages of the capital city for only five years. In imperial Russia, Kaunas was the center of the province (governorate). However, its urban development was handicapped by the status of the fortress city, where civil administration was subordinated to military authority, which was entitled to stop all city development projects considered detrimental to the military prowess of the fortress.

Our finding should stimulate further research in the economic history of Šiauliai region. Pending this research, we want only recall several pieces of more or less known contextual information, that can substantiate plausibility of our finding. The best starting point are findings of Kiaupa (2018) about economic disparities in the GDL in 1775–1787, reported in the first section. So, we should at first recall that the territory of the contemporary Šiauliai region (LT026) was divided between Žematija eldership and Upytė county (pavietas), which both belonged to the richest area of the GDL in 1775.

[38] G. Vaskela, *Tautiniai aspektai Lietuvos ūkio politikoje 1919–1940 metais* (Vilnius, 2014), p. 86–89.
[39] Excluding from total output the contribution interwar Ukmergė county, we would get slightly larger shares.
[40] Actually, the lag behind Panevėžys is very small, so we can also speak abou the tie between Panevėžys and Marijampolė regions.

How then to interpret data on land prices, seemingly indicating that in 1784–89 Žematija was only ninth richest region?

We would argue, that we risk being led astray by the use of land prices as an indicator of economic standing of complete Žemaitija eldership. It included within its limits the vast complex of state-owned estates, known as "Šiauliai ekonomija". Actually, this territory is the historical core of the contemporary Šiauliai region, including the Šiauliai city itself. Most importantly, the lands of "Šiauliai ekonomija" were public property (that of the treasury of the GDL), which could not be sold and so were exempted from the land market. So, land prices as of 1775–1787 could not indicate the economic standing of that part of Žemaitija eldership which now belongs to the Šiauliai region. The standing of the rest of Žemaitija could be as low as land prices indicate, but this does not apply to territories that made up "Šiauliai ekonomija", which together with Upytė county did make out the richest part of Lithuania already in XVIIIth century. If closeness to seaports was a distinctive feature of economically advanced regions, "Šiauliai ekonomija" did enjoy this advantage to the largest possible degree due to its closeness to Riga.

The bulk "Šiauliai ekonomija" was "privatized" after the last partition of Polish–Lithuanian Commonwealth in 1795, when the empress of Russia Catherine the Great distributed parts of the public domain among most deserving members of the imperial elite, starting in this way also the colonization of newly acquired territories. Her last favourite Platon Zubov did receive the largest share of the spoil. Over the centuries, Zubovs acculturated in Lithuania, and late member of the Zubovs house Vladimir Zubov (1862–1933) even became an important sponsor of the underground activities of the Lithuanian national movement. Zubovs and most other new landlord possessors of former state-owned estates in "Šiauliai ekonomija" turned out to be successful managers. According to the research of Stasys Pamerneckis, based on inventories and accountancy books of folwarks of former "Šiauliai ekonomija", they were thoroughly commercialized, producing nearly all output for market sale, and did surpass by productivity similar (serfdom-based) enterprises in other parts of Lithuania.[41]

Šiauliai county was reputed as the most agriculturally and economically progressive in the Kaunas governorate also during the decades following the abolition of serfdom in 1861.[42] In 1871, Šiauliai was connected by the Liepaja-Romny railway with the expanding railway network of imperial Russia, becoming by 1914 an important industrial center, specializing in leather and footwear production. What Zubovs did for the advancement of agriculture in the Šiauliai region, the Frenkel dynasty of industrialists of Jewish descent (Chaim (1857–1920) and Jacob (1883–1967)) did for the development of manufacturing.

In 1914, Kaunas (80,238 inhabitants) had a 3.5 times larger population than Šiauliai (23 271).[43] However, as of 1912, the number of larger industry enterprises in Kaunas (127) was only two times larger than in Šiauliai (62). The same applies to the number of workers (3,058 in Kaunas, 1,353 in Šiauliai). However, the value of output in Šiauliai enterprises (5,712,764 roubles) was 87.1 percent of the output of the Kaunas industry (6,553,309 roubles). This means that industry in Šiauliai was nearly two times more productive than in Šiauliai, with annual output per worker 2,143 roubles in

[41] S. Pamerneckis, 'Palivarkinės gamybos struktūra ir apimtys Lietuvos dvaruose XIX a. pirmoje pusėje', *Lietuvos Didžiosios Kunigaikštystės istorijos atodangos*, (Vilnius, 2016), pp. 547–578.
[42] P. Šalčius, *Lietuvos žemės ūkio istorija* (Vilnius, 1998), pp. 178–180.
[43] Z. Norkus, A. Ambrulevičiūtė, J. Markevičiūtė, V. Morkevičius, G. Žvaliauskas, 'Population of Cities and Towns in Lithuania (within Interwar and Contemporary Borders), 1897–1939', *Lithuanian Data Archive for SSH* (2021).

Kaunas and 4,222 roubles in Šiauliai.[44] These figures indicate that the manufacturing sector was more productive in Šiauliai than in Kaunas, and so support our findings.

Manufacturing in Šiauliai stagnated in the interwar period due to the loss of Russian markets. Most probably Kaunas region could use the advantages of the capital city status of its center and overtake Šiauliai by the end of this period in terms of rGDPpc. This is suggested by the much more rapid increase of the Kaunas city population. By the end of 1939, Kaunas had 154 109 inhabitants, while Šiauliai 31 641.[45] These figures imply a 92 percent (1914=100) increase of population for Kaunas, but only 36 percent for Šiauliai over 1914–1939. However, at the beginning of the independence period, Šiauliai still could outrank Kaunas due to inherited legacies of the former period.

3.4. Findings II: Cross-time comparison of disparities in regional productivity

In this section, we provide a comparison of cross-regional inequalities in 1923 and in the restored independent Lithuania, using quantitative measures of sigma convergence and divergence, those are coefficient of variation (CV), mean logarithmic deviation (MLD), Gini, and Theil indices. Because of the difference in the borders of interwar and contemporary Lithuania, we calculate the values for 2001–2020 twice. Table 13 provides them according to contemporary borders. Because of differences in borders, they are not strictly comparable with those of the interwar period. This does not apply to contemporary NUTS2 Central and Western Lithuania, which has territory nearly equal in size to that of the Republic of Lithuania in 1923–1938 and contains all county centers of interwar Lithuania, with the sole exception of Ukmergė county within its borders. Table 14 provides the values of disparity measures for Lithuania without contemporary Vilnius County for 2001–2020. Larger numerical values of our measure indicate greater differences between regions, and so their increase over time means sigma divergence, while the decrease reveals sigma divergence.

[44] *Obzor Kovenskoj gubernii za 1912 god, Priloženija, Vedomost Nr. 1.*
[45] Z. Norkus, J. Markevičiūtė, 'New Estimation of the Gross Domestic Product in Baltic Countries in 1913–1938', *Cliometrica*, vol. 15, (2021), pp. 565–67.

	1923		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
CV	0.19		0.26	0.29	0.29	0.29	0.30	0.33	0.35	0.32	0.32	0.31	0.29	0.30	0.31	0.31	0.32	0.32	0.31	0.32	0.33	0.32
MLD	0.02		0.03	0.04	0.04	0.04	0.05	0.05	0.06	0.05	0.05	0.05	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Gini	0.10		0.14	0.16	0.16	0.16	0.17	0.18	0.19	0.18	0.18	0.17	0.16	0.17	0.17	0.17	0.17	0.18	0.17	0.18	0.18	0.18
Theil	0.02		0.03	0.04	0.04	0.04	0.05	0.05	0.06	0.05	0.05	0.05	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

Table 13. Sigma convergence/divergence in interwar Lithuania (1923) and in contemporary Lithuania (2001-2020) in comparison. Source: Table 12 and own calculation.

	1923		**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
CV	0.18		0.15	0.14	0.15	0.15	0.16	0.17	0.17	0.16	0.18	0.17	0.17	0.17	0.17	0.17	0.17	0.18	0.18	0.18	0.18	0.17
MLD	0.02		0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Gini	0.10		0.09	0.09	0.10	0.09	0.10	0.11	0.11	0.10	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.12	0.11	0.12	0.12	0.12
Theil	0.02		0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02

Table 14 Sigma convergence/divergence in interwar Lithuania without Ukmergė county (1923) and in the NUTS2 region LT02 (Western and Central Lithuania) in comparison Source: Table 12 and own calculation.

Tables 13-14 disclose that the values for 2001–2020 are up to two times than those for 1923. This can be interpreted as cross-regional disparities in contemporary Lithuania are much larger than those for the interwar years. It should be added that despite the cross-regional productivity disparities in the restored independent Lithuania are considerable, they pale in comparison with those of other Baltic countries. Exploring Eurostat rGDP data we did find that in 2018 the value of weighted CV for Latvia was 0.50, and for Estonia 0.43 in comparison with 0.32 for Lithuania (Eurostat 2023). The values of MLD for the same year are 0.09 for Estonia, 0.12 for Latvia, 0.05 for Lithuania; those of Gini index are 0.21 for Estonia, 0.27 for Latvia, and 0.18 for Lithuania; Theil index 0.08 for Estonia, 0.12 for Latvia, and 0.05 for Lithuania.

During the last twenty years of restored independence, the values of all measures did increase. This means that the territorial development of contemporary Lithuania is characterized by divergence, despite its increase was unsteady. It was interrupted for three years (2010–2012) by the decrease of the values of all our parameters, which means convergence. Most probably this was an effect of the global Great Recession, which severely hit the Lithuanian economy in 2009–2010. Then divergence prevailed again, and the disparities did return or even surpassed the levels that were already reached before the Great Recession. Therefore, divergence among regions is widely perceived a as major socio-economical and social-political problem in Lithuania, although its scale is not dramatic in comparison with many other European countries.

But in fact, due to differences in borders, the values of our measures of cross-regional disparities in interwar Lithuania are not strictly comparable with those in contemporary Lithuania. Comparing them with those within NUTS2 Central and Western Lithuania, we discover that within the borders of interwar Lithuania, they remain on the same level, where they were in 1923. In fact, according to CV values, there was even some convergence in comparison with interwar time, as for all 2001–2020 period CV values are smaller than in 1923. Importantly, within this territory, there was neither sigma convergence nor divergence during last two decades, because the MLD and Theil index values didn’t change since 2003, while changes in values of the other two measures do not display any clear trend.

Contemporary NUTS3 and NUTS2 regions	1923 Interwar Lithuania	1923 Interwar Lithuania without Ukmergė county		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
LT011 Vilnius County	nd	nd		1.41	1.45	1.45	1.44	1.48	1.50	1.53	1.50	1.48	1.45	1.43	1.43	1.46	1.45	1.45	1.45	1.44	1.45	1.46	1.44
LT01 Capital City	nd	nd		1.41	1.45	1.45	1.44	1.48	1.50	1.53	1.50	1.48	1.45	1.43	1.43	1.46	1.45	1.45	1.45	1.44	1.45	1.46	1.44
LT021 Alytus County	0.84	0.82		0.79	0.75	0.71	0.69	0.67	0.65	0.64	0.67	0.65	0.66	0.66	0.64	0.64	0.65	0.64	0.63	0.63	0.61	0.60	0.60
LT022 Kaunas County	1.05	1.03		0.97	0.93	0.96	0.94	0.97	0.96	0.96	0.97	0.95	0.96	0.98	0.98	0.99	0.98	0.99	1.01	1.02	1.02	1.02	1.02
LT023 Klaipėda county	1.38	1.36		1.10	1.07	1.06	1.04	1.05	1.04	1.03	1.03	1.12	1.10	1.11	1.08	1.07	1.05	1.02	1.01	1.01	0.97	0.95	0.93
LT024 Marijampolė County	0.98	0.96		0.67	0.64	0.65	0.63	0.63	0.62	0.60	0.62	0.60	0.63	0.63	0.64	0.64	0.62	0.61	0.60	0.61	0.59	0.59	0.62
LT025 Panevėžys County	0.98	0.96		0.87	0.84	0.82	0.83	0.81	0.74	0.70	0.74	0.73	0.73	0.75	0.75	0.75	0.74	0.74	0.74	0.75	0.73	0.73	0.74
LT026 Šiauliai County	1.29	1.27		0.72	0.73	0.73	0.76	0.75	0.73	0.72	0.73	0.71	0.74	0.76	0.77	0.75	0.74	0.74	0.76	0.78	0.77	0.75	0.76
LT027 Tauragė County	0.82	0.81		0.59	0.55	0.53	0.50	0.48	0.46	0.46	0.51	0.53	0.55	0.58	0.56	0.56	0.56	0.55	0.54	0.56	0.57	0.55	0.55
LT028 Telšiai County	0.90	0.89		0.87	0.82	0.84	0.89	0.87	0.82	0.83	0.84	0.80	0.84	0.84	0.79	0.78	0.73	0.72	0.71	0.73	0.72	0.69	0.69
LT029 Utena County	0.74	0.72		0.87	0.86	0.88	0.87	0.84	0.80	0.78	0.80	0.84	0.69	0.69	0.66	0.66	0.66	0.64	0.62	0.60	0.59	0.58	0.60
LT02 Central and Western Lithuania	na	1.02		0.86	0.87	0.84	0.84	0.85	0.84	0.82	0.81	0.82	0.84	0.84	0.84	0.84	0.84	0.82	0.82	0.82	0.83	0.82	0.81

Table 15 Relative regional GDP per capita, 1923–2020 (current prices, Lithuania or LT02 (in 1923)=1.

The long-run cross-time comparison of regional disparities allows us to make an important conclusion that the prevalence of sigma divergence in contemporary Lithuania should be attributed to the more rapid economic growth of the contemporary Vilnius county compared to other NUTS3 regions or the "rest Lithuania". However, the remarkable stability of economic disparities over a hundred years does not mean that the rank of particular regions remained unchanged, as shown in Table 15.

In the restored independent Lithuania, Klaipėda preserved the first rank in the interwar territory of until 2017. However, by 2001 Šiauliai not only ceded second rank to Kaunas, but fell back behind Telšiai, Panevėžys, Alytus, and even Utena, which was the poorest region in 1923. But by 2020, Šiauliai gained the third rank. In most cases, it is not difficult to explain changes in ranking. The position of Telšiai region is boosted by the location of the largest enterprise of Lithuania *Mažeikių nafta* (now *ORLEN Lietuva*) in its territory. The sudden downward change in the rank of Utena since 2010 is accounted for by the closing of the Ignalina nuclear plant the previous year. The downward move of Panevėžys county since 2006 is related to the bankruptcy of the largest plant in the Panevėžys city *Ekranas* this year. The relative decline of Klaipėda is most probably related to Russian policies of diverting the transit from the Klaipėda seaport to punish Lithuania for its self-assertive foreign policies and then (since 2020) Lithuania's own stopping Belarusian transit to punish the neighboring country for electoral fraud during the presidential election this year.

It is more difficult to account for changes in the fortunes of the two Western regions: Marijampolė and Tauragė. In 1923, Marijampolė was the fourth, while Tauragė was richer than Utena and Alytus. In restored independent Lithuania, Tauragė did become the poorest, and Marijampolė the second poorest Lithuanian region. Most probably, their economic decline is related to the change of neighbors. In the interwar time, bordering Germany was an important asset in terms of opportunities to enhance economic productivity. Presently, due to nearly permanent tensions in Lithuanian-Russian relations, this is a liability.

2. Estonia

4.1. Contextual information

Like other countries, Estonia is divided into historical-ethnographic regions. This division was mainly shaped by the history of its dependence to various sovereigns, which can be started with the conquest and Christianization by 1227, which was accomplished by Danish and German Crusaders. Accordingly, Estonia was divided into the Northern part under the Danish king, and the Southern part under the Livonian Order. Since 1346 all its territory was united under Livonian Order, which was crushed by Russian troops during initial phase of Livonian War (1558-1583). Ultimately they were expelled, and Estonia's territory was divided between Sweden (North) and the Polish–Lithuanian Commonwealth (South), while Ösel (Saaremaa) island came under Danish rule. However, by 1660, all the contemporary territory of Estonia was united again under Swedish rule until 1710, when it was captured by the Russians, who ruled it until 1918, when independent Estonia was established.

Because of early unification under the rule of one foreign sovereign, Estonia displays lesser internal ethnographic and linguistic heterogeneity in comparison with Lithuania and Latvia, although until 1917 there was no administrative unit in Russian Empire encompassing all contemporary territory of Estonia. While its Northern part made out Estland governorate (with Reval/Tallinn as administrative center), Southern part together with Latvian Vidzeme belonged to Livland governorate (with Riga as center). Besides, there were territories populated by Setus (*setukesed, setud* in Estonian), living to the south of Lake Peipus, in the Setomaa region, which did not belong to the territory under Livonian Order and then Swedish sovereignty, but was part of Russian province. Therefore, different from the indigenous inhabitants of mainland Estonia, who were Lutherans since Reformation time, Setus were

Orthodox, with the Pskovo-Pechersky Monastery in Petseri as their important religious and communal center. There is no unanimity among ethnographers and linguists on whether Setu are an ethnicity separate from Estonians and whether they speak a dialect of Estonian or a separate language.

Negotiating the peace with Soviet Russia (signed on February 2, 1920), the Estonian government was able to secure Setumaa's inclusion in Estonia's borders, making it Petseri County (Petserimaa) in independent Estonia. Besides that, Estonia received not only Narva city on the left bank of the Narva river, which by 1918 was part of the metropolitan St. Petersburg governorate, but also a strip of land on its right bank (see Fig.9). It was populated by Russians but was considered by Estonia's government necessary for military reasons.

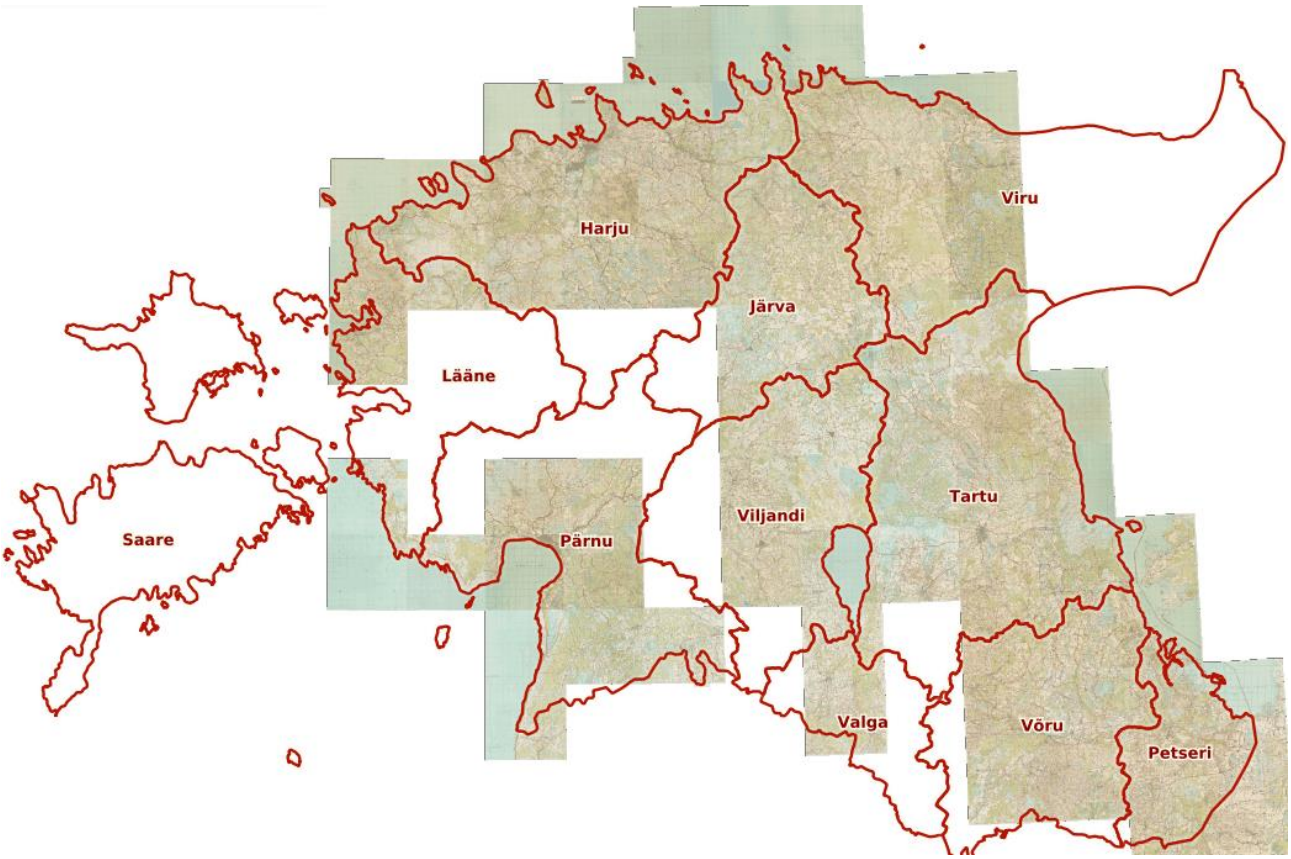

Fig. 9. Borders and adminstrative division of independent Estonia in 1938. Source: https://xgis.maaamet.ee/xgis2/page/app/ajalooline

In interwar Estonia, Petserimaa was known as the least developed among eleven Estonia's counties, with illiteracy (nearly absent in mainland Estonia) and infant mortality rates much above Estonian mean, differing from mainland Estonia nearly as much as Latgale differed from mainland Latvia. However, on the August 15, 1944, Estonia lost its Latgale, as the the border between the Estonian Soviet Socialist Republic and the Russian Soviet Federated Socialist Republic was revised by Soviet authorities to what it is now. Estonia also lost territories on the right bank of Narva river. However, Narva city remained within Estonia. As a result, the territory of Estonia contracted from 47,450 to 45,228 km^2 (Estonija 2008, p. 15), as restored independent Estonia was not able to get from the Russian Federation as the successor state of the USSR the restitution of its borders according to the 1920 Tartu Peace Treaty.

4.2. Issues of cross-temporal spatial harmonization

However, for the cross-time comparability of the measurements of the cross-regional economic disparities the the incongruity between Estonia's interwar and contemporary borders is only minor

nuissance, as they are too small to influence results. Major difficulties are related to differences between contemporary and interwar time administrative divisions. During both periods, key administrative units are counties (*maakond*).

There are 15 counties in contemporary Estonia. For statistical accounting (reporting to Eurostat) purposes they united into five NUTS3 regions: Northern (EE001), Western (EE004), Central (EE006), North-Eastern (EE007), Southern (EE008) Estonia. Northern Estonia region is identical to metropolitan Harju county, and North-Eastern Estonia is just Ida-Viru county. Among the remaining regions, Central Estonia includes three counties, Western Estonia four, and Southern Estonia six. Southern Estonia (with Tartu as its urban attraction center) is largest in terms of territory, closely followed by Central Estonia. However, up to 50% of Estonia's population is living in the metropolitan Northern Estonia region.

In the interwar Estonia, there were 11 counties. One of them (Petserimaa), which would belong to Southern Estonia region, has gone to Russia. The territory of the remaining four Southern Estonian countries (Tartu, Valga, Viljandi, Võru) corresponds rather closely to the that of the EE008, except that two new counties (Jõgeva and Põlva) were carved out of interwar Võru and Tartu counties. There is also reasonably close correspondence between the Western Estonia region and interwar Lääne, Pärnu, and Saare counties. New Hiiu County is just a part of the territory of interwar Saare County. Contemporary metropolitan Harju County is smaller than in interwar times, as part of its territory was carved out to establish the new Rapla County, which is now part of the Central Estonia region. It includes the old Järva County along with the new Lääne-Viru County. Last county was established by dividing large interwar Viru county into Ida-Viru county, which is also EE007 region, and Lääne-Viru county. In the cross-time spatial harmonization, we divide interwar statistics for Viru county into two (50% parts), one part attributing two contemporary EE007 region, and another adding to data on interwar Järva county, considering the sum as EE006 region.

Fig. 10 visualizes the relation between NUTS and Estonia's counties in 1938. Fig. 11 does the same for NUTS3 and contemporary counties of Estonia. Table 16 presents our cross-time spatial harmonization scheme.

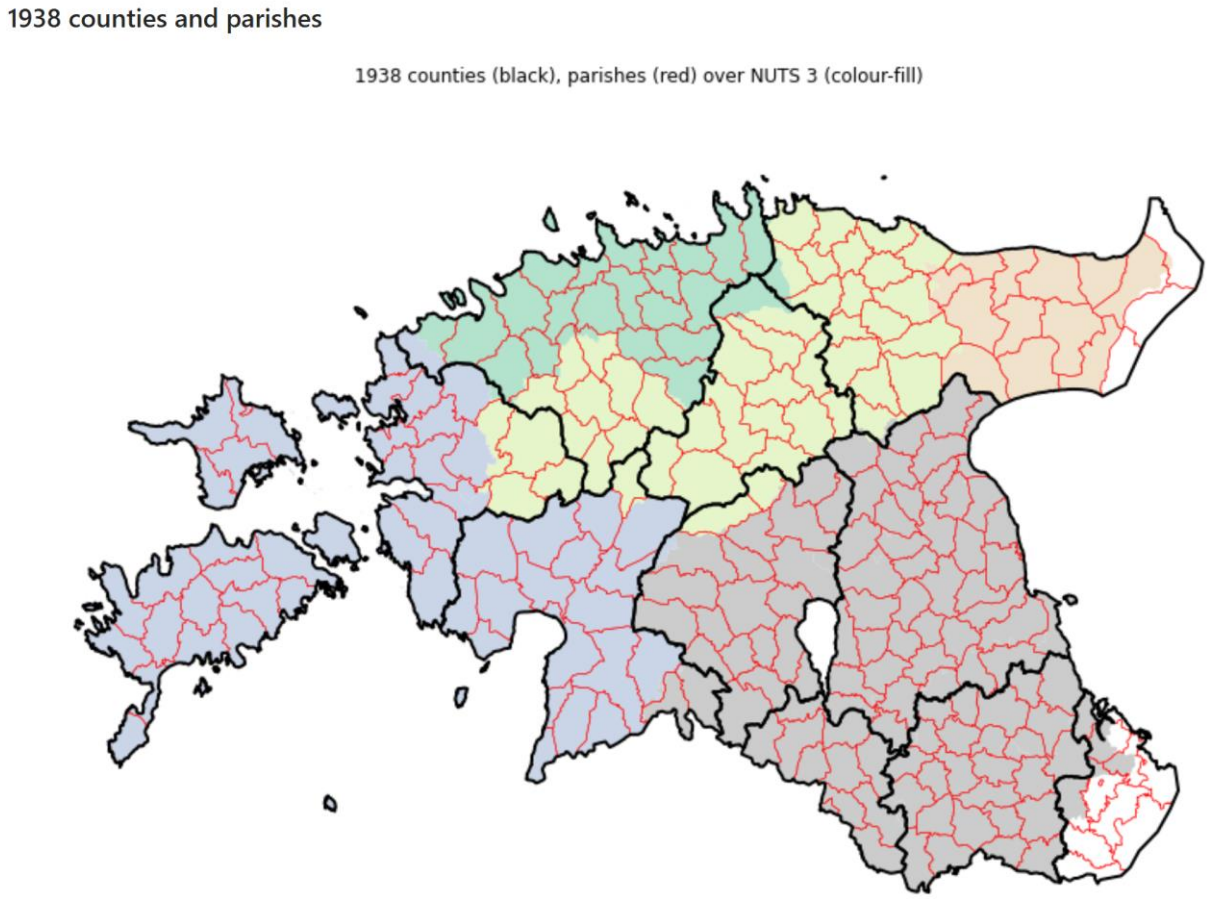

Fig. 10 NUTS3 and Estonia‘s administrative division in 1938.
Data source https://xgis.maaamet.ee/xgis2/page/app/ajalooline

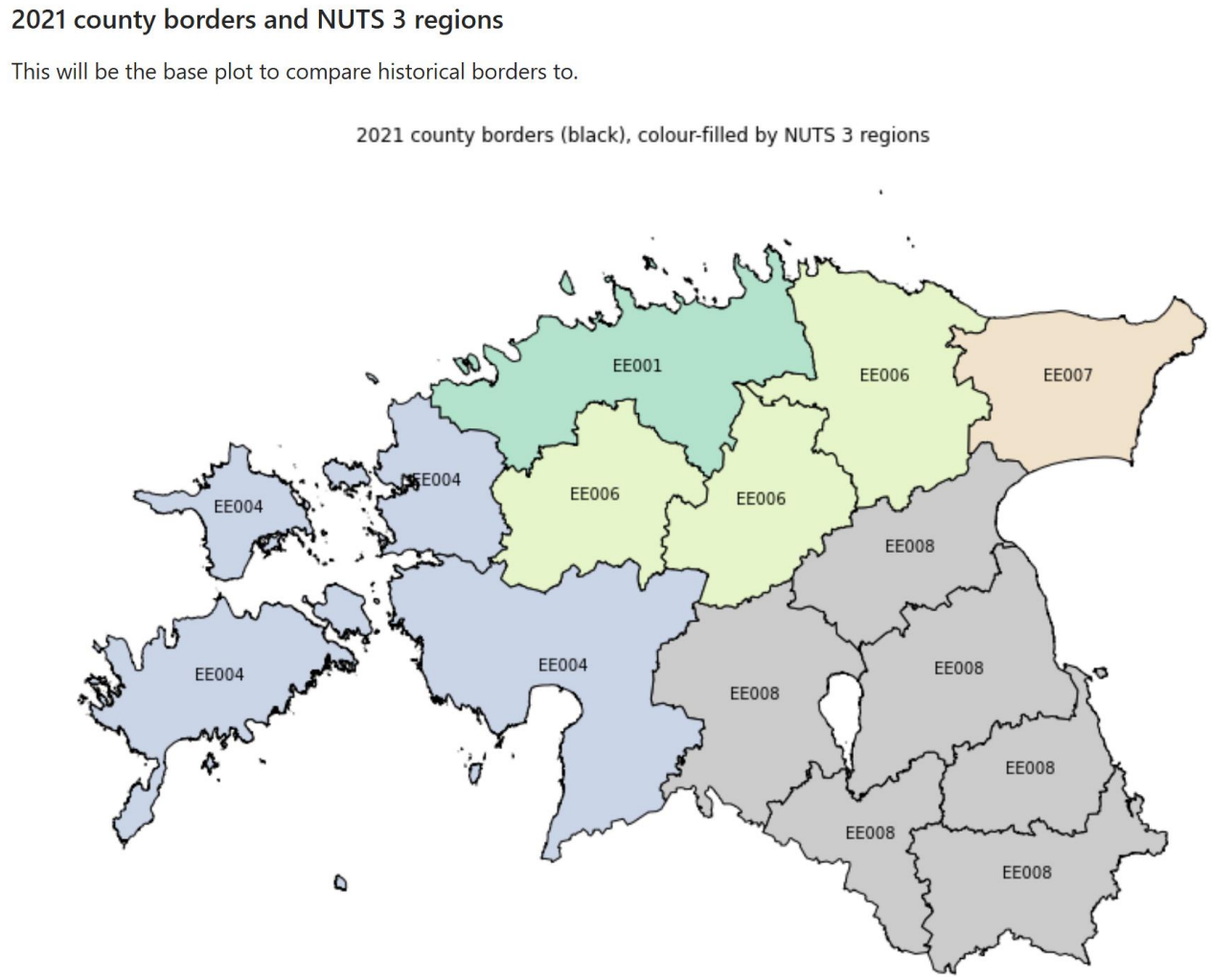

Fig. 11 NUTS3 and Estonia‘s administrative division in 2021.
Data source https://xgis.maaamet.ee/xgis2/page/app/ajalooline

Contemporary NUTS3 regions Total N=5	**Interwar Estonia´ counties (*maakond*) Total N=11**	**Contemporary Estonia`s counties (*maakond*) Total N=15**
Põhja-Eesti EE001 (Northern Estonia)	Harjumaa (Harju County) Contained the capital, Tallinn	Harjumaa (Harju County) Contains the capital, Tallinn
Lääne-Eesti EE004 (Western Estonia)	Läänemaa (Lääne County); Pärnumaa (Pärnu County); Saaremaa (Saare County)	Hiiumaa (Hiiu County); Läänemaa (Lääne County); Pärnumaa (Pärnu County); Saaremaa (Saare County)
Kesk-Eesti EE006 (Central Estonia)	Järvamaa (Järva County); 50% of Virumaa (Viru County)	Raplamaa (Rapla County); Järvamaa (Järva County); Lääne-Virumaa (Lääne-Viru County)
Kirde-Eesti EE007 (North-Eastern Estonia)	50% of Virumaa (Viru County)	Ida-Virumaa (Ida-Viru county)
Lõuna-Eesti EE008 (Southern Estonia)	Tartumaa (Tartu County); Valgamaa (Valga County); Viljandimaa (Viljandi	Jõgevamaa (Jõgeva county); Põlvamaa (Põlva county); Tartumaa (Tartu County);

	County); Võrumaa (Võru County); Petserimaa (Petseri County)	Valgamaa (Valga County); Viljandimaa (Viljandi County); Võrumaa (Võru County);

Table 16. The scheme of cross-time spatial harmonization between the administrative division of the Republic of Estonia (as of 1938) and the restored independent Estonia (as of 2021).

4.3. State of research and data

Similar to other Baltic countries, we can find ready-made RGDP data in Eurostat and national statistical office portal "Statistics Estonia".[46] To maximise cross-country data comparability, we use first source. Like in other Baltic countries, Estonia researchers are closely monitoring changes in cross-regional disparities, presenting analytical snapshots in the series *Eesti piirkondlik areng* (Regional development in Estonia). It has been published by the Estonian national statistical office since 2010, but the publications therein usually provide retrospective back to early 1990s. There is also vast literature produced by Estonian and international researchers ((e.g. Tammaru 2001; Raagmaa and Stead 2015 et al.) in other outlets, where disparities in RGDP are discussed among the others.

The situation in the Ida-Viru county (NUTS3 region Kirde-Eesti EE007) is usually given special consideration due to security reasons: location on the Estonia-Russian border and predominantly Russian-speaking population, with many of them still not naturalised.[47] This is location of Estonia's oil shale industry, which was established in the interwar time, using local Estonian workforce. In the first post-WWII years, Soviet planners decided to make it a supplier of electric power and gas to Leningrad, allocating considerable investments.

In this period, the buildup of shale oil industry in the North-Eastern Estonia attracted many immigrants from Slavic Soviet republics who settled en mass also in Tallinn, becoming another center of Estonia's industrial development, while Southern Estonia (with only partial exception for Tartu) remained mainly rural and agricultural. After 1990, the fates of two most industrially advanced counties (metropolitan Harju and Ida-Viru) changed, with Ida-Viru suffering decline, and Tallinn area developing most rapidly. This made Estonia's pattern of cross-regional disparities to resemble ever closer that of Riga, because Tartu was not able to counterbalance Tallinn.

In interwar Estonia, the geographer Edgar Kant (1935) pioneered the systematic investigation of socio-economic disparities among Estonia's region. However, he did no took into consideration the work already done in the national output accounting, already done by this time. In 1932, the employee of Estonian State Statistical Central Bureau (Riigi Statistika Keskbüroo; RSK) Juhan Janusson published the calculations of the national income at current prices in national currency (Estonian crown; EEK) and its structure of Estonia in 1928-1930 (Janusson 1932). Later he revised and extended this pioneering work, covering the 1929-1936 period (Janusson 1937). Arvo Horm (1940) extended this time series even further by two more years (1937-1938). However, he provided no information about his method or source.

After long break Jaak Valge (2003) extended time series covered in interwar publications backwards, including also 1923-1928 period. Janusson's calculation is grounded on assumption that only agriculture, industries, crafts and real estate (*tulu kinnisvaralt*) create added value. Transforming Janusson's calculation of national income in 1929-1938 into that of GDP for the same period, Valge included also service sector. He also provided estimation of the GDP of Estonia at constant 1929 prices,

[46] https://www.stat.ee/en

[47] Godkin, Brian & Forrest, Richard M. (1993). *Regional Development in Estonia and Ida-Virumaa: Economic Restructuring and Ethnic Conflict*. Roskilde: Roskilde Universitetscenter, 1993

using consumer price index as deflator. He also connected his estimates to Angus Maddison work, converting the estimates in EEK in those in Geary Khamis 1990 international $. Recently, his estimates were superseded by those of Klimantas (2025) for 1919-1940 period used in our RGDP estimations.

Applying the Geary-Stark method for the estimation of regional GDP, in addition, we need regional employment and wage data by sectors. Employment data are provided by two Estonia's interwar censuses (1922 and 1934). Wage data for agriculture and part of the data for industry are from Norkus et al. (2022d; 2022e). Remaining data on wages in industry were provided by Olaf Mertelsmann from Tartu University, who also helped at their cross-temporal spatial harmonization. In the calculations of the added value of industry, we took the daily wages of carpenters as a proxy for the available data on wages in services at the regional level were too fragmentary to be usable. Therefore, we used the means of wages in agriculture and in industry.

4.4.Findings

Table 17 presents findings on the RGPPpc of Estonia in 1922 and 1934, expressed in EEK at current prices and as percentages of the GDPpc for Estonia (=100%). It should be reported that interwar Estonia went through currency reform, with Estonian kroon replacing in 1928 Estonian Mark (*Eesti mark*), which was the currency of country in 1918-1928. Converting Estonia's GDP in 1919-1927, we followed Klimantas who used the parity 1 EEK=100 Estonian Marks, set by the Bank of Estonia during currency reform, and price indexes.

Table 18 contains the values of our four measures of inequality (CV, MLD, Gini, and Theil indexes) for the interwar period, supplemented by the values of these indices for 2002 and 2014, providing a picture of the long-run trend in the cross-regional economic disparities. Fig. 12 just The final Fig.13 visualizes the ratios of the GDP of five Estonia's NUTS3 to national mean, supplementing them with same ratios for 2002 and 2014, based on the ready-made Eurostat

	1922		1934	
Regions	RGPPpc, EEK	%, Estonia=100%	RGPPpc, EEK	%, Estonia=100%
Central Estonia	456,52	100,45	378,80	92,74
North Eastern Estonia	421,78	92,81	371,63	90,98
Western Estonia	404,62	89,03	340,81	83,44
Southern Estonia	459,16	101,03	368,70	90,26
Northern Estonia	510,59	112,35	589,13	144,23
Estonia	454,46	100,00	408,47	100,00

Table 17. RGDP of Estonia's five regions in EEK and in percentages of the national GDPpc in 1922 and 1934. Sources: Klimantas 2025: 323, 333; own calculations.

	1922	1934	2022	2014
CV	0,0751	0,2215	0,4147	0,4187
MLD	0,0028	0,0207	0,0829	0,8998
Gini	0,0396	0,0981	0,208	0,2137
Theil	0,0028	0,0224	0,0832	0,0873

Table 19 The values of the four measures of cross-regional economic inequality in Estonia in 1922 and 1934.

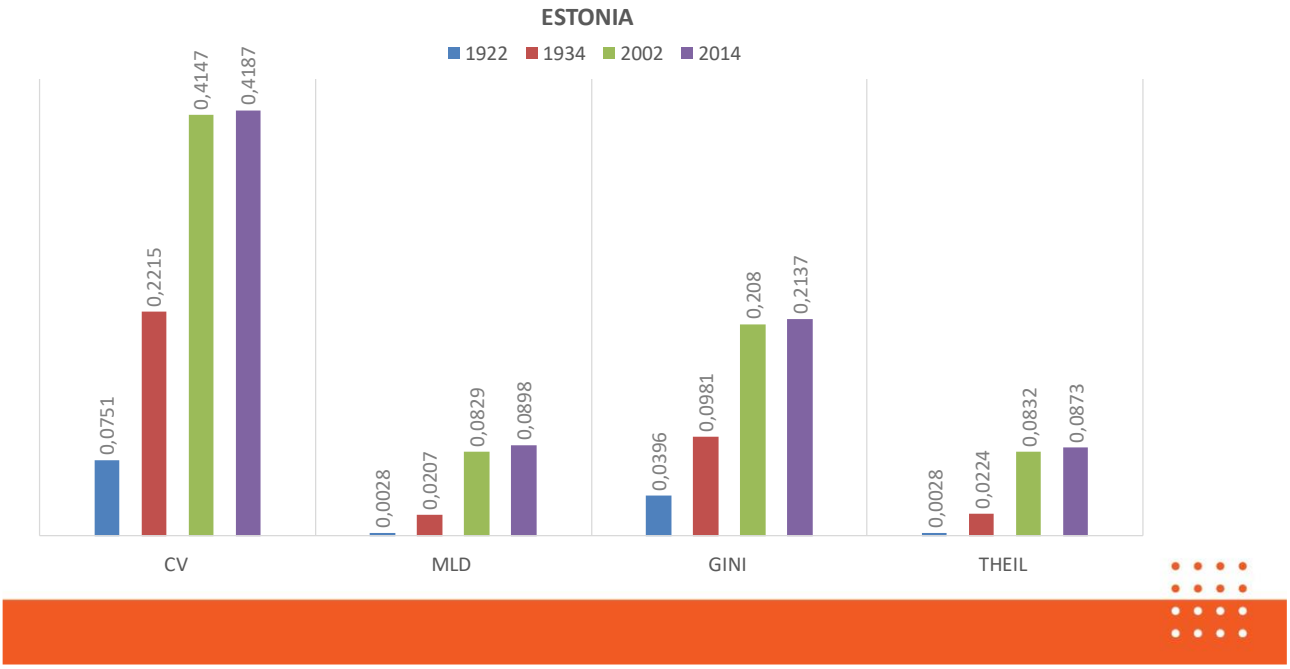

Fig. 12. The values of the four measures of the cross-regional economic inequality in Estonia in 1922 and 1934.

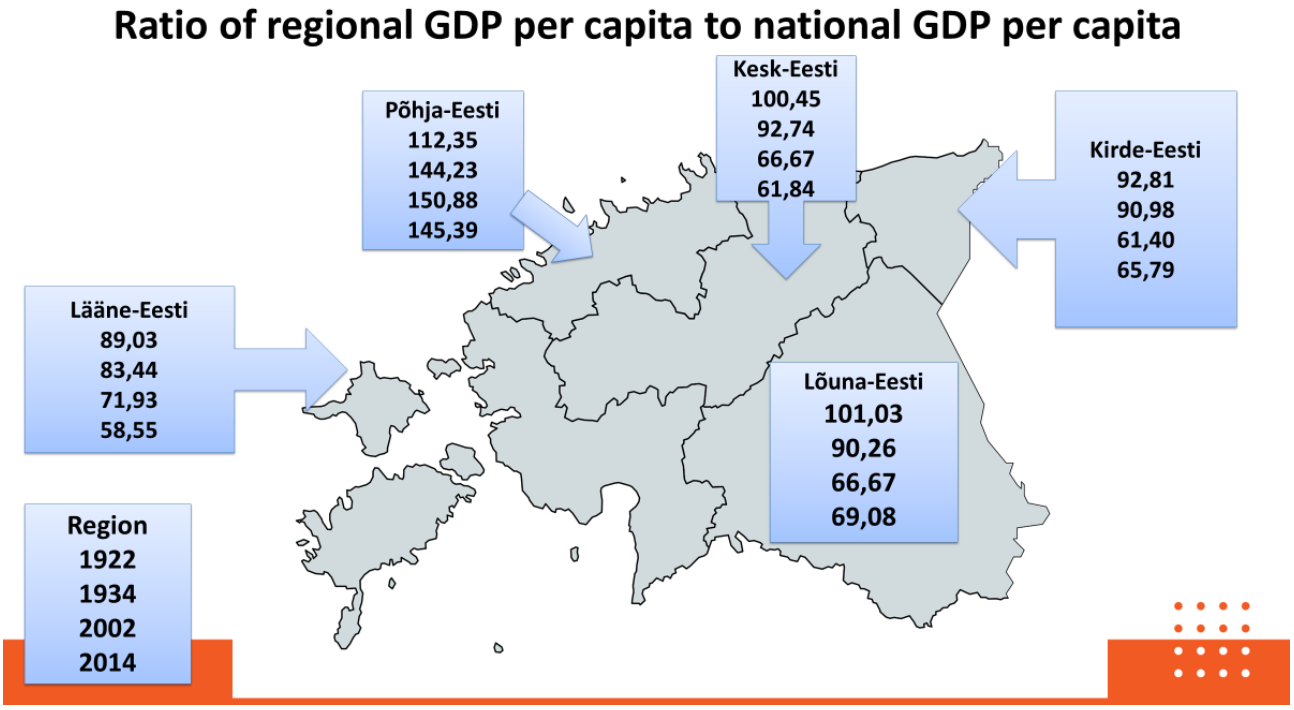

Fig.13. The ratio of the regional GDPpc of five Estonia‘s NUTS3 region to national GDPpc. Source: own calculations; Eurostat 2025 (for 2022 and 2014)

Our results show an increase in cross-regional disparity over 12 years of interwar independence from a very low level, on par with Lithuania's in 1923 (the Estonian level was actually lower). However, the disparity level by 1934 was still much lower in comparison with Latvia, where the ratio of the RGDPpc of the metropolitan area to the national mean was never lower 160%, while in Estonia in 1934 it was 144%. Notably, in 2002-2014 it remained at a similar level (144-151%). However, the values of the overall inequality measures increased markedly compared with 1934, reflecting a much broader dispersion of RGDPpc values across regions. In fact, in 1934 the RGDP of the poorest (Western Estonia) region made 83% of national mean. In 2014, the RGPpc of the poorest region was 59% of national mean.

Remarkably, this was the same (Western Estonia) region, disclosing continuities in the ranking order over nearly 100 year. However, while elevated position of Tallinn area remains permanent (similarly to that of Riga in Latvia and diiferently from Lithuania), there is no permanent laggard in Estonia similar to Latgale in Latvia. In 2001, worst performing region was North Eastern region, and the distance separating the laggard from the second worst region never was so large as that separating Latgale from Latvian „middle class“ regions Kurzeme, Vidzeme, Pieriga, and Zemgale. It could be different if Petserimaa would remain part of Estonia in 1945, but alas, it is too small to receive the status of the EE NUTS3 region.

Concluding Discussion

In Work

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