

ASSESSMENT OF BALTICS STATES REGIONAL ECONOMIC DISPARITIES ACCORDING TO GDP

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ABSTRACT

Analysis of the challenges of cohesion at the country and regional levels becomes especially relevant due to EU expansion, the Great Recession, and uneven economic recovery after that. Recent global events, such as the COVID-19 pandemic and imposed lockdowns, have further intensified interest in this issue. This study aims to evaluate the disparities in the development of Baltic States' regions using the author's proposed methodology for calculating an aggregate cohesion index. Some important conclusions can be made from the data analysis. A common trend across all countries was the notable economic strength of capital regions, with GDP per capita significantly exceeding national averages. Despite the pandemic's limited impact in 2020, a clear divergence trend emerged in 2021. Additionally, the club convergence between less developed regions was observed, especially in Lithuania and Latvia. In addition, Lithuania uniquely exhibited three distinct groups of regions based on economic development, in comparison with only two groups in Estonia and Latvia.

Keywords: Baltic states; cohesion; cohesion index; divergence; GDP convergence; regional disparities

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INTRODUCTION

Cohesion in the EU is a dynamic process that responds to global economic changes, crises, and new challenges. These changes can be dangerous, unwanted, or sometimes necessary to ensure the ability to achieve the cohesion objectives.

Before Eastern European countries joined the EU, there were many discussions and assessments about how this process would affect the EU. However, the enlargement is seen as a success. Income disparities have narrowed, and newly joined regions have moved closer to the level of older EU member states. On the other hand, the impact of EU enlargement on income inequality is often observed to vary. This comes from other factors such as globalization, digitization, and the general level of

competitiveness. (Incaltarau et al., 2020; Kashnitsky et al., 2020; Kokocinska and Puziak, 2018; Horridge and Rokicki, 2018)

The Great Recession of 2007-2009 impacted regional cohesion. As researchers have noted (Tulumello et al., 2020; Camagni et al., 2020; Janin Rivolin, 2017), regional disparities have become more pronounced in Europe, indicating that the impact of the crisis has varied across regions. Central, more developed regions of countries have often been more resilient to economic downturns than rural regions. This reflects the importance that large cities and urban agglomerations have in modern economies.

Since the crisis, EU cohesion policy has shifted towards greater competitiveness and an orientation towards larger cities. This is a

discussable topic and raises questions about how this policy shift might affect weaker regions (Rauhut and Da Costa, 2021b; Rodriguez-Pose, 2018). However, cohesion policy still aims to reduce regional disparities, although it must now also consider the role of cities.

The pandemic has affected regional disparities and has become a new challenge for cohesion policy (Di Caro and Fratesi, 2022; Ascani et al., 2021; Crescenzi et al., 2021; Conte et al., 2020). In this context, it is important to consider different regions and prepare to address the challenges posed by the impact of such crises. This may require new policies and strategies to ensure long-term sustainable development in all areas of the EU.

Traditionally, studies on cohesion, convergence, integration, and uneven economic growth in the EU are conducted at the level of countries or NUTS2 regions. This is explained by the fact that the EU's cohesion policy is implemented precisely at the NUTS2 level. Additionally, statistical data in this context are more comprehensive and readily available.

Recently, there has been a shift in focus toward smaller NUTS3-level regions. Several scholars (Ganau and Kilroy, 2023; Postiglione et al., 2020; Webber et al., 2018; Percoco, 2017) have noted that studies at this finer level may more accurately reflect regional disparities, often explaining the slower development or increasing lag of larger regions (NUTS2) over the long term. The choice of NUTS3-level regions can reveal more precise patterns and specificities that might go unnoticed at the level of larger regions. It is also worth mentioning that certain EU instruments (e.g., integrated territorial investment, the European Commission "Catching Up" initiative) are implemented at the NUTS3 level.

Other researchers (Ganau and Kilroy, 2023; Iammarino et al., 2019; Butkus et al., 2018) have indicated that despite the convergence of economic development levels between countries and at the NUTS2 level, disparities among NUTS3 level regions are increasing.

Similar trends are observed in studies that mention the Baltic States. Several problematic aspects are noticeable. First, the Baltic States are often analyzed in the context of other similar countries. For example, Pipien and Roszkowska (2019) examined CEE and CIS countries, Boltho (2020) compared the Baltic states with Slovakia

and Slovenia, and Deichmann et al. (2017) analyzed the progress of convergence among 10 newly joined countries. Second, all the mentioned authors (as well as Perez-Moreno et al., 2023) have concluded that the Baltic states, in the context of other countries, stand out with faster growth rates, consequently experiencing a faster convergence towards the EU average. Third, all of this is examined only at the level of countries or NUTS2 regions. The situation within countries, however, can be illustrated by the author's proposed analysis of the Baltic States at the NUTS3 regional level.

Regarding all of the above, the main aim of this paper is to evaluate the level of economic development cohesion among the regions of the Baltic states. In this context, economic regional development is measured by GDP per capita.

In order to achieve the stated goal, the theoretical review demonstrates that the cohesion concept is complex and multifaceted. Key perspectives on the perception of cohesion include definitions such as convergence, integration, regional development, and others. The objective is to show that while cohesion and uneven economic development are examined at various levels in various studies, this is mostly done at the level of countries or large regions. Meanwhile, smaller regional levels receive disproportionately little attention. Additionally, it is desired to ascertain the role of large cities and agglomerations in this context.

Altogether, this enables the construction of a methodological framework, which is built upon several key aspects, including the selection of the research period, the identification of subjects and their categorization, the indicators used, and their calculation methods. The study makes use of the author's devised research methodology – the cohesion index, which is founded on several basic principles, such as indicator normalization, standard deviation, and the Structural Divergence Index (SDI). The distinctiveness of the cohesion index lies in its ability to assess the aggregate cohesion level between different regions and demonstrate the percentage of similarity. That is, it evaluates not the alteration or lag but the actual level of cohesion.

The analysis based on the methodology mentioned above is discussed in the last part of the paper. It consists of three logical stages. In the first stage, the relative GDP of the regions of the Baltic States (compared to the national average)

was analyzed. In the second stage, the correlation between the changes in the GDP per capita of the regions of the Baltic States was examined. In the last stage, the aggregate cohesion indices of the Baltic States were calculated and analyzed and named as follows: CI_{EE} and CI_{EE4} for Estonia; CI_{LV} and CI_{LV5} for Latvia; and CI_{LT} , CI_{LT9} , and CI_{LT7} for Lithuania. As could be expected, the results of all analysis stages confirm each other's trends.

This study contributes to shaping cohesion and regional development policy design at the local level. It allows local policymakers to see a realistic picture of development trends at the region's level of interest. Additionally, the results can be valuable when compared with similar studies in other regions. Finally, the insights provided by the author could serve as a foundation for further research of this nature, expanding the geography of the regions studied.

LITERATURE REVIEW

The term "cohesion" can be interpreted in diverse ways in the scientific literature (Rumanovska et al., 2021; Kashnitsky et al., 2020; Kokocinska and Puziak, 2018; Gajdova, 2016). The diversity of this concept shows that it is complex and multifaceted. Key perspectives on the perception of cohesion include such definitions as convergence, integration, achieving living standards, level of territorial and social stability, and regional development. But first of all, cohesion is associated with convergence, i.e., an effort to reduce the differences between the levels of development of regions or social groups. This means that less developed areas are trying to catch up with more developed ones and reduce the gap. Also, cohesion can be understood as part of integration, where different localities or social groups seek greater cooperation and interaction to achieve common goals and increase well-being. Cohesion is sometimes seen as the process of achieving desirable standards of living, such as quality of life, well-being, and employment opportunities. It reflects efforts to improve people's living conditions. Cohesion can refer to the level of stability of territorial and social relations to maintain cohesion and harmony within regions or between social groups. Moreover, cohesion can be related to the promotion of regional development, where less developed areas try to reach a higher level of

development similar to that of more developed areas.

Many factors can contribute to the causes of regional disparities, with socioeconomic reasons among the most important (Di Caro and Fratesi, 2022; Calegari et al., 2021; Di Caro et al., 2020; Gagliardi and Percoco, 2017). This includes the structure of production, which can affect employment and economic development in the region. The accessibility of regions and their distance from important markets can affect trade opportunities and investment attraction. The inability of regions to adapt to economic and social changes can be an important cause of regional disparities. These include inadequate public administration (Di Caro et al., 2020), poor infrastructure, unfavorable labor supply structures, and an unfavorable demographic structure (Kashnitsky et al., 2020). The absence of a regional policy can also lead to regional disparities.

Some researchers (Di Caro and Fratesi, 2022; Rumanovska et al., 2021; Fratesi and Perucca, 2019) have noted that development inequalities can be understood not only as negative phenomena but also as positive in terms of the relative advantages of a particular region. Regional differences may be naturally occurring and may be related to different historical (past politics, conflicts, or legacy of colonization) or geographical (climate or geographical location) conditions.

Cohesion and regional development research are important for understanding economic and social development processes at different entity levels. Research often focuses on different levels of objects. Rauhut and Da Costa (2021b), Crescenzi and Giua (2020), Asprogesakas and Zachari (2020), and Bourdin (2019) analyzed countries and countries cluster levels. Club convergence is an important topic because it examines how countries or groups of countries seek to reduce economic differences between them, and it helps to understand how economic unions and cooperation can affect regional development. Scholars such as Evrard and Chilla (2021), Faludi (2021), Humer et al. (2021), and Calegari et al. (2021) analyzed the concept of cohesion at the regional level of countries to understand the causes of regional disparities and ways to reduce them. This makes it possible to identify which regions may require more attention and investment. Researchers such as

Gagliardi and Percoco (2017) focused on specific regions that may have unique characteristics or challenges. These can be urbanized or rural regions with varying degrees of development. Others such as Rauhut and Da Costa (2021a), Ehrlich and Overman (2020), Medeiros and Rauhut (2020), and Capello and Cerisola (2020) paid attention to individual cities to understand how urban agglomerations affect economic development and cohesion.

Large cities often play a significant role in their country's economy and have higher productivity than smaller areas (Capello and Cerisola, 2020; Garcilazo and Oliveira Martins, 2020; Camagni, 2019). This phenomenon is well known and is called the "city effect" or "urban agglomeration effect." This is due to several main factors, the first of which is economies of scale. Agglomerations of large cities provide an opportunity to use resources and infrastructure more efficiently. The concentration of production processes for most goods and services allows companies to benefit more economically by reducing unit production costs. The second is innovation and creativity. Big cities are knowledge centers that attract talented people and have high-level universities, research, and technology infrastructure. This environment encourages innovation and creativity and enables companies to develop and adapt to innovation rapidly. A third is transport and communication advantages. Big cities have better transport links, better infrastructure, and high-quality services, which facilitate the movement of goods, business transactions, and communication between companies. Last is the labor force. The diversity and population density of large cities give companies access to a larger labor base, which can be an important advantage when scaling up production.

In conclusion, this urban effect can lead to regional differences, as smaller areas and rural areas often suffer from the pull of large cities. Big cities can "suck" resources and talent from other areas, leaving them less competitive and disadvantaged. This is especially relevant for capital regions.

METHODOLOGY

The research methodology chosen consisted of several important aspects, including the choice of the research period, the subject level choice and their list, the indicators used, and their calculation methods (see Table 1).

Table 1: Research indicators and their values

Research indicator	Indicator's unit
Timeline	2000-2021
Variable	GDP per capita
Countries	Baltic States (Estonia, Latvia, Lithuania)
Regional level	NUTS3
Regions <i>*in alphabetic order</i> <i>*capital region underlined</i>	Estonia (5): Kesk, Kirde, Lääne, Lõuna, <u>Põhja</u> Latvia (6): Kurzeme, Latgale, Riga, Pieriga, Vidzeme, Zemgale Lithuania (10): Alytus, Kaunas, Klaipėda, Marijampolė, Panevėžys, Šiauliai, Tauragė, Telšiai, Utena, <u>Vilnius</u>
Statistical methods	Data normalization, Cohesion index (based on standard deviation and structural divergence index)

Source: according to Eurostat.

While the study aimed to cover as long a period as possible, the statistical data of all subjects used in the study were available only from the year 2000. Previous years' data was missing or incomplete. As a result, the study period covers the period from 2000 to 2021.

The studied areas are the regions of the Baltic States (Estonia, Latvia, Lithuania). The analysis was carried out at the region level (NUTS3). The NUTS classification subdivides the economic territory of the Member States into territorial units. The NUTS classification is hierarchical, subdividing each Member State into NUTS level 1 territorial units, each of which is subdivided into NUTS level 2 territorial units, and these in turn are subdivided into NUTS level 3 territorial units. The average size of the NUTS3 administrative units lies within the following population thresholds: between 150,000 and 800,000. (European Parliament) This includes a list of 5 regions in Estonia, 6 in Latvia, and 10 in Lithuania, listed in alphabetical order as follows for each country:

- Estonia (5): Kesk, Kirde, Lääne, Lõuna, Põhja;
- Latvia (6): Kurzeme, Latgale, Riga, Pieriga, Vidzeme, Zemgale;

- Lithuania (10): Alytus, Kaunas, Klaipėda, Marijampolė, Panevėžys, Šiauliai, Tauragė, Telšiai, Utena, Vilnius.

The regional differences and aggregate cohesion of the Baltic States were assessed according to one indicator – GDP (Gross Domestic Product) per capita, as it is one of the

most important indicators for the assessment of economic development.

The methodology for calculating the cohesion index was based on several basic principles, including the normalization of the indicator, the standard deviation, and the calculation of the structural divergence index (see Table 2).

Table 2: Research methods

Counting method	Formula and its explanation
Normalization of variable	$V_{norm} = \frac{V_{nom}}{V_{avg}} * 100\% \quad (1)$ <p>where, V_{norm} – normalized value of the region indicator; V_{nom} – nominal value of the region indicator; V_{avg} – average value of the region indicator.</p>
Standard deviation	$s = \sqrt{\frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{x})^2} \quad (2)$ <p>where, s – standard deviation; x_i – the i^{th} value of the indicator; \bar{x} – average value of the indicator; n – number of indicator values.</p>
Structural Divergence Index (SDI)	$SDI_{i,EU} = \sum_{j=1}^N abs(S_{j,i} - S_{j,EU}) \quad (3)$ <p>where $SDI_{i,EU}$ – the index of the country's structural divergence vis-à-vis the EU; N – number of economic structure elements (sectors) to be analyzed in country i or region; $S_{j,i}$ – the part of element j (sector) of the economic structure of country or region i, calculated in terms of gross value added, in the gross product of country i or region; $S_{j,EU}$ – the part of element j (sector) of the economic structure of an EU country or region, calculated in terms of gross value added, in the gross domestic product of an EU country or region.</p>
Aggregate Cohesion Index (CI)	$CI = 100 - \frac{1}{n} \sum_{i=1}^n abs(X_i - \bar{X}) \quad (4)$ <p>where, CI – level of cohesion for the analyzed indicator (cohesion index); X_i – normalized value of the indicator for the i region; \bar{X} – average value of the country's indicator; n – number of regions.</p>

Source: based on Britannica, Krugman (1991).

Data normalization in this context means that the GDP indicator of individual regions was calculated as a percentage ratio to the country's average. This is necessary because Eurostat provides nominal data or data compared to the EU average.

Standard deviation is one of the important indicators measuring differences (reference to the encyclopedia). The Structural Divergence

Index (SDI) was first introduced by Krugman (1991). Taking into account the principles of standard deviation and SDI calculation, the author of this study has proposed the Cohesion Index (CI). The uniqueness of the index lies in its ability to assess the aggregate cohesion level of groups of countries/regions, as compared to other indicators, which allows calculating the differences between one region and another or

the difference between one region and a potential/optimal value, or the difference between one region and the average of several regions.

The mentioned principles formed the basis for the calculation of the aggregate cohesion index, which makes it possible to assess the level of cohesion in regions and determine whether it is decreasing or increasing over the study period.

In total, seven indices were calculated and evaluated in the work - two indices each for Estonia and Latvia, plus three indices for Lithuania, as described below.

Indexes for Estonia: (a) aggregate cohesion index of all five Estonian regions – CI_{EE} ; (b) aggregate cohesion index of four Estonian regions, except capital – CI_{EE4} .

Indexes for Latvia: (a) aggregate cohesion index of all six Latvian regions – CI_{LV} ; (b) aggregate cohesion index of five Latvian regions, except capital – CI_{LV5} .

Indexes for Lithuania: (a) aggregate cohesion index of all ten Lithuanian regions – CI_{LT} ; (b) aggregate cohesion index of nine Lithuanian regions, except capital – CI_{LT9} ; (c) aggregate cohesion index of seven less developed Lithuanian regions, except Vilnius, Kaunas, and Klaipėda – CI_{LT7} .

The analysis was carried out, and significant results were obtained from this methodology.

In the first stage of the study (see Figures 1, 2, 3), the relative GDP of the regions of the Baltic States (compared to the national average) was analyzed. Several trends can be observed that are common to all the countries under consideration.

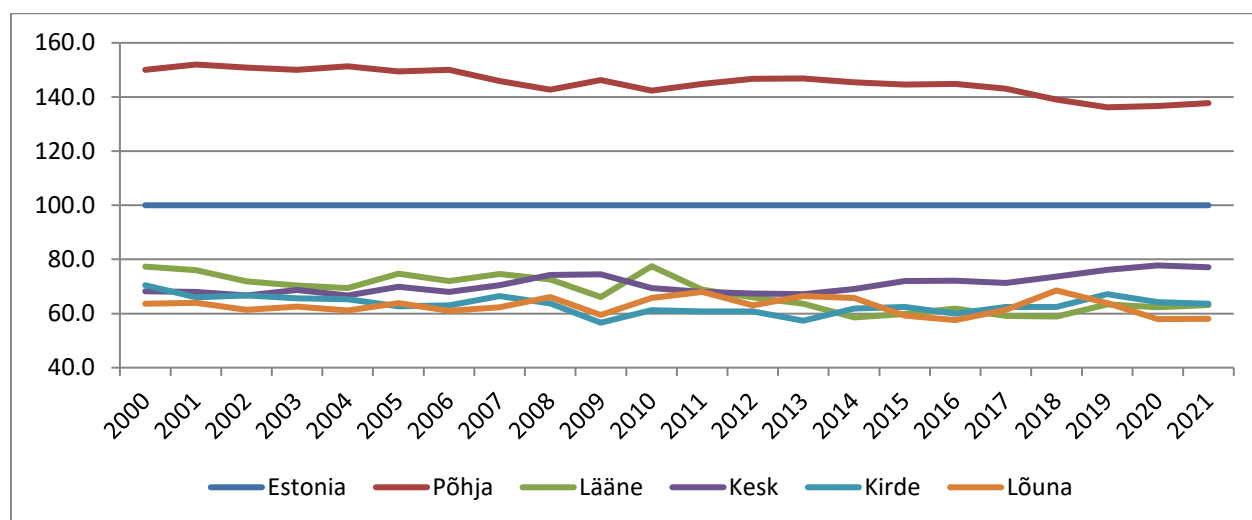


Figure 1: Change of conditional GDP per capita in Estonian regions

Source: counted by the author according to Eurostat data.

First, the regions of the capital stand out. The relative GDP of all the capital regions of the countries under consideration is significantly higher than the national average. Compared to the national average, the GDP of the capital cities in Estonia and Lithuania varies between 140-150% of the country's average values. In Latvia, the GDP per capita of the capital region exceeds the national data by even 60-70%.

In all countries, from 2006 to 2007, the data for the capital regions shows a moderate tendency to decrease. In Estonia, the relative GDP of the capital decreased from 150.0% in 2006 to 136.2%

in 2019. In Latvia, it decreased from 178.2% in 2006 to 162.5% in 2019. The GDP of the Lithuanian capital approached the national average from 153.3% in 2007 up to 144.4% in 2020.

In 2020, the pandemic and the quarantine used in the countries did not make significant changes to the cohesion of the regions (the GDP gap of the capital regions did not increase that year). However, in 2021, a clear trend of divergence began: the GDP of the Estonian capital risen from 136.7% of the national average in 2020 up to

137.7% in 2021, and Lithuanian capitals, respectively, from 144.4% up to 149.0%.

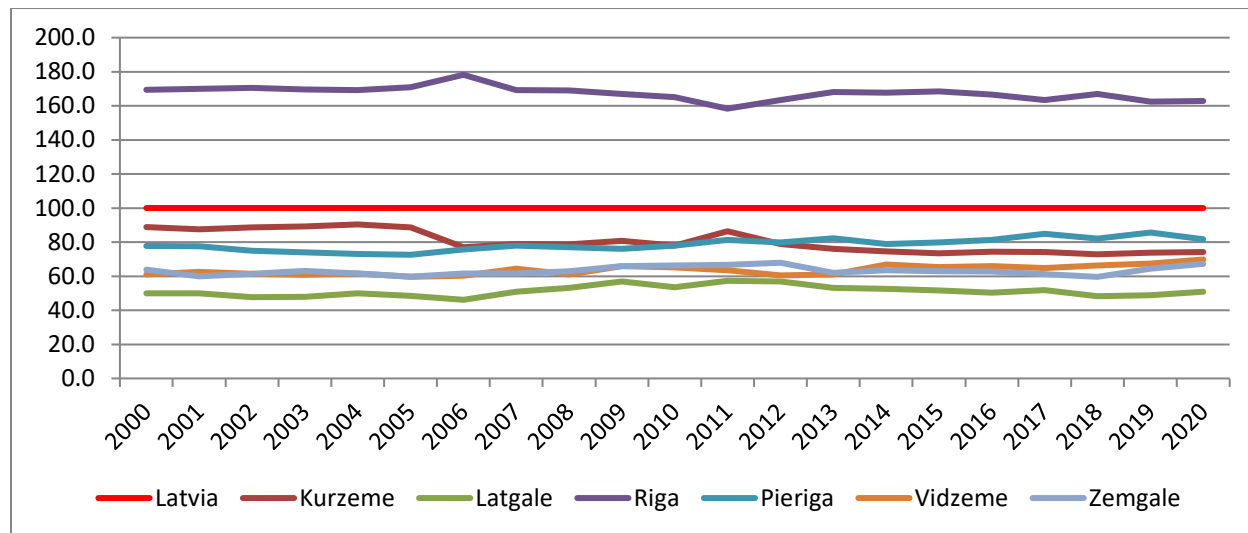


Figure 2: Change of conditional GDP per capita in Latvian regions

Source: counted by the author according to Eurostat data.

Second, most of the less developed regions experience club convergence over time. This is most prominent in Lithuania, where the difference between the highest and lowest relative GDP values in 2000 was 30.5% (the

highest value was 86.1%, and the lowest was 55.6%). It was similar in 2009 - 30.6% (respectively, 83.5% and 52.9%), and in 2021 it decreased to 20.5% (respectively, 75.0% and 54.5%).

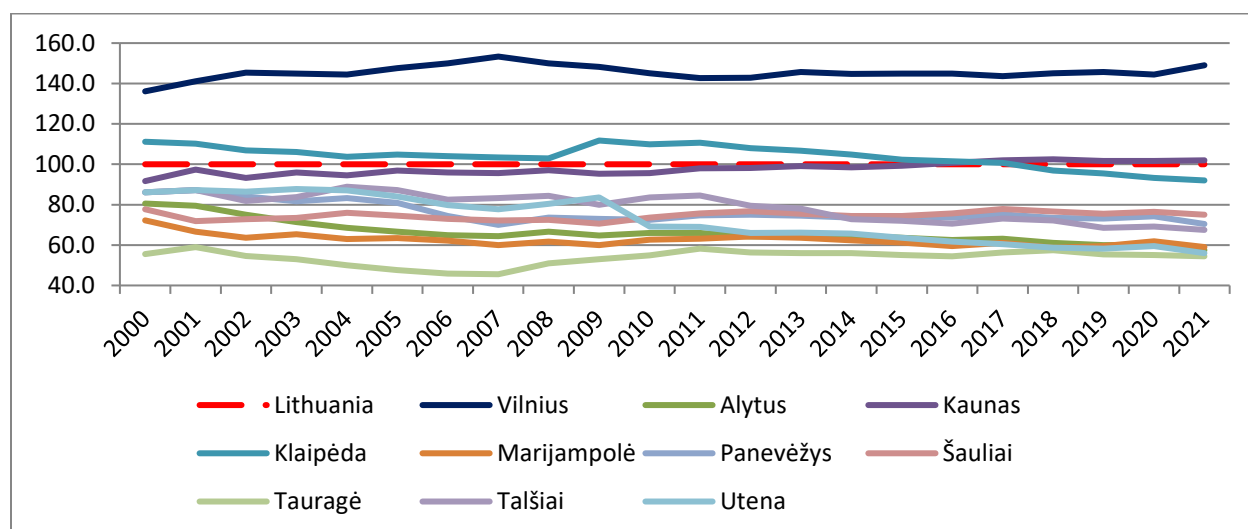


Figure 3: Change of conditional GDP per capita in Lithuanian regions

Source: counted by the author according to Eurostat data.

The club convergence of Latvian regions was also significant. In 2000, the difference between the highest and lowest relative GDP values was

38.4% (respectively, 88.9% and 50.5%). In 2009, it was already 33.9% (respectively, 80.7% and 56.8%) and decreased to 30.9% in 2020

(respectively, 81.8% and 50.9%). In this case, Estonia stood out of line, where the differences were increasing. In 2000, the difference was 13.7% (respectively, 77.3% and 63.6%). In 2009, it increased to 17.9% (respectively, 74.5% and 56.6%), and in 2021 it was 19.0% (respectively, 77.1% and 58.1%). Despite the similarities, there is one distinct difference. The regions of Lithuania, in terms of their economic development, can be divided into three groups (instead of two, as in Estonia and Latvia). First is the capital region, whose GDP per capita ranged from 139.0% (the lowest value recorded in 2001) to 153.3% (the highest value reached in 2007). The second consists of Kaunas and Klaipėda regions. The GDP per capita of these regions fluctuated around the Lithuanian average. All remaining seven regions form the third group. Although the indicators of

these counties approach each other (observed club convergence), there is still a noticeable lag behind the average value of Lithuania. Only two regions' (Šiauliai and Tauragė) GDP per capita remained similar, while the GDP of the other five regions decreased. The situation was particularly difficult in the Utena region, where the value of the indicator decreased from 86.8% in 2000 to 56.0% in 2021.

In the second stage of the study, the correlation between the changes in the GDP per capita of the regions of the Baltic States was examined. While analyzing each country separately, several interesting things can be noticed. In most cases, they confirm the results of the relative GDP analysis performed earlier.

Table 3: Pearson correlation between Estonian regions (GDP per capita)

		Põhja	Lääne	Kesk	Kirde	Lõuna
Põhja	Pearson Correlation	1	,549**	-,844**	,134	,038
	Sig. (2-tailed)		,008	<,001	,554	,868
Lääne	Pearson Correlation		1	-,441*	,426*	,197
	Sig. (2-tailed)			,040	,048	,379
Kesk	Pearson Correlation			1	-,049	-,348
	Sig. (2-tailed)				,827	,112
Kirde	Pearson Correlation				1	-,041
	Sig. (2-tailed)					,856
Lõuna	Pearson Correlation					1
	Sig. (2-tailed)					

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Source: counted by the author according to Eurostat data.

First, there is no clear correlation between the data of most Estonian regions (see Table 3). The only region that stands out is Kesk, for which the data are inversely correlated with all other regions of the country (with a particularly strong correlation with Põhja and Lääne regions, respectively, -0.844 with sig. <0.001 and -0.441 with sig. 0.40). This shows that the mentioned region is developing differently from others – its GDP is growing relatively faster than other non-capital regions. This means that the GDP of the Kesk region is approaching the national average and the indicators of the capital region while moving away from other less developed parts of the country. There is also a strong positive

correlation between Põhja and Lääne regions (0.549 with sig. 0.08) and a strong positive correlation between Lääne and Kirde regions (0.426 with sig. 0.048).

In Latvia, two regions of the country have a strong negative correlation with other regions (see Table 4). First, the capital region of Riga stands out and is very strongly (sig. <0.01) negatively correlated with almost all other regions except Kurzeme. Bearing in mind that the Riga region is significantly more developed than all others and is approaching the national average, such results mean that a convergence process is underway.

Table 4: Pearson correlation between Latvian regions (GDP per capita)

		Kurzeme	Latgale	Riga	Pieriga	Vidzeme	Zemgale
Kurzeme	Pearson Correlation	1	-,128	,235	-,720**	-,647**	-,153
	Sig. (2-tailed)		,581	,306	<,001	,002	,508
Latgale	Pearson Correlation		1	-,630**	,246	,143	,674**
	Sig. (2-tailed)			,002	,283	,535	<,001
Riga	Pearson Correlation			1	-,657**	-,523*	-,617**
	Sig. (2-tailed)				,001	,015	,003
Pieriga	Pearson Correlation				1	,604**	,244
	Sig. (2-tailed)					,004	,287
Vidzeme	Pearson Correlation					1	,332
	Sig. (2-tailed)						,141
Zemgale	Pearson Correlation						1
	Sig. (2-tailed)						

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Source: counted by the author according to Eurostat data.

The second region in which data is negatively correlated with the data of other regions (statistically significantly with Prieriga and Vidzeme) is the Kurzeme region. If other regions

gradually approach the national average, the relative GDP of the mentioned region moved away from them. This region is the only one showing divergent trends.

Table 5: Pearson correlation between Lithuanian regions (GDP per capita)

		1	2	3	4	5	6	7	8	9	10
Vilnius (1)	Pearson Correlation	1	-,499*	,042	-,254	-,673**	-,582**	-,584**	-,729**	-,013	,038
	Sig. (2-tailed)		,021	,855	,267	<,001	,006	,005	<,001	,957	,871
Alytus (2)	Pearson Correlation		1	-,724**	,636**	,847**	,871**	-,194	,113	,681**	,769**
	Sig. (2-tailed)			<,001	,002	<,001	<,001	,400	,627	<,001	<,001
Kaunas (3)	Pearson Correlation			1	-,707**	-,608**	-,522*	,402	,393	-,802**	-,865**
	Sig. (2-tailed)				<,001	,003	,015	,071	,078	<,001	<,001
Klaipeda (4)	Pearson Correlation				1	,582**	,371	-,346	,083	,700**	,596**
	Sig. (2-tailed)					,006	,098	,125	,722	<,001	,004
Marijampolė (5)	Pearson Correlation					1	,765**	,162	,176	,575**	,553**
	Sig. (2-tailed)						<,001	,482	,445	,006	,009
Panevėžys (6)	Pearson Correlation						1	,037	,133	,559**	,678**
	Sig. (2-tailed)							,872	,566	,008	<,001
Šiauliai (7)	Pearson Correlation							1	,379	-,348	-,529*
	Sig. (2-tailed)								,090	,122	,014
Tauragė (8)	Pearson Correlation								1	-,363	-,431
	Sig. (2-tailed)									,105	,051
Telšiai (9)	Pearson Correlation									1	,863**
	Sig. (2-tailed)										<,001
Utena (10)	Pearson Correlation										1
	Sig. (2-tailed)										

* . Correlation is significant at the 0.05 level (2-tailed).

** . Correlation is significant at the 0.01 level (2-tailed).

Source: counted by the author according to Eurostat data.

Other Latvian regions are positively correlated with each other. The most significant correlation is recorded between Latgale and Zemgale regions (0.674 with sig. <0.001) and Prieriga and Vidzeme regions (0.604 with sig. 0.004).

In Lithuania, the results of the correlation analysis are the most prominent (see Table 5). There are two clear trends. First, the two largest regions of the country (Vilnius and Kaunas) are developing opposite to all the rest – in this case, they are manifestations of divergence. Second, the GDP changes of most other (less developed) regions are, in most cases, highly correlated.

The data of the Vilnius and Kaunas regions have a strong negative correlation with the data from other areas of the country. In the case of Vilnius, there is a strong negative correlation (when sig. <0.01) with 4 regions and a strong negative correlation (when sig. <0.05) with one more region. In the case of Kaunas, it accrues a strong negative correlation (when sig. <0.01) with 5 regions and a strong negative correlation

(when sig. <0.05) with one more. This may indicate that the gap between the most developed and least developed regions is widening over time. Vilnius and Kaunas regions are economically developing faster than the rest of the country's regions.

The data of most of the less developed regions of Lithuania (a total of 6 - Alytus, Klaipėda, Marijampolė, Panevėžys, Telšiai and Utena) are characterized by a strong positive mutual correlation (in all cases sig. <0.01), indicating that the mentioned regions are developing in the same direction. Hence, there is a high probability that their cohesion is getting stronger.

In the third stage of the research, the aggregate cohesion indices of the Baltic States were calculated and analyzed. These indices are CI_{EE} and CI_{EE4} for Estonia; CI_{LV} and CI_{LV5} for Latvia; and CI_{LT} , CI_{LT9} , and CI_{LT7} for Lithuania. Figures 4, 5, and 6 show that the analysis confirms the trends discussed above.

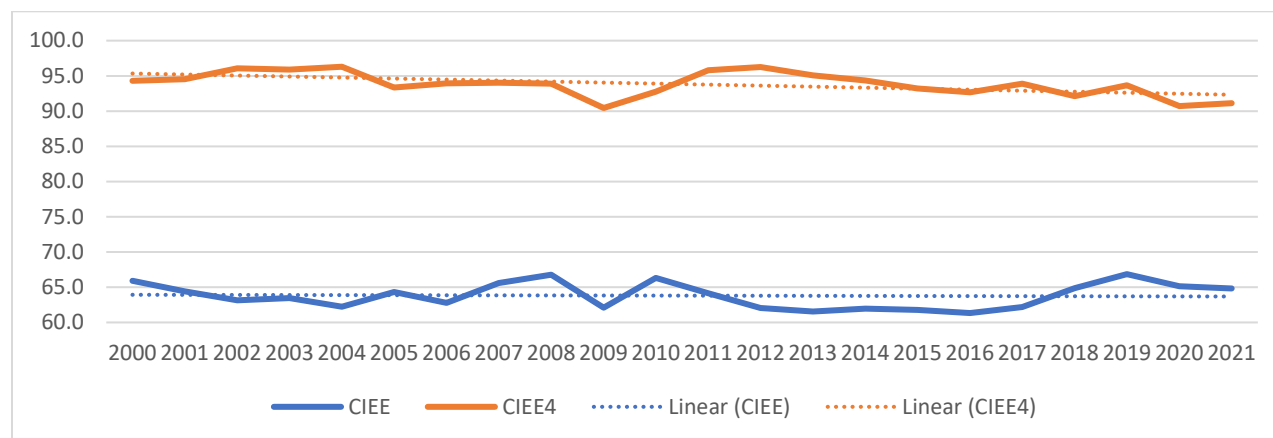


Figure 4: Change of aggregate cohesion indexes in Estonia

Source: counted by the author according to Eurostat data.

The commonality of all the countries under consideration is that the capital regions stand out in them. Aggregate cohesion indices for all regions of the country show lower levels of cohesion than indices calculated without capital regions. In Estonia, CI_{EE} data ranges from 61.3 to

66.9, and CI_{EE4} from 90.4 to 96.3, respectively. In Latvia, CI_{LV} data reach values from 57.1 to 66.1, and CI_{LV5} , respectively, from 82.0 to 89.2. In Lithuania, CI_{LT} is from 68.1 to 78.9, CI_{LT9} , respectively, from 81.7 to 87.7, and CI_{LT7} - from 84.5 to 91.7.

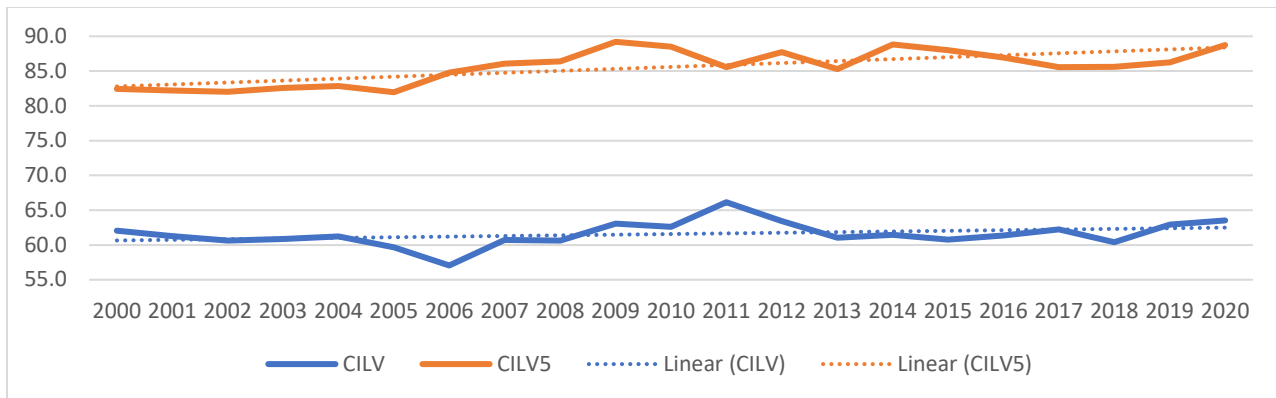


Figure 5: Change of aggregate cohesion indexes in Latvia
 Source: counted by the author according to Eurostat data.

That is where the similarities end, however; The trends of change in the level of cohesion are different in all countries. In Estonia, the aggregate cohesion index values for all country regions throughout the analyzed period were relatively stable, with CI_{EE} data averaging around 64.0. Meanwhile, the cohesion level of less

developed regions gradually decreased. This is particularly evident from 2012 when the index value was 96.3 and reached 91.1 in 2021. This indicates convergence between the capital and other regions but divergence among the less developed regions themselves.

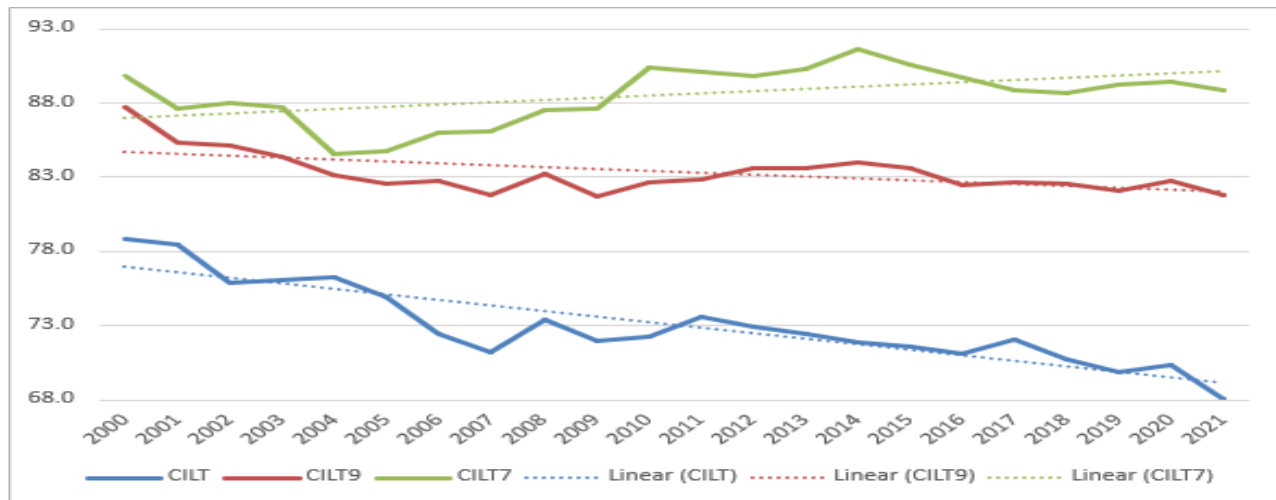


Figure 6: Change of aggregate cohesion indexes in Lithuania
 Source: counted by the author according to Eurostat data.

In Latvia, the values of both aggregate cohesion indices increased over time. In other words, the cohesion level increased not only among less developed regions but also among all country regions (including the capital). These trends emerged in 2005-2006. The aggregate cohesion index for all country regions (CI_{LV}) increased in two waves: first, from 57.1 (in 2006) to 66.1 (in 2011), and second, from 61.1 (in 2013) to 63.5 (in

2020). The aggregate cohesion index for less developed regions (CI_{LV5}) also increased in two stages: from 82.0 (in 2005) to 89.2 (in 2009) and from 85.6 (in 2011) to 88.7 (in 2020).

In Lithuania, the differences between all country regions showed a clear tendency to increase (there is a regional divergence at the national level). The aggregate cohesion index CI_{LT} decreased throughout the entire analyzed period

(excluding a brief increase from 2007 to 2011), having decreased from 78.9 in 2000 to 68.1 in 2021. At the same time, the differences among the 7 least developed regions had a long-term tendency to decrease (manifesting as regional club convergence). The aggregate cohesion index of these regions (CI_{LT7}) increased particularly rapidly from 2004 (when its value was 84.5) to 2014 (when the value reached 91.7). However, from 2016 to 2021, the index value remains relatively stable, fluctuating around 89–89.5. In recent years, the convergence process has halted.

CONCLUSION

Concerning the origins of regional disparities, numerous elements can contribute to such distinctions, with socioeconomic factors standing out as particularly influential. This encompasses the configuration of production, whose alterations can impact employment rates and economic advancement within a given region. The accessibility of regions and their proximity to pivotal markets can significantly shape trade prospects and allure investments. An inability of regions to acclimate to economic and social transformations emerges as a pivotal factor in regional disparities, encompassing suboptimal public administration, deficient infrastructure, undesirable labor supply configurations, and an adverse demographic structure.

One of the important reasons for regional disparities reasons is the economic influence of large cities, known as the "city effect" or "urban agglomeration effect", which stems from a range of factors. Economies of scale enable efficient resource and infrastructure utilization, reducing unit production costs. Big cities, serving as knowledge hubs with prestigious academic institutions, foster innovation and creativity, facilitating rapid adaptation to technological advancements. Superior transport and communication infrastructure in large cities enhances the movement of goods and business transactions. Moreover, diverse and densely populated urban areas provide companies with a vast labor pool, a crucial advantage during production scaling. This urban-centric development creates regional disparities as smaller and rural areas grapple with resource and talent drain towards large cities, particularly affecting capital regions, rendering them less competitive and disadvantaged.

The research methodology consisted of several important aspects, including the choice of the research period, the subject level choice and their list, the indicators used, and their calculation methods. The study covers the period from 2000 to 2021, with the studied areas being the regions of the Baltic States (Estonia, Latvia, Lithuania). The analysis was carried out at the region level (NUTS3) and included a list of 5 regions in Estonia, 6 in Latvia, and 10 in Lithuania. The regional differences and aggregate cohesion of the Baltic States were assessed according to one indicator – GDP (Gross Domestic Product) per capita. The methodology for calculating the cohesion index was based on several basic principles, including the normalization of the indicator, the standard deviation, and the calculation of the structural divergence index (SDI).

Data analysis led to the following conclusions:

The first stage of the study focused on analyzing the relative GDP of the Baltic States' regions compared to the national average. A consistent trend across all countries was the notable economic strength of capital regions, with GDP per capita significantly exceeding national averages. Since 2006–2007, there is a moderate decrease in the relative GDP of capital regions in all three countries. Despite the pandemic's limited impact in 2020, a clear divergence trend emerged in 2021. Additionally, a noteworthy pattern of club convergence was observed, especially in Lithuania and Latvia, where the economic development disparities among regions decreased over time. However, Lithuania uniquely exhibited three distinct groups of regions based on economic development, with the capital region standing out, followed by the Kaunas and Klaipėda regions, and the remaining seven regions forming a third group that, despite converging, still lagged the national average.

In the second stage of the study, the analysis focused on the correlation between changes in GDP per capita among the regions of the Baltic States, examining each country separately. The findings largely align with the earlier analysis of relative GDP. In Estonia, the Kesk region's inverse correlation with other regions is notable, indicating a distinct and faster economic growth, particularly concerning the Põhja and Lääne regions. Positive correlations between Põhja and Lääne, as well as Lääne and Kirde regions, were

also observed. In Latvia, Riga's strong negative correlation with almost all other regions suggests a convergence process, while Kurzeme stands out with divergent trends. The remaining Latvian regions exhibit positive correlations, notably between Latgale and Zemgale, and Prierīga and Vidzeme. In Lithuania, Vilnius and Kaunas regions show a significant negative correlation with other regions, indicating a widening gap between the most and least developed areas. Meanwhile, the less developed regions, including Alytus, Klaipėda, Marijampolė, Panevėžys, Telšiai, and Utena, demonstrate a strong positive correlation, suggesting increased cohesion among them.

In the third stage of the research, the focus shifted to calculating and analyzing aggregate cohesion indices for the Baltic States - CI_{EE} and CI_{EE4} for Estonia, CI_{LV} and CI_{LV5} for Latvia, and CI_{LT} , CI_{LT9} , and CI_{LT7} for Lithuania. Consistently across all countries, capital regions emerge as distinctive, with aggregate cohesion indices for all regions displaying lower levels than those calculated without including capital regions. In Estonia, CI_{EE} ranges from 61.3 to 66.9, and CI_{EE4} from 90.4 to 96.3. Latvia exhibits increasing values for both CI_{LV} (57.1 to 66.1) and CI_{LV5} (82.0 to 89.2) over time, indicating enhanced cohesion among all regions. Conversely, Lithuania demonstrates a clear trend of increasing differences among all regions (regional divergence). The aggregate cohesion index CILT shows a continual decrease from 78.9 in 2000 to 68.1 in 2021. In contrast, the 7 least developed regions in Lithuania exhibit a long-term tendency to decrease differences, displaying regional club convergence. Although the aggregate cohesion index (CI_{LT7}) increased rapidly from 2004 to 2014, that it stabilized around 89-89.5 from 2016 to 2021 suggests a recent halt in the convergence process.

In summary, the key outcome of the study can be formulated as follows. In small countries (such as the Baltic States), the capital region stands out significantly from other regions of the country. Meanwhile, the remaining lagging regions experience strong club convergence – the author's calculated indicator shows an 85-90% level of cohesion, with further convergence tendencies. This indicates that the proposed methodology has proven its effectiveness and can be further developed and utilized in future research, expanding the geography of countries and regions. Additionally, the findings of the

study can be valuable in shaping and evaluating the results of cohesion and regional policies, both at the local and EU levels.

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