Iceland Liechtenstein Norway grants

Norway grants

Lietuvos regionų ekonominio produktyvumo nelygybės kaita Baltijos šalių lyginamojoje perspektyvoje

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KONFERENCIJA

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TIKSLAS

This exploration is an introduction and first step in the broader research project, aiming at the investigation of long-run regional disparity trends, including periods with scarce or unpublished territorial statistics data.

- Kaip keitėsi Lietuvos ir kitų Baltijos šalių regionų ekonominis produktyvumas per paskutinius 20-25 metų?
- Produktyvumo matas – regioninis BVP
- BVP vis dažniau kritikuojamas kaip gerovės ar vien tik ekonominės gerovės rodiklis, bet produktyvumui matuoti nėra geresnio mato
- BVP – pridėtinė vertė, sukurta tam tikroje teritorijoje per tam tikrą laiką

NUTS 3 division of Baltic countries:

- ESTONIA N=5

- EE001 Põhja-Eesti (Harju County)
- EE004 Lääne-Eesti (Hiiu County, Lääne County, Pärnu County, Saare County)
- EE006 Kesk-Eesti (Järva County, Lääne-Viru County, Rapla County)
- EE007 Kirde-Eesti (Ida-Viru County)
- EE008 Lõuna-Eesti (Jõgeva County, Põlva County, Tartu County, Valga County, Viljandi County, Võru County)

LATVIA N=6

LV003 Kurzeme
LV005 Latgale
LV006 Rīga
LV007 Pierīga
LV008 Vidzeme
LV009 Zemgale

LITHUANIA N=10

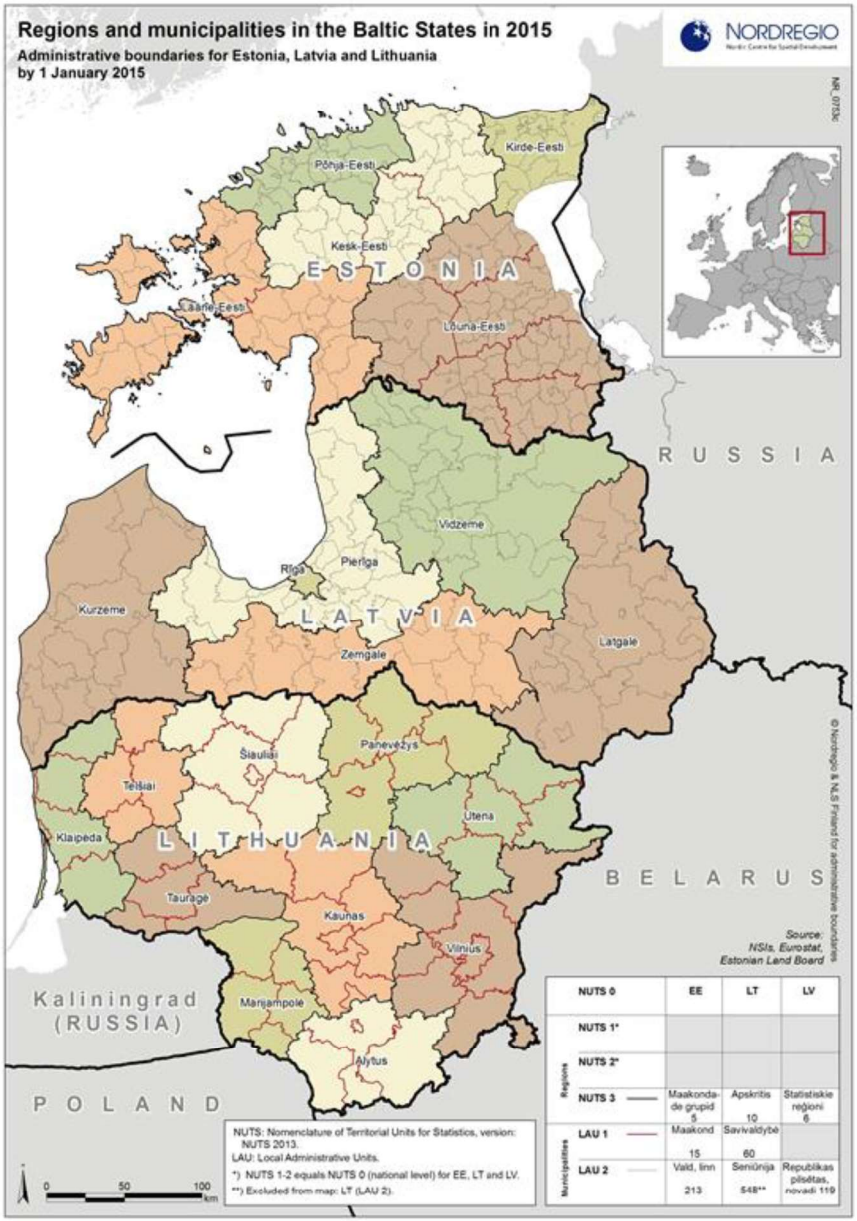
LT011 Vilnius County = NUTS II Metropolitan (Sostinės) region

LT021 Alytus County
LT022 Kaunas County
LT023 Klaipėda County
LT024 Marijampolė County
LT025 Panevėžys County
LT026 Šiauliai County
LT027 Tauragė County
LT028 Telšiai County
LT029 Utena County

=NUTS III Central and Western Lithuania Region

Nomenclature des Unités Territoriales Statistiques; Nomenclature of Territorial Units for Statistics)

Since 01.01.2018, Lithuania became the first Baltic country divided into two NUTS II regions, improving its participation conditions in the EU Cohesion Policy: Capital City (LT01), embracing Vilnius county; Central and Western Lithuania (LT02), including the remaining 9 Lithuanian counties



Data

- The source of the data is Eurostat database, Statistics Lithuania, Statistics Latvia, and Statistics Estonia. We use national/regional accounts by ESA (European System of Accounts) 2010 standard. Main indicators: GDP at current market prices by NUTS3 regions; price index (implicit deflator), 2010 = 100 and 2015 = 100, euro; average annual population; GDP at purchasing power standard (GDP PPS): million purchasing power standards and purchasing power standard per capita. Data for 1995–1999 is not available at Eurostat. For earlier period it is available, but we cannot use this data since it was computed with ESA95 standard for national accounts
- For earlier data (from 1995-1999), we use information from national statistics offices. For the moment, we do not have Latvian regional GDP before 2000. Lithuanian regional GDP is obtained from “Lietuvos apskritys 2000” and “Lietuvos apskritys 2001” in Litas (national currency of Lithuania in 1993-2015).
- In the Statistics Estonia, data for are available on the county level. The same is the case for Lithuania. However, while Lithuanian counties (*apskritis*) are identical to NUTS 3, Estonian NUTS3 mainly encompass more than one county (*maakond*). Exceptions are Harju County, identical to Põhja-Eesti region, and Ida-Viru County, identical to Kirde-Eesti region. Therefore, for 1995-99, Estonian NUTS3 data are aggregate county data for remaining three regions. Data allow to rerun analysis for Estonia with county level data. This may be important for continuation of the work, because exploring data for beta convergence, there are no statistically significant models for Estonia
- We used data on real GDP at PPP. Real GDP was calculated using price index (implicit deflator), 2010 = 100% and 2015 = 100%: "Real GDP"="Nominal GDP" /"GDP deflator" x100.

Kaip matyti standartinis nuokrypis lygus kvadratinei šakniai iš atsitiktinio dydžio dispersijos.

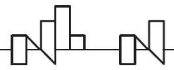
Concepts and measures: sigma convergence/divergence

- Standartinis nuokrypis (arba vidutinis kvadratinis nuokrypis) – dydis, nusakantis atsitiktinio dydžio įgyjamų reikšmių sklaidą apie vidurkį (įprasta žymėti s, SD arba σ).

$$\sigma = \sqrt{\frac{\sum(x_i - \mu)^2}{N}}$$

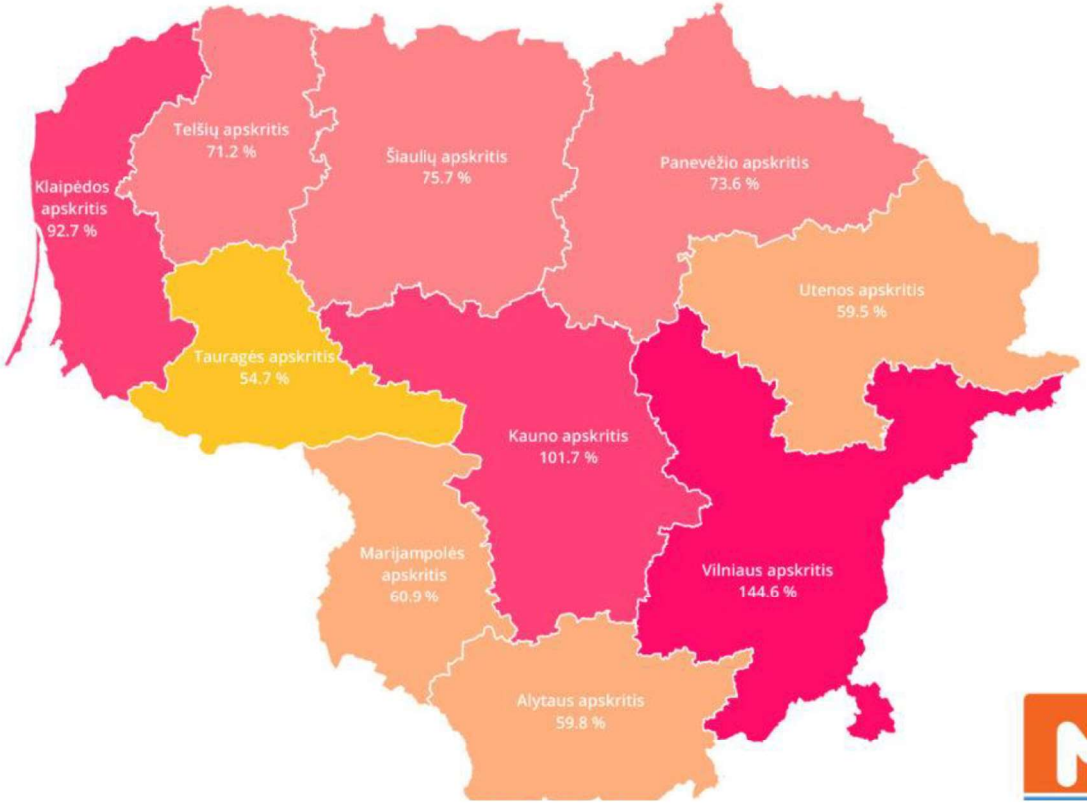
σ = population standard deviation
N = the size of the population
x_i = each value from the population
μ = the population mean

- The increase of sigma and therefore also of the coefficient of variation (NUTS 3 regions) indicates the increase of disparities across units of analysis or divergence and its decrease the convergence



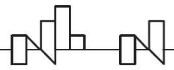
Kuo daugiau regionų, kurių BVPpc ženkliai skiriasi nuo šalies vidurkio, ir kuo tie skirtumai didesni, tuo sklaida aplink vidurkį didesnė

Apskričių BVP 1 gyventojui, proc. nuo Lietuvos vidurkio 2020 m.



Measures of sigma convergence/divergence: kindred measures

- The coefficient of variation (CV) is a measure of relative variability. It is the ratio of the standard deviation (sigma) to the mean (average).
- Kindred measures to CV are mean logarithmic deviation (MLD), Gini and Theil indices.
- Mean logarithmic deviation; vidurkio logaritminis nuokrypis (MLD is more sensitive to changes at the lower end of the distribution, while CV is more responsive to changes in the upper end of the distribution).
- Gini coefficient (G) is more sensitive when changes in inequality appear around the median;
- Theil index (T) that gives equal weights across the distribution;
- Both weighted and unweighted versions of all measures are provided. To provide more detailed picture, the disparities were also measured for pooled sample, consisting of NUTS 3 regions of all three Baltic countries



Weights (shares of population) tables

Estonia

	EE001	EE004	EE006	EE007	EE008
1995	0.38	0.12	0.10	0.14	0.26
1996	0.38	0.12	0.10	0.13	0.26
1997	0.38	0.12	0.11	0.13	0.26
1998	0.38	0.12	0.11	0.13	0.26
1999	0.38	0.12	0.11	0.13	0.26
2000	0.38	0.12	0.11	0.13	0.26
2001	0.38	0.12	0.11	0.13	0.26
2002	0.39	0.12	0.11	0.13	0.26
2003	0.39	0.12	0.10	0.13	0.26
2004	0.40	0.12	0.10	0.13	0.26
2005	0.40	0.12	0.10	0.12	0.26
2006	0.40	0.12	0.10	0.12	0.25
2007	0.41	0.12	0.10	0.12	0.25
2008	0.41	0.12	0.10	0.12	0.25
2009	0.42	0.12	0.10	0.12	0.25
2010	0.42	0.11	0.10	0.12	0.25
2011	0.43	0.11	0.10	0.12	0.25
2012	0.43	0.11	0.10	0.12	0.25
2013	0.43	0.11	0.10	0.11	0.25
2014	0.44	0.11	0.09	0.11	0.24
2015	0.44	0.11	0.09	0.11	0.24
2016	0.44	0.11	0.09	0.11	0.24
2017	0.45	0.11	0.09	0.11	0.24
2018	0.45	0.11	0.09	0.10	0.24
2019	0.45	0.11	0.09	0.10	0.24

Latvia

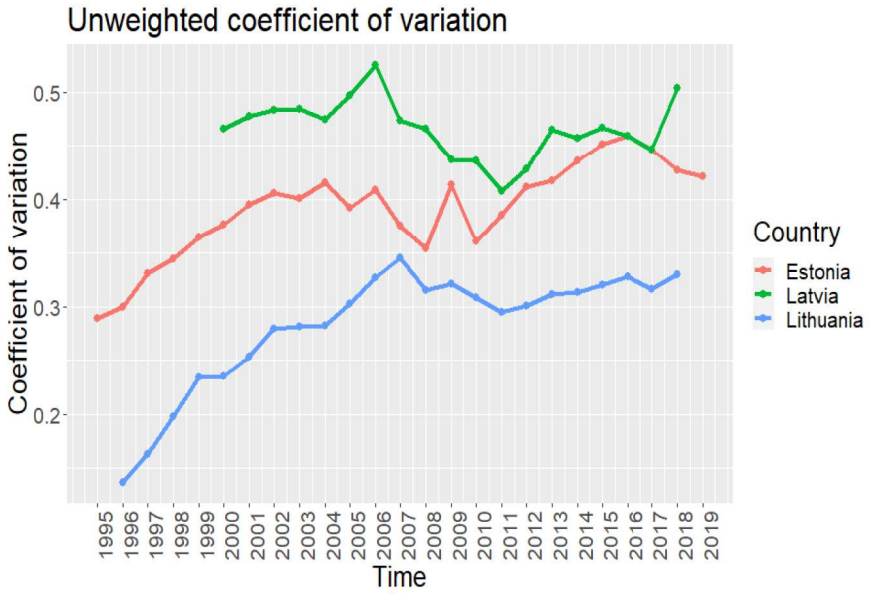
	LV003	LV005	LV006	LV007	LV008	LV009
1995	0.14	0.16	0.33	0.14	0.11	0.12
1996	0.14	0.16	0.33	0.15	0.11	0.12
1997	0.14	0.16	0.33	0.15	0.11	0.12
1998	0.14	0.16	0.32	0.15	0.11	0.12
1999	0.14	0.16	0.32	0.15	0.11	0.12
2000	0.14	0.16	0.32	0.15	0.11	0.12
2001	0.13	0.16	0.32	0.15	0.11	0.12
2002	0.13	0.16	0.32	0.16	0.11	0.12
2003	0.13	0.16	0.32	0.16	0.11	0.12
2004	0.13	0.16	0.32	0.16	0.11	0.12
2005	0.13	0.16	0.32	0.16	0.11	0.12
2006	0.13	0.15	0.32	0.17	0.11	0.12
2007	0.13	0.15	0.32	0.17	0.10	0.12
2008	0.13	0.15	0.32	0.17	0.10	0.12
2009	0.13	0.15	0.32	0.17	0.10	0.12
2010	0.13	0.15	0.32	0.18	0.10	0.12
2011	0.13	0.15	0.32	0.18	0.10	0.12
2012	0.13	0.15	0.32	0.18	0.10	0.12
2013	0.13	0.14	0.32	0.18	0.10	0.12
2014	0.13	0.14	0.32	0.18	0.10	0.12
2015	0.13	0.14	0.32	0.19	0.10	0.12
2016	0.13	0.14	0.33	0.19	0.10	0.12
2017	0.13	0.14	0.33	0.19	0.10	0.12
2018	0.13	0.14	0.33	0.19	0.10	0.12
2019	NA	NA	NA	NA	NA	NA

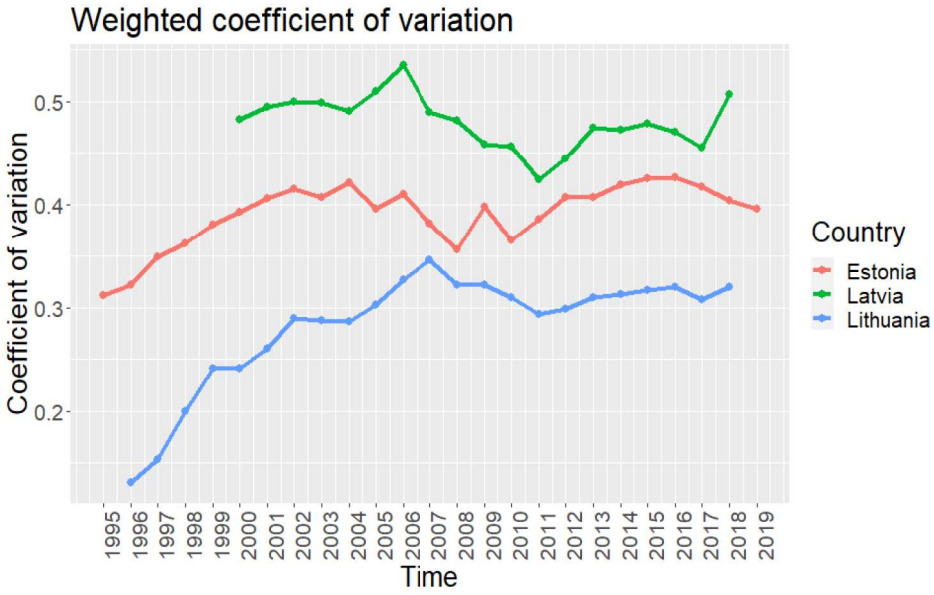
Lithuania

	LT011	LT021	LT022	LT023	LT024	LT025	LT026	LT027	LT028	LT029
1995	0.24	0.05	0.2	0.11	0.05	0.09	0.11	0.04	0.05	0.05
1996	0.24	0.05	0.2	0.11	0.05	0.09	0.11	0.04	0.05	0.05
1997	0.24	0.05	0.2	0.11	0.05	0.09	0.11	0.04	0.05	0.05
1998	0.24	0.05	0.2	0.11	0.05	0.09	0.11	0.04	0.05	0.05
1999	0.24	0.05	0.2	0.11	0.05	0.09	0.11	0.04	0.05	0.05
2000	0.24	0.05	0.2	0.11	0.05	0.09	0.11	0.04	0.05	0.05
2001	0.24	0.05	0.2	0.11	0.05	0.09	0.11	0.04	0.05	0.05
2002	0.25	0.05	0.2	0.11	0.05	0.09	0.11	0.04	0.05	0.05
2003	0.25	0.05	0.2	0.11	0.05	0.09	0.11	0.04	0.05	0.05
2004	0.25	0.05	0.2	0.11	0.05	0.09	0.10	0.04	0.05	0.05
2005	0.25	0.05	0.2	0.11	0.05	0.08	0.10	0.04	0.05	0.05
2006	0.25	0.05	0.2	0.11	0.05	0.08	0.10	0.04	0.05	0.05
2007	0.26	0.05	0.2	0.11	0.05	0.08	0.10	0.04	0.05	0.05
2008	0.26	0.05	0.2	0.11	0.05	0.08	0.10	0.04	0.05	0.05
2009	0.26	0.05	0.2	0.11	0.05	0.08	0.10	0.04	0.05	0.05
2010	0.26	0.05	0.2	0.11	0.05	0.08	0.10	0.04	0.05	0.05
2011	0.27	0.05	0.2	0.11	0.05	0.08	0.10	0.04	0.05	0.05
2012	0.27	0.05	0.2	0.11	0.05	0.08	0.10	0.04	0.05	0.05
2013	0.27	0.05	0.2	0.11	0.05	0.08	0.10	0.04	0.05	0.05
2014	0.28	0.05	0.2	0.11	0.05	0.08	0.10	0.04	0.05	0.05
2015	0.28	0.05	0.2	0.11	0.05	0.08	0.10	0.04	0.05	0.05
2016	0.28	0.05	0.2	0.11	0.05	0.08	0.10	0.03	0.05	0.05
2017	0.28	0.05	0.2	0.11	0.05	0.08	0.09	0.03	0.05	0.05
2018	0.29	0.05	0.2	0.11	0.05	0.08	0.09	0.03	0.05	0.05
2019	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

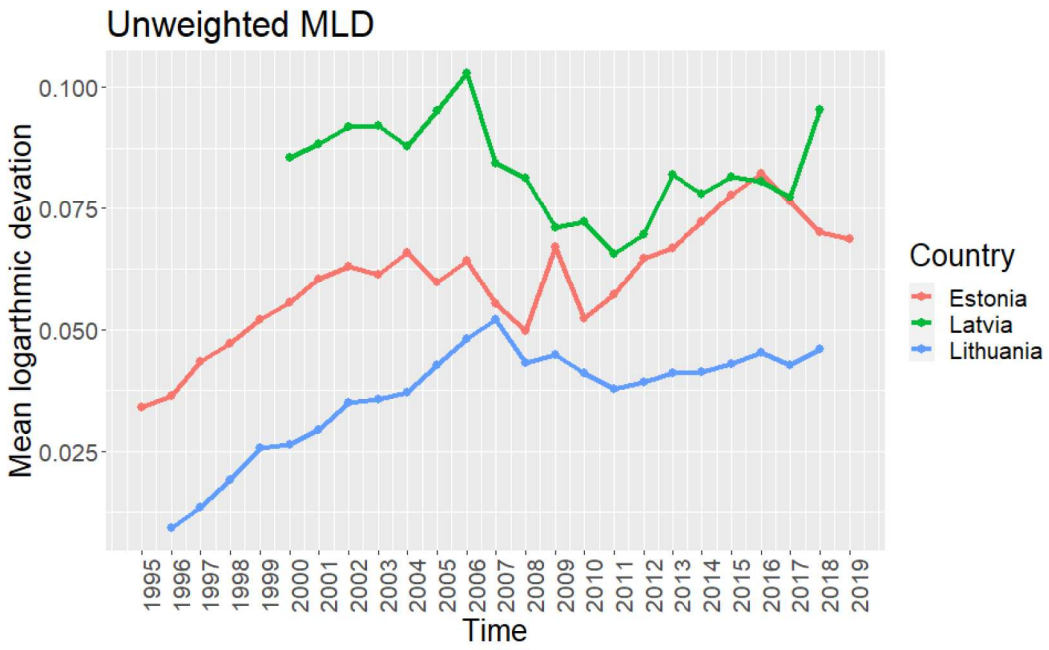
Unweighted and weigted CV

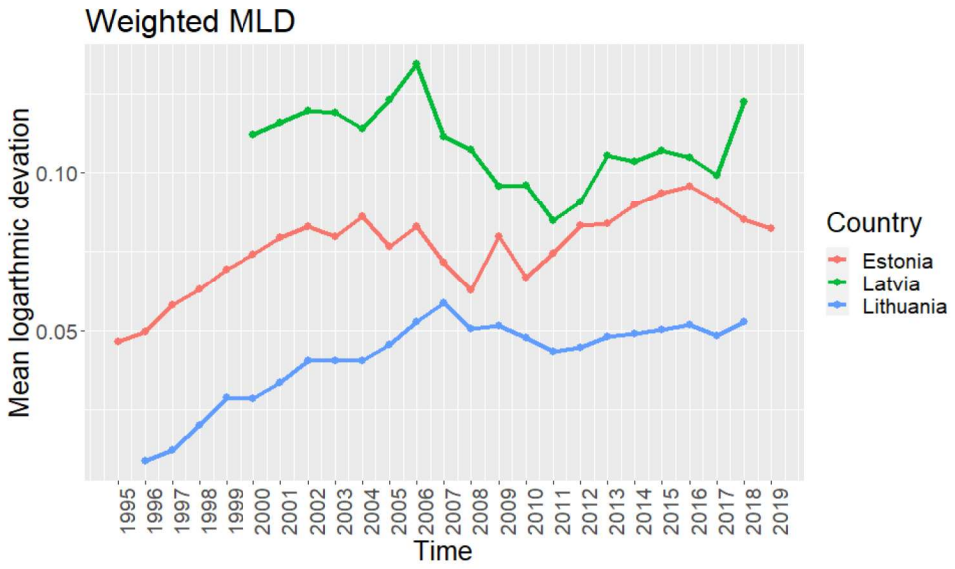
price index 2015=100%



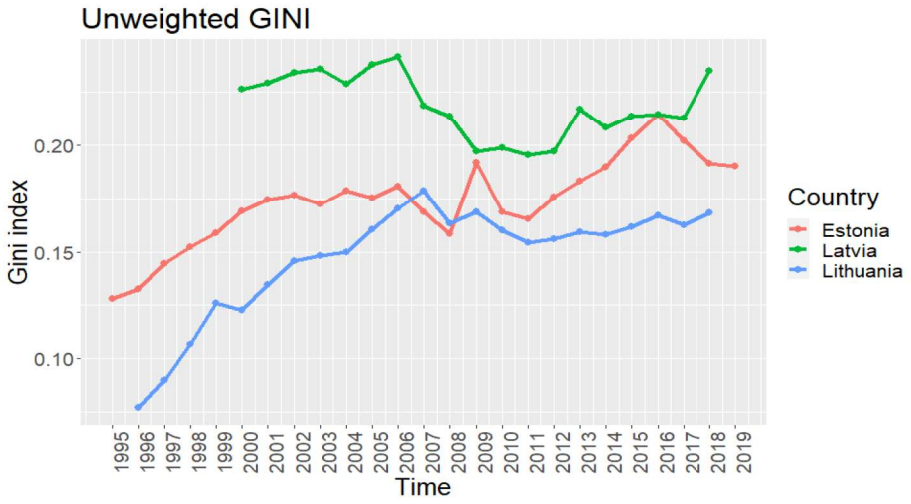


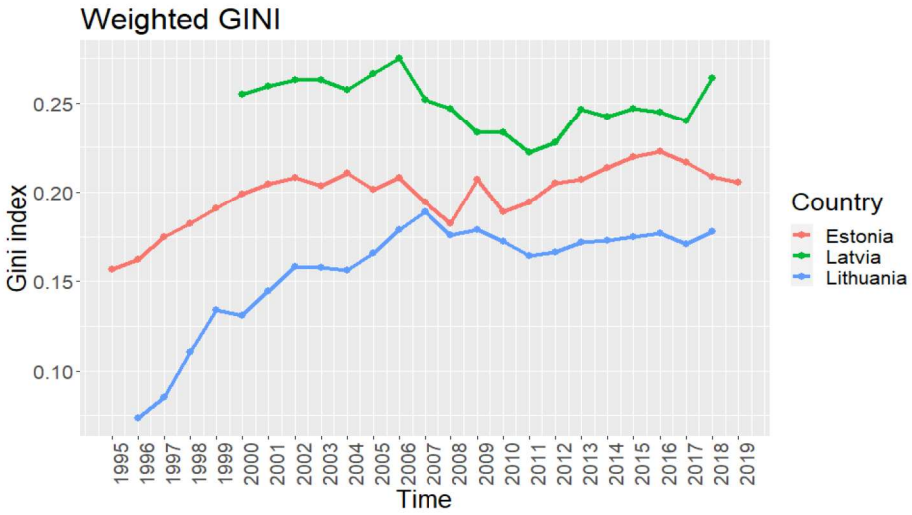
Unweighted and weighted MLD



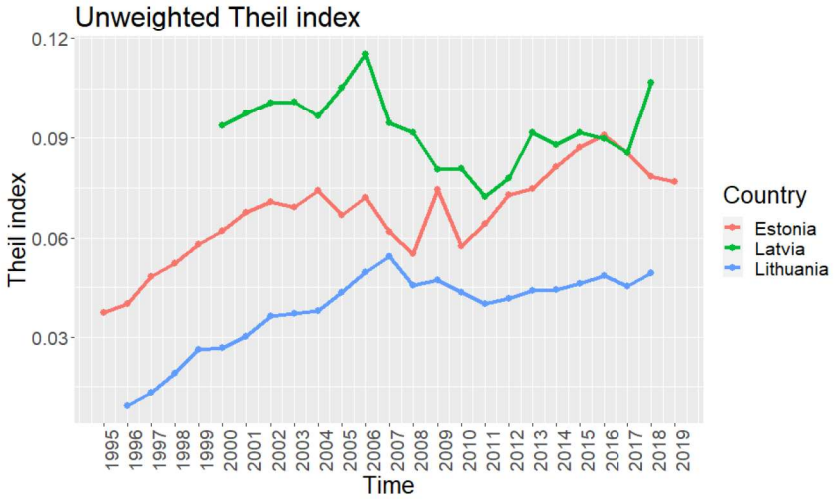


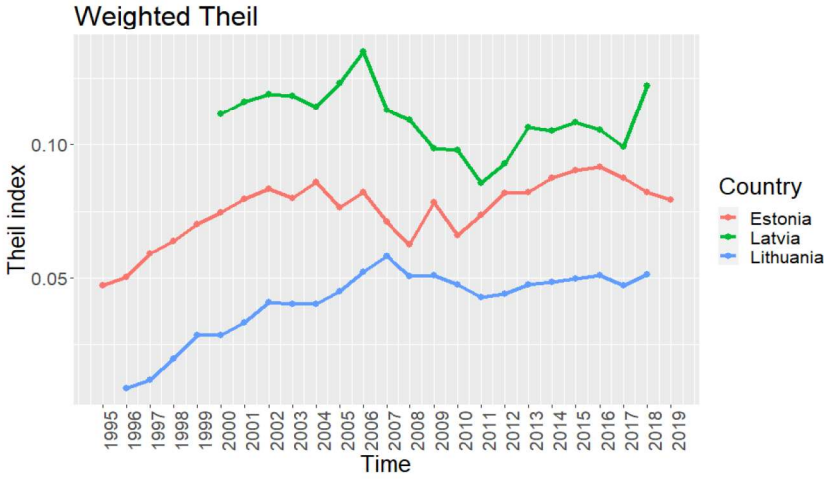
Unweighted and weighted Gini Index





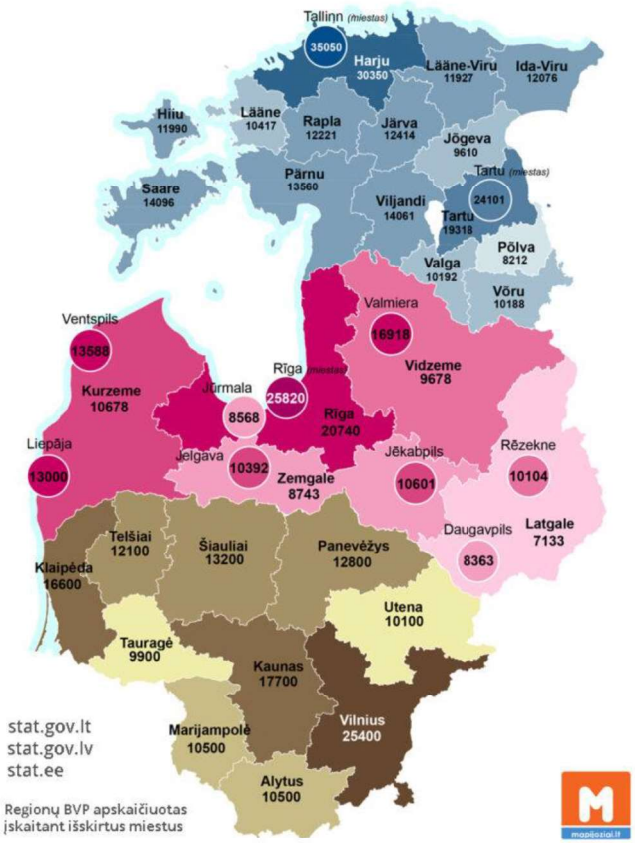
Unweighted and weighted Theil Index



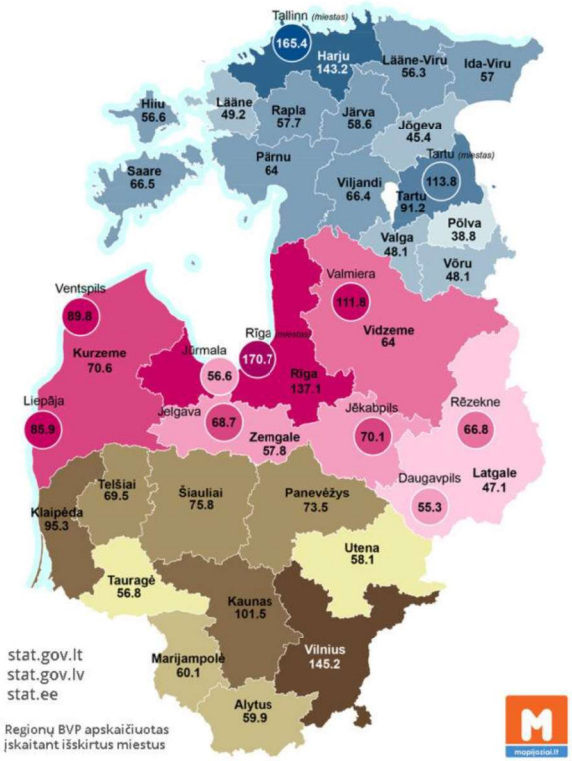


Baltijos šalių regionų ekonomika pasižymi tuo, kad sostinių regionai pagal BVP 1 gyventojui šalių vidurkį viršija maždaug 1,4 karto. Didžiausia atskirtis tarp Estijos apskričių Polva ir Harju (3,7 karto), mažiausia – Lietuvoje, tarp Tauragės ir Vilniaus apskričių (2,6 karto). Žinoma, jei lygintume tik sostines be supančio regiono su skurdžiausiais regionais, atskirtis būtų dar didesnė

Regioninis BVP EUR/1 gyv. 2019 m. (Latvijoje - 2018 m.)



Regioninis BVP/1 gyv., lyginant su šalies vidurkiu (%) 2019 m. (Latvijoje - 2018 m.)



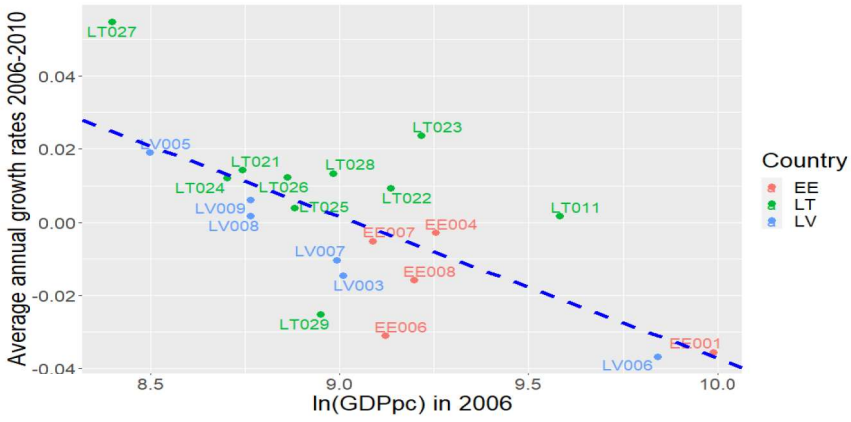
β convergence/divergence

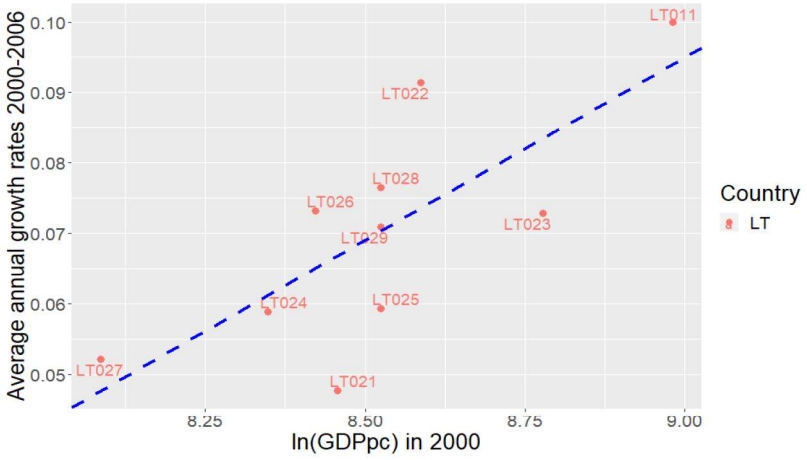
$$Y = \beta_0 + \beta_1 X + \epsilon$$

Y = metinis augimo (arba traukimosi) tempas per tam tikrą laiko periodą

X = BVP vienam gyventojui reikšmė periodo pradžioje

Beta convergence and divergence





Negative β coefficients and regression line as in Fig. 1 indicate convergence: GDPpc in regions with lower levels of GDPpc at the start of the period increase more rapidly (or decrease less rapidly in the case of negative growth) than those with higher initial levels. Positive β coefficients and regression line as in Fig. 2 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).

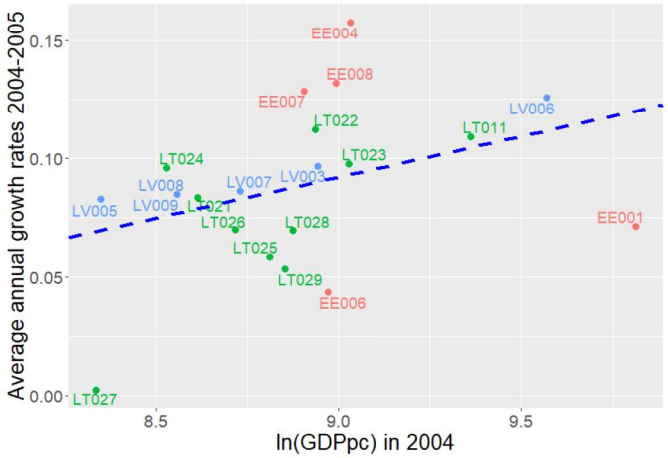
In other words, beta convergence of regional productivity takes place if productivity growth in the less productive regions is more rapid than in the more productive region and this is indicated by the minus sign of the beta coefficient. It also takes place if productivity in less productive regions increases while in more productive regions decreases; or if productivity in less productive regions decreases slower than in more productive regions (this may the case during recessions).

Under beta divergence, productivity growth is more rapid in the more productive regions and is indicated by the plus sign of the beta coefficient. It also takes place, when productivity in the less productive regions decreases, but productivity in the more productive regions increases; 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).

Beta divergence during boom, beta convergence during/through recession

[6] "Unweighted model without dummies"

term	estimate	std.error	statistic	p.value
(Intercept)	- 0.2193075	0.1773781	- 1.236384	0.2313824
x	0.0346059	0.0199583	1.733913	0.0991303

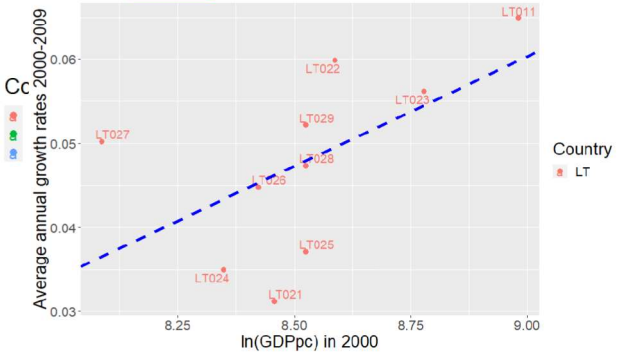


[328] "Period 2000-2009"

"Statistically significant correlation is observed"

"Unweighted model"

term	estimate	std.error	statistic	p.value
(Intercept)	-0.1735001	0.1151653	-1.506531	0.1703546
x	0.0259753	0.0135070	1.923096	0.0906815

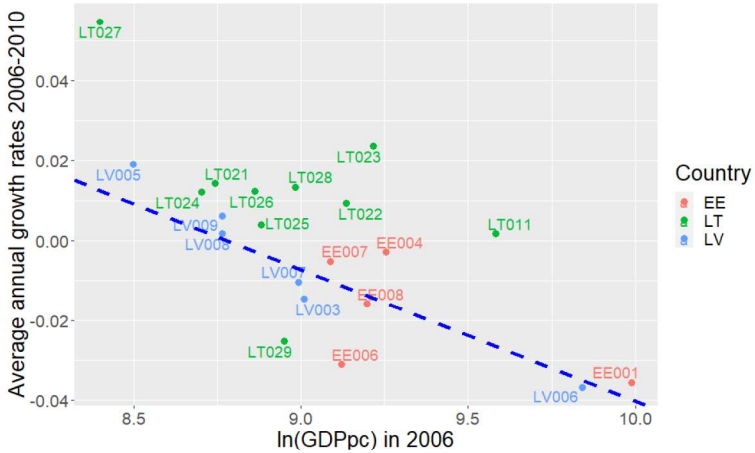


66] "Period 2006-2010"

"Statistically significant correlation is observed"

"Unweighted model with dummies"

term	estimate	std.error	statistic	p.value
(Intercept)	0.2884075	0.0844342	3.4157652	0.0032935
x	- 0.0328469	0.0090238	- 3.6400156	0.0020251
CountryLT	0.0174539	0.0086276	2.0230358	0.0590873
CountryLV	0.0007002	0.0092896	0.0753782	0.9407938



Models and graphs are provided only for periods with statistically significant (at the at least p=0.05 level) nonzero Spearman correlation values between GDPpc value at the start of the period and mean annual GDPpc growth values during this period. The names of periods passing Spearman correlation test are marked by yellow.
The models with β coefficients significant at this level (0,1≥p>0.5) are marked with green. The models significant at 0.5 level (p≤0.5) are marked with blue.

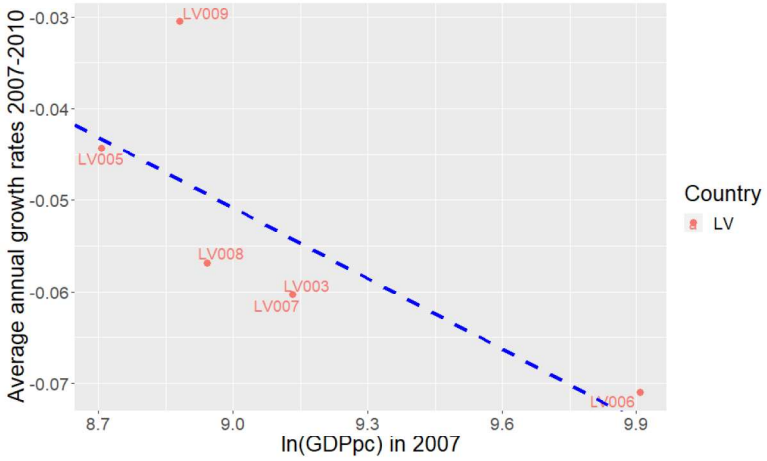
After recession: beta divergence again : Latvia

[425] "Period 2007-2010"

"Statistically significant correlation is observed"

"Unweighted model"

term	estimate	std.error	statistic	p.value
(Intercept)	0.1809447	0.1022787	1.769133	0.1515928
x	-0.0257571	0.0112089	-2.297918	0.0831292

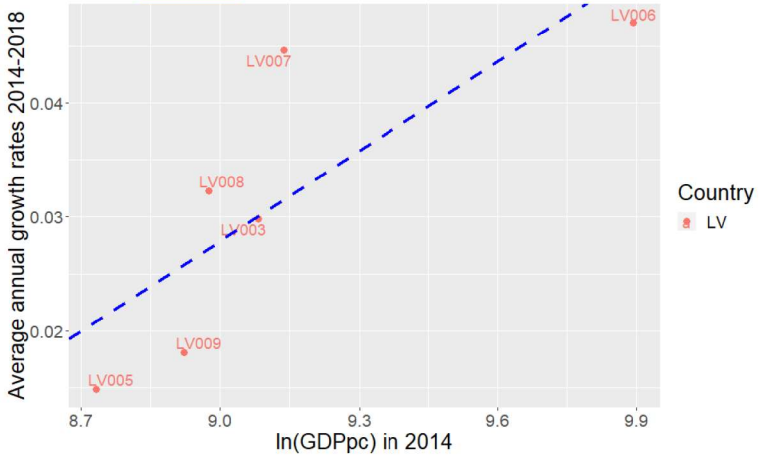


[448] "Period 2014-2018"

"Statistically significant correlation is observed"

"Unweighted model"

term	estimate	std.error	statistic	p.value
(Intercept)	-0.2097533	0.0898599	-2.334225	0.0798816
x	0.0264019	0.0098409	2.682887	0.0550632



Findings (I):

- According to applied measures of sigma convergence (CV and MLD) and inequality (Gini and Theil indices), during all periods under analysis (1995-2019), regional productivity disparities were largest in Latvia and smallest in Lithuania, with Estonia being the case in-between.
- In Lithuania and Estonia, regional productivity disparities increased from the comparatively low levels in 1995 (Estonia) and 1996 (Lithuania). This is the approximate time of the end of the transformational recession of Baltic countries. In Latvia, regional productivity disparities did not noticeably change in 2000-2018, so they may be legacy from the earlier time (Soviet occupation era). However, data series is too short for definitive conclusions.
- This ranking order is invariant with respect to the use of weighted and unweighted measures. However, using weighted measures, differences between Baltic countries are more conspicuous in comparison with unweighted measures. This applies foremostly to differences between Estonia and Latvia. By unweighted measures, in 2016-17 regional productivity disparities in Estonia and Latvia were nearly on same level.
- Generally, regional productivity disparities increased during periods of rapid economic growth and decreased during recession periods. In Lithuania and Latvia, the increase of disparities was most marked during recovery growth since the end of the transformational recession in 1995-96. The increase of disparities continued in 2001-2006, which was the time of most rapid economic growth during the complete restored independence period. In Lithuania, it did stop or was briefly reversed to convergence during “Russian crisis” in 1999-2000. 2001-2006 was the time of very rapid growth, driven by cheap foreign credit and direct investments. It seems that metropolitan regions did profit from them than peripheric regions, leading to an increase of cross-regional disparities during this period.

Findings (II)

- During the Great Recession in the wake of the Global Financial Crisis (GFC) 2007-2008, the productivity disparities decreased most in Latvia. In Estonia, the decrease was interrupted by their increase in 2009, which is difficult to interpret. Taking into account findings of estimation of beta convergence during periods encompassing crisis time, it can be claimed that cross-regional disparities decrease because metropolitan areas were affected by the crisis than peripheric areas (the contraction of regional GDP was larger in formerly rapidly growing regions than in those with lagging growth).
- After Great Recession in the wake of GFC, regional productivity disparities did remain on the stable level or only slowly increased in Lithuania and started to increase in Estonia and Latvia again, interrupted by the decrease in 2016 in Latvia. The last two years with data available (2017-18) were also marked by the productivity disparities increase in Latvia.
- Interpreting these findings, it is important to take into account that the timing of exit from recession was different in three Baltic countries. In Estonia and Latvia, recovery started already in 2010, while in Latvia, this still was the year of continuing economy contraction. In Estonia, it slowed down by the the impact of "double-dip" crisis in neighbour Finland in 2013-15, which did leave two other Baltic countries unscathed.
- 2016-18 was a time of strong growth in all three Baltic countries (however, growth was weaker than in the early 2000s). It looks like that it was a major force behind the new increase in cross-regional disparities. It was interrupted by the global COVID-19 pandemia shock in 2019-20, which is outside the range of available data, with no possibility to assess its impact on cross-regional disparities.

Findings (III)

- The size of N was sufficient to get statistically significant results only for few regressions estimating beta convergence. From total 684 models, which were estimated for the 2000-2018 period and its subperiods, only 85 (12.4%) are statistically significant at the p=0.1 level. Most of them (58) are models for the pooled sample, encompassing all Baltic NUTS-3 regions (N=21).
- Not even a single subperiod with statistically significant relation between GDPpc level at the start of the period and mean annual growth rates during the period were found for Estonia (N=5). Statisticallly significant results can be expected working with county level GDP data (N=15)
- However, there are 18 statistically significant models ($p \leq 0.1$) for Latvia (N=6) and 9 (N=10) for Lithuania. Why a number of statistically significant models is larger in Latvia than Lithuania despite smaller N size, is difficult to interpret.
- Beta-convergence and divergence may be estimated on the pooled sample level with statistically significant resultus, but such estimation lacks a clear theoretical rationale (however, it can be discovered or invented).

Findings (IV)

- All statistically significant results on beta convergence correspond to those on sigma convergence during specific periods.
- Theoretically, beta convergence is only necessary condition of sigma convergence, so there can be sigma divergence despite beta convergence. Beta convergence without sigma convergence may take place when less productive regions overtake (by far) formerly more productive regions.
- Another possibility when there is no sigma convergence despite beta convergence is change of rank order between regions due to catastrophic (human-made or natural) deep decline of productivity in most productive region(s), while it remains on the same level in the less productive region(s).
- Most of our findings of beta convergence refer to subperiods including the 2007-2008 Global Financial Crisis (GFC) and correspond to the finding that this was also the time of sigma convergence.
- Most findings of beta divergence refer to period of rapid growth in 2000-2006, which was also marked by the sigma divergence. There is no incongruencies between sigma and beta convergence.

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