

# Convergence between the Baltic and the Nordic economies: Some reflections based on new data for the Baltic countries

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# Convergence between the Baltic and the Nordic economies: Some reflections based on new data for the Baltic countries<sup>1</sup>

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## Abstract<sup>4</sup>

This short paper uses recent estimates of GDP per capita for the Baltic countries for the 1919-2020(22) period to test for convergence between the Baltic and the Nordic economies. Drawing from the methodology used in Bernard and Durlauf (1996) and Greasley and Oxley (1997), we utilise a time-series approach to test for bivariate convergence between the various Baltic and Nordic economies. We find some evidence of conditional convergence and catching up for the interwar period, 1919-1939 and the post-Soviet era 1993-2022, when for the communist growth period until 1988 we find no trace of convergence, when thereafter during the last years of communism, the Baltic economies went into a severe and devastating recession.

Keywords: Baltic, Scandinavia, economic growth, convergence, historical national accounts.

JEL-codes: N14, N34, N94, O47, O52.

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## 1. Introduction

Bruno et al. (2023) recently explored the economic convergence of the Nordic countries compared to the economic leaders from the early 18<sup>th</sup> century until present. The Baltic countries have previously not been included in this type of analysis as figures for GDP per capita have thus far been unavailable prior to 1993. However, Klimantas (2024) has as part of a Baltic project recently worked to produce estimates for GDP per capita for the Baltic countries for the 1919-1992 period. Klimantas work partly rests on several publications from this project, aiming at constructing economic and demographic key indicators for Estonia, Latvia, and Lithuania 1920-2020 (Grytten 2022a, 2024, Klimantas 2023a, 2023b, Norkus 2022, 2023a, 2023b, 2024a, 2024b, 2024c).

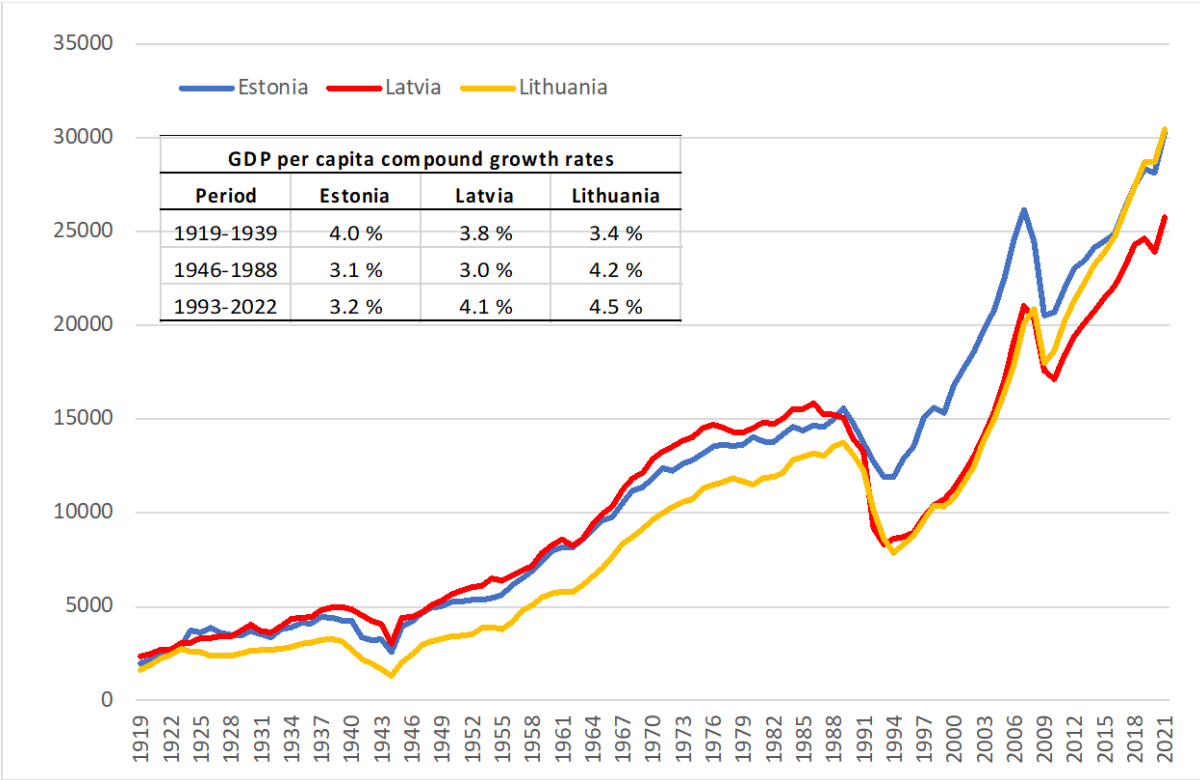
This paper asks in its first section the question whether we see any signs of economic convergence of the Baltic towards the Nordic countries during the last good hundred years. Section two presents the background and give some descriptive statistics. Section three outlines the time-series approach to measure economic convergence as applied in the recent literature. Section four presents the results. Section five concludes on our findings.

## 2. Background

Klimantas (2024) provides first annual estimates of the GDP per capita for the Baltic countries for more than the one-hundred-year period 1919-2022. These estimates are presented in figure 1, which also includes a table of compound growth rates for different sub-periods. The three Baltic countries follow a relatively similar growth trajectory.

There was a huge drop in GDP per capita during the 1939-1945 period with the Soviet occupation and World War II, and there was another devastating drop 1988-1993 before and during the collapse of the Soviet Union and the period when the three countries re-gained their independence. In all three countries the economic growth improved following the independence in 1993, the least so in Estonia, which also had the lowest drop in GDP per capita following its independence.

Figure 1: Gross Domestic Product per capita 1919-2022 Baltic countries measured in fixed 2011 US\$.



Source: Based on preliminary figures from Klimantas (2024)

The estimates presented in Figure 1 can be used to test for economic convergence with the Nordic countries, a region that the Baltics have had long and strong economic, historical, and cultural ties with. There are several estimates of GDP for the Nordic countries. Hansen (1974) calculated the commonly used historical GDP for Denmark covering every year from 1816. Hjerppe (1996) calculated annual historical GDP series for Finland from 1860 onwards. Johnsson made annual estimates for Iceland since 1870 (Iceland is not included in the present analysis). The most recent annual calculations for Norway are made by Grytten (2022b) from 1816 onwards, when the newest Swedish figures for the last centuries were calculated by Edvinsson (2013) from 1800 onwards. These series are spliced with the World Bank Data (2024) and reported in Figure 2.

Again, we trace similar patterns within the group. The all-round growth was significant, despite significant recessions during the interwar period, the second world war, the financial crises around 1990 and 2008 along with the covid crisis. We

also see that Norway was the winner when Finland was poorest, and Denmark had the lowest growth during these well 100 years. The compound growth rates seen in the attached table confirm the growth of the three different sub-periods. Confirming that 1946-1988 was a period of very high growth, and basically higher than for the Baltic states, except for Lithuania, which performed marginally better than the Nordic countries during this period, and for Sweden, which performed marginally poorer than the Baltic states.

However, one should consider some biases in the periodisation. In the first place, if one extends the middle period until the breakdown of the communist economy in the late 1980s and early 1990s, the Baltic states come considerably worse off. In the second place, starting in 1919 makes especially Norway’s growth performance during the interwar period weak, since 1919 was a peak year for economic growth in Norway. Using 1918 as starting year the annual growth rate for Norway during the interwar period increases from 1.9 to 2.4 per cent. Thirdly, by looking at the growth rates 1988-2022, one tends to neglect the strong petroleum led-growth period in Norway from the early 1970s and up until 2007, when the annual compound growth rate was 2.9 per cent against 1.4 per cent 1993-2022. Hence, shifts in periodisation would reveal significantly higher growth rates for Norway both for the interwar period and the latter period. As for the Baltic states the Soviet era would show significantly lower growth if extended to the early 1990s and apparently substantial divergence to their Nordic counterparts.

An alternative could have been calculating growth rates as log-linear regressions according to the log-linear equation to the left in the bottom line of Table 1.

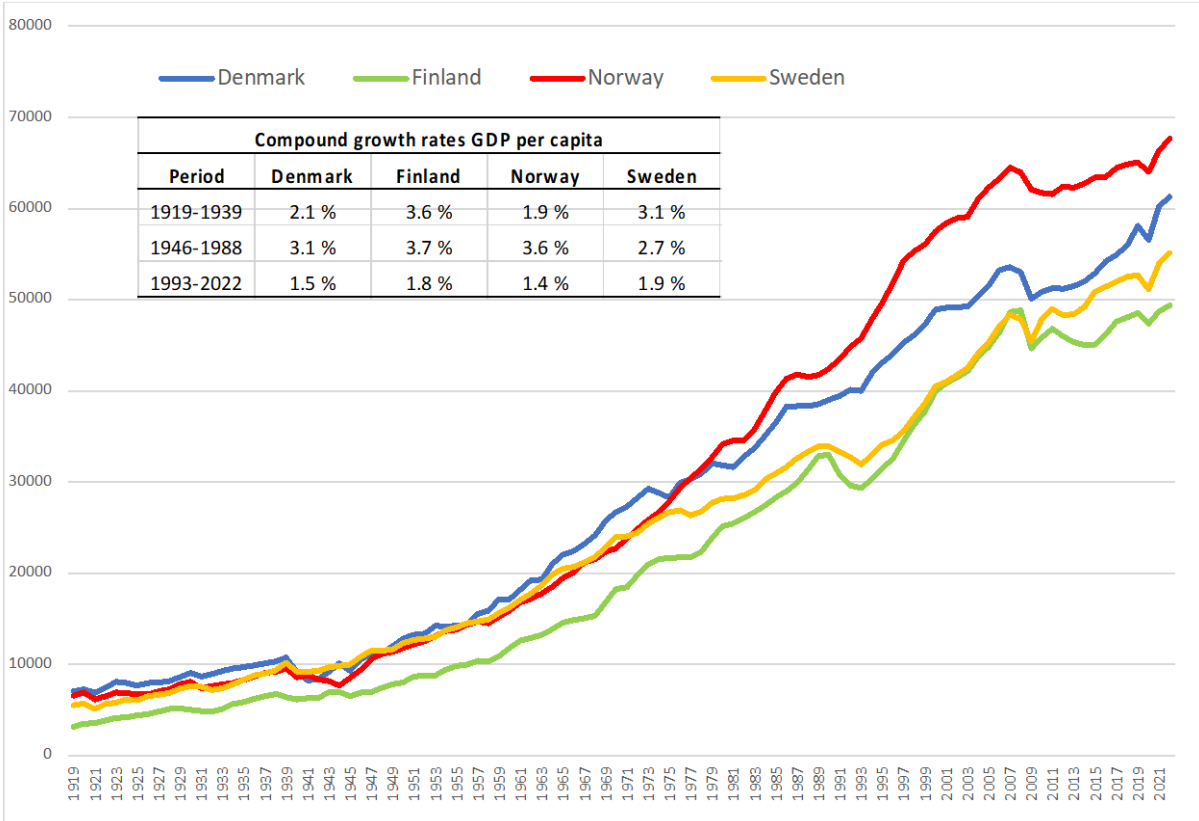
Table 1. Linear and log regressions to detect trends in time series.<sup>5</sup>

	<i>X</i>	
<i>Y</i>	<i>X</i>	$\log X$
<i>Y</i>	<i>linear</i> $\hat{Y}_i = \alpha + \beta X_i$	<i>linear-log</i> $\hat{Y}_i = \alpha + \beta \log X_i$
$\log Y$	<i>log-linear</i> $\log \hat{Y}_i = \alpha + \beta X_i$	<i>log-log</i> $\log \hat{Y}_i = \alpha + \beta \log X_i$

<sup>5</sup> <https://datastoriesweb.wordpress.com/2020/05/24/log-linear-and-log-log-regression/>

However, this will give too low  $R^2$  for the last sub-period, due to structural breaks, particularly with lower growth rates for the Nordic countries after the financial crisis from 2008 onwards. Hence, we stick to the periodisation aiming at examining the growth periods of the Baltic states. Thus, we end up with the present periodisation and sub-periodisation.

Figure 2: Gross Domestic Product per capita 1919-2022 Nordic countries measured in fixed 2011 US\$.

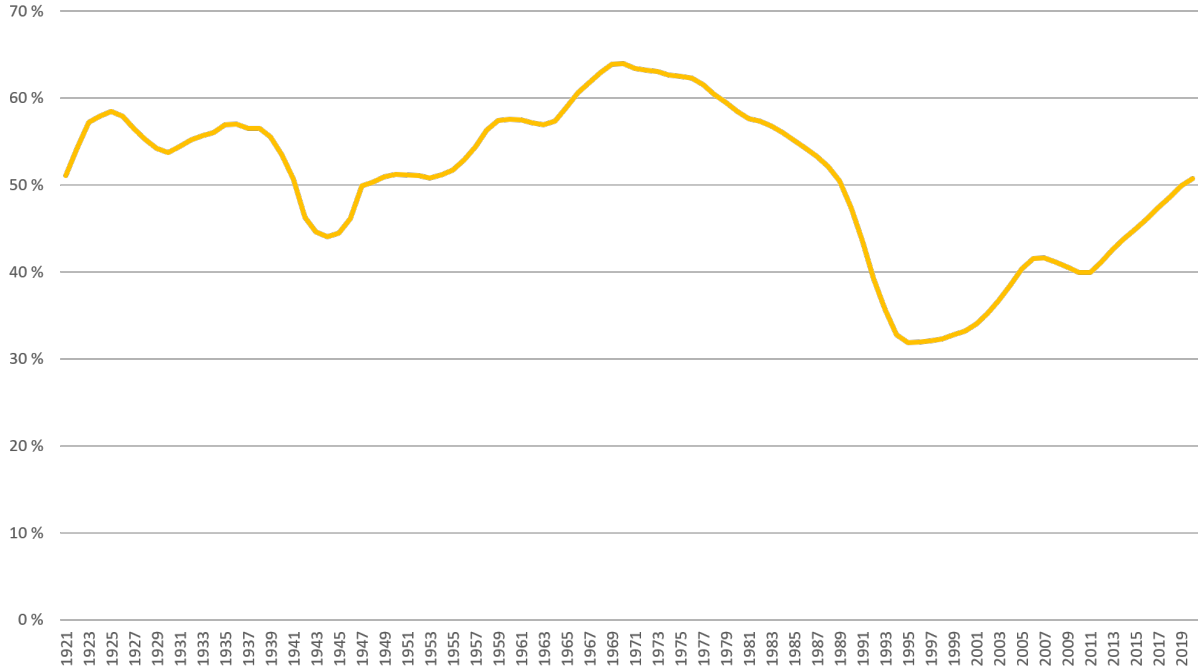


Source: Based on Hansen (1974), Hjerppe (1999), Edvinsson (2013), Grytten (2022), World Bank (2024).

In this paper we apply the reconciled figures by Bolt and van Zanden (2020) spliced with data from the World Bank (2024) to reach at present figures for the Nordic countries, as these basically rest on up-to-date research (with a minor exception for Norway). Figure 3 shows the average Baltic GDP per capita as a share of the average Nordic GDP per capita. Ideally one could argue that these should have been in current prices. However, due to the lack of relevant price data for the Baltic states during the Soviet occupation they are in real figures only. It is hard to spot any apparent

single long-term trend, with no obvious sign of catching-up for the period overall. From 1993 onwards, there seems to be a positive trend, but the share in 2022 is still below the shares for most of the pre-1993 era. Overall, this would indicate no convergence between the Baltic and the Nordic countries, which admittedly, except for Denmark, were among the growth winners in the western world during the more than hundred-year period we study here.

*Figure 3: Baltic share of Nordic GDP per capita, seven-year moving average.*



*Source: Own calculations based Klimantas (2024), World Bank (2024) and Bolt and van Zanden (2020).*

There are at least two caveats to such a conclusion. First, whilst there is no clear trend in the visual data, it does not allow to control for heterogeneity among the various countries. The four Nordic countries included in this study, as well as the three Baltic countries, are not uniform in their economic performance. For the Nordic countries, Finland historically had the lowest GDP per capita, something that persists to this day. Another example is Norway, which since becoming an oil and gas-producing country has had a higher economic growth than the other Nordic countries (Holden, 2013). Aiming at measuring convergence, it is more useful to do bivariate comparisons, in effect country-by-country comparisons. Second, eyebawling the data to identify patterns is imprecise and may lead to subjectivity.



Hence, a more formal way to test for convergence is needed to establish whether convergence did take place.

The formal testing is based on a time-series approach pioneered by Bernard and Durlauf (1995, 1996). This approach was used by Greasley and Oxley (1997, 1999) measuring convergence within Europe, finding among other that Denmark, Finland, and Sweden converged in the period 1900-1987. Liew and Ahmad (2009) also applied a similar approach to measure the convergence in income equality between the Nordic countries.

More recently, Bruno et al. (2023) used this approach to test for convergence between the Nordic countries and the economic leaders at the time for the period 1731-2010. The conclusion was that prior to the 20<sup>th</sup> century, the Nordic countries did not have a similar growth path. The similarities that are present today is largely a product of convergence that occurred during the 20<sup>th</sup> century. Because of a lack of data, it has not been possible to analyse the convergence pattern of the Baltic countries until now. The present paper takes up this challenge and attempts to fill this gap.

### 3. Methodology

Bernard and Durlauf (1995, 1996) approach to convergence, in effect that countries become more equal in terms of GDP per capita over time, is based on time-series data.  $y_i$  and  $y_j$  are defined as the logarithm of GDP per capita in country  $i$  and  $j$ , respectively. The income gap  $k$  years after the starting year  $t$  is defined as  $y_{t+k}^* = y_{i,t+k} - y_{j,t+k}$ . In this case,  $i$  will refer to the Baltic country and  $j$  is the Nordic country. The definition of convergence, meaning the equality of the long-term forecasts of output, at given information set  $I_t$ , is when the output gap is zero as  $k$  goes to infinity:

$$\lim_{k \rightarrow \infty} E(y_{t+k}^* | I_t) = 0 \quad (1)$$

A common approach to test for convergence is to apply a unit-root test, see for instance Greasley and Oxley (1997, 1999) and Bruno et al. (2023). The most

commonly used unit-root test the Augmented Dickey-Fuller (ADF) test, which test equation is given by:

$$y_t^* = \mu + \alpha(y_{t-1}^*) + \beta t + \sum_{i=1}^k c_i \Delta(y_{t-i}^*) + u_t \quad (2)$$

to determine whether there is a unit root, the parameter  $\alpha$  is tested with the null hypothesis that it is one (a unit root) relative to the alternative hypothesis that it is less than one (a stationary time-series).  $\mu$  is the intercept,  $t$  is a linear trend, and  $\beta$  the slope parameter. To control for potential autocorrelation in the error term ( $u_t$ ), lagged differenced terms of  $y_t^*$  are included,  $\Delta(y_{t-k}^*)$  with  $c_i$  being the coefficient for each lag. The number of lags is determined by using the small sample adjusted AIC. Based on this test equation, we can define the following:

1. *Full convergence*: the series is stationary,  $\mu = 0$  and  $\beta \neq 0$ . In this case the income gap is zero, and the difference in the GDP per capita series between two countries are stationary.
2. *Conditional convergence*: the series is stationary,  $\mu \neq 0$  and  $\beta \neq 0$ . Similar as above, but the income gap is non-zero.
3. *Catching-up*: the series is trend stationary with a positive trend,  $\beta > 0$ . The lagging country is catching-up with the leading country, meaning that the income gap is decreasing.
4. *Falling behind*: the series is trend stationary with a negative trend,  $\beta < 0$ . Opposite as above, as the lagging country is falling behind the leading country, meaning that the income gap is increasing.
5. *Inconclusive*: the series has a unit root and there is no evidence of any of the above. The income gap does not follow a particular pattern.

The Baltic country data does provide some challenges. There are most likely structural breaks in the time-series, a common concern when working with time-series data. We already know beforehand that the Baltic countries faced large shocks in terms of occupation, war, and independence. One solution implemented is to subdivide the data into subsamples, in effect the periods (i) 1919-1939 before Soviet

occupation, (ii) 1946-1988 Soviet occupation, and (iii) 1993-2022 independence after Soviet occupation. This solution comes with a problem, the subsamples have far fewer observations, meaning that the power of the unit-root test is reduced.

To keep as many observations as possible, two additional unit-root tests are run including break dummies. The test equation is:

$$y_t^* = \mu + \alpha(y_{t-1}^*) + \beta t + \theta DU_t(T_b) + \gamma DT_t(T_b) + \sum_{i=1}^k c_i \Delta(y_{t-k}^*) + u_t \quad (3)$$

in which  $DU_t(T_b)$  is an intercept break variable and  $DT_t(T_b)$  is a trend break variable, with  $\theta$  and  $\gamma$  indicating their significance, respectively. The break-point dummies tested are:

- WWII Intercept: One-time intercept break for the 1939-1945 period, with the value being set to 1 for the years 1939-1945 and 0 otherwise.
- USSR Intercept: Intercept Soviet dummy for the 1946-1988 period, with the value being 1 for the years 1946-1988 and 0 otherwise.
- WWII Trend: One-time trends break for the 1939-1945 period, with the value being set to 1 for the years 1939-1945 and 0 otherwise.
- USSR Trend: Trend Soviet dummy for the 1946-1988 period, with the value being 1 for the years 1946-1988 and 0 otherwise.

Using these break variables allow for us to extend the period prior to 1988 back to 1919.

#### 4. Results

The results are presented as a country-by-country comparison. The results for Estonia are presented in table 2. The first thing to note is that the results vary depending on which country Estonia is compared with. For the interwar period, 1919-1939 they indicate that Estonia had conditional convergence with Denmark but was falling behind Finland and Sweden. This was not a consequence of low growth in Estonia, but rather remarkably high growth in the Nordic countries compared to most other

European states during the interwar period. From 1993 we find catching up with Finland (significant at 10 per cent) and Sweden, but not Denmark and Norway. A surprising result was that Estonia did seem to be catching-up with Denmark if the 1919-1988 period is studied as one. This might partly be due to a larger number of observations, which increases the reliability of the test. It is also likely due to the economic performance of Denmark, which in relative terms clearly had weaker growth than that of the other Nordic countries during the 20<sup>th</sup> century, when Estonia had relatively high growth in the interwar period.

*Table 2. Results of the unit-root tests for Estonia*

Comparison	Period	ADF	Lags	Trend	Break dummy	Conclusion
<b>Estonia-Denmark</b>						
	1919-1939	-6.87***	4	Na	None	Conditional convergence
	1946-1988	0.45	6	Na	None	Inconclusive
	1993-2022	-2.91	1	Na	None	Inconclusive
	1919-1988	-4.32**	1	Pos**	WWII trend	Catching-up
<b>Estonia-Finland</b>						
	1919-1939	-3.61*	3	Neg**	None	Falling behind (10 %)
	1946-1988	-1.45	0	Na	None	Inconclusive
	1993-2022	-3.55*	1	Pos***	None	Catching-up (10 %)
	1919-1988	-3.71	4	Na	WWII intercept	Inconclusive
<b>Estonia-Norway</b>						
	1919-1939	-3.03	3	Na	None	Inconclusive
	1946-1988	-0.30	0	Na	None	Inconclusive
	1993-2022	-2.42	1	Na	None	Inconclusive
	1919-1988	-2.84	4	Na	None	Inconclusive
<b>Estonia-Sweden</b>						
	1919-1939	-5.59***	4	Neg**	None	Falling behind
	1946-1988	-0.94	0	Na	None	Inconclusive
	1993-2022	-3.86**	1	Pos**	None	Catching-up
	1919-1988	-4.03	4	Na	USSR intercept and trend	Inconclusive

The results for Latvia are presented in table 3. As with Estonia, there is some evidence that also Latvia was catching-up with Denmark during the interwar period (significant at 10 per cent), and thereafter with Finland and Sweden (significant at 10 per cent for the latter) after 1993, but no evidence of catching-up with Denmark and Norway. In addition, Latvia also shares the result that it might have been catching-up with Denmark when we consider the entire 1919-1988 period. This can basically be explained by the high growth in Latvia during the interwar period and the relative weak Danish growth during these years, losing its hegemony as the wealthiest Nordic country.

*Table 3. Results of the unit-root tests for Latvia*

Comparison	Period	ADF	Lags	Trend	Break dummy	Conclusion
Latvia-Denmark						
	1919-1939	-3.43*	0	Pos**	None	Catching-up (10 %)
	1946-1988	-0.94	0	Na	None	Inconclusive
	1993-2022	-1.39	2	Na	None	Inconclusive
	1919-1988	-4.49***	0	Pos***	None	Catching-up
Latvia-Finland						
	1919-1939	-2.84	1	Na	None	Inconclusive
	1946-1988	-1.13	1	Na	None	Inconclusive
	1993-2022	-4.33***	1	Pos***	None	Catching-up
	1919-1988	-4.05*	0	Pos***	WWII trend	Catching-up (10 %)
Latvia-Norway						
	1919-1939	-1.94	4	Na	None	Inconclusive
	1946-1988	-0.86	1	Na	None	Inconclusive
	1993-2022	-2.87	3	Na	None	Inconclusive
	1919-1988	-2.22	1	Na	None	Inconclusive
Latvia-Sweden						
	1919-1939	-2.26	4	Na	None	Inconclusive
	1946-1988	-1.32	1	Na	None	Inconclusive
	1993-2022	-3.39*	1	Pos***	None	Catching-up (10 %)
	1919-1988	-2.09	1	Na	WWII intercept and trend	Inconclusive

Finally, the results for Lithuania are presented in table 4. We find traces of conditional convergence with Denmark and Norway for the interwar period and falling behind Finland and Sweden (the latter with 10 per cent significance). After 1993 there is evidence at the 10 per cent level of significance of catching-up with Sweden. Again, compared with Denmark in relative decline, Lithuania experienced catching-up /significant at 10 per cent level for the joint period 1919-1998.

*Table 4. Results of the unit-root tests for Lithuania*

Comparison	Period	ADF	Lags	Trend	Break dummy	Conclusion
Lithuania-Denmark						
	1919-1939	-3.89**	4	Na	None	Conditional convergence
	1946-1988	-1.89	0	Na	None	Inconclusive
	1993-2022	-1.92	1	Na	None	Inconclusive
	1919-1988	-4.15*	0	Pos**	WWII Trend	Catching-up (10 %)
Lithuania-Finland						
	1919-1939	-5.11***	2	Neg**	None	Falling behind
	1946-1988	0.62	8	Na	None	Inconclusive
	1993-2022	-2.26	1	Na	None	Inconclusive
	1919-1988	-2.14	1	Na	WII Intercept and trend	Inconclusive
Lithuania-Norway						
	1919-1939	-3.92**	4	Na	None	Conditional convergence
	1946-1988	-1.21	1	Na	None	Inconclusive
	1993-2022	-2.55	1	Na	None	Inconclusive
	1919-1988	-2.23	1	Na	WII Intercept and trend	Inconclusive
Lithuania-Sweden						
	1919-1939	-4.47**	2	Neg*	None	Falling behind (10 %)
	1946-1988	-2.00	1	Na	None	Inconclusive
	1993-2022	-3.24*	1	Pos***	None	Catching-up (10 %)
	1919-1988	-3.92	1	Na	USSR Intercept and trend	Inconclusive

## 5. Conclusions

In this short paper we have studied convergence between the three Baltic economies Estonia, Latvia, and Lithuania on the one hand and the Nordic economies Denmark, Finland, Sweden, and Norway on the other hand. Doing that one has to remember that one is comparing two regions that overperformed both in the interwar period and in the past communist era compared to most other western economies. There are some findings that are common for all the three Baltic countries. First, the Baltic countries following 1993 did seem to catch up with Finland and Sweden, but not with Denmark and Norway. Second, there is no evidence for any Baltic country that they were catching-up with Norway, as this might be due to the differences in the economic structure of the Baltic countries compared to Norway and the significant growth in Norway due to oil and gas extraction. Third, there is no evidence for any Baltic country of convergence or catching-up when evaluating the Soviet period 1946-1988 by itself.

It might seem as the first couple of decades within the Soviet Union gave considerable economic growth even compared to western economies, when the development was strongly reversed thereafter. One also should bear in mind that the Baltic growth during the Soviet period rather mirrors increase in volumes of gross output than growth in the standard of living, which means that the comparison is less relevant for this sub-period, than both the interwar and the post-Soviet eras.

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