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REGIONAL DIVERGENCE VERSUS EUROPEAN CONVERGENCE WITH SPECIAL EMPHASIS ON THE NORTHERN HEMISPHERE[1]

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Abstract:

We analyze different patterns of economic development in Europe, and particularly in the Nordic and Baltic hemisphere based on an assessment of interregional and intraregional growth and trade performance. The central hypothesis is that large intra-regional disparities do not necessarily lead to lower economic growth on a national level than smaller disparities do.

We examine the pattern of regional convergence within all EU-countries. The Baltic Region is divided into East Baltic region and West Baltic region. We observe overall convergence. At the national level, divergence is frequently observed in the Baltic hemisphere.

With regard to trade hypothesis of trade, a close relation to the level of income is found. Finally, we discuss and evaluate the impacts on economic growth and competitiveness in the Baltic and Nordic hemisphere.

Key words: *Baltic dimension – convergence – trade – specialization*

JEL Classification*:* R11, R12, R58.

1. Introduction

The economic position of the Nordic countries and the Baltic Region has altered in the last two decades, partly due to internal changes and revitalized growth performance, partly by the removal of the iron curtain

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[1] This article is a revised and updated version of a paper presented at *48th Congress of the European Regional Science Association* in Liverpool August 2008.The article is based on a research project supported by the VASAB 2020 program. For details and full report see: http://www.vasab.org/i/documents/projects/APC-NKS-Vasab-report-final.doc.

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and the reintegration of the former state economies in the western market-based economic system. In some sense, the 'Nordic periphery' has turned into the center or at least has become a center of economic development, and much attention is still on the future perspectives of the region[1]. The purpose of this paper is to analyze two aspects of this process:

- economic growth and the development of inter and intraregional disparities;
- in addition, to address the impacts on trade and specialization with special attention to spatial integration in the Northern hemisphere.

The project reported in this paper aims to assess different patterns of economic development in Europe and in particular in the Nordic and Baltic region based on an assessment of interregional and intra-regional growth and trade performance[2]. The central hypothesis is that large intraregional disparities do not necessarily lead to lower economic growth on a national level than smaller disparities do. Furthermore, the paper provides an assessment of the consequences for economic integration in the region, here defined as the countries located in the Baltic Rim region, i.e. the old market economies Norway, Sweden, Denmark, Finland and Germany, and Russia, Poland and the Baltic states from the former socialistic economies.

In a period of globalization and outsourcing in business and industry, economic analysis often focuses on international transactions and organizational changes. Competition between the regions and metropolis in Europe or of the world has become a major topic in international economics and business as well as on the political scene. These tendencies raise the question of national and regional coherence. The issue of cohesion in regional economic associations like the EU becomes a decisive issue for further integration European Parliament (2007). Particularly in the more advanced forms of economic integration, the issue of re-distributive instruments becomes crucial, Molle (1999), p. 146ff.

In addition, we also examine the consequences of the increasing global orientation of large parts of the European economy concerning

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[1] For a review of recent trends see the thematic issue 'The Baltic Sea Region Strategy' of the Journal of Nordregio, no 1, 2009 (Nordregio 2009).

[2] See Cornett & Sørensen (2008a). The trade analysis has been supported by a grant from the Danish Ministry of the Environment within the VASAB 2010 initiative.

regional cohesion in the Northern part of Europe. This paper addresses the issue of cohesion in two ways:

- a brief theoretical examination of the concept of convergence and cohesion used in the literature, and the indicators used for measuring regional disparities is followed by an analysis of inter and intraregional convergence in the Baltic Rim Region;
- an alternative concept of cohesion is presented based on an outline of patterns of interregional specialization in the production system, here measured by intra-industry trade between countries in the Baltic Sea Region, hereafter BSR.

After a brief presentation of the concepts of convergence in Section 2, Section 3 addresses growth and convergence in the BSR based on GDP per capita data for NUTS-2 or NUTS-3 regions. In Section 4, an alternative approach to international economic convergence and integration based on international trade statistics is presented, and results for the BSR region are reported. The final section summarizes the results of the study with special attention to regional competitiveness and growth. Furthermore, the section addresses some methodological concerns related to the study.

2. Regional Coherence and Disparities

Coherence and disparities are frequently examined by use of the theories of convergence. Convergence implies that in the long run a unique pattern of steady state growth will be reached. Consequently, poorer regions will experience a higher rate of growth in GDP per capita than more wealthy regions. These may on the other hand experience a decrease in growth. This type of convergence process is also called *β-convergence*, and was introduced by Barro and Sala-i-Martin (1991).

The statement is a direct application of the neoclassical growth model developed by Solow (1956). For a relation to the convergence approach see Abreu, De Groot and Florax (2005). The existence of a unique pattern of growth *g,* will be true, if two key restrictions are imposed on the production function, namely diminishing returns to scale with respect to reproducible factors (capital), and constant and exogenous rate of labor augmenting technological progress. These assumptions will also secure a constant savings fraction of income.

The unique balanced growth equilibrium *g* in the neoclassical

growth model, can be stated as[1]

$$\frac{\dot{y}}{y} = \frac{\dot{k}}{k} = \frac{\dot{A}}{A} = g$$

Where: a "dot" indicating growth, $y = Y/L$, output per labour unit, $k = K/L$, capital, and A is labour augmenting technology.

If convergence is present, the growth rate of regions should approach towards this growth pattern. Denoting $\tilde{y} = Y / AL$ and $\tilde{k} = K / AL$ as output and capital per efficiency unit of labour respectively, a Taylor expansion in $\log \tilde{k}$ around the steady state $\tilde{k}^*$ results in the differential equation

$$\frac{\dot{\tilde{k}}}{\tilde{k}} = \lambda(\log \tilde{k}^* - \log \tilde{k})$$

It is observed that the growth rate of capital per efficiency unit of labour $\tilde{k}$ is proportional to the distance between its current value and the steady state. The parameter λ is the rate of convergence to the steady state. It depends on labour force growth and the rate of depreciation.

Solving the differential equation and using the Cobb-Douglas function in intensive form as $\tilde{y} = \tilde{k}^{\alpha}$ we obtain

$$\log \tilde{y}(t) = (1 - e^{-\lambda t}) \log \tilde{y}^* + e^{-\lambda t} \log \tilde{y}(0)$$

Where: t is the time operator at n periods from 0. In order to make this equation empirical testable note that the available data are defined in terms of per capita income, or $y = \tilde{y}A$. Substitution into the equation above and subsequent rearranging gives

$$\log y(t) - \log y(0) = (1 - e^{-\lambda t}) \ln A(0) + gt - (1 - e^{-\lambda t}) \ln y(0) + (1 - e^{-\lambda t}) \ln \tilde{y}^* + (1 - e^{-\lambda t}) \ln \tilde{y}^*$$

The neoclassical model is concerned with convergence *within* an

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[1] This condition is derived by use of a Cobb-Douglas production of the form $Y = K^{\alpha}(LA)^{\alpha}$ with 0 < α < 1, where *Y* is output, *K* is capital, *L* is labour and *A* is labour augmenting technological progress.

economy rather than *across* economies. However, in the majority of contributions on convergence a cross-sectional version of the model has been adapted. Assuming that the initial level and the growth rate of technology are constant across and x represents a vector containing the determinants of the steady state the equation just outlined can be written as

$$\log y(t) - \log y(0) = \beta_0 + \beta_1 \ln y(0) + x'\gamma$$

or

$$\Delta \log y_t = \beta_0 + \beta_1 \ln y_0$$

where the final version is an operational version to be estimated by use of OLS. Here $\Delta \log y_t$ is the growth rate from period *0* to *t*, β_0 is a constant, and β_1 is an estimate of the speed of convergence. If β_1 is significantly negative then convergence is present. If β_1 is positively significant, divergence is present.

Observe that in order to estimate the model in its most simple version several strong assumptions have to be imposed. Assuming that $x'\gamma$ does not influence on the model implies that the model by itself finds the steady state, and that the treatment of technological progress is assumed to be exogenous to the model. Abbeu, De Groot and Florax (2005) review the different attempts that have been undertaken in various contributions to cope with these issues.

Another criticism to the approach of β-convergence is that only two points in time are needed in order to estimate the model. Therefore, it is truly a cross-section approach. A related, but slightly different approach of convergence is to consider the variation around the mean of measured by the standard deviation of. Therefore, we are examining the distributional dynamics of per capita income. If decreases in time, then convergence will be present as stated by Quah (1993). This type of convergence is called *σ-convergence.* It is evident, that the concepts of β- and σ-convergence are strongly related, and it has been shown that β-convergence is a necessary, however not sufficient condition for σ-convergence to be present, i.e. a reduction in the dispersion of per capita income over time.

3. An Assessment of Convergence and Disparities in the Baltic Region in a European Context

Over the past decades, an avalanche of empirical cross-section convergence studies has emerged. Especially the process of convergence or "regional cohesion" as labelled by the Commission among the members of the European Union has been examined. The enlargement of the European Union has further increased the attention of the issue of convergence.

Eckey and Türck (2008) provide a critical review of the used approaches and summarize the results. They consider both types of convergence and are studying the presence of clusters as well. For the original six members of the European Union they report a decreasing rate of convergence. This picture is also prevailing if the number of member countries is increased to 12 or 15. However, if the number of countries is increased to 25 convergence as well as divergence is reported. Cornett and Sørensen (2008b) confirm this finding with regard to β-convergence. They find a strong convergence among the members of the European Union. However, within countries a more diversified picture is reported especially for the smaller member states. Divergence is observed not only for some of the Eastern European members, but also for several Scandinavian countries. For a detailed study of the regional development of the Nordic countries, see Neubauer et.al (2007). Corrado, Martin and Weeks (2005) use an econometric approach to test for regional convergence clusters across Europe. Their results suggest that the process of regional convergence across the European Union is complex and varying in time. At sector level, they consider agriculture, manufacturing, market service and non-market service. All sectors reveal quite large numbers of regional convergence clusters suggesting that there is no single European Union wide convergence process, but rather different paths. Interestingly they find little evidence that regional convergence has been strongly influenced by the provision of the European Union Structural and Cohesion Funds.

Many of the studies of the process of convergence have found a rate of β-convergence around 2 percent. Abreu, De Groot and Florax (2005) provide an examination of this statement or "myth". They use meta-analysis and reviews around 600 randomly selected estimates of convergence all published in peer reviewed journals. Their results indicate that it is misleading to speak of a "natural" rate of convergence. Further,

correcting for heterogeneity in technology will lead to an increase in the rate of convergence. This is interesting relative to the present study because we apply the simplest approach possible and do not consider the issue of technology. Furthermore, this study tries to shed some light on the issue of convergence among the Baltic nations. We adopt the division of the Baltic region into two parts namely:

Baltic East: Estonia, Latvia, Lithuania, Russia and Poland

Baltic West: Denmark, Norway, Sweden, Finland and Germany

This division is of course debatable. We have focused on the interaction among the new market economics, and the old ones. In addition, the former planned economies are actually located in the Eastern Baltic region. Germany, as well as Poland, is rather large nations with many regions not located at the Baltic coastline. In order to highlight the Baltic dimension we have provided the reduced data set *Germany Baltic* and *Poland Baltic*. Appendix 1 gives a more detailed view on the aggregations.

For the analysis of convergence, we use statistics supplied by Eurostat on GDP per capita in Euro at the NUTS 2 level except for Denmark where we use statistics at the NUTS 3 level[1]. The small Baltic nations Estonia, Latvia and Lithuania are not regionalized in the present analysis. The Russian part of the BSR is not included in the convergence analysis either[2]. Our analysis covers 1995 to 2004, and is based on data form Eurostat. For Norway data are only are available for 2004, and the data set constructed is based on Neubauer et. al. (2007), who reports regional GDP growth rates for the period 1998–2002. These values are used for the present analysis along with data from Statistics Norway. For Denmark, we use statistics from Statistics Denmark. Finally, Russia has been excluded for the analysis of convergence due to lack of data.

Table 1 reports the results of various regressions run in order to identify β-convergence. The first row shows the convergence relation run for all EU members at the NUTS 2 level reported in Cornett and Sørensen (2008b). Observe that we are very close to the rate of 2 percent examined by Abreu, De Groot and Florax (2005). For the Baltic region in total, a higher rate of convergence is reported equal to 2.46 percent.

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[1] The statistical material is available on request to the authors.

[2] In some of the policy-oriented frameworks like the VASAB-initiative the Russian part of the BSR usually includes the Murmansk region, Kaliningrad and the Leningrad oblast.

Figure 1 graphs the regressions for all EU members in the upper panel and the Baltic region in the lower panel. For both panels it is evident that data can be grouped by income per capita. This also confirms that the small Baltic nations share common factors as found by Fadejeva and Melihovs (2008). In addition, Cornett and Sørensen (2008b) show that for all EU members the level of income is lower in the Eastern parts of Europe than in the Western parts. Consequently, the rate of catch up will be higher.

Table 1: β-Convergence in the Baltic Region

		Constant, β_0			*β_1-coefficient*			*R^2*	*Standard Error*	*Obs.*
		Coef.	*Std.dv.*	*P-value*	*Coef.*	*Std.dv.*	*P-value*			
EU Total	C	22.97	0.97	0.00	–1.97	0.10	0.00	0.49	1.73	369
Baltic Total	C	26.54	1.39	0.00	–2.46	0.15	0.00	0.73	1.44	106
Baltic East	C	28.61	7.25	0.00	–6.63	1.75	0.00	0.37	1.91	26
Baltic West	C	18.75	5.80	0.00	–1.68	0.58	0.00	0.10	1.16	80
Baltic East:										
Poland	D	–13.04	8.56	0.14	2.48	1.09	0.03	0.20	0.74	23
Poland Baltic	I	12.88	10.59	0.26	–0.83	1.34	0.56	0.05	0.44	9
Baltic West:										
Germany	C	14.68	3.43	0.00	–1.34	3.87	0.00	0.23	0.59	51
Germany Baltic	I	10.60	8.42	0.25	–0.96	0.85	0.30	0.15	0.76	9
Denmark	I	–12.65	33.17	0.72	1.38	3.25	0.69	0.04	0.97	6
Sweden	D	–22.93	12.52	0.11	2.65	1.26	0.07	0.39	0.40	9
Norway	C	29.71	12.86	0.07	–2.63	1.29	0.10	0.45	0.69	7
Finland	D	–5.07	3.85	0.24	0.91	0.34	0.07	0.52	0.16	7

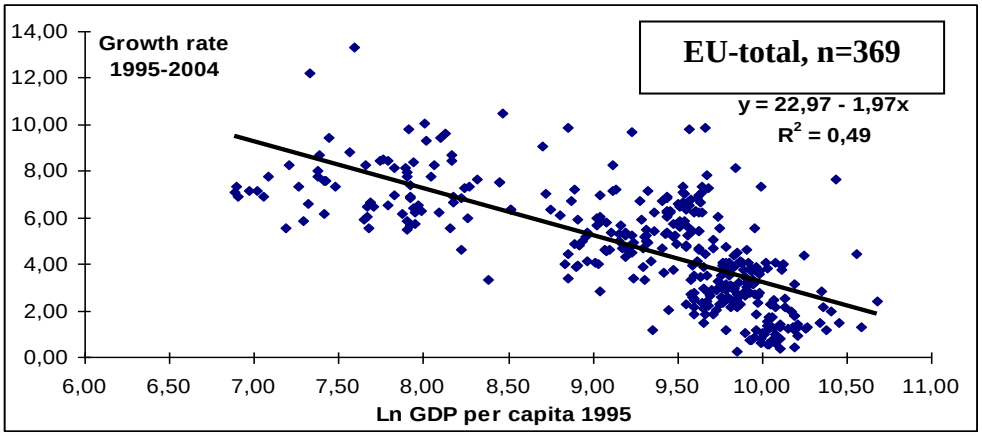
Note: C = convergence, D = divergence and I = inclusive. If the P-value is less than 0.10 a weak significance is observed (10 % level), if the P-value is less than 0.05 a 5 % level is noticed, and if the P-value is less than 0.01 a strong significance is noticed (1 % level).
Source: Our own research data.

The distribution of income per capita among the countries in the Baltic region is for 2004 examined in Figure 2 by using of Box-plots, and the two maps in Figure 3[1]. Initially, note that convergence is present in both regions, and that the highest rate is reached by the regions in the Baltic East equalling 6.61 percent more than 2.5 times the rate of convergence of the Baltic West. Looking at the graph and the map in the right panel of Figure 3, it is evident that the level of income is far lower in the Baltic East. The two maps in Figure 3 very distinctively illustrate the relation between growth and the level of income.

Notice further the horizontal axis in Figure 2, and observe that even the wealthiest region in the Baltic East is far below even in the most rural area in the Baltic West. In the Baltic West, the regions with the highest income are Oslo, Hamburg, Stockholm, Copenhagen and Åland regions. The poorest region included is Dessau in former Eastern Germany. Still, it has an income that is more than double the income per capita in Mazowieckie Poland, the wealthiest region in Baltic East. In the Baltic West region the mean income equals around 27,400 €, whereas in the Baltic East its amounts to about 5,100 €.

Moving back to Table 1, the lower part of the table brings some more disaggregated estimates of convergence. Due to the many nations with limited number regions, the number of observations is small and the results have to be interpreted with care. For the Baltic East region, calculations are only possible for Poland, and a situation of *divergence* is observed. The regions Mazowieckie and Centralny are moving away from the other regions.

[1] The authors would like to thank Postdoc, Geoinformatics, Niels Christian Nielsen at the Department of Business Communication and Information Science and Centre for Tourism, Innovation and Culture (TIC) at the University of Southern Denmark for excellently drawing the maps by use of his GIS-programs.



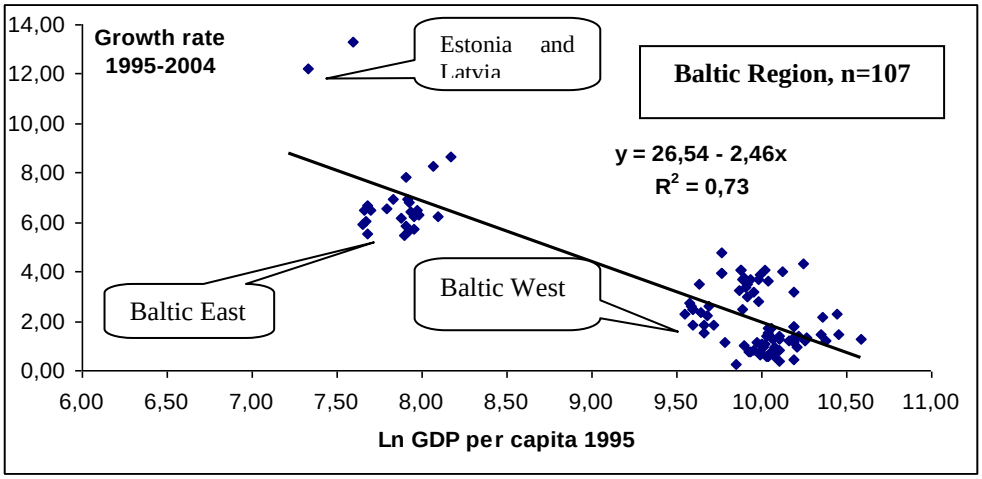
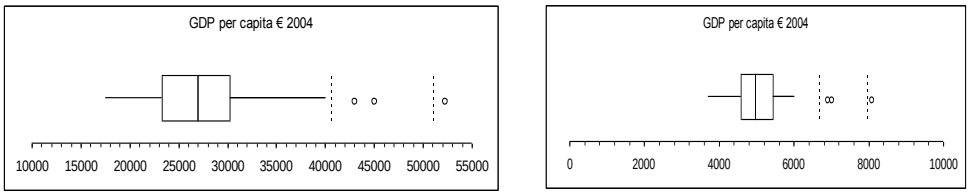


Figure 1: Scatter Plots and Regressions of β-convergence
Source: Our own calculations based on statistics from Eurostat and Danmarks Statistik.

On the other hand, the range in income among the other Polish regions is very little indicating a nation where the Metropolitan region is moving away from the rest of the nation. Gorzelak (2008) explores these issues further for Poland in a critical analysis of the regional development in Poland and the EU cohesion policy. Cornett and Sørensen (2008b) found

a similar pattern in several other Eastern European nations. An additional investigation for Poland has been conducted with regard to convergence. *Poland Baltic* constitutes a regression run for the nine most northern regions several of them with a coastline to the Baltic Sea. This regression reveals an inclusive result.



Baltic West Baltic East

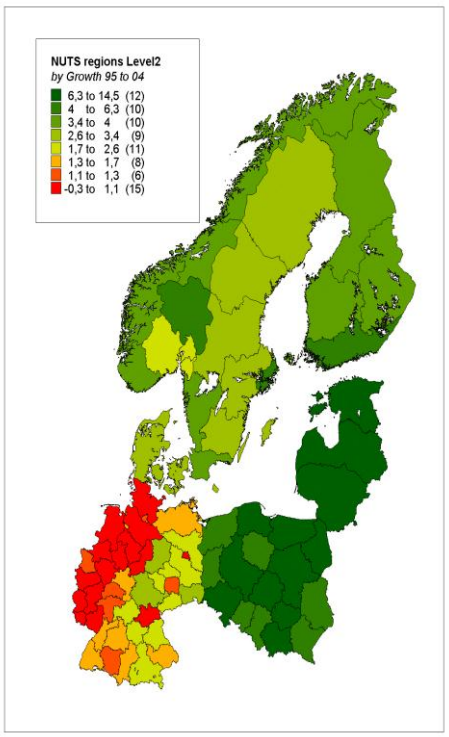
Figure 2: Box-plots of Regional Disparities in the Baltic region

Note: The Box plot is set up as follows: The median is marked as a vertical line across the box. The hinges of the box are the upper and the lower quartiles (the rightmost and leftmost sides of the box). The interquartile range (IQR) is the distance from the upper quartile to the lower quartile. The vertical dotted lines mark the inner and outer lower and upper fence respectively. The upper inner fence is a point at a distance of 1.5(IQR) above the upper quartile. The upper outer fence is a point at a distance of 3.0(IQR) above the upper quartile and vice versa with regard to the lower inner and outer fence respectively. If an observation is located between the inner and outer fence then it is considered as a suspected outlier. If an observation is located outside the outer fence then it is considered as an outlier.
Source: Our own calculations based on statistics from Eurostat (2007) and Danmarks Statistik.

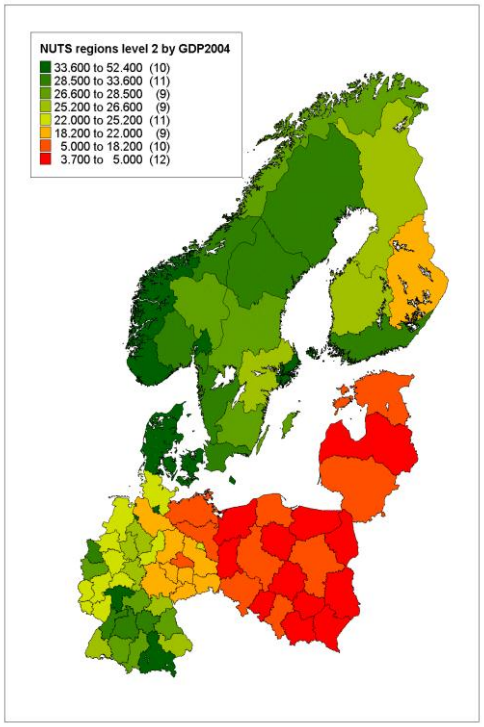
Turning to the Baltic West, Germany is a country with a slowly, but steady convergence. If we consider the nine German regions in the Baltic area, the picture is inclusive. For Sweden and Finland, a picture of divergence is observed. In Sweden, the Stockholm region is moving away

from the other parts of the country. In Finland, a similar pattern is observed, but here the regions of Helsinki and Åland are divergent and growing faster. For Denmark, the outcome (with five regions only) is inclusive. Finally, for Norway convergence although weak is found.

Cornett and Sørensen (2008b) along with Neubauer et. al. (2007) has provided a detailed analysis of the changes in regional structures in the Scandinavian countries. In sum, they report a picture of Scandinavia as a wealthy region where the metropolitan areas slowly are moving away from the other parts of countries especially their rural regions.



Annual growth in GDP per capita 1994 to 2005



GDP per capita in € 2004

Figure 3: **Economic Evolution in the Baltic Region 1995 - 2004**
Note: Exclusive Russia.
Source: Eurostat, Danmarks Statistik and Norges Statistik.

The next part examines whether the findings above can be confirmed by the use of σ-convergence. However, from Figure 1 and 2 it is observed that the average level of income per capita is substantially lower in the Baltic East than in the Baltic West region. In order to conquer with this issue we use the coefficient of variation (CV) defined as the standard deviation divided by the average. If CV decreases, it means that convergence will take place.

Further, by using the coefficient of variation we also solve a problem frequently present in analyses of convergence over time, namely the presence of a non-stationary or trend in the considered statistics. For example, if a positive trend is present it is likely that the mean as well as the standard deviation will increase. Then, if we measure on the standard deviation, we will only observe divergence although this may not be the case.

Table 2: Estimates of σ-convergence in the Baltic Region

CV		*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*
EU total	C	54.1	52.3	50.3	49.9	50.0	50.3	48.9	48.3	47.7	47.7
Baltic Total	C	57.1	55.8	54.8	54.1	54.3	52.9	51.5	51.5	52.3	51.7
Baltic East	I	19.8	19.9	18.7	19.7	20.9	20.2	21.4	20.4	20.6	20.4
Baltic West	I	22.8	22.6	22.8	22.9	23.2	23.5	23.6	23.0	22.6	22.5
Baltic East:											
Poland	D	14.5	16.4	17.5	18.5	20.6	20.1	21.2	20.8	21.0	20.5
Poland Baltic	I	10.9	10.3	9.8	10.1	11.4	11.0	10.4	10.4	9.9	10.8
Baltic West:											
Germany	I	24.1	23.6	23.7	24.0	24.0	24.2	24.6	24.0	23.4	23.1
Germany Baltic	I	36.7	36.0	36.7	37.4	36.5	36.4	38.3	38.0	36.7	36.3
Denmark	D	14.2	14.7	15.0	14.4	16.1	17.0	16.9	17.9	17.3	18.7
Sweden	D	12.4	14.1	15.9	16.6	17.6	17.6	16.9	17.2	16.3	16.7
Finland	D	16.8	18.5	17.8	20.3	22.2	19.1	22.2	20.6	19.2	18.0

Note: C = convergence, D = divergence and I = inclusive. Exclusive Norway.

Source: Own calculations based on statistics from Eurostat and Danmarks Statistik.

Table 2 examines σ-convergence. The design of the table is similar to Table 1 in order to facilitate comparison. By use of this measure, the number of groups with convergence decreases substantially. We only observe convergence for overall EU and the Baltic region in total. For Germany and Denmark, an inclusive pattern is observed, whereas the earlier observed pattern of divergence is confirmed for Sweden, Finland and Poland. Notice that a larger value of the coefficient of variation is found for the aggregates. This is so because a larger data set will normally increase the variation.

4. Growth, Trade and Competitiveness in the Nordic Hemisphere: Interregional Specialization - an Alternative Indicator of Coherence?

Until now, the analysis has focused on the regional (domestic) consequences of economic integration in the Baltic Rim region since the beginning of the transition processes in the East and the Central Europe. One driver behind this development is the change in trade and international specialization leading to a new type of spatial integration.

Spatial integration is not a common used phrase, but rather a kind of summary of a comprehensive notion dealing with an overall assessment of the importance of economic, political and social aspects of integrative processes in regional changes[1]. In particular, the last condition quoted in the footnote is restrictive. In this notion, the concept of spatial integration is the most far-reaching concept of integration, see also Table 3 below. In this analysis, the spatial concept is not merely a consequence of the physical environment, but also the result of economic and political integration.

In a BSR or regional perspective we have strong evidence that

[1] Among the features covered by the term 'Spatial integration' are:
"- The development of specific geographically defined systems of production such as industrial district, cluster of industries, or systems of innovation,
- A system of urban networks defined according to specific functional linkages,
- The availability of a relevant regional infrastructure linking the analyzed area together, and
- Last, but not least, the intensity of intra regional flows relative to the outside flows can be considered to be the 'conditio sine qua non' whether we talk about a spatial integrated area or not" Cornett (2008, p.212).

political and economic integration is 'powered' by spatial proximity and adjacency, but at the same time, political and economic integration reinforce the other aspect of spatial integration, accessibility, i.e. proposals for the development of traffic infrastructure.

The result of the process 'spatial integration' has to be seen in a dynamic perspective leading to trade and production system integration, here illuminated by regional trading figures offering a new perspective on interregional convergence in the BSR.

Table 3 illuminates the process of economic transition and integration based on intra-regional trade-flows for the BSR. The most important trend is that the Baltic Rim region is the dominant foreign trade partner for the smaller economies only, and that the last 5–6 years are characterized as a period of consolidation, only minor changes in the trading pattern have taken place. Of particular interest is that Russia seems to be back in a normal pattern after the extraordinary situation in the years around the turn of the millennium.

Table 3: Share of intra-regional trade (exports) as percentage of the total trade of the Baltic Rim countries since 1988

	1988	*1992*	*1996*	*2000*	*2006*
Denmark	39.8	48.7	42.5	40.9	43.6
Sweden	37.5	35.5	32.2	39.4	36.9
Norway	35.2	35.9	36.9	65.6	34.5
Finland	51.3	41.7	35.2	49.3	38.1
Germany (FRG)	13.5	8.6	9.3	9.6	11.2
German Democrat Republic (GDR)	24.6	…	…	…	…
Estonia	…	92.0	68.8	55.1	55.1
Latvia	…	61.8	48.8	45.9	33.4
Lithuania	…	57.8	46.1	33.3	55.5
Poland	46.7	47.4	48.2	29.7	39.8
Russia	34.1	18.9	21.5	75.2	22.9
Baltic Rim	26.5	17.9	18.9	19.9	21.0

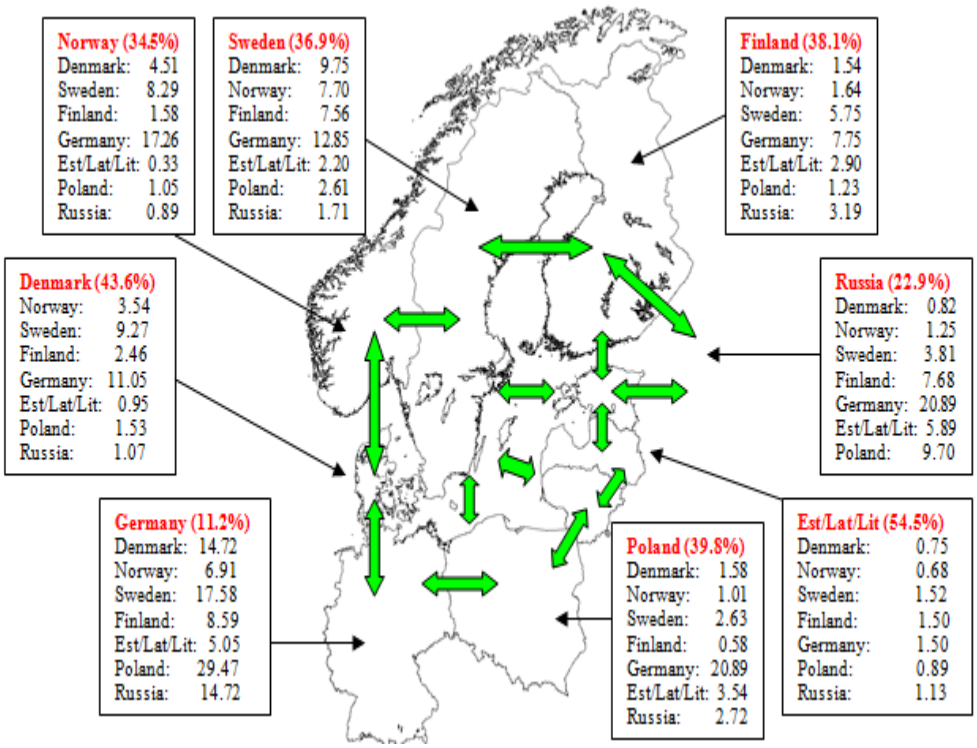
Note: Figures based on exports to Baltic Rim countries as pct. of total exports. All the data have been reported by countries receiving imports. Danish exports to Sweden 1992 are based on Danish exports. For 1992 some figures are missing for former state trade countries. 1998 figures are based on export to GDR and Soviet Union. Figures for GDR trade with Germany

and SU 1988 are based on German sources and converted to USD based on annual average exchange rate at Frankfurt (ultimo 1987 and 1988).
Source: IMF 1995, 1998, 2001 and 2007. Statistisches Bundesamt 1991.

Considering the nature and the size of the German economy, the importance of the Baltic Rim as a geographical region diminishes further. With regard to trends of trade, the three Baltic States are on the way toward a trade pattern more similar to the Nordic countries and find their historical place in the regional trading system as stated by Laaser and Schrader (1992). Only for Estonia and Lithuania the share of the BSR of total trade is above 50%. For the four Nordic countries, the share of BSR trade is between 34.5% for Norway and 43.6% for Denmark. Overall, the patterns have been very stable despite of the year 2000 for Norway, which is probably effected by energy exports, see below.

The issue of trade is further explored in Figure 4 giving the export in the Baltic Region based on reported imports from the receiving country. The figure is built up as a map where the textboxes gives the trade figures. The number in the parenthesis is the share of imports out of all imports from the Baltic Region. Especially the small Baltic nations and Denmark have substantial trade within the region. Notice also that the share for Germany is low. This is due to her size. Looking at the trade partners Germany is indeed important for all the other nations. Further, the map stresses the importance of the Linder hypothesis. In general, close relations are observed for countries sharing a land border line.

Figure 4: Intraregional Trade in the Baltic Sea Region based on Export in Billion €



Note: The number in the parenthesis is the share of exports out of all exports originating from the Baltic Region. Data has been converted from USD to € by use of the annual average exchange rate. The export figures are based on import data from receiving countries.
Source: Directions of Trade Statistics Yearbook (IMF 2007).

An alternative measure of coherence within the international system of production can be obtained by an analysis of specialization of international trade. One of the classical models of economic development stated that an increase in exports would lead to an increase in income. This export generated growth model will also be valid in a regional context. Sørensen (1996) developed a regional growth model with two trade

constraints namely a foreign one and a regional one. In general, regional trade was larger than foreign trade, due to the presence of the Linder hypothesis. Regions can be either domestic or internationally orientated relative to trade. It can be showed that this orientation has influence on the business cycle.

A commonly applied method in order to measure the amount of trade flows is to consider the amount of inter-industry trade. Intra-industry trade may be defined as the two-way exchange of goods in which neither country seems to have a comparative advantage. Intra-industry trade consists of the simultaneous exports and imports of products classified within the statistical product group *j*.

A straightforward application of this definition is the well known unadjusted GL_j index proposed by Grubel and Lloyd (1975) and defined for product group *j* as

$$GL_j = \left[1 - \frac{\left|X_j - M_j\right|}{(X_j + M_j)}\right] \times 100$$

X denoting exports and *M* imports. The index measures the amount of *IIT* in product group *j*. The value of the index will range from zero to 100 percent. When X_j or M_j equals zero there will be no overlap, so no *Intra-Industry trade* will take place. On the other hand if $X_j = M_j$ matching will be complete and GL_j equals unity. Further, the index is non-linear. For example, the rate of increase of GL_j for constant increases in M_j (or X_j) for a given level of X_j (or M_j), decreases as M_j (or X_j) increases. By weighted additive aggregation across all $j = 1, \ldots, N$ product groups we obtain the aggregate *GL*-index.

$$GL = \left[1 - \frac{\sum_{j=1}^{N}\left|X_j - M_j\right|}{\sum_{j=1}^{N}(X_j + M_j)}\right] \times 100$$

This index may be biased by at least two conditions working in opposite directions. First, a negative bias will be imposed, because trade at the industry level will match only by coincidence, trade overlap will arise, and the *GL*-index cannot attain its maximum value 1. Second, a positive bias will be imposed, from the use of categorical aggregation which occurs when products are inappropriately grouped together. For example, moving

from a lower to a higher SITC-level may result in the creation of heterogeneous product groups. This may lead to mismatch. See also Sørensen et. al (1991) and Lüthje (1997) who consider the issue of horizontal as well as vertical trade.

The idea behind this approach is to identify some of the fundamental trends of cooperation and integration of the international system of production in a regional BSR-context. It's well known that geographic proximity is one, if not the most, important factor behind international trade. Intra EU trade has dominated the foreign trade of the member states, just as trade with the EU had dominated the foreign trade of most non–EU countries in Western Europe before they became members. In particular, business to business trade - an indicator of the integration of the production system - is of increasing importance. In this perspective, growth of intra-industry trade is an indication of convergence of at least the production system of the involved economies[1].

An analysis of intra-industry trade based on Grubel-Lloyd type of index is very sensitive to the level of dis-aggregation of the data chosen for the analysis. If the dis-aggregation is very high, i .ex. 4 or 5 digit level of the SITC (Standard International Trade Classification), the analysis provides detailed insight into the nature of bilateral trade and in particular in the nature of the distribution of competitive advantages between countries. In any case also a less specified analysis can provide useful insight in the development and direction of integration and specialization processes within the BSR and with outside partners.

[1] For an application of the concept in a European perspective, see Cornett (2002), and in the BSR Cornett (2001). This section represents in many regards an update and extension of the results presented in the latter.

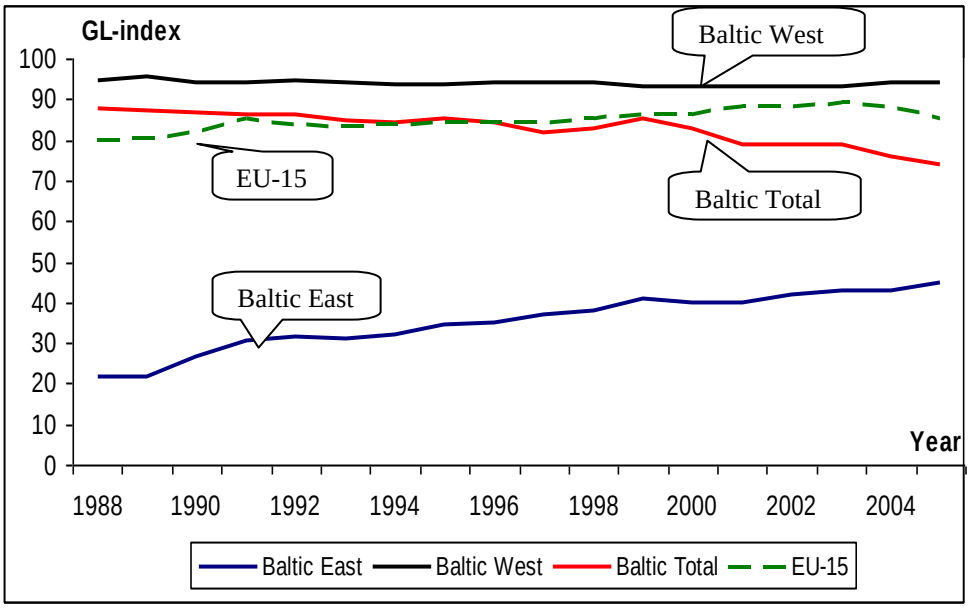


Figure 5: Intra-Industry Trade of Baltic Rim West 1988-2005

Note: Data according to Harmonized System Rev. 1 1988-1996 and Rev. 2 1996-2006. Grubel Lloyd index estimated on 2-digit level 100 (100 commodities). Commodity classification not fully comparable; data are based on chain-index. Chain is based on 1996 data.

Source: OECD, ITCS, 1998, 2000 and 2007.

Figure 4 provides an overview of the long-term trends of internal BSR intra-industry trade based on data reported from the five old market economies in the region[1]. A relation to the observed structure in income per capita found in Figure 2 and 3 is evident. The level of intra-industry trade in the Baltic East area is lower than in the Baltic West area where it is above the EU-15 average level.

[1] Unfortunately, the data from ITCS are only available based on OECD countries as reporting country, but the figure still provides a useful measure for trade integration and specialization in the BSR.

Table 4: ***Intra-Industry Trade in the Baltic Rim for the Six OECD Members in the Region***

	1996	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*
Denmark:											
Baltic East	31	32	31	36	32	35	39	40	42	48	47
Baltic Rim	72	70	71	73	76	77	78	78	76	73	72
EU-total	68	68	69	70	70	71	71	72	71	69	68
World	73	73	74	76	77	77	77	77	77	77	77
Finland:											
Baltic East	35	35	33	33	34	36	31	29	27	30	29
Baltic Rim	72	71	72	70	68	73	70	69	70	69	68
EU-total	59	58	56	55	52	55	54	52	54	59	60
World	63	63	64	63	64	65	63	63	65	67	67
Germany:											
Baltic East	32	32	36	40	40	41	44	47	43	43	42
Baltic Rim	47	46	49	51	50	51	52	51	49	52	51
EU-total	76	76	77	76	75	75	75	74	73	74	76
World	72	73	75	76	77	75	75	74	74	74	75
Sweden:											
Baltic East	41	48	49	49	50	45	44	46	48	45	…
Baltic Rim	77	79	81	80	79	80	79	81	82	80	…
EU-total	73	73	78	77	79	75	76	77	79	79	…
World	73	74	76	75	76	77	75	74	75	77	…
Norway:											
Baltic East	50	43	50	53	41	43	45	37	36	38	…
Baltic Rim	49	49	47	49	45	45	42	42	41	34	…
EU-total	34	34	38	36	30	30	29	28	26	23	…
World	39	38	41	40	33	36	37	35	33	31	…
Poland:											
Baltic East	13	11	12	12	8	9	10	10	11	12	…
Baltic Rim	33	35	35	33	37	41	45	49	53	54	…
EU-total	48	50	52	54	61	62	65	66	69	68	…
World	52	53	55	56	61	65	69	70	75	73	…

Note: Data according to Harmonized System Rev. 2 1996-2006. Grubel Lloyd index estimated on 2-digit level 100 (100 commodities).
Source: OECD, ITCS, 2007.

During the period, the amount of intra-industry trade in the Baltic East region has been constantly increasing. Overall, a moderate pattern toward convergence of foreign trade toward a higher share of intra-industry trade indicate the integration into the western market based a system of production. If the analysis is conducted on a rather modest level of dis-aggregation, the results have to be interpreted carefully. In this case, a high level or increasing share of intra-industry trade is only an indication of sectoral convergence of the considered economies foreign trade sectors. The figures reported in Table 3 and 4 have to be seen in this perspective.

Table 4 provides a brief overview of the level of intra-industry trade of the six OECD member countries in the region. Apart from Germany, the level of intra industry trade for the old market economies in the Baltic Rim area as a whole is higher compared to the total of foreign trade. The considerable low level of intra-industrial trade in the case of Norway is caused by the high share of crude oil and fuel in Norway's exports. With regard to East-West trade, intra-trade is significantly lower, but generally increasing during the period reported. The latter can be seen as an indicator of increasing integration of the transition economies into the regional system of production and specialization. An examination of non-agricultural trade confirms the pattern reported in Table 3, generally with slightly higher scores on the Grubel Lloyd index (Cornett and Sørensen 2008a).

The figures for the Baltic rim countries as a whole shows a high degree of coherence for the production system defined as high shares of intra-industry trade[1] measured on the 100–digit level. To what extent this can be interpreted as traditional trade based on comparative or competitive advantage is a another question, since the low level of disaggregation of our data does not allow a closer examination of intra-industrial trade, but only indicates the linkages of the production systems between the old and new market economies. In our analysis, this underpins the division of functions in the spatial production system rather than an overall convergence of the systems[2].

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[1] The figures reported here underestimate the intra-industry trade of the EU countries in the region because of the lower level of intra-trade of the transition economies (and Norway) being included.

[2] This is in accordance with the findings in Paas & Tafenau (2005, p. 15): "The clear

According to the approach of this study, the level of intra-industry trade on the high level of aggregation is used as an indicator for integration of the production system, partly based on comparative advantages, partly and over the course of time to a higher degree on competitive advantages.

Table 5: Intra-Industry Trade of the 5 Western BSR-countries with selected partners

	1996	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*
World:											
All commodities	73	73	74	76	77	77	77	77	77	77	77
Non agricultural products	79	78	78	81	81	82	81	81	80	80	80
EU-15:											
All commodities	68	68	69	70	70	71	71	72	71	69	68
Non agricultural products	73	74	74	74	74	76	75	76	74	72	70
BSR-West:											
All commodities	95	95	95	94	95	95	95	95	95	96	82
Non agricultural products	95	95	96	94	95	95	94	95	95	96	82
Estonia:											
All commodities	53	51	47	55	60	47	48	50	55	56	54
Non agricultural products	55	53	48	57	61	48	49	51	56	57	56
Latvia:											

distinction of the BSR as a trade cluster supports the view that there have been special relationships between countries of the region in existence favouring quick integration of economies with different factor endowments". This is also supported by the important role the western BSR countries have with regard to Foreign FDI in the eastern part of the BSR, see Cornett & Snickars (2002).

All commodities	36	39	34	28	24	23	24	26	27	38	29
Non agricultural products	39	41	35	27	24	22	24	26	26	38	29
Lithuania:											
All commodities	27	25	26	33	31	28	30	30	33	34	33
Non agricultural products	27	24	25	31	31	28	29	29	33	33	32
Poland:											
All commodities	28	29	28	29	35	38	41	45	49	50	51
Non agricultural products	28	29	28	29	35	39	42	46	49	49	51
Russia:											
All commodities	15	14	15	13	12	12	13	12	10	9	9
Non agricultural products	15	14	14	13	11	11	11	11	9	9	8

Note: Data according to Harmonized System Rev. 2 1996-2006. Grubel Lloyd index estimated on 2-digit level 100 (100 commodities). Figures for 2006 do not include data for Norway and Sweden.
Source: OECD, ITCS, 2007.

Usually, as mentioned above, this also leads to a higher level of intra-industry trade development for the nonagricultural trade. In previous studies this was much more significant (compare Cornett (2001) and (2002)). According to Cornett & Sørensen (2008a) the difference still exists, but has narrowed down during the analyzed period. The overall level is almost stable for the old market-economies, but as mentioned already the trade with the post-communist countries has continued toward higher shares of intra-industry trade[1]. The faster change of agricultural trade has

[1] The figures of the 5 Western BSR economies are to some extent affected by the fact that the BSR-level of intra-industry trade for Norway declined from 46–47 to 30 on the two

several explanation, i.e. that the agriculture also has become an increasingly international integrated industry both within the old market economies and with regard to the eastern part of the BSR.

5. Convergence and Spatial Integration in Northern Europe – Results and Perspectives

Regional divergence and overall European convergence has been visible for many years, not only in the old western EU-15, but also in the enlarged European Union (EU-25). This paper has reexamined the pattern with special attention on Northern Europe, i.e. the Baltic Rim region. The initial hypothesis that large intra-regional disparities not necessarily lead to lower economic growth on national level than smaller disparities do is confirmed by the present analysis of data for income and trade.

The Baltic Region is a region with large intra-regional disparities[1].

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indicators from 1996 to 2005, representing the huge increase in the relative importance of energy in Norwegian exports.

[1] The table below summarizes the nature of intraregional differences by comparing the richest and poorest regions in the BSR countries based on NUTS II regions of the EU regional classification were applicable or based on national data similar to EU NUTS III level. Within all BSR countries huge regional disparities exist, but due to differences in the regional delimitation the figures are only rough indications, but very illustrative. The most interesting measure is probably to compare the poorest region with the national average rather than with the best performing area, often a rather narrow defined metropolitan region heavily depending on commuting from suburbs outside the city-limits.

Regional disparities in BSR countries 2000 (GDP per cap. PPS)

	National average		*Richest BSR region*		*Poorest BSR region*	
	EU-15 100	*EU-25 100*	*Name*	*Index EU-15*	*Name*	*Index EU-15*
Germany	106.4	117.3	Hamburg	181.5	MVP	69.4
Denmark	118.6	130.7	…	…	…	…
Finland	104.0	114.6	Uusimaa	143.2	Väli-Soumi	74.5
Sweden	106.6	117.5	Stockholm	147.0	Norra Mellan	91.0
Poland	38.9	42.8	Pomorskie	39,1	Waminsko Maz.	29.0
Lithuania	35.7 (29)	39.3	Vilnius	(35)	Taurage	(22)
Latvia	30.9 (26)	34.0	Riga	(37)	Latgale	(16)
Estonia	40.1	44.2	Közép-Mag.	75.6	Észak-Alföld	31.5
Russia	…	…	…	…	…	…

The level of GDP per capita is much lower in the former planned economies Poland, Estonia, Latvia and Lithuania than in the Scandinavian economies. Even the wealthiest region in Poland is on a significant lower level than the poorest region in the former East Germany.

Economic growth and the development of inter- and intra-regional disparities are investigated by using the concept of β-convergence. The analysis of the countries confirmed the overall pattern of convergence among the nations forming the Baltic Region for the period from 1995 to 2004. The degree of convergence is more than 2.5 times higher for the Eastern Baltic region reaching a level of 6.83 percent than for the Baltic West region. This pattern is confirmed by use of σ-convergence. At the national level, the picture is much more unclear. The Baltic East region has experienced some very high levels of growth rates. However, in Baltic East region as well as in Baltic West region a pattern of divergence is observed, and confirms previous tendencies. The metropolitan regions and large cities are moving away from the rural districts. This pattern is especially visible in Poland, Sweden and Finland. For Germany and Norway, convergence is observed. The Baltic parts of Poland and Germany has not experienced a diverging pattern relative to the national patterns due to the geographic location. So, here a special Baltic effect is not observed.

The tendency toward a more homogenous development is also confirmed by the analysis of bilateral trade and specialization. In general, the nations around the Baltic Sea are deeply engaged in trade with each other. Especially, the three small Baltic economies have a high intra-regional trade share, in some case exceeding 50 percent. In 2006, the share for all countries except Germany and Russia were above 1/3 of the total exports of the countries. With regard to the integration of the Eastern part of the BSR into the Western production system, here measured by the level of intra-industry trade; the Baltic East is still on a much lower level than intra-industry trade among the Nordic countries. Whereas the level of

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Note: *Germany: Schleswig Holstein, Hamburg, Meklenburg Vorpommern (MVP). Poland: Pomorskie Waminsko Maz. Kujawsko-Pomorskie Figures for Lithuania and Latvia: (1996).*
Source: *European Commission (2003), Table 12. Nordregio (2000), here quoted from Cornett (2004), p.132.*

internal intra-industrial trade of the western BSR-countries and with the EU as a whole has been stable in the investigated period, the intra-industrial trade with the Eastern parts of the BSR shows a constant positive trend doubling the index-value from 1990 to 2005, see Figure 5 above.

Appendix 1: Baltic Regions in Poland and Germany

Germany Baltic:
Schleswig-Holstein, Hamburg, Lüneburg, Mecklenburg-Vorpommeren, Brandenburg and Berlin.
Poland Baltic:
Zachodniopomorske, Pomorskie, Warminsko-Mazurskie, Kujawsko-Pomorskie and Podlaskie.

Notice that the number of regions is larger than indicated due to a more detailed division of our statistics than indicated by the map below.

References

1. **Abreu, Maria, Henri L. F. de Groot and Raymond J.G.M. Florax** (2005) *A Meta-analysis of β-Convergence: The Legendary,* Journal of Economic Surveys 19.
2. **Barro, Robert J., and Xavier Sala-i-Martin** (1991) *Convergence Across States and Regions,* Brookings Papers on Economic Activity 1.
3. **Corrado, Luisa, Ron Martin and Melvyn Weeks** (2005) *Indentifying and Interpreting Regional Convergence Clusters across Europe*, in Economic Journal, 115.
4. **Cornett, Andreas P.** (2008) *Economic Integration in a cross border perspective: An emerging new system of production,* in International Journal of Public Policy, Special issue European Integration, Regional Growth and Cohesion, Inderscience publishers.
5. **Cornett, Andreas P.** (2004) *Regional Perspectives on Integration in the Baltic Sea Region,* in Søren Dosenrode and Henrik Halkier, The Nordic Regions and the European Union, in 'The International Political Economy of New Regionalisms Series, Asgate, Aldershot, UK & Burlington, VT, USA 2004.
6. **Cornett, Andreas P.** (2002) *Regional Cohesion in an enlarged European Union - an analysis of inter regional specialization and integration*, in Cuadrado-Roura, J.R. and Parellada, M. (eds), The European Monetary Union and Regional Convergence, Facts Prospects and Politics, Advances in Spatial Science, Springer-Verlag Heidelberg New York, 2002.
7. **Cornett, Andreas P.** (2001) *Regional Economic Integration in the Baltic Rim: Towards a European Region after ten Years of Transition?,* in Johannes Bröcker and Hajo Herrmann (eds.) Spatial Change and Interregional flows in the Integrating Europe - Essays in Honor of Karin Peschel, Contributions to Economics, Physica Verlag, Heidelberg_New York 2001.
8. **Cornett, Andreas P. and Folke Snickars** (2002) *Trade and Foreign Direct Investment as Measures of Spatial Integration in the Baltic Sea region*, in GEOGRAHIA POLONICA, 75, 2 autumn 2002.
9. **Cornett, Andreas P., and Nils Karl Sørensen** (2008a), *Interregional and intra-industry trade in the Baltic Sea Region*, back ground paper for the Vasab 2020 initiative, Danish Institute of Border Region Studies (IFG), Sønderborg, 2008. (http://www.vasab.org/i/documents/projects/APC-NKS-Vasab-report-final.doc. Last accessed December. 2010)
10. **Cornett, Andreas P. and Nils Karl Sørensen** (2008b) *International vs. Intra-national Convergence in Europe – an Assessment of Causes and Evidence*, in Investigaciones Regionales No. 13, Otoño 2008, Asociación Española de Ciencia Regional, Madrid.

11. *Danmarks Statistik,* Regional accounts, Copenhagen, Denmark.
12. **Eckey, Hans-Friedrich and Matthias Türck** (2008) *Convergence of EU-Regions: A Literature Report*, in Investigaciones Regionales, No. 12, Asociación Española de Ciencia Regional, Madrid.
13. **European Parliament** (2007) *Regionale Ungleichheiten und Kohäsion – Strategien für die Zukunft,* Fachabteilung Struktur- und Kohäsionspolitik, Mai 2007, Brüssel (IP/B/REGI/IC/2006_201 PE379.205 DE).
14. **Eurostat** (2007) *Regio Data* www.europa.eu.
15. **Fadejeva, Ludmila, and Aleksejs Melihovs** (2008) *The Baltic states and Europe: common factors of economic activity,* in Baltic Journal of Economic 8, no. 1.
16. **Gorzelak, G.** (2008) *Development of Polish Regions and the EU Cohesion Policy,* in Stubelt, W., and Gorzelak, G. (editors): City and the Region. Papers in Honour of Jiri Musil. Budrich UniPress, Opladen and Farmington Hills.
17. **Grubel, Herbert G., and Peter J. Lloyd** (1975*) Intra-Industry Trade*, Macmillan Press. London.
18. **IMF** (1995ff), Direction of Trade Statistics Yearbook, Washington.
19. **Laaser, C.-F. and K. Schrader** (1992) *Zur Reintegration der baltischen Staaten in die Weltwirtschaft*, in Die Weltwirtschaft, Heft 2, 1992, Kiel.
20. **Lütje, Teit** (1997) *Om opgørelsen af den danske intra-industrielle handel*, pp. in Nationaløkonomisk tidsskrift, 1997, Vol. 135, no. 3.
21. **Molle, Willem** (1999) *The Dynamics of Economic Integration and the Cohesion in the EU: Experience from the Past and Challenges for the Future*, in Fischer, M.M. & P.Nijkamp, (eds.) Spatial Dynamics of European Integration Regional and Policy Issues at the Turn of the Century, Springer-Verlag Berlin/Heidelberg 1999.
22. **Neubauer, J., Dubois, A., Hanell, T., Lähteemäki-Smith, K., Petterson, K., Roto, J., and Steineka J.M.** (2007) *Regional Development in the Nordic Countries,* Nordregio Report 2007*:1*.Stockholm.
23. **Norges Statistik**, *Regional accounts*, Oslo.
24. **OECD-ITCS** (1998, 2000 and 2007*), International Trade by Commodities Statistics*, Harmonized System, Paris.
25. **Paas, Tiiu and Egle Tafenau** (2005) *European trade integration in the Baltic Sea Region – A gravity model based analysis*, HWWA Discussion Paper 331, Hamburgisches Welt-Wirtschafts-Archiv (HWWA) Hamburg Institute of International Economics, Hamburg.
26. **Quah, Dan** (1993) *Galton's Fallacy and the Tests of Convergence Hypothesis,* in CEPR Discussion Paper no. 820, London.

27. Solow, Robert M. (1956) *A Contribution to the Theory of Economic Growth*, Quarterly Journal of Economics 70.

28. *Statistisches Bundesamt* (1991), Statistisches Jahrbuch 1991 für das vereinte Deutschland, Metzler Poeschel Wiesbaden 1991.

29. Sørensen, Nils Karl, Bent Dalum, Erik Strøjer Madsen and Jørgen Ulff-Møller Nielsen (1991), *Intra-Industry Trade in Denmark and Ireland. Memo 1991-19*, Department of Economics, University of Aarhus.

30. Sørensen, Nils Karl (1996) *Regional Trade and Modeling Regional Growth. The Case of the County of South Jutland*, in: Mønnesland, J. et.al. (editors): Regional National Accounts in Scandinavia, NordREFO Working Paper series *1996:9*.