MODELS OF REGIONAL SPECIALISATION AND INCOME DYNAMICS IN TRANSITION TO EU: EVIDENCE FROM ESTONIA

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Abstract

In the present paper we model development of regional specialisation and income dynamics in Estonia during 1993-2000 in the context of trade liberalization and integration with EU. A set of specialisation indices are calculated to study regional industrial dynamics and identify some internal factors that induced observed structural change, such as quality of infrastructure, availability of local supply networks, socio-economic conditions, etc.
Taking into account actual liberalisation of trade with EU, we study industrial specialisation and regional growth. Dynamics of real regional income are explained through interrelationships between various structural indicators. We find that proxies of quality of human capital, infrastructure and entrepreneurship are important factors in explaining regional growth dynamics. The results of this study may shed some light on a problem of allocation of EU structural aid.

1. **Introduction**

Since the early 1990s integration with EU has been one of the main engines of the economic growth and a source of improving social and economic well-being in Central and Eastern Europe.

Until now, the process of integration in Europe has been characterised by a two-fold effect on geographical distribution of income. Amiti (1998) and Hallet (1997) notice that while incomes in EU tend to converge on a national level, regional inequalities within the member countries are widening.

In this paper we wish to study an evolution of regional manufacturing structure in Estonia and to determine the impact of specialisation and various regional parameters on development of regional income. Specifically, we analyse the impact of factors associated with structural change, such as quality of infrastructure and human capital. We also try to assess what stage of regional development Estonia is currently undergoing in order to set the ground for policy modelling in allocation of the EU structural funds between Estonian regions. As Hallet (1997) *inter alia* suggested, there may exist a trade-off between better regional convergence and faster growth on a national level, which needs to be taken into account in the accession economies.

Conventional growth theory provided analytical framework that underlined the differences in productivity across regions and predicted convergence of regional income levels in the long run. However, a number of empirical studies conducted in Europe at various times confirmed the opposite, and demand for a new explanation arose (see, for example, Karsten (1996), Aiginger (1999), Haaland et al. (1999)).

A different approach was suggested by the new economic geography theorists. Their models were based on explicit assumption of monopolistic competition and increasing returns to scale. Under these assumptions, new theoretical predictions on development of the industrial production patterns have been proposed.

Applying new economic geography to the analysis of industrial dynamics in the transition economies yields the following argument. First, once the planned economy restrictions are abolished, companies in the open market start to allocate production closer to the regions with higher potential to consume. Given generally low levels of initial personal income in transition states, industrial production becomes driven by an external demand for exports. Therefore, regions that attract manufacturing at the initial stages of transition are most probably centres (capital regions) and regions with best access to the export market (border regions). However, as economic integration proceeds and FDI to the profitable central regions increases, marginal transport costs within a country become less important compared to the costs of immobile factors of production (rent and wages) in the agglomerates. Thus, when country reaches a certain level of transport costs, the initial industrial pattern starts to change, and economic activity spreads to the periphery.

Various researchers have frequently pointed out that it is difficult to evaluate empirically the theoretical assumptions outlined above (e.g.Venables (1998), Krugman (1998)). However, some attempts have been made. Hanson (1994) develops a methodology for evaluation of convergence of real regional wages. He looks at the apparel industry in Mexico and finds an indirect support to the new economic geography hypothesis. Brakman, Garretsen and Schramm (2001) apply the Helpman-Hanson model to analyse mechanism of regional development in Germany after unification and find that the new economic geography approach is able to explain the spatial characteristics of German economy.

In spite of the methodological breakthroughs, most of the researchers focus on inter-regional (such as Southern Europe, cohesion countries) development rather than on regional dynamics within one country. Tondl (1999) applies GMM to analyse disparities between Southern European regions. Hallet (1998) provides empirical results based on the EU regional industrial GVA data[1]. As a result, it is still rather unclear if the combined impact of small territory and position on the outskirts of European economic center undermines a role of transportation/infrastructure costs within a country.

Our empirical analysis attempts to fill this gap. We study five regions of Estonia at NUTS III level; using indicators of regional industrial activity, we look at dynamics of specialisation indices in the context of integration with EU and structural change.

[1] Some researchers focused on different aspects of regional disparities. E.g., Sibley and Walsh (2002) estimate impact of restructuring on regional earnings inequality in Poland. Kangasharju and Pehkonen (2001) look at the regional differences in employment-output relation and find partial explanation in differences in industrial specialization.

Rest of the paper is organized as follows: Section 2 describes the data set and the methodology. Section 3 gives an overview of the trade liberalization and process of integration with EU. Section 4 sketches the evolution of regional industrial activity in Estonia. Section 5 focuses on the modelling the interrelationship between various indicators of structural change and the dynamics of real regional income. Section 6 concludes.

2. The data.

In this study we used a panel data on employment in 5 geographic regions that were aggregated at NUTS III level according to DG Regio classification. For each region we calculated indices of regional specialisation based on the data for employment in manufacturing industries classified according to a two-digit NACE standard (total of 13 industries). It was impossible to conduct analogous study at the less aggregated level (for example, by counties) due to the lack of more specified employment data. We used time series provided in the Labour Force surveys by Estonian Statistical Office in 1990-2000.

Potential threat to reliability of the analysis was low confidence of data on some industries in certain regions due to a small sample of employment measure. However, as a low degree of confidence was likely to be associated with only the least significant industries by regions, it would not change the main trend in regional development, and might only cause fluctuations of the annual indicators within particular industries.

Wide set of regional parameters that indicate structural change was taken from the yearbooks of regional statistics of Estonia for 1992-2000. We also used regional development indicators for 1992-2000 that were published by the Statistical Office of Estonia.

The data source for analysis of foreign trade flows was a database of the Foreign Trade Division of Estonian Statistical Office. All commodities were classified according to the Estonian Goods Nomenclature (EGN) issued in 1993. The first six digits in the EGN are equivalent to the Harmonized System (HS) nomenclature that is used in international trade. The nomenclatures divide trade commodities into 21 broad sections and 97 chapters. We analyse development of commodity flows at the level of HS two-digit chapters, as broad NACE classification by manufacturing sectors is unreasonably high level of aggregation for Estonia. It is easy to link HS two-digit sectors and NACE broad manufacturing sectors.

Analysis of the dynamics of regional income presented in this paper was somewhat restricted by the lack of data on regional GDP in Estonia: regional GDP figures have been available only for 4 years since 1996. Using these data would not allow us to take an advantage of fairly long time series of regional indicators. Therefore, we calculated a proxy of regional GDP as an aggregated index comprising major GDP components measured by method of outflows:

$$g_{j,t} = 0,5*Icons_{j,t} + 0,2*Iinv_{j,t} + 0,2*Igov_{j,t} + 0,1*Iexp_{j,t}$$

where I indicates growth indices, $g_{j,t} = y_{j,t}/y_{jt-1}$
$Icons_{j,t}$ - index of regional disposable income in the year t
$Iinv_{j,t}$ – index of investments regional investment in fixed assets in year t
$Igov_{j,t}$ index of expenditures in local budgets in year t
$Iexp_{j,t}$ - index of special export without re-export in year t
y – proxy of regional GDP

Weights for the calculation were taken from the national account tables as the 1995-2000 averages. We estimated export weights so that the sum of the coefficients was normalized. Obtained index is a proxy of regional GDP growth in 1995-2000. Appendix 1 shows calculated index of regional economic growth in comparison with the available annual growth rates of Estonian GDP in total.

3. Trade liberalisation and industrial specialisation

Estonian economy is characterised by a high degree of openness. As in the case of any small open economy, liberalisation that has occurred after Estonia gained independence has been driven by a need to expand domestic production overseas in order to take an advantage of economies of scale. An indirect assessment of a degree of dependence on the foreign economies can be illustrated by the shares of Estonian imports and exports in GDP: 95% and 91% respectfully in 2001.

One of the factors that favoured Estonian economic liberalisation has been geographical location between Russia and EU and direct access to the Baltic Sea. Geographical location of Estonia enabled to establish very close trade relations with Western-European, Scandinavian and CIS countries offering transit services for commodity flows from west to east (mainly to Russia) and in the opposite direction.

Estonian foreign trade policy has been based on liberal principles and can be described by the following features[2]:

- no restrictions to a free movement of goods and capital;
- minimal regulation of the wage formation mechanism, foreign trade and property rights;
- minimal import duties only on the agricultural products, which weighted average is no more than 3.3%;
- liberal price formation mechanism.

Ratification of the bilateral agreements on free trade has formed a legislative basis for robust development of trade with EU (including potential members countries). In February 1992, a protocol was signed on temporary measures of economic and trade cooperation with Finland. Ratification of the free trade agreements with a number of other countries followed, including Sweden (July 1992), Norway (September 1993) and Switzerland (March 1994). The Free Trade Agreement between Estonia and EU was signed in July 1994 and entered into force in January 1995. As a result, a free trade area has been created between Estonia and the European Union where all trade barriers to industrial products were abolished. The only restriction to Estonian imports into EU is applied on Estonian agricultural products.

[2] See http://www.mineco.ee for details.

At present, foreign trade relations between Estonia and EU are regulated by the Europe Agreement (signed in August 1995, entered into force in February 1998) that incorporates all provisions and mandates of the Free Trade Agreement.
Estonia has been a full member of the World Trade Organisation (WTO) since November 1999.

Next, we look at the main characteristics of Estonian foreign trade.

Change of geographical trade patterns

Since the beginning of transition, a rapid re-orientation of Estonian foreign trade from the markets of CIS countries to western markets took place (see Table 3.1). This re-orientation can be explained by adjustment of centrally imposed structure of trade with the former eastern block countries towards territorial structure naturally determined by the factors of geopolitical location, comparative advantage and foreign demand.

Table 3.1

Development of geographical structure of foreign trade, %

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Export:										
EU	0.2	13.6	17.8	19.0	54.0	51.0	48.5	55.0	62.8	68.4
EFTA	2.8	36.4	31.5	30.9	2.4	2.8	3.8	3.7	3.0	3.2
CIS	82.9	35.2	30.4	30.3	25.1	25.1	26.4	20.7	13.5	9.7
European Transition Countries	12.3	10.0	14.8	15.3	13.8	15.5	15.8	15.1	13.8	11.9
Other	1.8	4.8	5.5	4.5	4.7	5.6	5.5	5.5	6.9	6.8
Import:										
EU	3.1	15.6	23.3	23.9	66.0	64.6	59.2	60.1	57.7	56.1
EFTA	3.1	32.0	38.1	40.7	1.7	2.1	2.2	2.2	2.1	2.0
CIS	73.3	36.0	21.6	20.4	18.8	17.0	17.4	14.2	17.0	17.7
European Transition Countries	13.2	5.9	7.0	5.8	5.6	6.2	5.7	6.3	7.4	7.4
Other	7.3	10.5	10.0	9.2	7.9	10.1	15.5	17.2	15.8	16.8

Source: Estonian Statistical Office.

Among the reasons for trade re-orientation in the beginning of transition were deterioration of terms of trade with Russia since 1992 caused by high inflation in Russia, collapse of the system of payments, introduction of import tariffs, rise in prices on raw materials, vulnerability of overall economic situation. In many cases, Estonian firms preferred importing more expensive raw materials from the west in order to guarantee just-in-time deliveries and quality that compensated for the price differential with more exposed Eastern market.

Just after monetary reform in Estonia in 1992 exports to western markets became highly profitable and have rapidly increased since due to significant difference in prices between the two regions. Initial rise occurred in such commodity groups as textiles, wood, paper and other products that are material- and labour- intensive. Trade structure with western countries conforms to the principle of geographical closeness: the largest trade partners are Finland, Germany, and Sweden. Share of the EU countries in Estonian foreign trade has increased.

Analysing geographical reorientation of foreign trade it is necessary to specify the ways in which it has occurred. One should distinguish growth of trade with western markets at the expense of trade decline with eastern markets in respective sectors (trade diversion), and originating of new commodity flows to the western markets (trade creation). In addition, the reasons of re-orientation could also be growth of re-exports, reorientation of domestic sales to external markets because of reduction of domestic demand, smaller decrease of exports to one market in comparison with other etc.

Due to the lack of statistical information, it was impossible to analyse actual trade diversion at the commodity groups level. Therefore, we calculated Finger-Kreinin coefficient (FK)[3] to study actual trade diversion at disaggregated level. This coefficient captures similarity of trade flows between two regions. Trade diversion may result in increasing similarity. Similarity falls if no diversion happens.

Table 3.2 shows values of Finger-Kreining trade similarity coefficients of exports and imports between EC + EFTA and CIS countries in 1993-2000. A decreasing similarity of exports between these two areas can be noticed, signifying that no essential trade diversion occurred in export flows in the given period. Partly it can be explained by the fact that impulse for trade creation with western countries have been western investments, which made structure of export to EU and EFTA more divergent from CIS countries.

Table 3.2

Finger- Kreining coefficients of similarity between Estonian foreign trade with EC+EFTA and CIS*

	1993	1994	1995	1996	1997	1998	1999	2000
EXPORT	0.4690	0.3779	0.3949	0.3247	0.3083	0.2965	0.2938	0.3008
IMPORT	0.4114	0.3826	0.3699	0.3172	0.3023	0.2911	0.2929	0.2611

Source: Estonian Statistical Office, own calculations.
** prior to 1996 general trade system*

Import similarity between the two areas has also declined indicating that main import articles from eastern markets (mostly raw materials) have remained unchanged, and growth of imports from the west has occurred on behalf of expansion in other commodity groups.

Comparative advantage

We used a specialisation index[4] to measure international specialisation of Estonian exports on the EU market (estimate external comparative advantage).

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[3] $FK(i) = \sum_i [\min s(i,k), s(i,l)]$ where: s(i,k) and s(i,l) are export and import shares of sector i in export (import) to (from) markets k and l respectively

[4] Specialisation index calculated as follows: $SI = \dfrac{X_i / \sum_i X_i}{M_i^{EU} / \sum_i M_i^{EU}}$

Where X(i) – Estonian export in commodity group i, $M(i)_{eu}$ – Imports to the EU in commodity group i

Table 3.3 represents commodity groups with the highest specialisation index in Estonian foreign trade with EU.

Table 3.3

Commodity groups with highest specialisation index in Estonian foreign trade with EU, 1995-2000, ranked by ratio values in 2000

		1995	1996	1997	1998	1999	2000	2000/1995
53	Other vegetable fibres	7.18	4.26	1.58	12.74	18.30	23.75	3.31
44	Wood and articles of wood	11.26	12.29	14.11	13.97	14.92	11.38	1.01
43	Fur skins and artificial fur	5.45	13.57	7.91	8.11	10.31	10.09	1.85
4	Diary products	28.22	17.58	18.11	6.16	5.80	10.02	0.35
94	Furniture; bedding; mattresses, etc	6.08	7.65	6.18	6.17	6.19	5.22	0.86
63	Other made-up textile articles	4.77	6.24	5.93	5.76	5.53	4.93	1.03
52	Cotton and articles thereof	3.62	6.04	5.53	4.51	3.96	4.18	1.15
56	Wadding, felt and nonwovens	3.83	5.88	5.00	3.77	3.21	3.06	0.80
85	Electrical machinery and equipment	0.52	0.82	1.73	2.13	2.01	2.83	5.41
31	Fertilizers	3.91	3.99	1.86	1.48	1.02	2.71	0.69
73	Articles of iron or steel	2.09	2.92	3.25	2.83	3.20	2.59	1.24
62	Articles of apparel and clothing accessories etc.	2.78	2.77	2.57	2.40	2.46	2.00	0.72
65	Headgear and parts thereof	3.64	3.27	2.61	2.45	2.27	1.88	0.52
3	Fish and crustaceans	2.92	1.72	1.26	1.53	1.53	1.73	0.59
14	Vegetable plaiting materials	2.13	2.47	1.58	1.35	1.94	1.61	0.76
72	Iron and steel	1.75	1.76	1.70	1.41	1.73	1.53	0.87
57	Carpets and other textile floor coverings	0.29	0.47	0.59	0.72	0.74	1.51	5.13
64	Footwear, gaiters and the like	1.96	2.42	1.66	1.74	1.83	1.46	0.75
48	Paper and paperboard	0.84	1.36	1.21	1.08	1.22	1.45	1.72

Source: database of Foreign Trade Division of the Estonian Statistical Office, COMEX database, own calculations.

The greatest commodity groups with fairly high comparative advantage on the EU market are wood and articles of wood; furniture; dairy products; made-up textile articles, cotton; articles of iron or steel; apparel and clothing accessories; electrical machinery and equipment; footwear; fish; apparel and clothing accessories.

In 1995-1999, comparative advantage on the EU market increased for the following groups: wood and articles of wood; fur skins and artificial fur, cotton, articles of iron or steel, electrical machinery and equipment, carpets and other textile floor coverings, paper and paperboard. Comparative advantage on the EU market has declined for the following groups: dairy products, apparel and clothing accessories; footwear, furniture, fertilizers.

GDP per capita growth

To conclude our analysis of integration with EU, we look at the evolution of real income per capita in Estonia. Table 3.4 shows values and growth rates of GDP per capita in Estonia during the transition years.

Table 3.4

GDP per capita in Estonia in 1994-2001, in euros and %

Estonia	1995	1996	1997	1998	1999	2000	2001
GDP per capita	1810.4	1912.9	2141.4	2270.4	2277.2	2446.6	2588.2
GDP per capita real growth rates	6.18	5.92	11.5	6.97	0.68	7.32	5.8

Source: Estonian Statistical Office

Remarkable growth records allow assuming that a real convergence towards the EU income levels has started taking place.

In the next section, we wish to determine what changes have occurred to Estonian regional development in the face of a rapid liberalization.

4. Regional developement patterns

Rapid liberalization and increase in foreign trade that followed restoration of Estonian independence sped up a collapse of the initial regional industrial structure and determined pace and direction for regional development in the consequent years. Having outlined the main characteristics of Estonian trade with EU, we now intend to look at the major trends in Estonian manufacturing. We start with a brief description of regional structure and disparities to proceed with analysis of regional specialisation and evaluation of observed structural change.

Regional structure and disparities

The biggest regional division of Estonia is determined only at NUTS III level. A second aggregated regional level is whole Estonia: it is represented as a regional unit at NUTS II level, and as an administrative entity at NUTS I. Table 4.1 shows five regions of Estonia[5] at NUTS III level, administrative units (counties) that each of the regions comprises, and some general economic characteristics.

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[5] Since 2001, new regional breakdown laid down by Regulation No. 126 of the Government of Estonia has been used. Counties are aggregated as follows:

Northern Estonia - Harju county (incl. capital city Tallinn),

Central Estonia - Järva, Lääne-Viru, Rapla counties,
Northeastern Estonia - Ida-Viru county,
Western Estonia - Hiiu, Lääne, Pärnu, Saare counties,
Southern Estonia - Jõgeva, Põlva, Tartu, Valga, Viljandi, Võru counties.

Table 4.1

Regional structure of Estonia

Regions at NUTS III level	Included counties (NUTS IV)	Area in Km^2 (% of total)	Population of region (% of total)	Regional GDP per capita 1998 (% of country average)
Northern	Harju county (Tallinn included)	4331.6	37.02	162.99
Western	Lääne, Pärnu, Hiiu and Saare counties	11134.68	12.94	55.90
Southern	Tartu, Põlva, Võru and Valga counties	9506.48	18.77	60.14
Central Estonia	Viljandi, Jõgeva, Järva and Rapla counties	11629.22	12.72	69.21
North-Eastern	Lääne-Viru and Ida-Viru counties	6828.63	18.56	66.51

Source: Estonian Statistical Office

Below we present a brief description of each of the NUTS III regions.

Northern region including capital Tallinn is by far the biggest economic region in Estonia with more than a third of the Estonian inhabitants living there. Share of industrial employed in the region in total industrial employment has slightly varied around 37%, share of employed in manufacturing to total regional employment is ca. 30%. In 1998 Northern region produced more than a half (52%) of total industrial output. Unemployment rate has been one of the lowest in Estonia, 6.4% in 2001. Labour force in the capital region has the biggest number of people with higher education.
In resent years, key industries in this region have been manufacturing of wood, food products, beverages and tobacco products, textiles and wearing apparel, furniture, and fabricated metal products (calculated on the basic of the employment figures and listed according to the share in regional manufacturing).

The North-Eastern Estonia is a big industrial region. Share of the region in total Estonian population is 19%. Although region's share in total industrial employment has decreased in recent years, it is still at 23%; industrial employment accounts for roughly a half of all employment in the region (47%). In 1998, the region produced ca 19% of total industrial output. Region is a gateway to the CIS market, and historically region's industrial structure has been determined by Russian market demand. Unemployment rate at 12.6% is the highest in Estonia. Structure of employment has not changed significantly during the transition years, and the most important industries have been manufacture of food products, beverages and tobacco products, textiles and wearing apparel, wood, furniture, and manufacture of rubber and plastic products.

By the size of manufacturing sector, next is the region of Southern Estonia, including second largest city of Tartu. This region comprises ca 19% of total population. Share of industrial employed in the region to total industrial employment is 14.8%; manufacturing accounts for ca 30% of regional employment. In 1998, roughly 12% of total industrial output was produced in the region. Unemployment rate was 7.2% in 2001. In recent years, among the most important industries have been manufacture of

food products, beverages and tobacco products, textiles and wearing apparel, wood, furniture, and manufacture of electrical machinery.

Central region is the biggest agricultural region of Estonia. Region accounts for ca. 13% of Estonian population. Share of industrial employment in the region to total industrial employment is 11%; employment in manufacturing accounts for ca. 31% of region's total employment. In 1998, share of the region in manufacturing output was 7%. Unemployment rate was 10% in 2001. In resent years, among the most important industries have been manufacture of textiles and wearing apparel, food products, beverages and tobacco products wood, furniture, and also manufacture of fuels, chemicals and chemical products.

The share of Western region in total population is ca 13%. Share of industrial employed in this region to total industrial employment is 12%; share of employed in manufacturing in total regional employment is ca 12%. In 1998, region produced 6.7% of total industrial output. This is second agricultural region of Estonia. Unemployment rate was 6.4% in 2001. In recent years, the most important industries were manufacture of wood, food products, beverages and tobacco products, furniture, textiles and wearing apparel, and manufacture of fabricated metal products.

Evaluation of regional disparity

Following Shankar and Shah (2001) we attempt to quantify a degree of regional inequality in Estonia using a set of static indices, each of which focuses on a specific dimension of disparity. Below we briefly describe those indices.

i) Maximum to minimum ratio MMR is a proportion between per capita regional GDP of the region with the highest and the lowest income per capita[6] and as such is a measure of a range of regional disparities. In case of perfect equality, a value of index would be 1, and the higher ratio represents substantial variation in the distribution of regional GDP per capita. Index estimates for some of the EU countries are around 2 (see Shankar and Shah, 2001).

ii) Coefficient of variation CC is one of the most widely used measures of dispersion of regional GDP per capita around the mean. We calculated a non-weighted CCu index[7] and a weighted coefficient of variation CCw where each regional GDP per capita deviation is weighted by this region's share in the national population[8]. CCu

[6] MMR = y_{maz}/y_{min}, y is per capita regional GDP

[7] CCu = $\frac{\sqrt{\sum_i \frac{(y_i - \bar{y}_U)^2}{N}}}{\bar{y}_U}$, where y_i is GDP per capita of a region i, N is a number of regions and $\bar{y}_U$ is the mean per capita GDP.

[8] CCw = $\frac{\sqrt{\sum_i (y_i - \bar{y}_U)^2 \frac{p_i}{P}}}{\bar{y}_U}$, where $\frac{p_i}{P}$ is a relation of population in region i to total national population.

varies from 0 in case of perfect equality to $\sqrt{N-1}$ in case if one region has all the national GDP. CCw varies from 0 to $\sqrt{\frac{P-p_i}{p_i}}$ in case of perfect inequality. CCw is more easily comparable across the countries as index value depends on the proportion of the population of the regions.

iii) Gini index G measures regional variation on a slightly different scale, evaluating the arithmetic average of N(N-1) differences of per capita regional GDPs. We calculate a non-weighted Gini index Gu[9] that varies from 0 to 1 as inequality increases, and a weighted Gini, Gw[10], that captures regional deviation that is weighted by the region's share in national population and varies from 0 to $1-\frac{p_i}{P}$ if regional GDP per capita is distributed unjustly. If regional population is substantially small relative to national population then the value for perfect inequality would approach 1.

iv) Theil index T[11] is an information or entropy measure of inequality. Index value increases with inequality from 0 to $\log\frac{P}{p_i}$ if population share of region i falls, but region i gets all the income.

Data used in calculations is regional income estimates and population statistics published by the Estonian Statistical Office. Table 4.2 below summarizes the results.

Table 4.2

Regional disparities for Estonian NUTS III regions in 1996-1998 in comparison to Chile in 1994 and Italy in 1995-1997

Estonia	**1996**	**1997**	**1998**	*Chile 1994**	*Italy, 1995-1997**
MMR	7.065	7.824	8.344	*5.696*	***1.794***
CVu	0.408	0.464	0.486	*0.486*	***0.177***
CVw	0.444	0.494	0.514	*0.334*	***0.178***
Gu	0.220	0.250	0.269	*0.267*	***0.085***

[9] Gu = $(\frac{1}{2\overline{y}_U})\frac{1}{N(N-1)}\sum_i^n\sum_j^n|y_i-y_j|$, where y indicate per capita GDP in regions i and j, N is a number of regions, and $\overline{y}_U$ is the non-weighted mean of reginoal per capita GDP.

[10] Gw = $(\frac{1}{2\overline{y}_U})\frac{1}{N(N-1)}\sum_i^n\sum_j^n|y_i-y_j|\frac{p_i p_j}{P^2}$, where y indicate per capita GDP in regions i and j, N is a number of regions, $\overline{y}_U$ is the non-weighted mean of regional per capita GDP, and P indicate populations of regions i and j respectively, P being total national population.

[11] T = $\sum_i x_i \log(\frac{x_i}{q_i})$, where x is the GDP share of region i and q is a population share of region i.

Gw	0.245	0.278	0.294	*0.165*	***0.083***
T	0.036	0.045	0.049	*0.052*	***0.015***

*Source: Estonian Statistical Office, own calculations; *Shankar, R. and Shah, A. (2001)*

Dynamics of the disparity indices in 1996-1998 reveal widening regional inequalities in Estonia. Magnitude of these differences across regions is somewhat typical for a developing economy, where disparities are usually larger than in developed countries[12]. Quite remarkable is a synchronic movement of population-weighted and non-weighted Gini measures. This might be an indication that the regional structure of population has been stable during the observed period in spite of the growing variance in incomes.

Although all 6 indices that were calculated show the same dynamics, these signals may simply reflect structural shifts that occurred to Estonian economy in the transition. To take into account factor of structural change in evaluation of regional income dynamics, we focus below on the developments in manufacturing sector in Estonia.

Specialised and diversified regions

We base our analysis of development of regional specialisation on three indices calculated for Estonian regions at NUTS III level for 1990-2000. As a measure of absolute specialisation in regions Herfindahl index[13] was chosen. Krugman (dissimilarity) index[14] and GINI coefficient[15] were calculated to measure relative specialisation. Values of the indices are presented in Appendix 2.

[12] The further insights into this problem could probably be obtained by evaluating relationship between speed of national economic growth and magnitude (or a rate of change) of regional disparities.

[13] The index was calculated according to the following formula:

$H_j^S = \sum_i (s_{ij}^S)^2$

where s_{ij}^S is the share of employment in industry i in region j in total employment of region j

$s_{ij}^S = \frac{Eij}{Ej} = \frac{Eij}{\sum_i Eij}$; Eij is the employment in industry i in region j.

[14] Dissimilarity index for regional specialisation is calculated as follows:

$DSR_j = \sum_i \left| s_{ij}^S - s_i \right|$, where s_i is the share of total employment in industry i in total employment $s_i = \frac{Ei}{E} = \frac{\sum_j Eij}{\sum_i \sum_j Eij}$. The smaller/bigger is a share of dominant regional industry in total manufacturing the higher is a degree of relative specialization.

[15] Gini coefficients for regional specialisation is calculated as follows:

$GINI_j^S = \frac{2}{n^2 \overline{R}} \left[\sum_{i=1}^{n} \lambda_i \left(R_i - \overline{R} \right) \right]$ where n is the number of industries; $R_i = \frac{s_{ij}^S}{s_i}$ (for each industry in region j); $\overline{R}$ is the mean of R_i across industries; λ_i is the position of the industry i in the ranking of R_i

Initial pattern of regional specialisation was established in the times of command economy. In two regions (Northern and Southern), a degree of industrial diversification was clearly higher than in the others. These regions encompass two biggest Estonian cities and historically have been the capital centres for Estonia. Third industrial region, North-Eastern Estonia, had a substantial number of industries and therefore low absolute specialisation; at the same time, those industries were big enough on the national level, as revealed by high degree of relative specialisation. Mostly agricultural and resort regions of Central and Western Estonia have the highest degree of both specialisation measures.

Even a visual inspection of indices suggests that liberalization in 1990s resulted in convergence of index levels across regions mostly due to a decrease of specialisation in periphery.

To evaluate the dynamics of specialisation numerically we calculated growth rates of absolute and relative specialisation indices at regional level (see Table 4.3 for results).

Table 4.3

Changes of specialisation indices at regional level compared to 1990 level, %

Years	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Northern Estonia: Herfindahl	101.0	99.0	103.1	106.1	116.3	114.3	118.4	106.1	102.0	106.1
Dissimilarity	97.5	96.3	102.0	103.3	177.5	166.4	157.0	148.4	148.0	150.8
GINI	100.0	95.4	101.8	98.6	139.2	138.2	143.8	121.7	99.5	110.6
Central Estonia Herfindahl	90.4	86.5	75.5	75.0	71.2	72.6	83.2	88.0	89.4	82.7
Dissimilarity	96.8	101.0	88.0	84.1	68.4	57.3	70.3	68.4	66.5	56.1
GINI	99.8	94.8	85.3	88.0	76.3	86.7	87.4	76.3	72.9	70.9
North-Eastern Estonia Herfindahl	99.3	99.3	103.4	105.5	93.1	96.6	102.1	100.0	102.1	104.1
Dissimilarity	95.5	89.0	80.7	73.0	78.9	77.1	78.2	67.9	56.8	64.1
GINI	96.4	92.5	94.4	90.8	100.0	98.3	88.1	83.1	76.8	79.7
Western Estonia Herfindahl	99.5	96.6	94.1	104.4	131.9	129.9	119.1	103.9	100.5	92.6
Dissimilarity	94.9	96.9	89.0	92.3	112.7	109.6	94.9	80.9	90.3	73.0
GINI	94.8	96.7	84.9	76.9	113.4	117.9	105.4	97.6	100.9	88.0
Southern Estonia Herfindahl	100.7	94.8	94.8	100.7	111.9	117.8	123.7	120.0	117.8	118.5
Dissimilarity	97.8	92.6	101.3	105.8	81.3	95.3	101.1	85.3	92.2	104.9
GINI	100.3	95.9	110.8	121.2	86.1	105.1	110.8	93.0	95.6	108.2

** calculated as geometrical average from 3 considered indices for considered year*

In 1995, relative specialisation as measured by dissimilarity and Gini indices has remarkably increased in Northern (capital) region, whereas index of absolute specialisation increased only slightly. At the same time, dissimilarity index in North-Eastern Estonia decreased, indicating that the share of industries dominant on the national level before 1995 has fallen gradually over the following years. New

branches of manufacturing that became nationally important concentrated in the capital region. Note that this structural shift coincided with entering into force of the principal free trade agreements.

Overall, specialisation dynamics reveal strong tendency of industrial specialisation in Estonia to homogenise across regions, and show some signs that industrial activity starts to relocate from fairly developed central regions to relatively poorly industrialised periphery.

To evaluate specialisation dynamics in Estonia as a whole, we calculated percentage change of specialisation indices as weighed average of regional percentage changes using employment shares of regions as weights (see Table 4.4 for index values).

Table 4.4

Percentage change for specialisation indices* at country level (compare to 1990)

Years	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Herfindahl	99.3	96.7	97.5	101.2	107.8	108.6	112.3	104.8	103.0	103.4
Dissimilarity	96.8	94.9	94.7	94.4	122.4	118.7	115.5	105.5	106.2	107.3
GINI	98.7	95.0	98.0	97.0	112.5	116.9	116.8	101.6	91.9	97.4

** calculated as weighed average from regional percentage changes using employment shares of regions as weights*

Dynamics of all three specialisation indices follow similar inverse U-shape pattern. Until 1995, relative and absolute specialisation increased; since 1997, specialisation decreased while industrial production started to spread to the periphery. Such developments reflect general economic evolution (and especially industrial growth) in Estonia. Before 1995, Estonian GDP had declined; increase in specialisation during the same period not only reflected optimisation of industrial structure, but also accounted for a fall in number of competitive industrial branches and enterprises in the regions. Accordingly, tendency of specialisation to decrease in the later years coincided with sustainable economic growth and inflow of FDI to the peripheral regions. Additional explanation, though rather difficult to test empirically, is the one proposed by the new economic geography theorists. Spread of manufacturing to periphery may be induced by the relative price increase on immobile factors of production in the capital region, and falling transportation cost as a result of intensive public investment programs.

Important addition to the present analysis would be evaluation of general trend in specialisation levels during the observed period. One of the ways to analyse this trend is to calculate average percentage changes for every index for given period.[16] We divide this change by the number of years to obtain average growth rate of the level of specialisation. For Herfindahl index of absolute specialisation it is 3.3%; for regional dissimilarity it is 5.2% and for relative specialisation measured by Gini index it is 2.2%. Therefore, over the observed period level of region-weighted specialisation in Estonia has increased on average by 2-5% a year. In our case time is a good proxy for economic integration of Estonia into EU. Therefore, we may suggest that integration process is an important factor of increasing regional specialisation as predicted by new economic geography hypotheses.

[16] This indicator was calculated as a geometrical average of percentage changes of indices by years

We now briefly summarize the outcomes of the previous analysis. First, the process of integration into the EU has resulted in overall increase in regional specialisation in industry especially in the premier stage of transition (up to 1995). However, since mid-1990s, the trend has been reversed, and industrial activity has started to spread into the regions. This tendency may indirectly support the hypothesis of new economic geography.

It is necessary to mention that the results discussed above should be treated cautiously, as one of the crucial elements in new economic geography theoretical framework, the additional transport cost associated with re-location, in case of Estonia has a minor significance.

6. Regional specialisation and growth

Next we investigate factors that coincide with the observed regional diversification and influence economic growth. We first determine the general framework for investigation. We then carry out some necessary data tests (multicollinearity and stationarity of data) and adjust the initial model specification accordingly. Finally, we estimate regressions and discuss the results.

Initially, one would be interested to find out if the most important growth factors in both new economic geography and new growth framework hold their place in Estonia. A starting point is assumption that main source of regional variation in growth have been infrastructure that minimizes transportation costs, and a good quality of human capital that accounts for high labour productivity in a region. To test that hypothesis, we look at the extensive set of regional indicators that proxy quality of infrastructure and labour.

General analytical model is specified as follows:

$$\log (y_{j,t+1}/y_{jt}) = \alpha + \beta_t \log(SPEC_{jt}) + \gamma_t \log(y_{jt}) + \log(\sum_{i=1}^{10} \gamma_{jt} X_{ijt}) + \varepsilon_{jt}$$

where $y_{j,t}$ regional GDP in year ***t*** in region ***j***

SPEC = specialisation measure in year ***t*** in region ***j***

X_{ij} = structural variables for qualitative regional characteristics:

x_{1j} = the number of firms with foreign capital per 100000 inhabitants

x_{2j} = the number of self-employed per 100000 inhabitants

x_{3j} = the number of students per 100000 inhabitants

x_{4j} = the number of telephone lines per 100000 inhabitants

x_{5j} = the density of roads

x_{6j} = public expenditure per capita

x_{7j} = the percentage of population in the working age group

x_{8j} = the share of employment in the secondary sector

x_{9j} = the share of employment in services

Although this specification would provide a fairly good explanation to the process of regional growth, the analysis must be adjusted to the available data. As explained in Section 2, statistics of regional GDP in Estonia were accessible only for 1996-1998. To take advantage of a fairly wide set of regional indicators provided since 1992, we calculated a proxy of regional GDP (see Section 2). Initial level of GDP per capita, $\log(y_{jt})$, was included into the model to enable estimation of regional convergence.

Measures of specialisation in basic model are Herfindahl, dissimilarity and Gini specialisation indices calculated for the NUTS III level of Estonia in the period adjusted to the use of regional growth index (1995-2000).

Proposition of the extensive set of regional indicators inevitably leads to the problem of data multicollinearity. To overcome this problem, we constructed correlation matrix, and omitted those variables that were highly correlated.

Next, we controlled GDP growth rates for stationarity using standard Dicky-Fuller procedure. The hypothesis of a unit root in growth indices was rejected.

Initially, we attempted to evaluated the models in two ways: with fixed effect to allow for region-specific factors, and under the framework of common intercept (GLS method). Hypothetically, if the variation in regional time series data is not significant, indicators themselves capture the region-specific effects, and region-specific dummies may be omitted. The final decision as for the estimation technique was made on the basis of F-statistic. In our case, F-statistic under the common intercept GLS specification was fairly low.

Estimation results

Table 6.1 presents estimation results for model where regional growth is regressed on the specialisation measure and a group of regional indicators. It is essential that out of a wide set of regional parameters only several were statistically significant in all three specifications. Model was estimated for every specialisation index.

Table 6.1

Estimation results (values of standard errors are given in parentheses)

Model	Herfindahl	GINI	Dissimilarity index
Constant	7.20 (4.03)***	7.13 (3.22)***	6.81 (2.89)***
Initial level of GDP per capita, $\log(\mathbf{y_{jt}})$	-0.10 (-2.39)**	-0.06 (-1.54)	-0.05 (-1.39)
Specialisation index	-0.21 (-2.26)**	-0.05 (-0.52)	0.00 (0.02)
Percentage of the population in working age group^	0.75 (4.15)***	0.79 (3.42)***	0.74 (2.98)***
Number of self-employed^	0.08 (3.15)***	0.06 (2.29)**	0.06 (2.26)**
Number of students^	0.03 (2.75)***	0.02 (2.08)**	0.02 (2.09)**
Number of telephone lines^	-0.18 (-2.12)**	-0.19 (-2.11)**	-0.18 (-1.7)*
Adjusted R-squared	0.36	0.24	0.21
F-statistic	3.31	2.29	2.10
Probability F-statistic	0.02	0.08	0.10
Observations	25	25	25

, and *** denote coefficient estimates significant at 10, 5 and 1 per cent level; ^ denotes values per capita.*

A proposed model specification reflects the sectors of structural shifts. In all models three variables are highly significant and can be considered as factors that contributed to the economic growth. First, a percentage of the population in the working age group is important due to specialisation in industries with labour-intensive production, typical for transition economy. As most of the investors were aiming at exploiting the advantage of low labour costs, regions with higher labour had stronger growth potential. Second, number of students may be a proxy to the accessibility of high quality labour. Finally, number of telephone lines in our case should represent the developing infrastructure. Negative coefficient reflects a factor of convergence that has occurred to Estonian regions in terms of infrastructure. All these measures are statistically significant at 1 percent level.

We found measure of absolute specialisation to be important under this model, as well as initial level of regional GDP per capita. Negative β-coefficient indicates that some regional convergence has occurred.

8. Conclusions

In the present paper, we focus on analysis of structure and dynamics of regional specialisation and income in Estonia during the transition years.

As the analysis of export flows to the EU market reveals, most of the changes that occurred to Estonian manufacturing were induced by export re-orientation and exploiting the factors of comparative advantages. Soon after the solid legislative base for trade with EU was established, Estonian manufacturing picked up from its U-shaped recession and has stably expanded since.

However, growth inside the country has not been uniform. Analysis of Estonian regional structure reveals deep disparities as captured by various indices calculated on the basis of regional income. One of the explanations we propose in this paper is associated with new economic geography theory of industrial location. It assumes that regional manufacturing pattern evolves under the constant structural change. Given elimination of planned production structure, economic agents start to locate driven by the factors of economies of scale and better access to the foreign markets. Therefore, the regions that initially attract economic activity are capital and the so-called border regions. Later, when structural investments in infrastructure result in falling transport costs and due to the higher prices of immobile factors of production in economically flourishing regions, manufacturing starts to re-locate to the cheaper periphery. Therefore, if the hypothesis is correct, development of regional industrial pattern must follow an inverse U-shape curve.

Our analysis of regional industrial dynamics is based on specialisation indices calculated for 13 industries in NUTS III regions of Estonia. We find that specialisation in Estonia had increased at the initial stages of liberalization due to the overall fall in production and concentration of activity to the capital region. However, since 1995-1997, both absolute and relative specialisation in most of the regions has declined as a result of key investments and improving infrastructure. Therefore, we indirectly confirm the hypothesis stated above.

We also attempt to evaluate the role of structural change in regional development. We construct an analytical model that regresses regional growth on the proxies of investment, infrastructure and quality of human capital. We find all three factors are significant under a proposed specification. Measure of absolute specialisation is an explanatory variable as well. Introduction of a factor of initial GDP per capita allows evaluating convergence between the Estonian regions. At a 5% confidence level we confirm the hypothesis of regional convergence.

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Appendix 1.

Calculation of aggregated index of regional economic growth

Index of regional economic growth was calculated as follows:

$$Iy_{j,t} = 0,5*Icons_{j,t} + 0,2*Iinv_{j,t} + 0,2*Igov_{j,t} + 0,1*Iexp_{j,t}$$

where

$Iy_{j,t} = y_{j,t}/y_{jt-1}$

$Icons_{j,t}$ - regional index of consumption in the year t
$Icons_{j,t} = cons_{j,t} / cons_{j,t-1}$
As a proxy to this parameter we took the regional disposable income

$Iinv_{j,t}$ – regional index of investments in year t
$Iinv_{j,t} = inv_{j,t} / inv_{j,t-1}$
As a proxy to this parameter we took regional investment in fixed assets

$Igov_{j,t}$ - regional index of government expenditure in year t
$Igov_{j,t} = gov_{j,t} / gov_{j,t-1}$
As a proxy to this parameter we took the expenditures in local budgets
$Iexp_{j,t}$ - regional index of exports in year t
$Iexp_{j,t} = exp_{j,t} / exp_{j,t-1}$
As a proxy to this parameter we took regional spesial export without re-export.

Weights were taken from the national account tables as a 1996-2000 mean. Export weight was estimated by author. After the estimation all weights were normated.

In the table A1 we present the calculated aggregated indices of regional economic growth.

	1995	1996	1997	1998	1999	2000
Northern Estonia	1.144	1.059	1.154	1.116	0.998	1.103
Central Estonia	1.168	1.048	1.120	1.089	1.031	1.063
North-eastern Estonia	1.045	1.027	1.087	1.057	0.989	1.062
Western Estonia	1.128	1.090	1.127	1.081	0.975	1.091
Southern Estonia	1.110	1.007	1.143	1.117	1.031	1.088
Estonia in total	1.119	1.046	1.126	1.092	1.005	1.081
GDP grow average rate	1.04	1.04	1.1	1.5	0.993	1.06

Appendix 2

Indexes of regional spesialisation

Herfindahl regional specialisation index

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Northern Estonia	0.098	0.099	0.097	0.101	0.104	0.114	0.112	0.116	0.104	0.100	0.104
Central Estonia	0.208	0.188	0.180	0.157	0.156	0.148	0.151	0.173	0.183	0.186	0.172
North-eastern Estonia	0.145	0.144	0.144	0.150	0.153	0.135	0.140	0.148	0.145	0.148	0.151
Western Estonia	0.204	0.203	0.197	0.192	0.213	0.269	0.265	0.243	0.212	0.205	0.189
Southern Estonia	0.135	0.136	0.128	0.128	0.136	0.151	0.159	0.167	0.162	0.159	0.160

Regional disimilarity index

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
	0.244	0.238	0.235	0.249	0.252	0.433	0.406	0.383	0.362	0.361	0.368

Northern Estonia											
Central Estonia	0.585	0.566	0.591	0.515	0.492	0.400	0.335	0.411	0.400	0.389	0.328
North-eastern Estonia	0.555	0.530	0.494	0.448	0.405	0.438	0.428	0.434	0.377	0.315	0.356
Western Estonia	0.544	0.516	0.527	0.484	0.502	0.613	0.596	0.516	0.440	0.491	0.397
Southern Estonia	0.448	0.438	0.415	0.454	0.474	0.364	0.427	0.453	0.382	0.413	0.470

Specialisatin GINI

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Northern Estonia	0.217	0.217	0.207	0.221	0.214	0.302	0.300	0.312	0.264	0.216	0.240
Central Estonia	0.443	0.442	0.420	0.378	0.390	0.338	0.384	0.387	0.338	0.323	0.314
North-eastern Estonia	0.413	0.398	0.382	0.390	0.375	0.413	0.406	0.364	0.343	0.317	0.329
Western Estonia	0.425	0.403	0.411	0.361	0.327	0.482	0.501	0.448	0.415	0.429	0.374
Southern Estonia	0.316	0.317	0.303	0.350	0.383	0.272	0.332	0.350	0.294	0.302	0.342