The European Journal of Comparative Economics
Vol. 10, n. 1, pp. 49-79
ISSN 1824-2979

# Specialization and Agglomeration Patterns in Eastern Europe[1]

Sheila A. Chapman[2]

**Abstract**

The paper investigates specialization and agglomeration trends in EU-27 NUTS2 regions over 1991-2011 by means of two versions of the relative Theil indicator that use employment data. The paper's main focus is on Central and Eastern European Countries (CEECs) regions. As a legacy of central planning, in the early 'Nineties these regions presented significantly above-average specialization and agglomeration. The paper shows that over 1991-2011 these features change very little; moreover, while disproportions fall in the other EU members, they rise in CEECs, implying growing divergence among the two groups in real terms, notwithstanding EU emphasis on real convergence. Indicators disaggregated by sectors show that for CEECs specialization/agglomeration change most in agriculture, market services and manufacturing. The paper focuses on the last two sectors. It argues that performance in the service sector is largely due to capital regions catching up on previous underdevelopment in the sector, therefore getting closer to Western regions. Non-capital regions instead lag behind, moving away from the EU sectoral average. As far as manufacturing is concerned, CEECs regions continue to specialize in the more traditional lines of production, for which also agglomeration remains extremely high. Consideration of the changes over time gives a partially different picture and shows that the higher specialization in overall manufacturing results from the development of a small but dynamic medium-high technology sub-sector that is significantly disseminated across regions, thus appearing to result from successful industrial restructuring and reconversion.

JEL Classification: O18, O52, P25, R11, R12

Keywords: Regions, European Union, Theil indicator, specialization, agglomeration

## 1. Introduction

Traditional text-book trade theory claims that a fall in transport costs – due for instance to tighter economic integration – unambiguously leads to higher specialization across countries[3]. The reduction of trade barriers exposes firms to growing competition from abroad; although this can make production drop in previously protected sectors, eventually it leads to higher specialization in the sectors in which a country has a comparative advantage. In addition, New Economic Geography (NEG) models show that lower transport costs following the reduction of trade barriers, associated with increasing returns to scale, determine a spatial agglomeration of production.

On the basis of these results, it seems reasonable to assume that over the last two decades the strengthening of economic integration among European Union (EU) members resulted in a rise in both specialization and agglomeration. Empirical evidence on the issue, however, remains unclear. Some authors (among the others, Krugman, 1993, Amiti, 1997, and Overman *et al.*, 2001) contend that production in EU countries has indeed become more specialized, even if rather slowly – slower, for instance, than in

[1] The paper was presented at the XXXIII AISRe (Italian Association of Regional Science) Conference, Rome, September 2012. Thanks go to Conference participants, to Valentina Meliciani and to two anonymous referees for helpful comments. The usual disclaimers apply. E-mail:chapman@lumsa.it
[2] Department of Political Science, LUMSA - Rome
[3] Even if the prediction of specialization patterns may differ, Heckscher-Ohlin-type models expecting it to take place in the sectors that are relatively intensive in the factors of which a country is relatively more endowed, inter-industry trade theories in those in which higher returns to scale may be obtained.

the United States (Krugman, 1993). Other authors, including Paci *et al.*, 2000, Aigigner *et al.*, 2002 and Aigigner *et al.*, 2004, claim the opposite. Agglomeration in Western EU members is found to have fallen in some sectors (manufacturing) but not in others (agriculture and services) (Brülhart *et al.*, 2005). Considering separate industries in some Western countries shows that agglomeration takes place in most branches even if it remains low and, as expected, is generally lower in Europe than in the United States[4].

The issue of sectoral relocation in the EU becomes all the more relevant following the latest enlargements (in 2004 and in 2006) that extend membership to Central and East European Countries (CEECs). These enlargements took place after a long process dating back to the early 'Nineties that saw previously centrally planned countries adapt their economies to the rules and standards of the EU. In fact, some forty years of central planning had left CEECs over-specialized in some sectors (agriculture and traditional manufacturing) and under-specialized in others (services and R&D-intensive manufacturing). Production generally took place in huge conglomerates and often gave life to mono-industrial economies at the regional level. Material- and labour-intensive technology, resulting in low productivity and in obsolete, low quality, goods was the rule. In the early years of transition the removal of trade barriers led to sharp falls in output due to plant closures and to domestic production giving way to imports from abroad[5]. However, as integration with the West tightened in view of EU membership, competition and globalisation gained momentum and CEECs started growing at positive, often high, rates[6]. According to NEG models the abolition of trade barriers across a number of countries initially leads to de-industrialization and dispersion in the less developed areas. However, as trade liberalization continues to deepen, a new phase is opened during which agglomeration prevails and production becomes more specialized[7]. Also the sectoral composition of production appears to be important as not all sectors present the same growth potential. Recently this issue has been explored by the literature: in particular, it is found that when markets in a country are not fully integrated (i.e. factor returns are not equalized across sectors) and/or technology is not a public good, the sectoral mix of production can result in uneven growth across countries or regions[8]. Empirical findings generally agree that a strong specialization in agriculture determines low growth while specialization in the industrial and service sector may bring better results (see, for instance, Paci *et al.*, 1997). In this respect, it is further acknowledged that the technology content of sectors counts as well, growth and productivity being higher in high-tech industries and services (Mora *et al.*, 2005).

This paper aims at investigating the recent evolution of specialization and agglomeration patterns in the enlarged EU. It analyses relocation trends throughout EU-27 members and considers whether recent growth in CEECs has gone hand-in-hand with changes in specialization and agglomeration and, when these occur, in what

[4] See Ellison *et al.*, 1997, for the US; Deveraux *et al.*, 2004, and Duranton *et al.*, 2005, for the UK; Maurel *et al.*, 1999, for France; Guimaraes *et al.*, 2007, for Portugal.

[5] This phase is reminiscent of industrial restructuring problems faced by declining old industrialised regions in Western countries during the '80s. On the point see Rodriguez-Pose, 1998, and Chapman, 2008, and the literature quoted therein.

[6] In CEECs GDP in PPPs per inhabitant grew by a yearly average of 7.3% during 1994-99 and by 5.4% in 2000-04. In older members it grew respectively by 5.1% and by 2.5% (calculations based on Eurostat data).

[7] This is reminiscent of the so-called *inverted U hypothesis* (Kuznets, 1955), according to which the early stages of development are characterized by a positive relation between growth and inequality.

[8] See Paci *et al.*, 1997, for a survey of the literature on structural change and economic growth.

direction they go. It compares CEECs' performance with that of the other EU members in order to verify the extent and the evolution in differences between the two groups. Finally, it considers whether it is possible to trace new emerging patterns of production in CEECs sharing any feature with those prevailing among the other EU members[9].

To this end, this paper adopts two versions of the dissimilarity index first developed by Theil, 1967. It extends the approach defined by Aigigner *et al.*, 2001, Brülhart *et al.*, 2005, and Cutrini, 2006. The first work shows that, when properly defined, the Theil indicator can measure both the specialization and the geographic concentration (agglomeration) of production. The second one defines a methodology to decompose the concentration index; the last one applies decomposition to specialization.

The paper is organized as follows: section 2 briefly describes the methodology and identifies the indicators and their decomposition into within- and between-country components. Section 3 reports and comments the results concerning all EU-27 members. Country groups (CEECs and Other members) and main sectors (agriculture, manufacturing, construction, market and non market services) are considered separately. Section 4 addresses the evolution of CEEC countries individually and considers a breakdown of both the service sector and manufacturing according to their knowledge/technology content, distinguishing among traditional and more advanced branches. Section 5 contains a few brief conclusions.

The selected point of view is sectoral for specialization and geographic for agglomeration. The basic unit of analysis are regions, generally taken at the NUTS2 level. For the sake of uniformity, both in terms of geographic extension and, more important still, of administrative powers and autonomy, for some countries (Belgium, Germany, Greece, the Netherlands and the United Kingdom) the NUTS1 level (macro-regions) is selected. The country level (NUTS0) is used for one-region countries (Estonia, Cyprus, Latvia, Lithuania, Luxemburg and Malta). This leads to consider in all 189 units, referred to in the paper as "regions"[10]. Data are from Cambridge Econometrics and from Eurostat REGIO database; they cover the period 1991-2011 or shorter sub-periods. As in much of the literature on the subject, employment is taken as a proxy for value added[11]. Macro-sectors (agriculture, construction, manufacturing, market and non-market services) reflect NACE Rev 1.1. The subdivision of manufacturing in low, medium-low and medium-high technology as well as the

[9] The issue of sectoral specialization and relocation in CEECs has been addressed by several authors. By analyzing trade flows Zaghini, 2005, shows a rise in the specialization of production; signs of an overall reduction in specialization of CEEC regions over 1992-2005 are found by Marelli, 2007. Kallioras *et al.*, 2004, find that dissimilarities in specialization and concentration remain largely unchanged between 1991-1998 in some CEECs (notably Bulgaria, Romania and Slovenia) but change in others (Estonia and Hungary). The authors conclude that production patterns change only in intermediate income CEECs and remain stable in low and in high income ones.

[10] Owing to their geographical remoteness and peculiar features that set them apart from other EU economies, Ciudad Autonoma de Ceuta, Ciudad Autonoma de Melilla and Canarias (Spain); French Overseas Departments (France); Regiao Autonoma de Madeira (Portugal) are not included in the sample.

[11] In fact, "…employment data (are considered) as preferable to data based on production values, because the former are not subject to the problems associated with price conversions across countries and years". See Brulhart *et al.*, 2005, p.609.

definition of knowledge-intensive services are all taken from Eurostat REGIO classifications[12]. A list of groups and definitions is in Appendix 1.

## 2. Specialization and agglomeration indexes

Specialization and agglomeration capture two closely-related, yet distinct, aspects of production. Specialization arises from differences across territorial units (countries, regions) in terms of employment or value added; it is highest when one sector accounts for all the employment or value added in the unit (complete specialization) and lowest when all units present the same share in all sectors (no specialization). Geographic concentration, or agglomeration, measures the differences in the distribution among sectors in territorial units; it is at its maximum when all the jobs or the value added of one sector are concentrated in a single geographic unit (complete agglomeration) and lowest when employment or value added in a sector is equally distributed among many geographic units (no agglomeration)[13]. In general, it may appear that both phenomena are bound to go hand-in-hand, higher specialization leading to a rise in geographic concentration and vice-versa. However, Aigigner *et al.*, 2001, show that, when correctly measured, these two aspects of production may indeed diverge.

Both specialization and agglomeration can be measured in different ways. Regional specialization is generally captured through some measure of a region's share (in value added, employment, exports or another variable) with respect to the universe. Indexes of this type are the ones by Balassa, by Finger-Kreinin, by Krugman, and so on. Also agglomeration may be studied through different measures, the most well-known being the Hoover and the so-called locational Gini ones[14].

A class of indicators that has been recently explored is the Theil dissimilarity index, that derives from general entropy indicators. With respect to other measures, the Theil index has the advantage of satisfying a number of requirements (axioms) that appear to be desirable when identifying inequality; in particular it is easily decomposed

[12] Eurostat follows OECD standards and classifies industries on the basis of the technology content of the goods they produce or export; this is measured by R&D expenditure as a percentage of value added (the sector approach). Other methods are the product approach, that evaluates directly whether a product is high, medium or low-tech, and the patent approach, that considers whether a patent is high, medium or low-tech. These indicators complement the first one. For services instead the share of tertiary educated personnel in the sector is calculated. Activities presenting shares above a selected threshold are then classified as knowledge-intensive. See OECD, 2001 and 2002.

[13] Although the two phenomena are likely to go hand-in hand (see Maurel *et al.*, 1999, p.593 and Deveraux *et al.*, 2004, pp. 536-7), agglomeration, or *geographic* concentration, should be kept distinct from *sectoral*, or industrial, concentration. The latter occurs when a small number of independent enterprises (at the extreme, only one) provides all the jobs or the value added in a sector (industry); it is generally measured by the Herfindahl index.

[14] A review of these measures is, among the others, in Bickenbach *et al.,* 2008. Recently a new class of agglomeration indicators (so-called "second generation" measures) has been developed. Following the seminal work by Ellison *et al.*, 1997, these measures differ from inequality indicators inasmuch as they control for random localization that is inherent in production. Hence they capture only the agglomeration that is above firms' general tendency to cluster. In this line, Ellison *et al.*, 1997, and Maurel *et al.*, 1999, measure concentration in excess of an ideal situation in which firms select location randomly over discrete spatial units (e.g. regions). Duranton *et al.*, 2005, overcome the arbitrariness of units defined *ex ante* by considering the distribution of distances between all pairs of enterprises in a given industry over a continuous space. Although providing considerable insight into agglomeration and its determinants, these indicators require large amounts of detailed information (at the 3- or 4-digit level); moreover, international comparisons are made difficult by differences in industry classifications. For these reasons, "second generation" measures of agglomeration will not be pursued in this paper.

into a *within* group and a *between (or across)* group effect (the so-called decomposability axiom), a property not shared by other indicators[15]. Moreover, independence from the number of observations allows comparison between different sub-sets of cases.

The Theil index captures inequality among independent basic units. It is a type of geometric mean that downgrades extreme observations inasmuch as each one is weighted by its relative intensity. For instance, assume a set of $n$ individuals where each unit $i$, for $i = 1,...n$, has a nonnegative fraction of total income $y_i$. The Theil index $T$ is defined as follows[16]:

$$T = \sum_{i=1}^{n} y_i \ln(n \cdot y_i) \quad (1)$$

The index reaches its maximum when all income is concentrated in one unit and the others have zero income (complete inequality). It is easily verified that in this case $T$ equals $\ln(n)$. On the other side, when activity is distributed equally among units each one receives the same share $1/n$ and (1) reduces to zero (complete equality).

This last point warrants some further consideration. As already mentioned, the present paper applies the Thiel index to EU NUTS2 regions. This implies assuming regions as the basic units, which however is mistaken, as regions have a spatial dimension and differ deeply from one another[17]. Returning to the complete equality case just discussed, its benchmark assumes that all regions in the sample have the same share in overall activity, which is evidently not the case, due to differences in size, population, economic activity, and so on - an issue referred to as the MAUP – the modifiable areal unit problem. A way for dealing with the MAUP consists in substituting *absolute* measures like (1) with *relative* ones, where the economic variable under consideration is weighted by region-specific weights. Possible weights suggested so far are a region's geographic extension (in square kilometers), its resident population or aggregate economic activity[18]. In what follows we choose the latter approach and weight sectoral employment by overall employment, respectively at the regional and at the aggregate level. This reduces but does not eliminate potential biases; the resulting index continues

[15] The other requirements are scale independence, or homogeneity of degree one (if all observations are scaled by the same number, the measure of inequality should not change) and independence from the number of observations (inequality measured for one group should remain unchanged when the group is merged with another identical group). Most inequality measures share these two properties, but only the Theil index satisfies them all. See Sala-i-Martin, 2002, and the literature quoted therein.

[16] The Theil index derives from information theory. Basically, it measures how much a message concerning an event changes its probability to occur. When the initial probability is high (the event is almost certain) a message stating that the event is likely to occur does not change its probability by much; it is said to have a low information content. Vice versa, when the probability of an event is low the same message changes its probability greatly and has a high information content. The expected average difference between the initial probabilities of a distribution of events ("prior probability") and the one that follows the message ("posterior probability") is called *entropy*, in resemblance with the notion in physics. See Theil, 1967.

[17] See Theil, 1967, ch.4.

[18] See Brulhart *et al.*, 2005 and Bickenbach *et al.*, 2008.

to underestimate dissimilarity inasmuch as the benchmark assumes homogeneous shares of regional activity with respect to total activity for all sectors and regions[19].

The indexes used in this study, $T_{sp}$ and $T_{con}$, are two different versions of the relative Theil index, modified in order to capture respectively sectoral specialization (or similarity) and/or regional geographic concentration (or agglomeration).

Starting from agglomeration, for region $r$, where $r = 1,...R$, and $R$ is the total number of regions in the sample and for sector $s$, with $s = 1,...S$, employment is a nonnegative amount $y_r^s$. Agglomeration is defined as a sector's share in employment over all regions' employment in the sector. Both variables are weighted by the respective aggregate employment to yield:

$$T_{con} = \sum_{r=1}^{R}\sum_{s=1}^{S}\left[\frac{y_r^s}{y_R^s}\ln\left(\frac{y_r^s/y_r^S}{y_R^s/y_R^S}\right)\right] \tag{2}$$

Defining specialization accordingly is straightforward, but poses the additional question of identifying the most appropriate territorial benchmark. For the purposes of this study regional specialization in a sector could be usefully set either against *country* specialization or against supra-national, *aggregate*, specialization in the sector. In what follows we choose the second possibility, for sake of homogeneity with $T_{con}$ as in (2). $T_{sp}$ is defined as follows:

$$T_{sp} = \sum_{r=1}^{R}\sum_{s=1}^{S}\left[\frac{y_r^s}{y_r^S}\ln\left(\frac{y_r^s/y_R^s}{y_r^S/y_R^S}\right)\right] \tag{3}$$

Like base index (1) both indicators measure dissimilarity, or disproportion, across basic units; hence (2) and (3) are directly related, respectively, to agglomeration or to specialization.

Equations (2) and (3) can be easily decomposed by partitioning regions into $C$ sub-groups (countries). Each region $r$ belongs to only one sub-group $c$ and each sub-group contains $r_c$ regions, such that for $c = 1,...C$, $\sum_{c=1}^{C} r_c = R$. Decomposition allows to separate the *within*-country component from the *across*, or between-country, component of inequality. Following Theil, 1967, this may be done as follows for equation (3):

$$T_{sp} = \sum_{s=1}^{S}\sum_{c=1}^{C}\left[\sum_{r=1}^{rc}\frac{y_r^s}{y_r^S}\ln\left(\frac{y_c^s/y_c^S}{y_R^s/y_R^S}\right) + \sum_{r=1}^{rc}\frac{y_r^s}{y_r^S}\ln\left(\frac{y_r^s/y_c^s}{y_r^S/y_c^S}\right)\right] \tag{4}$$

[19] See Brulhart *et al.*, 2005. Relative indexes of dissimilarity are closely related to the Balassa index of comparative advantage. See Cutrini, 2006.

and for equation (2):

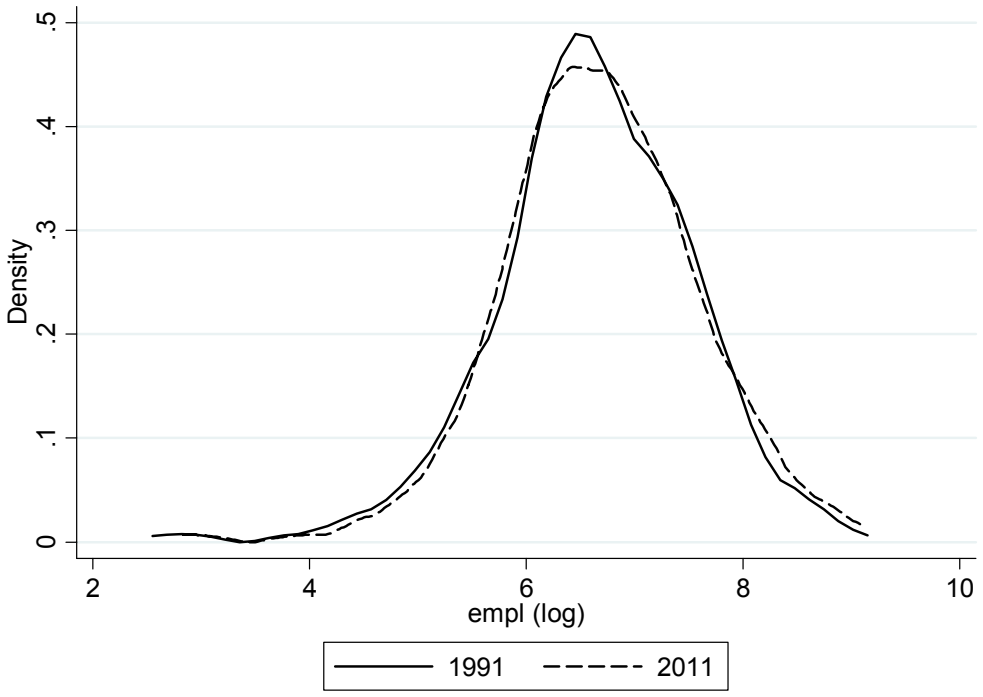
$$T_{con} = \sum_{s=1}^{S}\sum_{c=1}^{C}\left[\sum_{r=1}^{rc}\frac{y_r^s}{y_R^s}\ln\left(\frac{y_r^s/y_r^S}{y_R^s/y_R^S}\right)+\sum_{r=1}^{rc}\frac{y_r^s}{y_R^s}\ln\left(\frac{y_r^s/y_r^S}{y_c^s/y_c^S}\right)\right] \quad (5)$$

In each formula the first addendum in the square brackets is the *between*-country element of the index ($T_b$); the second one is the *within*-country component ($T_w$)[20].

## 3. Specialization and agglomeration patterns in EU regions

A preliminary idea of the dynamics of differences among European regions can be gained from Fig.1, where the estimated density function of employment (in logs) in EU- 27 regions is plotted respectively for 1991 and 2011[21]. The figure shows that the two distributions are practically identical, apart from an almost imperceptible growth in dispersion. The Kolmogorov-Smirnov equality-of-distribution test rules out statistically significant difference between the two distributions.

*Figure 1 – Probability Density Functions: Employment in EU regions (in logs) in 1991 and in 2011*




Tables 1-2 report the yearly aggregate indexes $T_{sp}$ and $T_{con}$ along with their breakdown into the within and between countries components over 1991-2011;

[20] Obviously, $T = T_b + T_w$ for either index. $T_w = y_c^s / y_c^S \cdot T_{sp}$ in the first formula and $T_w = y_c^s / y_C^s \cdot T_{con}$ in the second one and $T_{sp}$ and $T_{con}$ refer to each sub-group.

[21] Probability density functions are based on the Epanechnikov kernel, using the "optimal" bandwidth (=0.2365), without weighting observations (189 observations). Results are consistent with other estimators.

averages are calculated for the whole period and for two sub- periods (1991-2000 and 2001-11). Over the whole period EU-27 regions become more similar in terms of specialization but less similar in terms of the geographic concentration of activity. However, both indicators grow in the first decade but drop in the second one, implying that in the Two Thousands EU regions become on average more homogeneous. The major source of inequality is the *between*-countries component; differences *within* countries are on average lower.

Separating the regions of CEECs from those of Western members ("Other" countries in the tables; see Appendix 1 for definitions) provides yet a different picture. First, on average both specialization and agglomeration in CEEC regions are significantly different from the whole of the EU and significantly higher than in Other countries. Second, the evolution over time of the two indicators differs as well, at least in part: over 1991-2011 both rise for CEEC regions but drop for Other ones. Some similarity emerges only in 2001-11 when average indicators fall for both groups, signaling a general reduction in inequalities, even if somewhat weaker in CEECs (no variation is statistically significant). Third, the *within-* and *between*-country components show that CEECs regions are relatively equal country-wise and that the major source of inequality comes from differences *between* countries in the group. The opposite holds for Other countries: Western regions are relatively similar to one another (and become significantly more so) but present high divergences *within* each country. Fourth, albeit only a minor source of inequality, in CEECs *within*-country differences grow significantly in terms of agglomeration in the second sub-period (they remain practically unchanged in terms of specialization).

Additional information is provided by the breakdown of the two indexes into the economy's main sectors: agriculture, construction, manufacturing, market and non market services[22]. Tables 3 and 4 show the results for the entire sample, for CEEC regions and for Other ones. Consistently with the findings of similar studies covering different time periods (e.g. Aigigner *et al.*, 2001, Brülhart *et al.*, 2005), for the whole of EU regions specialization and geographic concentration are highest in agriculture and in manufacturing. This, however, is mostly due to CEECs regions, that throughout 1991-2011 specialize significantly more than Other ones in these sectors. Western regions instead specialize in services (both market and non-market) and in construction. In CEECs agglomeration is highest in agriculture and in manufacturing; in Other ones in services and in construction. Furthermore, on average in all sectors both phenomena differ significantly between the two groups, confirming deep dissimilarity between them. The evolution over time of the indicators shows general de-specialization and de-localization (i.e. rising homogeneity) in most sectors for Western regions, with disproportions growing only in agriculture in the second sub-period. For CEECs instead results are somewhat more mixed, often due to diverging behaviour in the two sub-periods. Considering only the second one gives a more clear-cut picture: disproportions grow in practically all sectors except agriculture and non market services, where they fall. While in the second sub-period in the West only de-localization in services is significant, pointing to relative stability, for CEECs all sectors except construction and non market services undergo significant changes. In particular, Eastern regions record significant de-specialization in agriculture and in market services, while agglomeration rises significantly in manufacturing and in market services.

[22] The same subdivision in five broad sectors is found (even if in a different context) among the others, in Paci *et al.*, 1997, and in Le Gallo *et al.*, 2006.

In summary, so far the Theil indicators show significantly different specialization and agglomeration patterns prevailing in the two groups of regions. Notwithstanding tighter economic integration, in real terms they move in opposite directions: in the West inequalities (which are significantly lower in the first place) generally fall over time; in the East they generally grow. Further, the breakdown by sectors shows that significant differences are present in most branches of activity and tend to grow over time, especially during the second sub-period. These conclusions are in line with some results that are emerging in the literature, according to which a new divide between Eastern and Western regions is taking place in the EU, complementing and possibly replacing the more traditional North-South one[23]. While falling specialization for CEECs in agriculture can be easily accounted for by high initial levels, the same phenomenon in market services, that becomes significant in the second sub-period, appears *prima facie* more difficult to explain and calls for closer examination. So does the - fairly unexpected – growth of both indicators in the manufacturing sector. It is to these problems that we now turn.

[23] See, among the others, Chapman *et al.*, 2011. On the other hand, another result that is generally acknowledged in the literature – i.e. that *within*-country differences grow strongly in post-communist CEECs (see Paas, 2007, and Chapman *et al.*, 2011) – is confirmed in this work only for agglomeration.

**Table 1 – The $T_{sp}$ indicator: whole sample and country groups, within and between country components, mean values and yearly average growth rate (1991-2011, 1991-2000 and 2001-2011)**

| | EU | | | CEECs | | | Other countries | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Tsp** | **Tspw** | **Tspb** | **Tsp** | **Tspw** | **Tspb** | **Tsp** | **Tspw** | **Tspb** |
| 1991 | 6.5339 | 3.1831 | 3.3507 | 3.0709 | .8933 | 2.1776 | 3.4630 | 2.3104 | 1.1526 |
| 1992 | 6.7176 | 3.1271 | 3.5905 | 3.2693 | .9013 | 2.3679 | 3.4483 | 2.2459 | 1.2025 |
| 1993 | 6.7345 | 3.0471 | 3.6873 | 3.3959 | .8822 | 2.5136 | 3.3386 | 2.1848 | 1.1538 |
| 1994 | 6.8010 | 3.0011 | 3.7999 | 3.5311 | .8693 | 2.6618 | 3.2699 | 2.1516 | 1.1183 |
| 1995 | 6.6661 | 2.9810 | 3.6852 | 3.4837 | .8429 | 2.6409 | 3.1824 | 2.1601 | 1.0223 |
| 1996 | 6.7928 | 2.9437 | 3.8490 | 3.6495 | .8364 | 2.8131 | 3.1433 | 2.1313 | 1.0120 |
| 1997 | 6.9304 | 2.9345 | 3.9960 | 3.8187 | .8542 | 2.9646 | 3.1117 | 2.1027 | 1.0090 |
| 1998 | 7.2171 | 2.8705 | 4.3466 | 4.2199 | .8586 | 3.3612 | 2.9973 | 2.0340 | .9633 |
| 1999 | 7.1825 | 2.9060 | 4.2765 | 4.1883 | .8980 | 3.2903 | 2.9942 | 2.0325 | .9617 |
| 2000 | 7.2875 | 2.8214 | 4.4662 | 4.3235 | .8525 | 3.4710 | 2.9640 | 1.9906 | .9734 |
| 2001 | 6.7446 | 2.7812 | 3.9634 | 3.9019 | .8418 | 3.0601 | 2.8427 | 1.9593 | .8834 |
| 2002 | 6.2756 | 2.6931 | 3.5826 | 3.5785 | .8221 | 2.7565 | 2.6971 | 1.8934 | .8037 |
| 2003 | 6.2656 | 2.6282 | 3.6375 | 3.5987 | .7933 | 2.8054 | 2.6669 | 1.8560 | .8109 |
| 2004 | 6.0433 | 2.6058 | 3.4375 | 3.4887 | .8026 | 2.6861 | 2.5546 | 1.8250 | .7296 |
| 2005 | 5.9880 | 2.5591 | 3.4289 | 3.4694 | .7878 | 2.6816 | 2.5186 | 1.7921 | .7265 |
| 2006 | 5.7969 | 2.5325 | 3.2644 | 3.3388 | .8053 | 2.5334 | 2.4582 | 1.7487 | .7095 |
| 2007 | 5.7141 | 2.5324 | 3.1817 | 3.2858 | .8012 | 2.4846 | 2.4283 | 1.7313 | .6970 |
| 2008 | 5.5576 | 2.5122 | 3.0454 | 3.2085 | .8019 | 2.4065 | 2.3492 | 1.7346 | .6145 |
| 2009 | 5.5230 | 2.5208 | 3.0022 | 3.2567 | .8215 | 2.4352 | 2.2664 | 1.7222 | .5442 |
| 2010 | 5.3422 | 2.5050 | 2.8373 | 3.1238 | .7973 | 2.3265 | 2.2184 | 1.7298 | .4885 |
| 2011 | 5.2988 | 2.4843 | 2.8146 | 3.0739 | .7836 | 2.2903 | 2.2250 | 1.7233 | .5017 |
| mean91-11 | 6.3530 | 2.7700 | 3.5830 | 3.5369 [a,b] | .8356 [a,b] | 2.7013 [a,b] | 2.8161 [a] | 1.9552 [a] | .8609 [a] |
| avgr91-11 | -.9990 | -1.2259 [c] | -.7330 | .1194 | -.6263 | .4421 | -2.1767 | -1.4487 [c] | -3.9454 [c] |
| mean91-00 | 6.8863 | 2.9815 | 3.9048 | 3.6951 [a,b] | .8689 [a,b] | 2.8262 [a,b] | 3.1913 [a] | 2.1344 [a] | 1.0569 [a] |
| avgr91-01 | .3663 | -1.3342 [c] | 1.8490 | 2.5603 | -.5585 | 3.6835 | -1.9455 [c] | -1.6287 [c] | -2.5414 |
| mean01-11 | 5.8682 | 2.5777 | 3.2905 | 3.3932 [a,b] | .8053 [a,b] | 2.5879 [a,b] | 2.4750 [a] | 1.7923 [a] | .6827 [a] |
| avgr02-11 | -2.3643 [c] | -1.1175 [c] | -3.3151 [c] | -2.3216 | -.6941 | -2.7992 | -2.4079 [c] | -1.2686 [c] | -5.3495 [c] |

*Source: calculated from Cambridge Econometrics*

*[a] denotes rejection of Ho (group mean = EU mean) based on Student's t, 95% confidence interval; [b] denotes rejection of Ho (CEEC mean = Others mean) based on Student's t, 95% confidence interval; [c] denotes rejection of Ho (yearly average growth rate = 0) based on bootstrap sampling, 95% confidence interval, 10,000 replications*

**Table 2 – The $T_{con}$ indicator: whole sample and country groups, within and between country components, mean values and yearly average growth rate (1991-2011, 1991-2000 and 2001-2011)**

| | EU | | | CEECs | | | Other countries | | |
|---|---|---|---|---|---|---|---|---|---|
| | $T_{con}$ | $T_{con}w$ | $T_{con}b$ | $T_{con}$ | $T_{con}w$ | $T_{con}b$ | $T_{con}$ | $T_{con}w$ | $T_{con}b$ |
| 1991 | .2896 | .1093 | .1803 | .2190 | .0320 | .1870 | .0706 | .0773 | -.0067 |
| 1992 | .3067 | .1082 | .1985 | .2422 | .0324 | .2098 | .0645 | .0758 | -.0113 |
| 1993 | .3161 | .1064 | .2097 | .2549 | .0323 | .2226 | .0612 | .0741 | -.0129 |
| 1994 | .3247 | .1051 | .2196 | .2663 | .0325 | .2338 | .0584 | .0726 | -.0142 |
| 1995 | .3275 | .1066 | .2209 | .2666 | .0320 | .2345 | .0609 | .0745 | -.0136 |
| 1996 | .3378 | .1058 | .2321 | .2793 | .0314 | .2479 | .0585 | .0744 | -.0158 |
| 1997 | .3437 | .1047 | .2389 | .2883 | .0313 | .2571 | .0554 | .0735 | -.0181 |
| 1998 | .3526 | .1020 | .2506 | .3064 | .0311 | .2753 | .0461 | .0708 | -.0247 |
| 1999 | .3658 | .1034 | .2624 | .3135 | .0305 | .2830 | .0523 | .0728 | -.0205 |
| 2000 | .3758 | .1014 | .2745 | .3241 | .0303 | .2938 | .0517 | .0711 | -.0194 |
| 2001 | .3701 | .1053 | .2648 | .3213 | .0314 | .2899 | .0488 | .0739 | -.0251 |
| 2002 | .3382 | .1091 | .2292 | .2874 | .0329 | .2545 | .0509 | .0762 | -.0253 |
| 2003 | .3508 | .1090 | .2417 | .3006 | .0326 | .2681 | .0501 | .0765 | -.0263 |
| 2004 | .3370 | .1116 | .2254 | .2916 | .0344 | .2573 | .0454 | .0772 | -.0318 |
| 2005 | .3381 | .1122 | .2259 | .2933 | .0346 | .2587 | .0448 | .0776 | -.0328 |
| 2006 | .3313 | .1156 | .2157 | .2880 | .0374 | .2506 | .0433 | .0782 | -.0349 |
| 2007 | .3319 | .1168 | .2151 | .2934 | .0384 | .2550 | .0386 | .0784 | -.0397 |
| 2008 | .3268 | .1182 | .2086 | .2967 | .0397 | .2570 | .0301 | .0785 | -.0484 |
| 2009 | .3232 | .1185 | .2047 | .3008 | .0402 | .2606 | .0224 | .0783 | -.0559 |
| 2010 | .3105 | .1210 | .1895 | .2864 | .0398 | .2466 | .0241 | .0812 | -.0571 |
| 2011 | .3114 | .1211 | .1903 | .2874 | .0401 | .2473 | .0240 | .0810 | -.0570 |
| mean91-11 | .3338 | .1101 | .2237 | .2861 [a,b] | .0342 [a,b] | .2519 [a,b] | .0477 [a] | .0759 [a] | -.0282 [a] |
| avgr91-11 | .4189 | .5309 | .4258 | 1.4639 | 1.1758 | 1.5373 | -5.5448 [c] | .2537 | -12.5534 [c] |
| mean91-00 | .3340 | .1053 | .2288 | .2761 [a,b] | .0316 [a,b] | .2445 [a,b] | .0580 [a] | .0737 [a] | -.0157 [a] |
| avgr91-01 | 2.4973 [c] | -.3564 | 3.9705 [c] | 3.9497 [c] | -.1710 | 4.5379 [c] | -3.3396 | -.4228 | -16.2658 |
| mean01-11 | .3336 | .1144 | .2192 | .2952 [a,b] | .0365 [a,b] | .2587 [a,b] | .0384 [a] | .0779 [a] | -.0395 [a] |
| avgr02-11 | -1.6596 | 1.4183 [c] | -3.1189 | -1.0218 | 2.5225 [c] | -1.4632 | -7.7500 | .9303 | -8.8410 [c] |

*Source: calculated from Cambridge Econometrics*

*[a] denotes rejection of Ho (group mean = EU mean) based on Student's t, 95% confidence interval; [b] denotes rejection of Ho (CEEC mean = Others mean) based on Student's t, 95% confidence interval; [c] denotes rejection of Ho (yearly average growth rate = 0) based on bootstrap sampling, 95% confidence interval, 10,000 replications*

**Table 3 – The $T_{sp}$ indicator: major sectors, whole sample and country groups (absolute values, means and yearly average growth rates, 1991-2011, 1991-2000, 2001-11)**

| | EU | | | | | CEECs | | | | | Other countries | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **agr** | **constr** | **man** | **mktser** | **nnmktser** | **agr** | **constr** | **man** | **mktser** | **nnmktser** | **agr** | **constr** | **man** | **mktser** | **nnmktser** |
| 1991 | 4.7341 | .4937 | .3956 | -.4765 | 1.3870 | 4.0808 | .0439 | 1.4979 | -1.6062 | -.9456 | .6533 | .4498 | -1.1023 | 1.1296 | 2.3326 |
| 1992 | 4.8420 | .5093 | .4454 | -.5460 | 1.4669 | 4.4100 | .0420 | 1.4541 | -1.6252 | -1.0117 | .4320 | .4673 | -1.0087 | 1.0792 | 2.4786 |
| 1993 | 4.8674 | .4694 | .5713 | -.6311 | 1.4573 | 4.5963 | -.0218 | 1.4850 | -1.6159 | -1.0478 | .2711 | .4912 | -.9137 | .9849 | 2.5051 |
| 1994 | 4.9385 | .4200 | .6838 | -.6669 | 1.4255 | 4.7935 | -.0482 | 1.4751 | -1.6276 | -1.0618 | .1450 | .4682 | -.7913 | .9607 | 2.4873 |
| 1995 | 4.9160 | .4453 | .8658 | -.8521 | 1.2911 | 4.7075 | -.0905 | 1.5479 | -1.6307 | -1.0505 | .2085 | .5358 | -.6820 | .7786 | 2.3416 |
| 1996 | 5.0898 | .4515 | .9015 | -.8575 | 1.2074 | 4.8857 | -.0741 | 1.6017 | -1.6179 | -1.1460 | .2041 | .5256 | -.7002 | .7604 | 2.3534 |
| 1997 | 5.1876 | .5047 | 1.0077 | -.9765 | 1.2070 | 5.0825 | -.0728 | 1.6213 | -1.6644 | -1.1478 | .1051 | .5775 | -.6136 | .6879 | 2.3548 |
| 1998 | 5.5338 | .5055 | 1.0617 | -.9733 | 1.0894 | 5.5195 | -.0621 | 1.6507 | -1.6935 | -1.1947 | .0143 | .5676 | -.5889 | .7202 | 2.2841 |
| 1999 | 5.5283 | .5319 | 1.1508 | -1.1449 | 1.1165 | 5.5471 | -.1028 | 1.5336 | -1.6292 | -1.1604 | -.0188 | .6347 | -.3828 | .4842 | 2.2769 |
| 2000 | 5.7032 | .6020 | 1.2018 | -1.2012 | .9817 | 5.7726 | -.1384 | 1.4816 | -1.6008 | -1.1915 | -.0694 | .7404 | -.2798 | .3995 | 2.1732 |
| 2001 | 5.1399 | .6164 | 1.3882 | -1.3110 | .9112 | 4.9680 | -.0931 | 1.7460 | -1.6002 | -1.1188 | .1718 | .7095 | -.3578 | .2892 | 2.0300 |
| 2002 | 5.0245 | .6153 | 1.4318 | -1.5026 | .7065 | 4.5896 | -.1105 | 1.8477 | -1.6032 | -1.1450 | .4349 | .7259 | -.4159 | .1005 | 1.8516 |
| 2003 | 4.9442 | .6462 | 1.4426 | -1.5053 | .7379 | 4.5768 | -.0903 | 1.8178 | -1.5914 | -1.1142 | .3674 | .7365 | -.3752 | .0861 | 1.8522 |
| 2004 | 4.7284 | .6398 | 1.5839 | -1.5947 | .6860 | 4.3466 | -.0728 | 1.9899 | -1.5973 | -1.1777 | .3819 | .7126 | -.4061 | .0025 | 1.8637 |
| 2005 | 4.6620 | .6946 | 1.6606 | -1.6245 | .5954 | 4.2976 | -.0638 | 2.0294 | -1.5719 | -1.2218 | .3645 | .7583 | -.3688 | -.0526 | 1.8172 |
| 2006 | 4.4313 | .7022 | 1.7091 | -1.5806 | .5349 | 4.0230 | -.0253 | 2.1324 | -1.5544 | -1.2368 | .4083 | .7276 | -.4233 | -.0262 | 1.7717 |
| 2007 | 4.2713 | .7398 | 1.7454 | -1.5909 | .5484 | 3.8805 | .0605 | 2.1554 | -1.5167 | -1.2939 | .3908 | .6793 | -.4100 | -.0742 | 1.8424 |
| 2008 | 4.0916 | .7409 | 1.7532 | -1.5629 | .5348 | 3.7045 | .1742 | 2.1535 | -1.4836 | -1.3402 | .3871 | .5667 | -.4004 | -.0792 | 1.8750 |
| 2009 | 4.1256 | .6899 | 1.6570 | -1.5240 | .5746 | 3.7197 | .2613 | 2.0901 | -1.4018 | -1.4127 | .4059 | .4286 | -.4331 | -.1222 | 1.9873 |
| 2010 | 4.0375 | .6307 | 1.6488 | -1.5053 | .5307 | 3.5426 | .2424 | 2.0929 | -1.3311 | -1.4230 | .4949 | .3882 | -.4442 | -.1742 | 1.9536 |
| 2011 | 3.9690 | .6483 | 1.6624 | -1.5071 | .5262 | 3.4588 | .2511 | 2.0999 | -1.3333 | -1.4027 | .5102 | .3972 | -.4375 | -.1738 | 1.9289 |
| mean | 4.7984 | .5856 | 1.2366 | -1.1969 | .9294 | 4.5002 [a,b] | .0004 [a,b] | 1.7859 [a,b] | -1.5665 [a,b] | -1.1831 [a,b] | .2982 [a] | .5852 | -.5493 [a] | .3696 [a] | 2.1124 [a] |
| avgr | -.8127 | 1.5648 | 7.7817 [c] | -6.2334 [c] | -4.4482 | -.6705 | 13.3165 | 1.8296 | -.9047 | -2.0552 | -9.5061 | -.1236 | 3.4433 | -135.5895 | -.8743 |
| mean1 | 5.1341 | .4933 | .8286 | -.8326 | 1.2630 | 4.9396 [b] | -.0525 [a,b] | 1.5349 [a,b] | -1.6311 [a,b] | -1.0958 [a,b] | .1945 [a] | .5458 | -.7063 [a] | .7985 [a] | 2.3588 [a] |
| avgr1 | .9126 | 2.4947 | 13.6764 [c] | -10.9476 [c] | -3.9533 | 2.1828 | -39.8327 | 1.7344 | -.0211 | -1.7871 | -36.3786 | 4.9328 | 9.2866 | -11.9660 [c] | -1.3140 |
| mean2 | 4.4932 | .6695 | 1.6075 | -1.5281 | .6261 | 4.1007 [a,b] | .0485 [a,b] | 2.0141 [a,b] | -1.5077 [b] | -1.2624 [a,b] | .3925 [a] | .6209 | -.4066 [a] | -.0204 [a] | 1.8885 [a] |
| avgr2 | -2.5379 [c] | .6349 | 1.8869 | -1.5193 | -4.9430 | -3.5237 [c] | 66.4657 | 1.9248 | -1.7884 [c] | -2.3232 | 17.3663 | -5.1799 | -2.4001 | -259.2129 | -.4345 |

*Source: calculated from Cambridge Econometrics*

*mean and avgr (average growth): 1991-2011; mean 1 and avgr1: 1991-2001; mean2 and avgr2: 2002-2011*

*[a] denotes rejection of Ho (group mean = EU mean) based on Student's t, 95% confidence interval; [b] denotes rejection of Ho (CEEC mean = Others mean) based on Student's t, 95% confidence interval; [c] denotes rejection of Ho (yearly average growth rate = 0) based on bootstrap sampling, 95% confidence interval, 10,000 replications*

**Table 4 – The $T_{con}$ indicator: major sectors, whole sample and country groups (absolute values, means and yearly average growth rates, 1991-2011, 1991-2000, 2001-11)**

| | EU | | | | | CEECs | | | | | Other countries | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **agr** | **constr** | **man** | **mktser** | **nnmktser** | **agr** | **constr** | **man** | **mktser** | **nnmktser** | **agr** | **constr** | **man** | **mktser** | **nnmktser** |
| 1991 | .2151 | .0186 | .0224 | .0174 | .0161 | .2354 | -.0011 | .0282 | -.0223 | -.0212 | -.0203 | .0197 | -.0059 | .0398 | .0374 |
| 1992 | .2339 | .0169 | .0216 | .0168 | .0175 | .2612 | -.0005 | .0255 | -.0219 | -.0221 | -.0273 | .0174 | -.0040 | .0387 | .0396 |
| 1993 | .2445 | .0172 | .0214 | .0159 | .0171 | .2775 | -.0049 | .0253 | -.0212 | -.0217 | -.0330 | .0222 | -.0038 | .0371 | .0388 |
| 1994 | .2534 | .0179 | .0213 | .0154 | .0166 | .2907 | -.0064 | .0247 | -.0211 | -.0215 | -.0372 | .0243 | -.0033 | .0366 | .0382 |
| 1995 | .2566 | .0197 | .0213 | .0145 | .0153 | .2902 | -.0083 | .0260 | -.0204 | -.0209 | -.0337 | .0280 | -.0047 | .0349 | .0362 |
| 1996 | .2656 | .0206 | .0216 | .0149 | .0152 | .3013 | -.0074 | .0271 | -.0202 | -.0215 | -.0357 | .0280 | -.0054 | .0351 | .0367 |
| 1997 | .2715 | .0205 | .0220 | .0148 | .0149 | .3107 | -.0069 | .0260 | -.0202 | -.0212 | -.0393 | .0275 | -.0040 | .0350 | .0362 |
| 1998 | .2802 | .0193 | .0228 | .0166 | .0137 | .3266 | -.0060 | .0262 | -.0196 | -.0207 | -.0464 | .0253 | -.0033 | .0362 | .0344 |
| 1999 | .2946 | .0199 | .0229 | .0144 | .0140 | .3379 | -.0084 | .0223 | -.0184 | -.0199 | -.0434 | .0283 | .0006 | .0328 | .0340 |
| 2000 | .3047 | .0205 | .0230 | .0146 | .0130 | .3505 | -.0103 | .0208 | -.0175 | -.0194 | -.0458 | .0308 | .0022 | .0321 | .0324 |
| 2001 | .3009 | .0188 | .0246 | .0143 | .0115 | .3368 | -.0071 | .0256 | -.0169 | -.0172 | -.0359 | .0259 | -.0011 | .0312 | .0287 |
| 2002 | .2724 | .0181 | .0260 | .0122 | .0095 | .2968 | -.0073 | .0298 | -.0159 | -.0160 | -.0244 | .0255 | -.0038 | .0281 | .0255 |
| 2003 | .2834 | .0188 | .0269 | .0121 | .0097 | .3084 | -.0068 | .0303 | -.0157 | -.0156 | -.0250 | .0256 | -.0034 | .0278 | .0253 |
| 2004 | .2685 | .0194 | .0288 | .0109 | .0094 | .2941 | -.0055 | .0341 | -.0149 | -.0161 | -.0256 | .0249 | -.0053 | .0259 | .0255 |
| 2005 | .2676 | .0207 | .0301 | .0105 | .0092 | .2934 | -.0047 | .0354 | -.0146 | -.0162 | -.0258 | .0253 | -.0053 | .0252 | .0254 |
| 2006 | .2610 | .0205 | .0311 | .0100 | .0088 | .2820 | -.0021 | .0384 | -.0142 | -.0162 | -.0210 | .0226 | -.0073 | .0241 | .0249 |
| 2007 | .2607 | .0208 | .0318 | .0094 | .0092 | .2820 | .0031 | .0390 | -.0136 | -.0172 | -.0212 | .0177 | -.0072 | .0230 | .0263 |
| 2008 | .2584 | .0173 | .0326 | .0090 | .0094 | .2793 | .0087 | .0397 | -.0133 | -.0178 | -.0209 | .0086 | -.0071 | .0223 | .0272 |
| 2009 | .2580 | .0127 | .0342 | .0086 | .0098 | .2785 | .0121 | .0412 | -.0126 | -.0184 | -.0206 | .0006 | -.0071 | .0212 | .0282 |
| 2010 | .2478 | .0110 | .0344 | .0079 | .0094 | .2621 | .0120 | .0421 | -.0117 | -.0181 | -.0143 | -.0011 | -.0076 | .0196 | .0275 |
| 2011 | .2484 | .0111 | .0347 | .0079 | .0093 | .2620 | .0125 | .0425 | -.0117 | -.0179 | -.0136 | -.0014 | -.0077 | .0195 | .0272 |
| mean | .2641 | .0181 | .0265 | .0128 | .0123 | .2932 [a,b] | -.0021 [a,b] | .0310 [a,b] | -.0170 [a,b] | -.0189 [a,b] | -.0291 [a] | .0203 | -.0045 [a] | .0298 [a] | .0312 [a] |
| avgr | .8036 | -2.1186 | 2.2587 [c] | -3.7402 [c] | -2.5447 | .6605 | -17.1275 | 2.3959 | 3.1697 [c] | 0.7658 | .6264 | -22.8856 | -4.5026 | -3.4353 [c] | -1.4724 |
| mean1 | .2620 | .0191 | .0220 | .0155 | .0154 | .2982 [a,b] | -.0060 [a,b] | .0252 [b] | -.0203 [a,b] | -.0210 [a,b] | -.0362 [a] | .0251 [a] | -.0032 [a] | .0358 [a] | .0364 [a] |
| avgr1 | 3.4419 [c] | 0.2760 | 0.9804 | -1.7352 | -3.1907 | 3.7122 [c] | -90.3513 | -0.4984 | 2.7316 [c] | 1.9939 | -7.0324 | 3.5568 | 25.7527 | -2.3269 | -2.5107 |
| mean2 | .2661 | .0172 | .0305 | .0103 | .0095 | .2887 [a,b] | .0014 [a,b] | .0362 [b] | -.0141 [a,b] | -.0170 [a,b] | -.0226 [a] | .0158 | -.0057 [a] | .0244 [a] | .0265 [a] |
| avgr2 | -1.8347 | -4.5132 | 3.5370 [c] | -5.7453 [c] | -1.8986 | -2.3912 | 56.0963 | 5.2903 | 3.6078 [c] | -0.4622 | 8.2852 | -49.3279 | -34.7579 | -4.5436 [c] | -0.4341 |

*Source: calculated from Cambridge Econometrics*

*mean and avgr (average growth): 1991-2011; mean 1 and avgr1: 1991-2001; mean2 and avgr2: 2002-2011*

*[a] denotes rejection of Ho (group mean = EU mean) based on Student's t, 95% confidence interval; [b] denotes rejection of Ho (CEEC mean = Others mean) based on Student's t, 95% confidence interval; [c] denotes rejection of Ho (yearly average growth rate = 0) based on bootstrap sampling, 95% confidence interval, 10,000 replications*

## 4. Patterns of specialization and agglomeration in CEECs

In order to consider the features and the evolution of production patterns in CEECs more closely, these countries are now considered individually. The focus is on manufacturing and market services, i.e. on the sectors that most of all register significant changes, especially in the second sub-period (2002-11).

We start from market services. As already seen from Tables 3-4, during 1991-2011 CEECs show below-average specialization and agglomeration in the sector, growing as far as geographic concentration is concerned, but falling for specialization. Sectoral indicators in Table 5 confirm these results for individual countries: over 1991-2011 regions in Eastern countries all present significantly below-average sectoral specialization (part a) and agglomeration (part b).

**Table 5 - $T_{sp}$ and $T_{con}$ indicators in market services for individual CEECs (absolute values, means and yearly average growth rates, 1991-2011, 1991-2000, 2001-11)**

*(part a: $T_{sp}$)*

| | Bg | Cz | Ee | Lv | Lt | Hu | Pl | Ro | Si | Sk |
|---|---|---|---|---|---|---|---|---|---|---|
| 1991 | -.2488 | -.0634 | -.0392 | -.0382 | -.0361 | -.1587 | -.4929 | -.3726 | -.0501 | -.1061 |
| 1992 | -.2512 | -.0648 | -.0375 | -.0367 | -.0390 | -.1609 | -.5098 | -.3692 | -.0520 | -.1041 |
| 1993 | -.2533 | -.0690 | -.0307 | -.0322 | -.0361 | -.1725 | -.5027 | -.3725 | -.0440 | -.1029 |
| 1994 | -.2524 | -.0664 | -.0244 | -.0290 | -.0312 | -.1792 | -.5268 | -.3750 | -.0444 | -.0987 |
| 1995 | -.2518 | -.0667 | -.0191 | -.0289 | -.0346 | -.1886 | -.5335 | -.3672 | -.0453 | -.0950 |
| 1996 | -.2572 | -.0787 | -.0170 | -.0292 | -.0361 | -.1718 | -.5396 | -.3873 | -.0405 | -.0604 |
| 1997 | -.2646 | -.0910 | -.0185 | -.0327 | -.0324 | -.1641 | -.5541 | -.3909 | -.0449 | -.0714 |
| 1998 | -.2638 | -.0846 | -.0146 | -.0244 | -.0368 | -.1937 | -.5635 | -.4166 | -.0426 | -.0528 |
| 1999 | -.2425 | -.0696 | -.0120 | -.0207 | -.0403 | -.1818 | -.5624 | -.4025 | -.0480 | -.0492 |
| 2000 | -.2499 | -.0597 | -.0088 | -.0170 | -.0395 | -.1660 | -.5757 | -.3912 | -.0451 | -.0478 |
| 2001 | -.2423 | -.0632 | -.0148 | -.0204 | -.0395 | -.1741 | -.5634 | -.4002 | -.0457 | -.0367 |
| 2002 | -.2456 | -.0648 | -.0105 | -.0212 | -.0387 | -.1871 | -.5599 | -.4167 | -.0358 | -.0229 |
| 2003 | -.2456 | -.0683 | -.0163 | -.0178 | -.0387 | -.1804 | -.5659 | -.4090 | -.0350 | -.0143 |
| 2004 | -.2334 | -.0759 | -.0244 | -.0161 | -.0360 | -.1868 | -.5791 | -.3915 | -.0365 | -.0176 |
| 2005 | -.2284 | -.0791 | -.0187 | -.0168 | -.0363 | -.1719 | -.5896 | -.3930 | -.0389 | .0008 |
| 2006 | -.2317 | -.0854 | -.0167 | -.0100 | -.0283 | -.1789 | -.5867 | -.3913 | -.0355 | .0100 |
| 2007 | -.2267 | -.0846 | -.0199 | -.0080 | -.0286 | -.1808 | -.5499 | -.3940 | -.0325 | .0082 |
| 2008 | -.1957 | -.0980 | -.0173 | -.0074 | -.0205 | -.1762 | -.5663 | -.3870 | -.0308 | .0155 |
| 2009 | -.1893 | -.0793 | -.0134 | -.0050 | -.0187 | -.1811 | -.5535 | -.3774 | -.0246 | .0405 |
| 2010 | -.1744 | -.0690 | -.0134 | -.0045 | -.0115 | -.1880 | -.5289 | -.3675 | -.0204 | .0465 |
| 2011 | -.1803 | -.0652 | -.0134 | -.0047 | -.0116 | -.1941 | -.5179 | -.3706 | -.0210 | .0455 |
| mean | -.2347[a,b] | -.0737[a,b] | -.0191[a,b] | -.0200[a,b] | -.0319[a,b] | -.1779[a,b] | -.5487[a,b] | -.3878[a,b] | -.0387[a,b] | -.0339[a,b] |
| avgr | 1.5015 | -.7217 | 1.9442 | 8.7575 | 4.5385 | -1.2151 | -.2846 | -.0130 | 3.7633 | 81.9809 |
| mean1 | -.2536[a,b] | -.0714[a,b] | -.0222[a,b] | -.0289[a,b] | -.0362[a,b] | -.1737[a,b] | -.5361[a,b] | -.3845[a,b] | -.0457[a,b] | -.0788[a,b] |
| avgr1 | .2137 | -.5868 | 6.4258 | 5.1867 | -1.3113 | -1.2419 | -1.3662 | -.7659 | .5546 | 8.8013 |
| mean2 | -.2176[a,b] | -.0757[a,b] | -.0163[a,b] | -.0120[a,b] | -.0280[a,b] | -.1818[a,b] | -.5601[a,b] | -.3907[a,b] | -.0324[a,b] | .0069[a,b] |
| avgr2 | 2.7894 | -.8566 | -2.5374 | 12.3283 | 10.3882 | -1.1883 | .7970 | .7400 | 6.9720 | 155.1604 |

*(part b: $T_{con}$)*

| | Bg | Cz | Ee | Lv | Lt | Hu | Pl | Ro | Si | Sk |
|---|---|---|---|---|---|---|---|---|---|---|
| 1991 | -.00223 | -.00036 | -.00044 | -.00077 | -.00088 | -.00109 | -.00602 | -.00921 | -.00040 | -.00094 |
| 1992 | -.00206 | -.00037 | -.00040 | -.00068 | -.00093 | -.00098 | -.00627 | -.00893 | -.00039 | -.00092 |
| 1993 | -.00205 | -.00042 | -.00031 | -.00056 | -.00083 | -.00102 | -.00604 | -.00875 | -.00032 | -.00092 |
| 1994 | -.00203 | -.00040 | -.00023 | -.00045 | -.00067 | -.00104 | -.00639 | -.00873 | -.00031 | -.00088 |
| 1995 | -.00201 | -.00040 | -.00017 | -.00040 | -.00072 | -.00097 | -.00652 | -.00805 | -.00031 | -.00085 |
| 1996 | -.00200 | -.00050 | -.00015 | -.00038 | -.00074 | -.00079 | -.00659 | -.00816 | -.00026 | -.00061 |
| 1997 | -.00196 | -.00061 | -.00016 | -.00044 | -.00066 | -.00073 | -.00688 | -.00781 | -.00028 | -.00067 |
| 1998 | -.00192 | -.00050 | -.00012 | -.00032 | -.00074 | -.00096 | -.00691 | -.00736 | -.00026 | -.00053 |
| 1999 | -.00155 | -.00031 | -.00009 | -.00026 | -.00076 | -.00081 | -.00655 | -.00728 | -.00029 | -.00047 |
| 2000 | -.00152 | -.00022 | -.00007 | -.00020 | -.00070 | -.00067 | -.00634 | -.00711 | -.00027 | -.00043 |
| 2001 | -.00137 | -.00026 | -.00011 | -.00025 | -.00066 | -.00064 | -.00595 | -.00702 | -.00027 | -.00036 |
| 2002 | -.00140 | -.00028 | -.00008 | -.00026 | -.00067 | -.00070 | -.00566 | -.00637 | -.00021 | -.00029 |
| 2003 | -.00143 | -.00026 | -.00012 | -.00022 | -.00068 | -.00072 | -.00560 | -.00622 | -.00020 | -.00023 |
| 2004 | -.00134 | -.00033 | -.00018 | -.00020 | -.00062 | -.00069 | -.00541 | -.00574 | -.00020 | -.00024 |
| 2005 | -.00127 | -.00033 | -.00014 | -.00020 | -.00063 | -.00053 | -.00558 | -.00558 | -.00021 | -.00013 |
| 2006 | -.00128 | -.00031 | -.00013 | -.00012 | -.00049 | -.00053 | -.00563 | -.00540 | -.00019 | -.00008 |
| 2007 | -.00123 | -.00030 | -.00015 | -.00010 | -.00049 | -.00053 | -.00522 | -.00528 | -.00017 | -.00008 |
| 2008 | -.00110 | -.00039 | -.00013 | -.00009 | -.00034 | -.00042 | -.00553 | -.00508 | -.00016 | -.00004 |
| 2009 | -.00108 | -.00023 | -.00009 | -.00006 | -.00030 | -.00043 | -.00551 | -.00492 | -.00013 | .00013 |
| 2010 | -.00094 | -.00014 | -.00009 | -.00005 | -.00017 | -.00047 | -.00525 | -.00466 | -.00010 | .00016 |
| 2011 | -.00095 | -.00011 | -.00009 | -.00005 | -.00017 | -.00051 | -.00515 | -.00470 | -.00011 | .00016 |
| mean | -.00156 [a,b] | -.00033 [a,b] | -.00016 [a,b] | -.00029 [a,b] | -.00061 [a,b] | -.00073 [a,b] | -.00595 [a,b] | -.00678 [a,b] | -.00024 [a,b] | -.00039 [a,b] |
| avgr | 4.0149 [c] | 3.1935 | 4.2873 | 11.3494 [c] | 6.7321 | 2.9533 | .6944 | 3.2713 [c] | 6.0272 [c] | 32.4400 |
| mean1 | -.00193 [a,b] | -.00041 [a,b] | -.00021 [a,b] | -.00045 [a,b] | -.00076 [a,b] | -.00091 [a,b] | -.00645 [a,b] | -.00814 [a,b] | -.00031 [a,b] | -.00072 [a,b] |
| avgr1 | 4.5349 | .7364 | 9.8897 | 9.6275 | 2.2814 | 4.2452 | .0297 | 2.6412 [c] | 3.6465 | 8.5426 |
| mean2 | -.00122 [a,b] | -.00027 [a,b] | -.00012 [a,b] | -.00015 [a,b] | -.00047 [a,b] | -.00056 [a,b] | -.00550 [a,b] | -.00554 [a,b] | -.00018 [a,b] | -.00009 [a,b] |
| avgr2 | 3.4948 | 5.6506 | -1.3152 | 13.0712 [c] | 11.1828 | 1.6614 | 1.3591 | 3.9013 [c] | 8.4079 [c] | 56.3374 |

*Source: calculated from Cambridge Econometrics*
*mean and avgr (average growth): 1991-2011; mean 1 and avgr1: 1991-2001; mean2 and avgr2: 2002-2011;*
*[a] denotes rejection of Ho (each mean = corresponding EU mean) based on Student's t, 95% confidence interval;*
*[b] denotes rejection of Ho (each mean = corresponding Others mean) based on Student's t, 95% confidence interval;*
*[c] denotes rejection of Ho (yearly average growth rate = 0) based on bootstrap sampling, 95% confidence interval, 10,000 replications*

Not counting one-region countries (i.e. the three Baltic - more on this point *infra*) specialization grows in only three cases (Bulgaria, Slovenia and Slovakia) while agglomeration grows for all. Specializations generally picks up in the second sub-period even if average growth rates are never significant and never high enough to allow indicators to become positive[24]. In some countries (Bulgaria, Slovenia and Slovakia) growth occurs in both sub-periods and is higher in the second one; in others (Poland and Romania) specialization first falls and starts growing only in the Two Thousands, showing initial adjustment and later catching up. In two cases (the Czech Republic and Hungary) it falls throughout the entire period. In general, the indicators point to surprisingly low growth in sectoral specialization throughout the period, notwithstanding initial underdevelopment. As far as agglomeration is concerned, the dynamics is more clear-cut: average indicators grow for all cases (significantly for

[24] Only in one case (Slovakia) regional specialization in the sector grows to the extent of reaching, from 2005 on, positive (i.e. above EU-average) values.

Bulgaria, Romania and Slovenia) even if the sector remains significantly more dispersed than for Western regions.

Consistent growth in agglomeration coupled with moderate (or negative) growth in specialization points to a sector that is largely dominated by diverging behaviour between capitals and non-capital regions. Sectoral indexes for CEECs capitals (excluding the three Baltic ones) show above-average specialization and agglomeration for all cases except the Polish and Bulgarian capital regions Mazowieckie and Yugozapaden[25]. The role of capital regions was investigated further by calculating the indicators for a sub-sample obtained by excluding all CEECs capitals; the null hypothesis was then tested that average indicators for the original sample and for the sub-sample were statistically different[26]. The results show significant differences between the two samples for all cases except for Bulgaria and Slovenia, confirming the leading role of capitals in the sector[27].

The need to separate capital from non-capital regions makes the analysis of the three one-region Baltic countries difficult, inasmuch as country performance could reflect a dominant capital effect that cannot be disentangled from other factors. In fact in 1991 the three countries presented the highest group specialization in the sector together with relatively high geographic concentration. However, over time only Latvia and Lithuania achieved further specialization and agglomeration (significant in the case of Latvia) while both indicators fell for Estonia after initial growth in the first sub-period.

A further breakdown of sectoral specialization and agglomeration patterns in CEECs addresses the role, if any, of the most advanced activities in the sector i.e. of knowledge-intensive markets services, including financial intermediation. This is done with reference to the Eurostat REGIO database. In principle the data covers 1999-2007 but for many CEECs the period is shorter and can start as late as 2004 (Poland) or 2003 (Bulgaria) (details on the time coverage are in Appendix 1). Given the additive nature of the Theil indicators, missing data represents a serious drawback inasmuch as it limits analysis to the period during which data is complete (in the case in object only to 2004-07). In what follows an attempt is made to overcome this limit by calculating indicators prior to 2004. This is done by substituting in equations (2) and (3) total employment with the total employment available for the year. The values obtained are strictly not comparable with the ones based on the whole sample and should therefore be interpreted with caution; nevertheless they do provide some information on sectoral evolution at least from a qualitative point of view[28]. Indicators for market knowledge-intensive services and financial intermediation are in Table 6. Over 2004-07 they show significantly below-average specialization and agglomeration for all CEECs, growing

[25] For Poland both indicators remain negative throughout the whole period, but for Yugozapaden they turn positive in the second sub-period. Indicators for individual regions are not shown in the paper but are available on request.

[26] Test performed through Student's t, at 95% confidence interval.

[27] For both countries, this points to low sectoral disproportions between capital and non-capital regions; however, for Bulgaria this appears to follow from sectoral underdevelopment in the capital region (see note 25 above).

[28] Before 2004 the indicators naturally underestimate the phenomenon to which they relate. However, the hypothesis that the yearly differences between total and available employment are equal to zero was tested by means of bootstrap inference with 10,000 replications and turned out to be acceptable for all years from 1997 to 2004 with a 95% confidence interval. Due to the purely indicative character of the indicators thus obtained, none of the usual tests is performed prior to 2004.

somewhat (never significantly) in the three Baltic countries, in Bulgaria, the Czech Republic and Slovenia but falling in all the rest. Again, separating capitals from non-capital regions shows that, where it occurs, specialization in the more advanced market services is achieved almost entirely by capitals.

All-in-all, the analysis of market services in CEECs shows a deep divide building between capital and non-capital regions. While agglomeration in the sector grows for all capitals it falls for most other regions. The development of market services and of its most advanced sub-sectors, which often represent a driving force for growth, is entirely limited to capitals. As these slowly catch up on their Western counterparts, the other regions lag behind, moving away from the EU average.

**Table 6 - $T_{sp}$ and $T_{con}$ indicators in knowledge-intensive market services and in financial intermediation for individual CEECs, absolute values (1999-2007) mean and yearly average growth rate (2004-07)**

| $T_{sp}$ | Bg | Cz | Ee | Lv | Lt | Hu | Pl | Ro | Si | Sk |
|---|---|---|---|---|---|---|---|---|---|---|
| 1999 | | -.0470 | -.0017 | -.0108 | -.0133 | -.0630 | | | | -.0234 |
| 2000 | | -.0287 | -.0029 | -.0078 | -.0127 | -.0517 | | -.0875 | | -.0174 |
| 2001 | | -.0481 | -.0004 | -.0141 | -.0151 | -.0598 | | -.0898 | -.0138 | -.0093 |
| 2002 | | -.0774 | .0009 | -.0131 | -.0149 | -.0757 | | -.1024 | -.0191 | -.0283 |
| 2003 | -.0784 | -.0597 | -.0052 | -.0105 | -.0138 | -.0699 | | -.1041 | -.0153 | -.0211 |
| 2004 | -.0893 | -.0790 | -.0098 | -.0154 | -.0167 | -.0793 | -.1972 | -.1078 | -.0212 | -.0157 |
| 2005 | -.0896 | -.0860 | -.0084 | -.0140 | -.0167 | -.0817 | -.1990 | -.1138 | -.0196 | -.0252 |
| 2006 | -.0895 | -.0749 | -.0103 | -.0118 | -.0159 | -.0872 | -.2132 | -.1178 | -.0193 | -.0294 |
| 2007 | -.0905 | -.0708 | -.0104 | -.0115 | -.0162 | -.0904 | -.2090 | -.1207 | -.0198 | -.0267 |
| mean | -.0875 [a,b] | -.0741 [a,b] | -.0088 [a,b] | -.0126 [a,b] | -.0159 [a,b] | -.0817 [a,b] | -.2046 [a,b] | -.1128 [a,b] | -.0191 [a,b] | -.0236 [a,b] |
| avgr | .5065 | 1.2184 | 1.4732 | 4.3768 | 1.3082 | -.9523 | -.9889 | -1.2575 | 2.6075 | -13.9907 |
| **$T_{con}$** | **Bg** | **Cz** | **Ee** | **Lv** | **Lt** | **Hu** | **Pl** | **Ro** | **Si** | **Sk** |
| 1999 | | -.00215 | -.00008 | -.00084 | -.00158 | -.00159 | | | | -.00154 |
| 2000 | | -.00120 | -.00012 | -.00054 | -.00133 | -.00087 | | -.00851 | | -.00120 |
| 2001 | | -.00184 | -.00020 | -.00067 | -.00126 | -.00126 | | -.00767 | -.00044 | -.00093 |
| 2002 | | -.00233 | -.00001 | -.00072 | -.00110 | -.00132 | | -.00625 | -.00047 | -.00115 |
| 2003 | -.00176 | -.00173 | .00003 | -.00066 | -.00110 | -.00112 | | -.00605 | -.00036 | -.00103 |
| 2004 | -.00189 | -.00211 | -.00027 | -.00072 | -.00111 | -.00129 | -.00656 | -.00592 | -.00047 | -.00090 |
| 2005 | -.00183 | -.00225 | -.00023 | -.00064 | -.00110 | -.00117 | -.00684 | -.00585 | -.00043 | -.00102 |
| 2006 | -.00183 | -.00190 | -.00029 | -.00055 | -.00102 | -.00128 | -.00748 | -.00595 | -.00041 | -.00110 |
| 2007 | -.00183 | -.00176 | -.00028 | -.00053 | -.00102 | -.00131 | -.00696 | -.00587 | -.00041 | -.00109 |
| mean | -.00183 [a,b] | -.00195 [a,b] | -.00021 [a,b] | -.00062 [a,b] | -.00107 [a,b] | -.00123 [a,b] | -.00696 [a,b] | -.00593 [a,b] | -.00042 [a,b] | -.00103 [a,b] |
| avgr | .85170 | 1.3227 | 4.4726 | 2.9572 | .8179 | .8895 | -1.6722 | -.0605 | 2.9719 | -3.5621 |

*Source: calculated from Eurostat*
*mean and avgr (average growth) calculated over 2004-07;*
*[a] denotes rejection of Ho (country mean = corresponding EU mean) based on Student's t, 95% confidence interval;*
*[b] denotes rejection of Ho (country mean = corresponding Others mean) based on Student's t, 95% confidence interval*

The indicators relating to the manufacturing sector are in Table 7. As already seen, during 1991-2011 CEECs as a group present above-average and rising sectoral disproportions both in the field of specialization and of agglomeration. Table 7 largely confirms these results and shows significantly higher average sectoral indicators in each CEEC both with respect to the EU and to Other countries, rising over time in most cases[29]. A breakdown of the indicators by sub-periods is interesting inasmuch as it

[29] Except in Bulgaria, Slovenia and Slovakia for specialization, in Latvia and Slovenia for agglomeration.

provides *prima facie* insight on industrial reconversion and restructuring processes in former centrally planned economies. Focusing on specialization, it would appear reasonable to expect indicators to fall in 1991-2001 on account of decline and heavy restructuring in traditional branches, and to fall much less – or grow – in 2002-11, due to restructuring getting close to completion and/or to successful completion leading to higher comparative advantage in the sector. Inspection of Table 7, part a, shows that this scheme applies only to a minority of CEECs, notably Bulgaria, Romania, Slovenia and Slovakia. Apart from Slovenia, where the indexes fall significantly in both sub-periods and the fall deepens in the second one, signaling what appears to be structural de-specialization in the sector, the hypothesis of initial decline and restructuring followed by later consolidation appears to fit fairly well for the other three countries. For the remaining ones instead positive and high growth rates in the first sub-period (significant in two cases - the Czech Republic and Hungary) followed by further growth, albeit lower, in the second one apparently points to delayed restructuring. This is particularly evident for the Czech Republic and Poland where sectoral specialization continues to grow well into the Two Thousands.

Table 7, part b, also shows that in CEECs deeper sectoral specialization is coupled with higher agglomeration. This occurs in eight countries out of ten, and in some cases results in significant rates of growth. Industry's geographic concentration falls only in Slovenia and in Latvia. Again, this runs counter the general intuition according to which successful restructuring would require the dissemination of firms across regions, in line with what happens in Other members' regions; in some sense, it recalls instead the production patterns that used to prevail under central planning[30].

In summary, industrial specialization and agglomeration indicators in CEEC regions show an unexpected persistence of initial patterns. Only one country (Slovenia) shows signs of structural reconversion away from manufacturing, in line with what generally occurs in Other countries. Early and successful restructuring appears to have taken place only in Bulgaria and in Romania[31], even if in both cases, unlike what occurs in the West, it goes hand-in-hand with higher concentration across regions. Also in the other CEECs, where slow and delayed industrial restructuring prevails, localization becomes more intense, as regions move away from the patterns prevailing among Western regions.

A further point worth investigating is whether CEECs regions' growing specialization in manufacturing shown in Tables 3 and 7 is related to the development of more modern, up-to-date lines of production – and in this sense may be interpreted as a sign of successful industrial restructuring – or instead it originates from more traditional areas, pointing to an extension over time of the production schemes typical of former centrally planned economies. This is done by considering the intra-sectoral differentiation of regional manufacturing on the basis of its technology level. Data is taken from the Eurostat REGIO database and distinguishes between low and medium technology manufacturing (respectively, light and heavy industry), the latter divided into

[30] As with services, a new sample was built without capital regions. The new sample was then compared with the original one by testing for statistical differences between the two. Results rule out significant sectoral differences for all CEECs, except for Hungary for specialization, Bulgaria for agglomeration and Slovenia for both. Test performed through Student's t, at 95% confidence interval.

[31] In the case of Romania restructuring processes appear to have been largely related to investments from abroad.

medium-low and medium-high technology sectors (see Appendix 1 for definitions)[32]. Again, the dataset is complete only from 2004 on; indicators for previous years are built according to the method described above and should be considered as purely indicative.

**Table 7 - $T_{sp}$ and $T_{con}$ indicators in manufacturing for CEECs (absolute, mean values and yearly average growth rates, 1991-2011, 1991-2000, 2001-11)**

*(part a: $T_{sp}$)*

| $T_{sp}$ | Bg | Cz | Ee | Lv | Lt | Hu | Pl | Ro | Si | Sk |
|---|---|---|---|---|---|---|---|---|---|---|
| 1991 | .2099 | .3984 | .0253 | .0184 | .0278 | .0875 | .0032 | .4317 | .1303 | .1654 |
| 1992 | .1980 | .4149 | .0246 | .0138 | .0319 | .1189 | .0466 | .3038 | .1355 | .1661 |
| 1993 | .1976 | .4392 | .0173 | .0062 | .0173 | .1724 | .0926 | .2429 | .1293 | .1701 |
| 1994 | .1863 | .4489 | .0170 | -.0023 | .0013 | .2161 | .0993 | .2154 | .1262 | .1668 |
| 1995 | .1677 | .4421 | .0359 | .0041 | .0057 | .2470 | .1368 | .2277 | .1225 | .1584 |
| 1996 | .1440 | .4849 | .0319 | -.0004 | .0010 | .2526 | .1464 | .2656 | .1138 | .1620 |
| 1997 | .1451 | .5264 | .0223 | -.0035 | .0016 | .2862 | .1647 | .1927 | .1107 | .1752 |
| 1998 | .1296 | .5254 | .0219 | -.0042 | .0039 | .3274 | .1691 | .2186 | .1081 | .1509 |
| 1999 | .1122 | .5189 | .0235 | -.0037 | .0024 | .3464 | .1516 | .1139 | .1101 | .1582 |
| 2000 | .1193 | .5362 | .0315 | .0003 | .0038 | .3440 | .1019 | .0769 | .1101 | .1576 |
| 2001 | .1071 | .5567 | .0312 | -.0031 | .0040 | .3738 | .3246 | .0841 | .1102 | .1575 |
| 2002 | .1153 | .5478 | .0243 | -.0051 | .0056 | .3784 | .2488 | .2783 | .1026 | .1518 |
| 2003 | .1017 | .5476 | .0308 | -.0021 | .0069 | .3257 | .2781 | .2629 | .1027 | .1635 |
| 2004 | .1143 | .5620 | .0428 | -.0027 | .0057 | .3222 | .3515 | .3275 | .1032 | .1635 |
| 2005 | .1224 | .5924 | .0384 | -.0052 | .0077 | .3143 | .3911 | .3027 | .1033 | .1622 |
| 2006 | .1315 | .6082 | .0292 | -.0034 | .0073 | .3250 | .4422 | .3358 | .0971 | .1596 |
| 2007 | .1384 | .6048 | .0255 | -.0041 | .0073 | .3480 | .4813 | .2949 | .0927 | .1667 |
| 2008 | .1223 | .6170 | .0292 | -.0012 | .0082 | .3586 | .4932 | .2782 | .0851 | .1629 |
| 2009 | .1244 | .5815 | .0301 | -.0032 | .0055 | .3196 | .5556 | .2851 | .0723 | .1193 |
| 2010 | .1359 | .5792 | .0340 | .0031 | .0043 | .3213 | .5254 | .3071 | .0665 | .1163 |
| 2011 | .1433 | .5717 | .0347 | .0043 | .0049 | .3286 | .5175 | .3109 | .0669 | .1171 |
| mean | .1413 a,b | .5288 a,b | .0286 a,b | .0003 a,b | .0078 a,b | .2911 a,b | .2725 a,b | .2551 a,b | .1047 a,b | .1558 a,b |
| avgr | -1.5091 | 1.8872 | 5.1857 | 25.2733 | 20.0999 | 7.6742 | 88.1176 | 6.1583 | -3.1739 c | -1.3958 |
| mean1 | .1610 a,b | .4735 a,b | .0251 a,b | .0029 a,b | .0097 a,b | .2399 a,b | .1112 a,b | .2289 a,b | .1197 a,b | .1631 a,b |
| avgr1 | -6.2940 c | 3.4659 c | 7.4420 | 47.1628 | 35.4500 | 16.4244 c | 170.6159 | -12.3634 | -1.6101 | -.3195 |
| mean2 | .1233 a,b | .5790 a,b | .0318 a,b | -.0021 a,b | .0061 a,b | .3378 a,b | .4190 a,b | .2789 a,b | .0911 a,b | .1491 a,b |
| avgr2 | 3.2758 | .3086 | 2.9295 | 3.3838 | 4.7498 | -1.0759 | 5.6193 | 24.6799 | -4.7378 c | -2.4721 |

[32] Consideration of the most advanced sub-sector (high technology manufacturing) is not possible due to incomplete data.

*(part b: $T_{con}$)*

| $T_{con}$ | Bg | Cz | Ee | Lv | Lt | Hu | Pl | Ro | Si | Sk |
|---|---|---|---|---|---|---|---|---|---|---|
| 1991 | .00229 | .00494 | .00041 | .00053 | .00097 | .00126 | .00094 | .01341 | .00147 | .00200 |
| 1992 | .00208 | .00531 | .00040 | .00039 | .00114 | .00156 | .00187 | .00919 | .00148 | .00211 |
| 1993 | .00220 | .00596 | .00027 | .00017 | .00063 | .00209 | .00294 | .00727 | .00143 | .00230 |
| 1994 | .00216 | .00633 | .00027 | -.00006 | .00005 | .00251 | .00321 | .00649 | .00139 | .00233 |
| 1995 | .00199 | .00632 | .00053 | .00009 | .00020 | .00243 | .00413 | .00670 | .00134 | .00229 |
| 1996 | .00175 | .00692 | .00046 | -.00001 | .00003 | .00242 | .00437 | .00759 | .00120 | .00237 |
| 1997 | .00167 | .00759 | .00033 | -.00008 | .00006 | .00275 | .00495 | .00500 | .00115 | .00254 |
| 1998 | .00168 | .00733 | .00032 | -.00010 | .00013 | .00320 | .00502 | .00529 | .00112 | .00218 |
| 1999 | .00110 | .00713 | .00033 | -.00008 | .00008 | .00353 | .00430 | .00245 | .00118 | .00225 |
| 2000 | .00137 | .00743 | .00044 | .00001 | .00013 | .00354 | .00290 | .00158 | .00121 | .00219 |
| 2001 | .00121 | .00776 | .00044 | -.00007 | .00013 | .00384 | .00723 | .00170 | .00121 | .00217 |
| 2002 | .00142 | .00782 | .00035 | -.00012 | .00019 | .00395 | .00550 | .00733 | .00116 | .00219 |
| 2003 | .00138 | .00780 | .00046 | -.00005 | .00024 | .00350 | .00667 | .00671 | .00117 | .00242 |
| 2004 | .00151 | .00813 | .00065 | -.00007 | .00020 | .00333 | .00822 | .00842 | .00119 | .00248 |
| 2005 | .00169 | .00876 | .00061 | -.00013 | .00028 | .00327 | .00951 | .00771 | .00120 | .00249 |
| 2006 | .00184 | .00907 | .00048 | -.00009 | .00027 | .00338 | .01096 | .00880 | .00114 | .00255 |
| 2007 | .00198 | .00921 | .00042 | -.00012 | .00028 | .00361 | .01220 | .00763 | .00112 | .00270 |
| 2008 | .00182 | .00950 | .00049 | -.00003 | .00031 | .00364 | .01315 | .00706 | .00105 | .00272 |
| 2009 | .00209 | .00927 | .00048 | -.00009 | .00021 | .00322 | .01559 | .00743 | .00091 | .00210 |
| 2010 | .00214 | .00944 | .00053 | .00008 | .00016 | .00333 | .01523 | .00823 | .00084 | .00207 |
| 2011 | .00220 | .00936 | .00055 | .00012 | .00018 | .00345 | .01520 | .00843 | .00085 | .00212 |
| mean | .0018 [a,b] | .0077 [a,b] | .0004 [a,b] | .0000 [a,b] | .0003 [a,b] | .0030 [a,b] | .0073 [a,b] | .0069 [a,b] | .0012 [a,b] | .0023 [a,b] |
| avgr | .6808 | 3.3378 [c] | 4.7134 | -93.3045 | 20.3580 | 5.7264 | 20.1700 | 9.7328 | -2.5641 | .5773 |
| mean1 | .0018 [a,b] | .0065 [a,b] | .0004 [a,b] | .0001 [a,b] | .0003 [a,b] | .0025 [a,b] | .0035 [a,b] | .0065 [a,b] | .0013 [a,b] | .0023 [a,b] |
| avgr1 | -5.0617 | 4.7512 [c] | 5.4717 | -188.046 | 34.0975 | 12.3183 [c] | 31.6713 | -15.6148 | -1.7876 | 1.0379 |
| mean2 | .0018 [a,b] | .0087 [a,b] | .0005 [a,b] | -.0001 [a,b] | .0002 [a,b] | .0035 [a,b] | .0109 [a,b] | .0072 [a,b] | .0011 [a,b] | .0024 [a,b] |
| avgr2 | 6.4232 | 1.9243 | 3.9551 | 1.4373 | 6.6186 | -0.8656 | 8.6688 | 35.0805 | -3.3405 | .1167 |

*Source: calculated from Cambridge Econometrics*
*mean and avgr (average growth): 1991-2011; mean 1 and avgr1: 1991-2001; mean2 and avgr2: 2002-2011;*
*[a] denotes rejection of Ho (each mean = corresponding EU mean) based on Student's t, 95% confidence interval;*
*[b] denotes rejection of Ho (each mean = corresponding Others mean) based on Student's t, 95% confidence interval;*
*[c] denotes rejection of Ho (yearly average growth rate = 0) based on bootstrap sampling, 95% confidence interval, 10,000 replications*

Table 8 reports indicators $T_{sp}$ and $T_{con}$ relative to low, medium-low and medium-high technology manufacturing respectively for the whole and/or available sample, for CEECs and Western countries over 1998-2007. Coherently with previous findings, Table 8 shows that from 2004 on in CEECs regions specialization and agglomeration in the three branches is above-average and higher than in the West (with some exception for agglomeration, to which we shall return in a moment). CEECs regions specialize mostly in low technology manufacturing; medium-low and medium-high activities follow at a distance. Agglomeration reflects the same pattern: it is highest in low technology sectors, followed by the other two. Western regions instead specialize mostly in medium-low technology sectors, in medium-high and finally in low technology ones. As expected, CEEC regions' specialization is significantly above-average and higher than in the Others' group for low technology manufacturing even if it falls significantly. Also agglomeration in the sub-sector falls over 2004-07, but remains above average and far higher than in Western regions. Somewhat unexpectedly, Table 8 shows significant

above-average specialization also in the relatively most advanced sector (i.e. in medium-high technology), together with significantly below-average agglomeration. Both indicators are also significantly different from those of Other regions. The same holds for medium-low technology, where specialization is significantly higher than in the West and agglomeration significantly lower. In both sub-sectors indicators grow, even if not significantly.

**Table 8 - $T_{sp}$ and $T_{con}$ indicators in low, medium-low and medium-high technology manufacturing: whole sample and country groups, absolute values (1998-2007) mean and yearly average growth rate (2004-07)**

| | EU | | | CEEC | | | Other | | |
|---|---|---|---|---|---|---|---|---|---|
| **Tsp** | **Low** | **Low-med** | **Med-hi** | **Low** | **Low-med** | **Med-hi** | **Low** | **Low-med** | **Med-hi** |
| 1998 | 1.3491 | .7427 | .3839 | .6736 | .2767 | .1272 | .6756 | .4660 | .2567 |
| 1999 | 1.3415 | .7625 | .3886 | .6376 | .2791 | .1211 | .7039 | .4834 | .2675 |
| 2000 | 1.3662 | .8256 | .4148 | .6806 | .2785 | .0871 | .6856 | .5472 | .3277 |
| 2001 | 1.2090 | .8768 | .4266 | .7701 | .3495 | .1199 | .4389 | .5273 | .3067 |
| 2002 | 1.3726 | .8959 | .4189 | .8858 | .3580 | .1476 | .4868 | .5379 | .2712 |
| 2003 | 1.5334 | .8559 | .3980 | 1.0999 | .3538 | .1367 | .4335 | .5021 | .2612 |
| 2004 | 1.2780 | .6559 | .1699 | 1.3063 | .3200 | .0443 | -.0283 | .3359 | .1256 |
| 2005 | 1.2615 | .6851 | .2000 | 1.2478 | .3700 | .1179 | .0136 | .3151 | .0821 |
| 2006 | 1.2244 | .6962 | .2251 | 1.2337 | .4031 | .1670 | -.0093 | .2931 | .0582 |
| 2007 | 1.1220 | .6171 | .2909 | 1.1564 | .4057 | .2407 | -.0344 | .2113 | .0502 |
| mean04-07 | 1.2215 | .6636 | .2215 | 1.2360[a] | .3747[b] | .1425 [a b,] | -.0146 | .2888 | .0790 [a] |
| avgr04-07 | -4.1968 | -1.7636 | 19.8443[c] | -3.9579 [c] | 8.4068 | 84.0572 | -7.6292 | -.1369 | -.2581 [c] |
| **Tcon** | | | | | | | | | |
| 1998 | .0430 | .0477 | .0471 | .0163 | .0105 | .0039 | .0252 | .0362 | .0428 |
| 1999 | .0383 | .0448 | .0450 | .0114 | .0077 | .0021 | .0256 | .0361 | .0426 |
| 2000 | .0424 | .0470 | .0486 | .0170 | .0091 | .0014 | .0240 | .0372 | .0468 |
| 2001 | .0324 | .0452 | .0478 | .0189 | .0099 | .0021 | .0135 | .0354 | .0457 |
| 2002 | .0419 | .0437 | .0468 | .0230 | .0113 | .0034 | .0189 | .0324 | .0434 |
| 2003 | .0414 | .0450 | .0461 | .0262 | .0109 | .0030 | .0153 | .0341 | .0431 |
| 2004 | .0261 | .0275 | .0317 | .0304 | .0089 | -.0002 | -.0043 | .0186 | .0319 |
| 2005 | .0262 | .0299 | .0291 | .0298 | .0116 | .0011 | -.0036 | .0183 | .0280 |
| 2006 | .0262 | .0289 | .0320 | .0305 | .0130 | .0028 | -.0043 | .0159 | .0292 |
| 2007 | .0257 | .0297 | .0308 | .0293 | .0125 | .0046 | -.0035 | .0172 | .0262 |
| mean04-07 | .0291 | .0322 | .0340 | .0292 [a b,] | .0114 [a] | .0022 [a b,] | -.0001 [a] | .0208 [a] | .0317 |
| avgr04-07 | -.5286 | 2.6908 | -.6853 | -1.2617 | 12.7350 | -127.7979 | -4.7946 | -2.2175 | -6.0582 |

*Source: calculated from Eurostat*

*[a] denotes rejection of Ho (mean2 = EU mean) based on Student's t, 95% confidence interval; [b] denotes rejection of Ho (mean2 = Others mean) based on Student's t, 95% confidence interval; [c] denotes rejection of Ho (yearly average growth rate = 0) based on bootstrap sampling, 95% confidence interval, 10,000 replications*

Consideration of the indicators for individual CEECs gives an idea on specialization and localization patterns also prior to 2004; it shows consolidation and growing, or unchanged, agglomeration taking place in medium-low and in medium-high technology sectors but falling for all countries in low technology except for Romania (see the Tables in Appendix 2). Average specialization in the two more advanced sectors is highest in the Czech Republic and in Slovakia. Albeit growing, it remains negative (i.e. below-average) in the three Baltic countries and in Bulgaria; in the relatively most advanced sector it is negative also in Poland and Romania. On the contrary, these two countries present the highest group specialization and agglomeration in low technology

manufacturing; however, while specialization falls somewhat for Poland, it grows considerably in Romania, possibly in relation to foreign investments. In medium-low technology manufacturing (traditional heavy industry) Romanian regions represent the only case among CEECs for which specialization and agglomeration fall to the extent that they become negative, implying considerable sectoral de-specialization and de-localization. Polish regions instead present negative values in the medium-high technology sector – a feature they share with some other cases for which restructuring processes seem more backwards, namely Bulgaria and the Baltic countries. Furthermore, in Poland agglomeration grows in all three sub-sectors.

In summary, the breakdown of manufacturing according to its technology content shows persisting above-average specialization in the more traditional lines of production, i.e. in low and medium-low technology manufacturing. Although present, restructuring processes appear extremely slow, given the high levels of geographic concentration that continue to prevail especially in light industry. Some interesting change appears instead to be under way in medium-high technology manufacturing for which average specialization does not differ significantly from that of Western regions. Furthermore, agglomeration is significantly lower, albeit on the increase during 2004-07, implying relevant dissemination of activity across regions. The breakdown by individual CEEC (coupled with the consideration, when possible, of more extended time-periods) shows the Czech Republic, Slovakia and possibly Hungary at the forefront in the more advanced lines of manufacturing, even if agglomeration remains extremely high in the Czech Republic. At the other extreme, more traditional lines of production continue to prevail in Poland, Bulgaria and in the three Baltic countries.

## 5. Conclusion

The paper analyses specialization and agglomeration patterns of production in CEECs by means of the Thiel index. It shows that over 1991-2011 both phenomena grow, implying that regional economies become more diversified. This contrast with parallel developments in the West, according to which dissimilarities on average fall. Rising disproportions in the East could be interpreted as an effect of plant closures and reconversion processes following the end of central planning. In this respect, an interesting finding is that, while growing overall, in the second decade of transition (2001-11) disproportions fall also in Eastern regions, *prima facie* conforming to Western behaviour. However, unlike what occurs in the West, in CEECs this is associated with a significant jump in the *within*-countries component of agglomeration, due to the building up of considerable location effects. In this sense the Theil indicators confirm for CEECs the direct relationship between growth and inequality identified by Kuznets.

A breakdown by main sectors shows that CEECs are still significantly specialized in agriculture and in manufacturing and that these sectors are significantly more concentrated than in the rest of EU regions. At the same time, under-specialization in services remains evident. As far as manufacturing is concerned, CEEC regions continue to specialize in the more traditional lines of production, for which agglomeration remains extremely high, hardly indicating successful restructuring. In addition, comparing the evolution over time of CEEC regions with that of the Other countries shows that, notwithstanding EU emphasis on real convergence, sectoral patterns in the two groups are largely different.

Considering the changes over 2001-11 gives a partially different picture. In the first place, agglomeration grows significantly in both market and non-market services

(while overall specialization in the sector falls). This can be interpreted as a growing "capital region effect" that, however, does not spread to other areas. As CEECs capital regions start catching up on Western standards, non-capital regions lag behind. Second, both specialization and agglomeration grow in manufacturing in CEECs (they fall in the rest of the sample). Over 2004-07 growth gains momentum from a small but dynamic medium-high technology sub-sector that is also significantly disseminated across regions, which could point to successful restructuring. As far as individual Eastern countries are concerned, the diversification and dissemination of the more advanced lines of production appears to be strongest in the Czech Republic, Hungary and Slovakia; it is largely missing in Poland, Bulgaria and in the three Baltic countries. Finally, manufacturing in Romania presents peculiar features that set its regions apart from group performance and appear to be largely determined by foreign investments.

## References


Aigigner K., Leitner W. (2002), 'Regional Concentration in the United States and Europe: Who Follows Whom? ', *Weltwirtschaftliches Archiv*, **138**, 652-79

Aigigner K., Davies S. W. (2004), 'Industrial Specialisation and Geographic Concentration: Two Sides of the Same Coin? Not for the European Union', *Journal of Applied Economics*, **2**, 231-48

Amiti M. (1997), 'Specialisation Patterns in Europe', *Weltwirtschaftliches Archiv*, **138**, 573-93

Bickenbach F., Bode E. (2008), 'Disproportionality Measures of Concentration, Specialization and Localization', *International Regional Science Review*, **4**, 359-88

Brulhart M., Traeger R. (2005), 'An account of geographic concentration patterns in Europe', *Regional Science and Urban Economics*, **35**, 597-624

Brulhart M., Mathys N. A., (2008), 'Sectoral agglomeration ecnomies in a panel of European regions', *Regional Science and Urban Economics*, **38**, 348-62

Chapman S. A. (2008), 'Regional Growth Patterns in the Enlarged EU: Are New Members Conforming to Old Development Schemes?' *Economia, impresa e mercati finanziari*, **6**, 7-33

Chapman S. A., Cosci S., Mirra L., (2012), "Income dynamics in an enlarged Europe. The role of capital regions", *The Annals of Regional Science*, **48**, 663-93

Cutrini E. (2006), *The Balassa Index Meets the Dissimilarity Theil Index: a Decomposition Methodology for Location Studies*, Paper presented at the International Workshop on Spatial Econometrics and Statistics, Rome, 25-7 May

Deveraux M. P., Griffith R., Simpson H., (2004), 'The geographic distribution of production activity in the UK', *Regional Science and Urban Economics*, **34**, 533-64

Duranton G., Overman H. G., (2005), 'Testing for Localization Using Micro-Geographic Data', *Review of Economic Studies*, **72**, 1077-166

Ellison G., Glaeser E. L., (1997), 'Geographic Concentration in U.S. Manufacturing Industries: A Dartboard Approach', *Journal of Political Economy*, **105**, 889-927

Guimaraes P., Figueiredo O., Woodward D., (2007), 'Measuring the Localization of Economic Activity: A Parametric Approach', *Journal of Regional Science*, **47**, 753-74

Kallioras D., Fotopoulos G., Petrakos G. (2004), *Patterns of Regional Specialization and Sectoral Concentration of Industrial Activity in Bulgaria, Romania, Slovenia, Hungary and Estonia*, Paper presented at the 44th European Congress of the European Regional Science Association, Porto, 25-9 August

Krugman P. (1993), 'Lessons of Massachussetts for EMU', in Torres F. and Giavazzi F. (eds.) *Adjustement and Growth in the European Monetary Union*, Cambridge, Cambridge University Press

Le Gallo J., Dall'erba S. (2008), 'Spatial and Sectoral Productivity Convergence Between European Regions, 1975-2000', *Papers in Regional Science*, **87(4)**

Marelli E. (2007), 'Specialisation and Convergence of European Regions', *The European Journal of Comparative Economics*, **2**, 149-78

Maurel F., Sedillot B. (1999), 'A measure of geographic concentration in French manufacturing industries', *Regional Science and Urban Economics*, **29**, 575-604

Mora T., Vaya E., Surinach J. (2005), 'Specialisation and growth: the detection of European regional convergence clubs', *Economic letters*, **86**, 181-5

OECD (2001), OECD Science, Technology and Industry Scoreboard, Paris

OECD (2002), *Frascati Manual*, VI$^{th}$ edition, Paris

Overman H. G., Redding S., Venables A. (2001), *The economic geography of trade, production and income: a survey of empirics*, CEPR Discussion Paper, **2978**

Paas T. *et al.* (2007), *Econometric analysis of income convergence in selected EU countries and their NUTS3 level regions*, University of Tartu Working Paper Series, **60**

Paas T., Sepp J., Kaldaru H. (2008), *Sectoral Changes In The EU Economies: The Main Trends And Typology Of The Countries*, Papers of the European Association of Comparative Economic Systems, 10$^{th}$ Conference, Moscow, 28-30 August

Paci R., Pigliaru F. (1997), 'Structural change and convergence: an Italian regional perspective', *Structural Change and Economic Dynamics*, **8**, 297-318

Paci R., Usai S. (2000), 'The Role of Specialisation and Diversity Externalities in the Agglomeration of Innovative activities', *Rivista Italiana degli Economisti*, **5**, 237-68

Rodriguez-Pose A. (1998), *The Dynamics of Regional Growth in Europe*, Oxford, Clarendon Press

Sala-i-Martin X. (2002), *The Disturbing 'Rise' of Global Income Inequality*, Working Paper, Departement of Economics and Business, Universitat Pompeu Fabra

Terrasi M. (1999), 'Convergence and divergence across Italian regions', *The Annals of Regional Science*, **33**, 491-510

Theil H. (1967), *Economics and information theory*, Amsterdam, North-Holland

Williamson J.G. (1965), 'Regional inequality and the process of national development: a description of the patterns', *Economic Development and Cultural Change*, **3**, 3-84

Zaghini A. (2005), 'Evolution of trade patterns in the new EU member states', *Temi di discussione*, **568**, Banca d'Italia

## Appendix 1

**List of the (NUTS2) regions included in the sample, classified as "Others" or CEECs (initial year of REGIO dataset in brakets)**

| "Others" (older members) | | CEECs (new members) | |
|---|---|---|---|
| **NUTS Code** | **Countries and regions** | **NUTS Code** | **Countries and regions** |
| | **Belgium** (1995) | | **Bulgaria** (2003) |
| be1 | Région de Bruxelles | bg31 | Severozapaden |
| be2 | Vlaams Gewest | bg32 | Severen tsentralen |
| be3 | Région Wallonne | bg33 | Severoiztochen |
| dk | **Denmark** (1995) | bg34 | Yugoiztochen |
| | **Germany** (1996) | bg41 | Yugozapaden |
| de1 | Baden-Württemberg | bg42 | Yuzhen tsentralen |
| de2 | Bayern | | **Czeck Republic** (1998) |
| de3 | Berlin | cz01 | Praha |
| de4 | Brandenburg | cz02 | Strední Cechy |
| de5 | Bremen | cz03 | Jihozápad |
| de6 | Hamburg | cz04 | Severozápad |
| de7 | Hessen | cz05 | Severovýchod |
| de8 | Mecklenburg-Vorpommern | cz06 | Jihovýchod |
| de9 | Niedersachsen | cz07 | Strední Morava |
| dea | Nordrhein-Westfalen | cz08 | Moravskoslezsko |
| deb | Rheinland-Pfalz | ee | **Estonia** (1997) |
| dec | Saarland | lv | **Latvia** (1998) |
| ded | Sachsen | lt | **Lithuania** (1998) |
| dee | Sachsen-Anhalt | | **Hungary** (1999) |
| def | Schleswig-Holstein | hu10 | Közép-Magyarország |
| deg | Thüringen | hu21 | Közép-Dunántúl |
| | **Ireland** (1998) | hu22 | Nyugat-Dunántúl |
| ie01 | Border, Midlands and Western | hu23 | Dél-Dunántúl |
| ie02 | Southern and Eastern | hu31 | Észak-Magyarország |
| | **Greece** (2000) | hu32 | Észak-Alföld |
| gr1 | Voreia Ellada - | hu33 | Dél-Alföld |
| gr2 | Kentriki Ellada | | **Poland** (1999 or 2004) |
| gr3 | Attiki | pl11 | Lódzkie |
| gr4 | Nisia Aigaiou, Kriti | pl12 | Mazowieckie |
| | **Spain** (1995) | pl21 | Malopolskie |
| es11 | Galicia | pl22 | Slaskie |
| es12 | Principado de Asturias | pl31 | Lubelskie |
| es13 | Cantabria | pl32 | Podkarpackie |
| es21 | Pais Vasco | pl33 | Swietokrzyskie |
| es22 | Comunidad Foral de Navarra | pl34 | Podlaskie |
| es23 | La Rioja | pl41 | Wielkopolskie |

| | | | |
|---|---|---|---|
| es24 | Aragón | pl42 | Zachodniopomorskie |
| es30 | Comunidad de Madrid | pl43 | Lubuskie |
| es41 | Castilla y León | pl51 | Dolnoslaskie |
| es42 | Castilla-la Mancha | pl52 | Opolskie |
| es43 | Extremadura | pl61 | Kujawsko-Pomorskie |
| es51 | Cataluña | pl62 | Warminsko-Mazurskie |
| es52 | Comunidad Valenciana | pl63 | Pomorskie |
| es53 | Illes Balears | | **Romania** (2000) |
| es61 | Andalucia | ro11 | Nord-Vest |
| es62 | Región de Murcia | ro12 | Centru |
| | **France** (1995) | ro21 | Nord-Est |
| fr10 | Île de France | ro22 | Sud-Est |
| fr21 | Champagne-Ardenne | ro31 | Sud - Muntenia |
| fr22 | Picardie | ro32 | Bucuresti - Ilfov |
| fr23 | Haute-Normandie | ro41 | Sud-Vest Oltenia |
| fr24 | Centre | ro42 | Vest |
| fr25 | Basse-Normandie | si | **Slovenia** (1996 or 1997) |
| fr26 | Bourgogne | | **Slovak Republic** (1998) |
| fr30 | Nord - Pas-de-Calais | sk01 | Bratislavský kraj |
| fr41 | Lorraine | sk02 | Západné Slovensko |
| fr42 | Alsace | sk03 | Stredné Slovensko |
| fr43 | Franche-Comté | sk04 | Východné Slovensko |
| fr51 | Pays de la Loire | | |
| fr52 | Bretagne | | |
| fr53 | Poitou-Charentes | | |
| fr61 | Aquitaine | | |
| fr62 | Midi-Pyrénées | | |
| fr63 | Limousin | | |
| fr71 | Rhône-Alpes | | |
| fr72 | Auvergne | | |
| fr81 | Languedoc-Roussillon | | |
| fr82 | Provence-Alpes-Côte d'Azur | | |
| fr83 | Corse | | |
| | **Italy** (1995) | | |
| itc1 | Piemonte | | |
| itc2 | Valle d'Aosta/Vallée d'Aoste | | |
| itc3 | Liguria | | |
| itc4 | Lombardia | | |
| itd3 | Veneto | | |
| itd4 | Friuli-Venezia Giulia | | |
| itd5 | Emilia-Romagna | | |
| ite1 | Toscana | | |
| ite2 | Umbria | | |
| ite3 | Marche | | |
| ite4 | Lazio | | |
| itf1 | Abruzzo | | |

| | | | |
|---|---|---|---|
| itf2 | Molise | | |
| itf3 | Campania | | |
| itf4 | Puglia | | |
| itf5 | Basilicata | | |
| itf6 | Calabria | | |
| itg1 | Sicilia | | |
| itg2 | Sardegna | | |
| cy | **Cyprus** (1999) | | |
| lu | **Luxemburg** (1995) | | |
| mt | **Malta** (2000) | | |
| | **Netherlands** (2001) | | |
| nl1 | Noord-Nederland | | |
| nl2 | Oost-Nederland | | |
| nl3 | West-Nederland | | |
| nl4 | Zuid-Nederland | | |
| | **Austria** (1995) | | |
| at11 | Burgenland | | |
| at12 | Niederösterreich | | |
| at13 | Wien | | |
| at21 | Kärnten | | |
| at22 | Steiermark | | |
| at31 | Oberösterreich | | |
| at32 | Salzburg | | |
| at33 | Tirol | | |
| at34 | Vorarlberg | | |
| | **Portugal** (1995) | | |
| pt11 | Norte | | |
| pt15 | Algarve | | |
| pt16 | Centro (PT) | | |
| pt17 | Lisboa | | |
| pt18 | Alentejo | | |
| | **Finland** (1999) | | |
| fi13 | Itä-Suomi | | |
| fi18 | Etelä-Suomi | | |
| fi19 | Pohjois-Suomi | | |
| fi1a | Länsi-Suomi | | |
| fi20 | Åland | | |
| | **Sweden** (1995) | | |
| se11 | Stockholm | | |
| se12 | Östra Mellansverige | | |
| se21 | Småland med öarna | | |
| se22 | Sydsverige | | |
| se23 | Västsverige | | |
| se31 | Norra Mellansverige | | |
| se32 | Mellersta Norrland | | |
| se33 | Övre Norrland | | |
| | **Great Britain** (2002) | | |
| ukc | North East | | |

| | | | |
|---|---|---|---|
| ukd | North West | | |
| uke | Yorkshire and The Humber | | |
| ukf | East Midlands | | |
| ukg | West Midlands | | |
| ukh | Eastern | | |
| uki | London | | |
| ukj | South East | | |
| ukk | South West | | |
| ukl | Wales | | |
| ukm | Scotland | | |
| ukn | Northern Ireland | | |

- *Low technology manufacturing* (light industry) includes:
  food products, beverages and tobacco; textiles and textiles products; leather and leather products; wood and wood products; pulp, paper and paper products; publishing and printing; manufacturing n.e.c.
- *Medium-low technology manufacturing* (heavy industry) includes:
  manufacture of coke, refined petroleum products and nuclear fuel; manufacture of rubber and plastic products; basic metals and fabricated metal products; other non-metallic mineral products; building and repairing of ships and boats.
- *Medium-high technology manufacturing* includes:
  manufacture of chemicals and chemical products (excl. pharmaceuticals, medicinal chemicals and botanical products); manufacture of machinery and equipment n.e.c.; manufacture of electrical machinery and apparatus n.e.c.; manufacture of motor vehicles, trailers and semi-trailers; manufacture of other transport equipment (excl. building and repairing of ships and boats and manufacture of aircraft and spacecraft).

## Appendix 2

**Table A.1. $T_{sp}$ and $T_{con}$ indicators in low technology manufacturing for individual CEECs (absolute values, 1997-2007 and mean, 2004-07)**

| $T_{sp}$ | Bg | Cz | Ee | Lv | Lt | Hu | Pl | Ro | Si | Sk |
|---|---|---|---|---|---|---|---|---|---|---|
| 1997 | | | .0509 | | | .1778 | | | .0460 | |
| 1998 | | .1557 | .0483 | .0598 | .0296 | .2266 | | .0871 | .0461 | .0665 |
| 1999 | | .1467 | .0389 | .0487 | .0228 | .2043 | | .0969 | .0444 | .0793 |
| 2000 | | .1284 | .0488 | .0588 | .0309 | .1980 | | .1254 | .0444 | .0905 |
| 2001 | | .1470 | .0440 | .0386 | .0313 | .1997 | | .1488 | .0812 | .0795 |
| 2002 | | .1580 | .0453 | .0321 | .0318 | .2158 | | .2393 | .0779 | .0855 |
| 2003 | .2931 | .1478 | .0496 | .0284 | .0346 | .1762 | | .2268 | .0667 | .0768 |
| 2004 | .2747 | .0924 | .0485 | .0245 | .0273 | .1195 | .3310 | .2674 | .0525 | .0686 |
| 2005 | .3105 | .0824 | .0443 | .0193 | .0276 | .1075 | .2988 | .2628 | .0478 | .0468 |
| 2006 | .2997 | .0915 | .0340 | .0170 | .0287 | .1017 | .3112 | .2577 | .0438 | .0483 |
| 2007 | .2758 | .0858 | .0278 | .0141 | .0308 | .0860 | .3178 | .2374 | .0361 | .0449 |
| mean04-07 | .2902 | .0880 | .0387 | .0187 | .0286 | .1037 | .3147 | .2563 | .0451 | .0521 |
| $T_{con}$ | Bg | Cz | Ee | Lv | Lt | Hu | Pl | Ro | Si | Sk |
| 1997 | | | | | .0000 | .0031 | | | .0017 | |
| 1998 | | .0033 | .0020 | .0015 | .0001 | .0033 | | .0037 | .0014 | .0014 |
| 1999 | | .0031 | .0016 | .0012 | .0001 | .0031 | | .0040 | .0013 | .0017 |
| 2000 | | .0027 | .0019 | .0015 | .0001 | .0031 | | .0049 | .0014 | .0019 |
| 2001 | | .0031 | .0013 | .0015 | .0001 | .0032 | | .0060 | .0013 | .0017 |
| 2002 | | .0034 | .0011 | .0016 | .0000 | .0034 | | .0096 | .0013 | .0018 |
| 2003 | .0049 | .0032 | .0010 | .0018 | -.0001 | .0028 | | .0086 | .0011 | .0017 |
| 2004 | .0044 | .0018 | .0008 | .0013 | -.0002 | .0017 | .0081 | .0092 | .0008 | .0014 |
| 2005 | .0050 | .0017 | .0007 | .0013 | -.0002 | .0015 | .0079 | .0092 | .0008 | .0010 |
| 2006 | .0050 | .0019 | .0006 | .0014 | -.0002 | .0014 | .0083 | .0093 | .0007 | .0011 |
| 2007 | .0047 | .0018 | .0005 | .0015 | -.0002 | .0012 | .0088 | .0084 | .0006 | .0010 |
| mean04-07 | .0048 | .0021 | .0007 | .0015 | -.0002 | .0017 | .0083 | .0090 | .0008 | .0013 |

*Source: calculated from Eurostat*

**Table A.2. $T_{sp}$ and $T_{con}$ indicators in medium-low technology manufacturing for individual CEECs (absolute values, 1997-2007, and mean 2004-07)**

| $T_{sp}$ | Bg | Cz | Ee | Lv | Lt | Hu | Pl | Ro | Si | Sk |
|---|---|---|---|---|---|---|---|---|---|---|
| 1997 | | | -.0056 | | | .0037 | | | .0139 | |
| 1998 | | .1761 | -.0067 | -.0067 | -.0070 | .0099 | | .0428 | .0187 | .0682 |
| 1999 | | .1972 | -.0059 | -.0064 | -.0069 | .0187 | | .0225 | .0184 | .0598 |
| 2000 | | .2045 | -.0040 | -.0066 | -.0066 | .0239 | | .0129 | .0123 | .0544 |
| 2001 | | .2311 | .0004 | -.0070 | -.0066 | .0324 | | -.0067 | .0346 | .0713 |
| 2002 | | .2217 | -.0020 | -.0068 | -.0063 | .0430 | | .0059 | .0432 | .0594 |
| 2003 | -.0063 | .2412 | -.0027 | -.0061 | -.0066 | .0319 | | .0055 | .0392 | .0578 |
| 2004 | -.0093 | .2155 | -.0041 | -.0062 | -.0066 | .0306 | .0202 | -.0035 | .0368 | .0466 |
| 2005 | -.0070 | .2272 | -.0016 | -.0063 | -.0050 | .0334 | .0341 | -.0058 | .0401 | .0610 |
| 2006 | -.0041 | .2359 | -.0004 | -.0059 | -.0052 | .0335 | .0616 | -.0105 | .0435 | .0547 |
| 2007 | -.0044 | .2321 | .0006 | -.0052 | -.0062 | .0352 | .0613 | -.0081 | .0393 | .0613 |
| mean04-07 | -.0062 | .2277 | -.0014 | -.0059 | -.0058 | .0332 | .0443 | -.0070 | .0399 | .0559 |
| **$T_{con}$** | **Bg** | **Cz** | **Ee** | **Lv** | **Lt** | **Hu** | **Pl** | **Ro** | **Si** | **Sk** |
| 1997 | | | | | -.0005 | -.0002 | | | .0009 | |
| 1998 | | .0060 | -.0004 | -.0006 | -.0004 | .0000 | | .0033 | .0010 | .0024 |
| 1999 | | .0065 | -.0004 | -.0006 | -.0003 | .0003 | | .0016 | .0010 | .0021 |
| 2000 | | .0069 | -.0004 | -.0006 | -.0002 | .0005 | | .0009 | .0007 | .0019 |
| 2001 | | .0075 | -.0004 | -.0005 | -.0003 | .0007 | | -.0005 | .0009 | .0022 |
| 2002 | | .0076 | -.0004 | -.0005 | -.0002 | .0010 | | .0005 | .0012 | .0020 |
| 2003 | -.0003 | .0080 | -.0004 | -.0006 | -.0002 | .0007 | | .0004 | .0010 | .0020 |
| 2004 | -.0003 | .0068 | -.0004 | -.0005 | -.0003 | .0005 | .0007 | -.0004 | .0010 | .0017 |
| 2005 | -.0002 | .0073 | -.0004 | -.0004 | -.0004 | .0006 | .0021 | -.0005 | .0011 | .0021 |
| 2006 | -.0002 | .0076 | -.0004 | -.0004 | -.0004 | .0006 | .0034 | -.0007 | .0012 | .0019 |
| 2007 | -.0002 | .0074 | -.0003 | -.0005 | -.0004 | .0006 | .0029 | -.0006 | .0011 | .0022 |
| mean04-07 | -.0002 | .0073 | -.0003 | -.0005 | -.0004 | .0006 | .0023 | -.0006 | .0011 | .0020 |

*Source: calculated from Eurostat*

**Table A.3. $T_{sp}$ and $T_{con}$ indicators in medium-high technology manufacturing for individual CEECs (absolute values, 1997-2007, and mean 2004-07)**

| $T_{sp}$ | Bg | Cz | Ee | Lv | Lt | Hu | Pl | Ro | Si | Sk |
|---|---|---|---|---|---|---|---|---|---|---|
| 1997 | | | -.0082 | | | .0064 | | | .0073 | |
| 1998 | | .0780 | -.0081 | -.0061 | -.0082 | .0392 | | .0311 | .0093 | .0014 |
| 1999 | | .0854 | -.0087 | -.0069 | -.0082 | .0400 | | .0236 | .0082 | -.0039 |
| 2000 | | .0910 | -.0086 | -.0053 | -.0089 | .0263 | | -.0056 | .0105 | -.0017 |
| 2001 | | .0870 | -.0063 | -.0088 | -.0089 | .0391 | | -.0047 | .0226 | -.0001 |
| 2002 | | .0866 | -.0083 | -.0089 | -.0090 | .0307 | | .0133 | .0290 | .0142 |
| 2003 | -.0160 | .0928 | -.0086 | -.0085 | -.0085 | .0267 | | .0091 | .0279 | .0218 |
| 2004 | -.0223 | .0904 | -.0077 | -.0084 | -.0091 | .0199 | -.0652 | .0131 | .0160 | .0175 |
| 2005 | -.0143 | .1206 | -.0080 | -.0086 | -.0088 | .0312 | -.0583 | .0002 | .0292 | .0348 |
| 2006 | -.0155 | .1495 | -.0085 | -.0086 | -.0088 | .0401 | -.0490 | .0106 | .0203 | .0369 |
| 2007 | -.0064 | .1648 | -.0084 | -.0087 | -.0090 | .0507 | -.0280 | .0194 | .0235 | .0427 |
| mean04-07 | -.0146 | .1313 | -.0082 | -.0086 | -.0089 | .0355 | -.0501 | .0108 | .0223 | .0330 |
| **$T_{con}$** | **Bg** | **Cz** | **Ee** | **Lv** | **Lt** | **Hu** | **Pl** | **Ro** | **Si** | **Sk** |
| 1997 | | | | | .0000 | .0001 | | | .0003 | |
| 1998 | | .0022 | -.0003 | -.0006 | .0003 | .0009 | | .0016 | .0004 | .0002 |
| 1999 | | .0023 | -.0003 | -.0006 | .0001 | .0008 | | .0012 | .0003 | .0001 |
| 2000 | | .0024 | -.0002 | -.0006 | -.0002 | .0004 | | -.0005 | .0004 | .0001 |
| 2001 | | .0023 | -.0004 | -.0005 | -.0002 | .0007 | | -.0005 | .0005 | .0002 |
| 2002 | | .0024 | -.0004 | -.0006 | -.0002 | .0005 | | .0005 | .0006 | .0006 |
| 2003 | -.0005 | .0026 | -.0004 | -.0006 | -.0001 | .0005 | | .0002 | .0006 | .0008 |
| 2004 | -.0006 | .0023 | -.0004 | -.0006 | -.0002 | .0003 | -.0025 | .0003 | .0003 | .0007 |
| 2005 | -.0005 | .0032 | -.0004 | -.0006 | -.0003 | .0004 | -.0022 | -.0004 | .0006 | .0011 |
| 2006 | -.0005 | .0039 | -.0004 | -.0006 | -.0003 | .0006 | -.0018 | .0001 | .0004 | .0012 |
| 2007 | -.0004 | .0043 | -.0004 | -.0006 | -.0003 | .0008 | -.0012 | .0004 | .0005 | .0014 |
| mean04-07 | -.0005 | .0034 | -.0004 | -.0006 | -.0003 | .0005 | -.0019 | .0001 | .0005 | .0011 |

*Source: calculated from Eurostat*