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Specialization and Concentration from a Twofold Geographical Perspective: Evidence from Europe

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CUTRINI E. Specialization and concentration from a twofold geographical perspective: evidence from Europe, *Regional Studies*. This paper investigates European location patterns during a period of economic integration, seeking to identify the distinct roles played by the different geographical levels. The evolution of localization in Europe proved much more complicated empirically than the predictions based on Krugman's hypothesis. Using Eurostat regional data for the period 1985–2001, the paper shows that while manufacturing employment trickled down among regions, after the completion of the European Single Market a slight agglomeration occurred, but only across national boundaries. National specialization has emerged particularly in the European Union founding Member States. Moreover, there is evidence of an increasing polarization of the North–South divide closely connected with the growing concentration of high-technology sectors.

Localization Specialization Concentration European economic integration Twofold geographical analysis

CUTRINI E. 以双重的地理学视角来考察专业化与集中性：来自欧洲的相关证据，区域研究。 本文探讨了在经济一体化时期欧洲空间分布的模式，试图明确不同地理层级在其间所发挥的独特作用。欧洲地方化演进过程的现实状况较之以克鲁格曼假设为基础的理论预测要复杂得多。利用1985年至2001年期间欧盟统计局的区域数据，本文指出，尽管制造业就业惠及各地区，在欧洲统一市场形成之后仅仅只在跨国界地区出现部分集聚现象。国家专业化只特定地存在于欧盟创始会员国。此外有证据表明，南北两极分化的日趋加剧与高科技行业逐步集中有关。

本地化 专业化 集中 欧洲经济一体化 双重地理学分析

CUTRINI E. La spécialisation et la concentration d'un point de vue géographique à deux temps: des preuves européennes, *Regional Studies*. Cet article cherche à examiner la distribution européenne des emplacements pendant une période d'intégration économique et à identifier les rôles différents joués par les divers niveaux géographiques. L'évolution des emplacements en Europe s'est avérée beaucoup plus compliquée du point de vue empirique par rapport aux prévisions fondées sur l'hypothèse de Krugman. A partir des données régionales Eurostat pour la période allant de 1985 jusqu'à 2001, cet article cherche à démontrer que, pendant que l'emploi industriel s'infiltrait dans les régions au compte-gouttes, il y a eu une certaine tendance à l'agglomération suite à l'échéance du marché unique, mais seulement de façon transfrontalière. Une spécialisation nationale a vu le jour, notamment dans les pays fondateurs de l'Ue. Qui plus est, il y a des peuves d'une polarisation croissante du clivage Nord–Sud, ce qui se rapporte étroitement à la concentration croissante des secteurs à la pointe de la technologie.

Emplacements Spécialisation Concentration Intégration économique européenne Analyse géographique à deux temps

CUTRINI E. Spezialisierung und Konzentration aus einer zweiteiligen geografischen Perspektive: Belege aus Europa, *Regional Studies*. In diesem Beitrag untersuche ich die Standortmuster in Europa während einer Periode der wirtschaftlichen Integration, um die charakteristischen Rollen zu identifizieren, die von den verschiedenen geografischen Ebenen wahrgenommen werden. Die Evolution der Lokalisierung in Europa erwies sich in empirischer Hinsicht als weitaus komplizierter als die Prognosen auf der Grundlage der Krugman-Hypothese. Mit Hilfe von Eurostat-Regionaldaten weise ich für den Zeitraum von 1985 bis 2001 nach, dass das Beschäftigungsniveau der produzierenden Industrie innerhalb der Regionen zwar einem Trickle-Down-Effekt unterlag, aber nach Vollendung des Europäischen Binnenmarkts eine leichte Agglomeration auftrat, allerdings nur über nationale Grenzen hinweg. Eine nationale Spezialisierung hat sich insbesondere in den Gründungsmitgliedsstaaten der EU herausgebildet. Darüber hinaus liegen Belege für eine zunehmende Polarisierung des Nord–Süd-Gefälles vor, die eng mit der wachsenden Konzentration von High-Tech-Sektoren verknüpft ist.

Lokalisierung Spezialisierung Konzentration Europäische Wirtschaftsintegration Zweiteilige geografische Analyse

CUTRINI E. Especialización y concentración desde una perspectiva geográfica dual: el ejemplo de Europa, *Regional Studies*. En este artículo examinamos los modelos de ubicación europea durante un periodo de integración económica con el fin de identificar los

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distintos papeles desempeñados por los diferentes niveles geográficos. La evolución de la localización en Europa resulta ser empíricamente mucho más complicada que las predicciones basadas en la hipótesis de Krugman. Usando datos regionales de Eurostat para el periodo 1985–2001, en este artículo mostramos que mientras el empleo manufacturero sufrió un efecto 'goteo' entre las regiones, tras la creación del Mercado Único Europeo ocurrió una ligera aglomeración, pero sólo entre fronteras nacionales. La especialización nacional ha surgido especialmente en los estados miembros fundadores de la UE. Además, hay muestras de una mayor polarización de la división norte/sur estrechamente conectada con la creciente concentración de sectores de alta tecnología.

Localización Especialización Concentración Integración económica europea Análisis geográfico dual

JEL classifications: C43, F15, N60, R12

INTRODUCTION

During the past two decades, declining trade barriers associated with the construction of the Single European Market have been supposed to engender drastic changes in the spatial distribution of economic activities, and they have become a prominent topic in political debate and in academic and research environments. The increasing clustering of high-value-added economic activities in high-incomes regions, together with the low-technology specialization of lagging regions, is an example of the expected trend towards a greater inequality presumed to exacerbate the existing uneven spatial distribution of income and welfare.

Both traditional trade theories and the new trade theories envisage that countries will specialize as a consequence of international integration. According to the 'Krugman hypothesis' (KRUGMAN, 1991), European integration will give rise to the coalescence of industrial activities in order to mimic the geographical concentration that previously arose in the USA. On this view, various models developed in the New Economic Geography, intentionally designed for the case of Europe, predict that when international transaction costs fall below a certain threshold, international openness will lead to the agglomeration of industrial activities within countries (MONFORT and NICOLINI, 2000; PALUZIE, 2001; CROZET and KOENIG-SOUBEYRAN, 2004a, 2004b; MONFORT and VAN YPERSELE, 2003). Although inspired by the territorial changes following the Mexican liberalization programme (HANSON, 1998), the study by KRUGMAN and LIVAS (1996) can be adopted as a theoretical framework for the study of European integration. Krugman and Livas's model highlights the importance of congestion costs as a centrifugal force pushing the internal dispersion of economic activities. Similarly, PUGA (1999) predicted a dispersion propelled by congestion-related forces.

Apart from international integration, further economic forces may disrupt the existing patterns of localization and foster the dispersion of economic activities. Recent theoretical studies have conceived widespread firm fragmentation as the cause of changes in within-country economic geography, which in many countries has been characterized by the agglomeration of executive functions in urban areas, with peripheral areas becoming the sites of routine tasks.

International integration in commodity markets and fragmentation of productive processes are bringing about the progressive irrelevance of national borders. Consequently, adopting sub-national economies as units of spatial analysis is fundamental for understanding the complexity of structural change dynamics at different spatial scales. Moreover, from a normative perspective, the development of rigorous methodologies to disentangle structural changes at different geographical levels of analysis is becoming important in light of the existence of overlapping institutional levels. Assessing whether the concentration of economic activities is occurring mostly within countries or at wider distances aids an understanding of how and to what extent European, national, and regional policy-makers must be involved in designing appropriate policies.

To date, few empirical studies have analysed specialization as well as concentration (for example, AIGINGER and DAVIES, 2004; AIGINGER and PFAFFERMAYR, 2004; and MULLIGAN and SCHMIDT, 2005), but none has adopted a two-scale framework (within and across perspective). Therefore, the integrated analysis of overall localization conducted by the present study – with concentration on one side and specialization on the other – combined with the adoption of a twofold geographical perspective is still a novelty in the literature. Its advantage is that it enables deeper and richer assessment than do the methodologies prevalent in previous studies.

The aim of the paper is to provide clear-cut evidence of the location patterns of European manufacturing industries during the period 1985–2001, adopting a new methodology developed in a previous work (CUTRINI, 2006). Starting from a twofold geographical perspective, it is shown that localization within countries does not evolve in parallel with localization across national boundaries. However, since relative measures were adopted,[1] the equivalence between specialization and concentration trends is

maintained at the level of each single geographical scale. In particular, the results suggest that national specialization (and agglomeration of industries across countries) have slightly increased since the enactment of the European Single Market Programme, whilst substantial regional despecialization (the deconcentration of industries within countries) is evident during the entire period. A new core–periphery pattern besides the North–South divide is emerging whereby Northern Europe is specialized in high-technology industries and Southern Europe in labour-intensive industries.

The remainder of the paper is organized as follows. The next section reviews the empirical evidence on regional specialization and concentration in Europe, focusing specifically on the main methodological issue of a multilevel analysis. The third section describes the data and the methodology: the identity between aggregate concentration of industries and aggregate specialization of regions and its geographical decomposition. The forth section presents the results. The fifth section puts forward some conjectures on the interpretation of the apparently contrasting results obtained. The final section makes some concluding remarks and indicates further directions for research.

SURVEY OF THE EMPIRICAL LITERATURE

The empirical literature has usually evaluated specialization in Europe on the basis of a single-scale analysis. The slow specialization of countries during the 1970s and 1980s was identified by several studies (for example, BRÜLHART and TORSTENSSON, 1996; AMITI, 1999; ÖSTERREICHISCHES INSTITUT FÜR WIRTSCHAFTSFORSCHUNG (WIFO), 1999; HAALAND *et al.*, 1999; and MIDELFART *et al.*, 2004, among others). At the same time, some authors suggested that, from the 1970s to the 1990s, regional specialization decreased in Spain (PALUZIE *et al.* (2001), in Italy (ROMBALDONI and ZAZZARO, 1997; DE ROBERTIS, 2001; CICIOTTI and RIZZI, 2003), and in Germany (SUEDEKUM, 2006). However, if one looks at the specialization of European Union regions disregarding national borders, contrasting empirical evidence is found. In fact, MIDELFART-KNARVIK *et al.* (2002) show that a majority of regions (53%) became more specialized, although only to a slight extent (COMBES and OVERMAN, 2004).

The evidence is similarly mixed if one focuses on the geographical concentration of sectors. Adopting the region as a unit of analysis gives rise to contrasting results on concentration trends compared with those emerging from the more common country-based studies. If analysis relies on national borders, it is found that the pre-Single Market period was characterized by increasing international agglomeration in the majority of sectors, especially during the 1980s (BRÜLHART and TORSTENSSON, 1996; BRÜLHART, 1998, 2001; AMITI, 1999; HAALAND *et al.*, 1999; MIDELFART *et al.*, 2004), while during the post-Single Market period spreading forces prevailed (MIDELFART *et al.*, 2004; AIGINGER and PFAFFERMAYR, 2004).

Although a decreasing regional concentration of industries was a common result for specific countries,[2] European Union-wide regional concentration analysis empirically supports the idea that the completion of the single market fostered the agglomeration of industries, allowing the better exploitation of regional localized advantages. On the basis of regional data on gross value added, HALLET (2000) suggested that concentration slightly declined during the 1980s, while it increased during the first half of the 1990s. Although BRÜLHART and TRAEGER (2005) found generally mixed evidence for manufacturing industries, they obtained robust results for the European Union-wide agglomeration of textile industry value added. More recently, EZCURRA *et al.* (2006) supported the 'Krugman hypothesis', showing that as soon as the European Single Act came into force, geographical concentration across European Nomenclature des Unités Territoriales Statistiques (NUTS) 2 regions increased in most manufacturing activities.

Assessment of straightforward evidence has been hindered until recent years, not only by the shortage of comparable regional data, but also, as COMBES and OVERMAN (2004) claimed, by the lack of an appropriate methodology with which to disentangle the geographical clustering internal to countries from cross-country location patterns. In fact, as Combes and Overman suggest, evaluating the regional specialization patterns relative to a country is different from assessing the same process relative to Europe as a whole.[3]

To date, different basic units of analysis (either region or country), different geographical benchmarks (either country or Europe), or different measures (either absolute or relative)[4] have been the main variations adopted. The multiplicity of methodologies makes it difficult to define an unquestionable pattern of specialization and concentration in Europe through simple comparison among existing empirical studies. Moreover, economists and geographers have continued to assess the two sides of overall localization[5] separately, thus disregarding their mutual dynamic relationship. To the best of the author's knowledge, only one work adopts an integrated approach: that by AIGINGER and ROSSI-HANSBERG (2006), who show that specialization of countries and geographical concentration of industries do not necessarily evolve in parallel. Against the background of a theoretical model (ROSSI-HANSBERG, 2005),[6] these authors furnish consistent evidence for Europe and the USA based on the application of an absolute Gini coefficient. Nonetheless, they also suggest that the trends over time in specialization and concentration cannot diverge when relative measures are adopted.

DESCRIPTION OF THE METHODOLOGY AND DATA

Sectoral and spatial partitions of data

The analysis relies on employment data subdivided by manufacturing sectors. The data are drawn from the EUROSTAT Region-SBS (Structural Business Statistics) for the years 1985, 1993, and 2001. The sample of the 145 regions considered almost completely covers the following European countries: Belgium and Luxembourg (consolidated), Finland, France, Western Germany, Greece, Italy, the Netherlands, Spain, and the UK. Some regions have been dropped, either because of overwhelming missing data or because they are not included at all in the database. The regional grid is mainly based on the NUTS 2 grid except for Germany, for which reference has been made to the NUTS 1 regions (*Länder*). As to Belgium, the data are drawn from a data set provided by the national statistics office and based on the previous Nomenclature générale des Activités économiques dans les Communautés Européennes (NACE) 70 classification. Therefore, Bruxelles, Vlaams Brabant, and Brabant Wallon have been clustered as a single region (for detailed information on geographical coverage, see Appendix Table A1).

The analysis is restricted to the manufacturing sector owing to a lack of data for the services sector.[7] Employment data are disaggregated by twelve manufacturing industries[8] according to NACE rev. 1 classification: food (DA), textiles (DB), wood (DD), paper (DE), chemicals (DG), rubber and plastic products (DH), other non-metallic mineral products (DI), basic metals and fabricated metal products (DJ), machinery and equipment not elsewhere classified (n.e.c.) (DK), electrical and optical equipment (DL), transport equipment (DM), and manufacturing n.e.c. (DN).

Since the results might be affected by the scale aggregation problem – which is an expression of the modifiable areal unit problem (MAUP) (ARBIA, 1989) – the present paper assesses overall localization, varying the basic unit of analysis and the intermediate aggregation level to control for the alleged sensitivity of the methodology to scale aggregation and basic geographical partition. Table 1 uses a set of European regions belonging to different countries as the intermediate aggregation level (instead of the country). In this case, *Northern Europe* consists of all the regions of the following European countries: Belgium and Luxembourg, Finland, France, Western Germany, the Netherlands, the UK, and some regions of Northern Italy, namely Piemonte, Valle d'Aosta, Liguria, Lombardia, and Friuli-Venezia Giulia. The rest of Italy, Greece, and Spain are labelled as *Southern Europe*.

Different partitions in the sectoral dimension should be considered since agglomeration in the real world may arise from inter-industry linkages (that is, linkages across the artificial boundaries of industrial classifications derived from the available statistical data). Therefore, the analysis on concentration based on the twelve manufacturing sectors is complemented with a dichotomic classification based on the taxonomy adopted by the ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (OECD) (2003). In this case (for example, in Fig. 2), chemicals, machinery and equipment n.e.c., electrical and optical equipment, transport equipment, furniture, recycling, and manufacturing n.e.c. are considered as they form a single sector labelled *high-technology industries*. Similarly, food, textiles, wood, paper, rubber and plastic products, other non-metallic mineral products, basic metals, and fabricated metal products belong to the category *low-technology industries*.

The methodology

Notation and basic definition. This section briefly summarizes the analytical model introduced in CUTRINI (2006) and adapted to the purposes of this paper. AIGINGER and DAVIES (2004) have already analysed concentration and specialization as the two sides of the same matrix by using absolute entropy measures. The present study relies on relative measures, and specifically on dissimilarity entropy indices which assess the 'distance' between two distributions.[9]

Let x denote the variable of main interest (employment in the present case); and subscripts i, j, and k the index country, region, and industry, respectively. Thus:

x_{ijk} = employment in manufacturing industry k ($k = 1, \ldots, n$) of region j ($j = 1, \ldots, r_i$) belonging to country i ($i = 1, \ldots, m$)
x_{ij} = total manufacturing employment in region i of country j
x_{ik} = total employment in the manufacturing industry k of country i
x_i = total employment in country i
x_k = total employment in manufacturing industry k in Europe
x = total manufacturing employment in Europe
N = number of manufacturing industries
R = number of regions in the whole economy

The concept of *overall localization* refers to the pattern of an aggregate economic activity (manufacturing employment, in the present case) which is composed of N industries and spans across R regions. Perfect regularity arises when all industries are distributed across space proportionally to total employment; accordingly, each region in the entire area has the same manufacturing structure as Europe.

Conceptually, specialization and concentration are tightly connected and can be condensed into the

concept of overall localization. From a purely statistical viewpoint, measuring overall localization involves evaluating the entire distribution of manufacturing industries across regions.

Relative concentration. Relative concentration, agglomeration, and coalescence are used interchangeably in what follows. The degree of *concentration (or agglomeration)* of an industry refers to the divergence in the spatial distribution of that industry with respect to the spreading of the overall economic activity (overall manufacturing, in this case). *Relative concentration* indices are used for this purpose, since they are better suited to gauging the economic forces driving within-industry agglomeration economies. Perfect regularity arises when industries are spatially distributed proportionally to total employment. The more the interregional distribution of one industry departs from the interregional allocation of aggregate manufacturing, the stronger the localization forces at work within the specific industry.[10]

Relative specialization. Relative specialization of a basic unit of analysis (for example, region j of country i) is taken to be the dissimilarity between the regional manufacturing structure (that is, the allocation of the variable of main interest across all the manufacturing industries of the region) and the allocation of European employment across manufacturing industries. All the raw measures of concentration and specialization that constitute the background for the aggregate analytical model can be traced back to the dissimilarity Theil index (THEIL, 1967; MAASOUMI, 1993). THEIL (1967) first introduced a dissimilarity version of the entropy index to evaluate the information content of an indirect message. *Dissimilarity* is, therefore, synonymous here with divergence, discrepancy in the comparison of two overlapping distributions.

Raw measures of relative concentration

The basic dissimilarity entropy index adopted here to measure concentration of one industry k is:

$$T_k = \sum_{i=1}^{m}\sum_{j=1}^{r_i}\frac{x_{ijk}}{x_k}\ln\left(\frac{x_{ijk}/x_k}{x_{ij}/x}\right) \text{ (total relative concentration of industry } k\text{)} \quad (1)$$

The degree of concentration of each industry (T_k) can be conceived as a measure of the strength of localization economies and/or the importance of industry-specific natural advantages. In fact, in the case of perfect regularity ($T_k = 0$), the location of the industry is mainly due to the advantages of being located in those regions with the highest density of the aggregate economic activity. The concentration of an industry can be explained in terms of the regional agglomeration economies that arise *within countries* and the national comparative advantages shaping the *between-countries* location pattern. Hence:

$$T_k^w = \sum_{i=1}^{m}\sum_{j=1}^{r_i}\frac{x_{ijk}}{x_k}\ln\left(\frac{x_{ijk}/x_{ik}}{x_{ij}/x_i}\right) \text{ (within-country relative concentration of industry)} \quad (2)$$

evaluates *within-country* concentration of industry k, while:

$$T_k^b = \sum_{i=1}^{m}\frac{x_{ijk}}{x_k}\ln\left(\frac{x_{ik}/x_k}{x_i/x}\right) \text{ (between-country relative concentration of industry)} \quad (3)$$

assesses the *between-country* concentration of industry k.[11]

Raw measures of relative specialization

Turning to the specialization side, it is possible to evaluate the dissimilarity between the economic structure of one region (composed by the n manufacturing industries) and that of a supra-regional economy.

Therefore, further raw specialization indices are derived from the dissimilarity Theil index:

$$T_{ij} = \sum_{k=1}^{n}\frac{x_{ijk}}{x_{ij}}\ln\left(\frac{x_{ijk}/x_{ij}}{x_k/x}\right) \text{ (specialization of region } j \text{ belonging to country } i \text{ relative to the European Union)} \quad (4)$$

$$T_{ij}^w = \sum_{k=1}^{n}\frac{x_{ijk}}{x_{ij}}\ln\left(\frac{x_{ijk}/x_{ij}}{x_{ik}/x_i}\right) \text{ (specialization of region } j \text{ of country } i \text{ relative to the respective country)} \quad (5)$$

$$T_i^b = \sum_{i=1}^{m}\frac{x_{ik}}{x_i}\ln\left(\frac{x_{ik}/x_i}{x_k/x}\right) \text{ (national specialization of country } i \text{ relative to the European Union)} \quad (6)$$

When the dissimilarity logic is adopted, the national specialization relative to Europe (T_i^b) can be envisaged as a residual of the averaged regional specialization relative to the same benchmark, once the divergence of the regional manufacturing structures with reference to the country has been accounted for.

Let us define:

$$aRS_i = \sum_{j=1}^{r_i} T_{ij} \frac{x_{ij}}{x_i} \quad \text{(average regional specialization of all the regions of country } i \text{ relative to the European manufacturing structure)} \quad (7)$$

and:

$$aRS_i^w = \sum_{j=1}^{r_i} T_{ij}^w \frac{x_{ij}}{x_i} \quad \text{(average regional specialization of all the regions of country } i \text{ relative to the country's manufacturing structure)} \quad (8)$$

When a regional perspective is adopted, the average regional specialization of a country relative to Europe (aRS_i) is composed of two elements: the *within-country* component and the *country bias*. Specifically, the following relation holds:

$$aRS_i = aRS_i^w + T_i^b \quad (9)$$

The entropy index of overall localization

The entropy index with which overall localization (*L-index*) is measured is a weighted sum of the logarithms of location quotients where the weights are the industry-region shares of the aggregate manufacturing (x_{ijk}/x):

$$L = \sum_{k=1}^{n} \sum_{i=1}^{m} \sum_{j=1}^{r_i} \frac{x_{ijk}}{x} \ln\left(\frac{x_{ijk}/x_k}{x_{ij}/x}\right) \quad (10)$$

In the present analytical model, the *L-index* represents the equivalence between geographical concentration and regional specialization. In fact, it is possible to derive the *L-index* as a composite index of both relative specialization measures and relative concentration ones (CUTRINI, 2006):

$$L = \sum_{j=1}^{r} \frac{x_{ij}}{x} T_{ij} = \sum_{k=1}^{n} \frac{x_k}{x} T_k \quad (11)$$

The evolution of overall localization *within* countries may depart from localization *between* countries (for details on the spatial decomposition of the *L-index*, see CUTRINI, 2006). Here, the paper points out how specialization and concentration conceptually and analytically underpin each factor component of the composite index of overall localization.

The *between-country* component (L^b) of overall localization is defined as:

$$L^b = \sum_{k=1}^{n} \sum_{i=1}^{m} \frac{x_{ik}}{x} \ln\left(\frac{x_{ik}/x_k}{x_i/x}\right) \quad (12)$$

The twofold definition of the concept of overall localization still holds at the between-country level, since the following identity holds:

$$L^b = \sum_{i=1}^{m} \frac{x_i}{x} T_i^b = \sum_{k=1}^{n} \frac{x_k}{x} T_k^b \quad (13)$$

The within-country component (L^w) of overall localization is:

$$L^w = \sum_{k=1}^{n} \sum_{i=1}^{m} \sum_{j=1}^{r_i} \frac{x_{ijk}}{x} \ln\left(\frac{x_{ijk}/x_{ik}}{x_{ij}/x_i}\right) \quad (14)$$

Again, specialization and concentration underpin the overall localization pattern within countries:

$$L^w = \sum_{j=1}^{r} \frac{x_{ij}}{x} T_{ij}^w = \sum_{k=1}^{n} \frac{x_k}{x} T_k^w \quad (15)$$

Each component defined in equations (13) and (15) assesses the average dissimilarity between the two distributions of interest. They are both the average sum of the raw indices of relative concentration and relative specialization.

This implies that the *L-index* will also be a valuable reference for the analysis of specialization and concentration. In the case of specialization patterns, it represents the weighted average of raw indices and is therefore a valuable reference with which to understand 'how large is large' (MCCLOSKEY and ZILIAK, 1996), particularly in the absence of an upper bound on the specialization and concentration measures.

In fact, the overall localization index (L) is a summary statistics of regional specialization indices (T_{ij}°) weighted by the regional manufacturing shares (x_{ij}/x):

$$L = \sum_{j=1}^{r} \frac{x_{ij}}{x} T_{ij} = \sum_{i=1}^{m} \frac{x_i}{x} T_i^b + \sum_{j=1}^{r} \frac{x_{ij}}{x} T_{ij}^w \quad (16)$$

On the concentration side, overall localization can be seen as a summary statistics of relative concentration Theil indices (T_k) weighted by the industry shares (x_k/x):

$$L = \sum_{k=1}^{n} \frac{x_k}{x} T_k = \sum_{k=1}^{n} \frac{x_k}{x} T_k^b + \sum_{k=1}^{n} \frac{x_k}{x} T_k^w \quad (17)$$

To conclude, both equation (16) and equation (17) correspond to:

$$L = L^b + L^w \quad (18)$$

The *L-index* and each single components are non-negative. Perfect regularity ($L = 0$) implies that $L^b = 0$ and $L^w = 0$. Any departure from the case of perfect

regularity ($L > 0$) means that some localization economies are at work within countries ($L^w > 0$) or some comparative advantage between countries exists ($L^b = 0$), or both. Usually, overall localization is jointly explained by international and intra-national components.

However, like all measures based on aggregate regional data, the index of overall localization is affected by the modifiable areal unit problem and the checkerboard problem (ARBIA, 1989). Recently developed has been a line of methodological development based on spatial disproportionality measures of polarization and concentration to deal with the checkerboard and the MAUP problems (BICKENBACH and BODE, 2006).

Entropy measures are suitable for statistical testing. Bootstrapping is a valuable method with which to ascertain whether the observed localization has significantly changed over time. The bootstrap was introduced by EFRON (1979), and it has been more recently adopted in the context of inequality measures, although its implementation for the spatial distribution of economic activities has been quite rare.[12] The main issue to be addressed herein is whether overall localization, relative concentration, and relative specialization changed significantly over the period under scrutiny. This issue can be resolved by bootstrapping the entropy measures and their components. The resampling process is repeated 10 000 times and the following hypothesis test is conducted:

$$H_0 : \Delta I = 0$$
$$H_1 : \Delta I \neq 0$$

where I refers to each entropy measure of relative concentration, relative specialization, or overall localization.

LOCATION PATTERNS IN EUROPE: THE EMPIRICAL EVIDENCE

A declining trend in overall localization: an overview

From the mid-1980s onwards, manufacturing employment as a whole became less localized across European regions. Fig. 1 illustrates the trend in overall localization during the period 1985–2001. The internal geography of countries was much more differentiated than the European landscape evaluated on the basis of national borders. Put differently, the spatial organization of manufacturing industries was driven mostly by the regional scale, and only to a minor extent it is due to the different national characteristics, for example, comparative advantages. On average, the latter component accounts for less than one-third of the overall localization.

As for the dynamics, the spreading forces acting within countries were stronger than the contrasting trends across countries.

In fact, the evolution of overall localization is explained mostly by the modification of the regional agglomeration of manufacturing industries. The subnational component accounted for more than 80% of the total variation of the *L-index* (Appendix Table A2). Internal regions of each country converged towards the manufacturing structure of the country to which they belonged. As a result, the spatial distribution of each industry became more similar to the interregional allocation of total manufacturing employment. Compared with the within-country pattern, the international component was rather stable, with a slight decrease in the first period (−17.7%) which was partly recovered from 1993 onwards (+5.6%).

The sensitivity of the results on the evolution of overall localization to the choice of the basic unit of analysis and to the choice of the intermediate aggregation level[13] is presented in Table 1, where the same geographical benchmark (Europe[14]) is used to evaluate overall localization by adopting different spatial hierarchical structures. This comparison makes it possible to assess the robustness of the findings. The main conclusion to be drawn is that a pronounced declining localization at the smaller scale – namely, within countries – is a robust finding irrespective of the basic unit (NUTS2 or NUTS1) and the intermediate aggregation level adopted (NUTS1, country).

After the completion of the European Single Market, localization at higher spatial aggregations – namely, across national boundaries and over the North–South divide – displayed an upward trend (Table 1). The

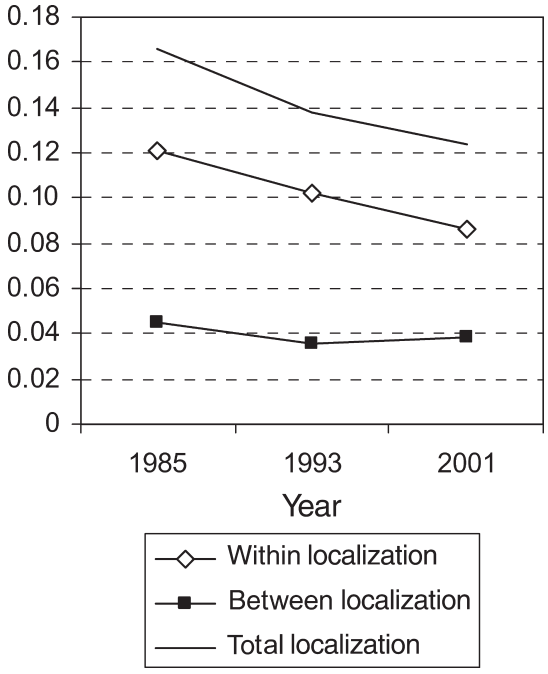

Fig. 1. *Evolution of European Union-wide localization within and across countries: entropy index of overall localisation (*L-index*), 1985–2001*
Source: EUROSTAT Region-SBS (Structural Business Statistics) database employment by manufacturing sectors

Table 1. *Robustness of results to the choice of the basic geographic unit of analysis, spatial aggregation, sectoral aggregation, same geographical benchmark*

Basic unit (R)	Intermediate level	Industry aggregation		ΔL	ΔL^w	ΔL^b
NUTS2 (145)	Country	One-digit, NACE rev. 1	1985–1993	−0.028***	−0.019***	−0.009**
				(0.005)	(0.003)	(0.003)
			1993–2001	−0.014**	−0.016***	**0.002**
				(0.006)	(0.004)	(0.004)
NUTS1 (60)	Country	One-digit, NACE rev. 1	1985–1993	−0.023***	−0.013***	−0.009**
				(0.005)	(0.003)	(0.003)
			1993–2001	−0.009*	−0.011***	**0.002**
				(0.005)	(0.002)	(0.005)
NUTS2 (145)	Northern/ Southern Europe	High-technology/ low-technology dichotomy	1985–1993	−0.005***	−0.004**	−0.001
				(0.002)	(0.002)	(0.001)
			1993–2001	0.000	−0.001	**0.001**
				(0.004)	(0.003)	(0.002)
NUTS2 (145)	NUTS1	One-digit, NACE rev. 1	1985–1993	−0.029***	−0.006***	−0.023***
				(0.005)	(0.002)	(0.005)
			1993–2001	−0.014**	−0.005**	−0.009*
				(0.007)	(0.002)	(0.006)

Notes: Weighted relative Theil; bootstrap standard errors are given in parentheses; based on 10 000 replications; positive changes over time are emboldened.

NACE, Nomenclature générale des Activités économiques dans les Communautés Européennes; NUTS, Nomenclature des Unités Territoriales Statistiques.

positive changes between-country and over the North–South divide are almost zero and they are not significant. Nevertheless, they may represent a relevant sign of a change for the second period of analysis. In fact, the interesting point here is the differential patterns at the lower geographical scale (within-country) compared with the international evolutions (that is, between-country and the North–South divide). The declining polarization at the smaller spatial scale and the contemporaneous slight localization at larger distances are shown to be robust to different basic units and intermediate aggregations and call for differential economic forces that may have been at work internationally and locally.

Overall, localization patterns can be also viewed in terms of relative concentrations of manufacturing industries. As already shown, after 1993 the general fall in overall localization over long distances stopped not only across countries, but also between the North–South divide (Table 1). It is interesting to note that the rising overall localization during the 1990s derived mainly from an increasing agglomeration of high-technology manufacturing activities which happened both at the local level and between the North–South divide.

PACI and USAI (2000) already showed that, in 1990, the distribution of technological activity was highly concentrated in Europe due to substantial differences between southern and northern regions.

The evidence of the present work confirms that innovative industries are more geographically clustered than traditional industries. Moreover, during the 1990s, instead of spreading across European economies, the former become more concentrated across regions and across the North–South divide (Fig. 2). In other words, proximity matters particularly in the

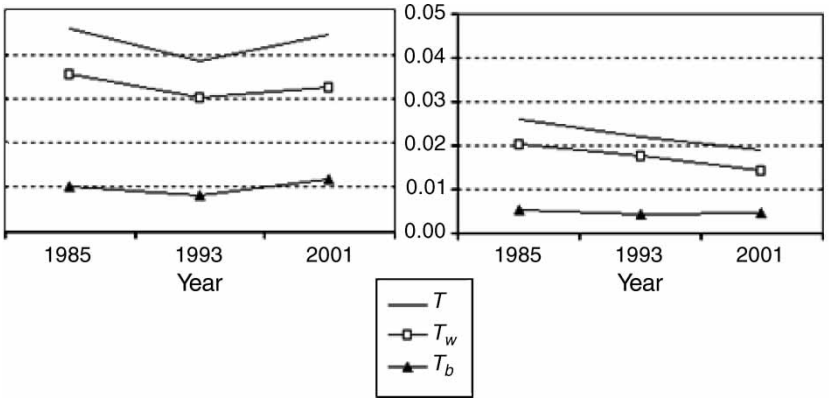

Fig. 2. *Relative concentration of high-technology (left) and low-technology (right) manufacturing industries over the North–South divide*

knowledge-intensive sector,[15] plausibly because of the higher intensity of knowledge spillovers[16] and input–output linkages within the sector.

The increasing polarization of the knowledge-intensive industries in the 1990s that favoured Northern European countries is usually associated with the wider availability of highly skilled labour. During the 1990s, structural changes in Northern Europe occurred towards greater specialization in high-technology manufacturing industries, while Southern regions lagged behind.

In the following sections a more detailed analysis is conducted of the concentration and specialization trends across and within countries.

Internal dispersion and the associated mixed trends in manufacturing concentration between countries

Table 2 ranks manufacturing industries according to their average values of relative concentration (reported in the third column) calculated on the basis of the 145 NUTS2 regions for the observation period.

Textiles and wearing apparel emerge as an industry endowed with pronounced localization economies, for it exhibits the highest divergence from the spreading of overall manufacturing. Other resource-based industries, such as *wood production* and *non-metallic mineral products*, rank among the most localized. Innovative industries, such as *chemicals* and *transport equipment*, have intermediate levels of concentration or, like *electrical and optical equipment* and *machinery*, they are spreading even more similarly to total manufacturing. This might be because these industries are usually highly represented where manufacturing employment is geographically concentrated.

BRÜLHART and TRAEGER (2005) found that the relative concentration of value added increased in the majority of manufacturing industries, even though the changes were generally minimal and not significant (Table 2, last column). At the same time, employment data show a widespread decline in relative concentration, and the results are highly significant in half of the industries. To be stressed is that the regional agglomeration of value added combined with the spreading of employment suggests the importance of within-industry spatial fragmentation along functional lines[17] (DURANTON and PUGA, 2005). The widespread increase in relative concentrations of value added found in a previous study by BRÜLHART and TRAEGER (2005) (Table 2, last column) was almost simultaneous with a significant decline in employment agglomeration (Table 2, third column) in the majority of manufacturing industries.

Increasing returns to scale sectors – *non-metallic products, chemicals, transport equipment*, and *paper and publishing* – are characterized by consolidated regional localization economies. In fact, not only do they emerge as highly clustered at the beginning of the period, but also they exhibit minimal changes. Relative concentration increases in *textile and wearing apparel*, where external economies are notably important, and, if value added is considered, the change is also significant.

Apart from the above-mentioned exceptional case, de-agglomeration is a widespread and robust result for the entire period considered. The most important feature of the overall modification is that it conceals different changes, which occurred within and between countries, respectively. The within-country evolution and the national change did not evolve in parallel. Some of the industries characterized by a substantial decrease in internal localization experienced intensifying between-country relative concentration associated with a process of the national specialization of European Union economies.

Table 2. Relative concentration of manufacturing industries across European Union regions

			Absolute change	
	Taxonomy[a]	Average, 1985–2001	1985–2001[b]	1980–1995[c]
Textiles and wearing apparel	LT	0.26	0.034	0.165**
Wood	LT	0.22	−0.130**	–
Non-metallic mineral products	LT	0.18	−0.032	0.017
Chemicals	HT	0.17	−0.020	0.000
Manufacturing n.e.c.	HT	0.16	−0.125***	−0.004
Transport equipment	HT	0.15	0.021	0.020
Food	LT	0.14	−0.054***	0.011
Paper, publishing and printing	LT	0.13	−0.014	0.010
Electrical and optical equipment	HT	0.10	−0.046***	−0.006
Basic metals and fabricated metal products	LT	0.11	−0.083***	−0.056
Machinery	HT	0.10	−0.025	−0.006
Rubber and plastic products	LT	0.10	−0.056**	–

Notes: [a]Organisation for Economic Co-operation and Development (OECD) technology classification: LT, low-technology; and HT, high-technology.

[b]Rejection of the null hypothesis that $\Delta T_k = 0$ at the *90%, **95% or ***99% levels of significance, respectively.

[c]Results for the period 1980–1995 are drawn from BRÜLHART and TRAEGER (2005).

n.e.c., Not elsewhere classified.

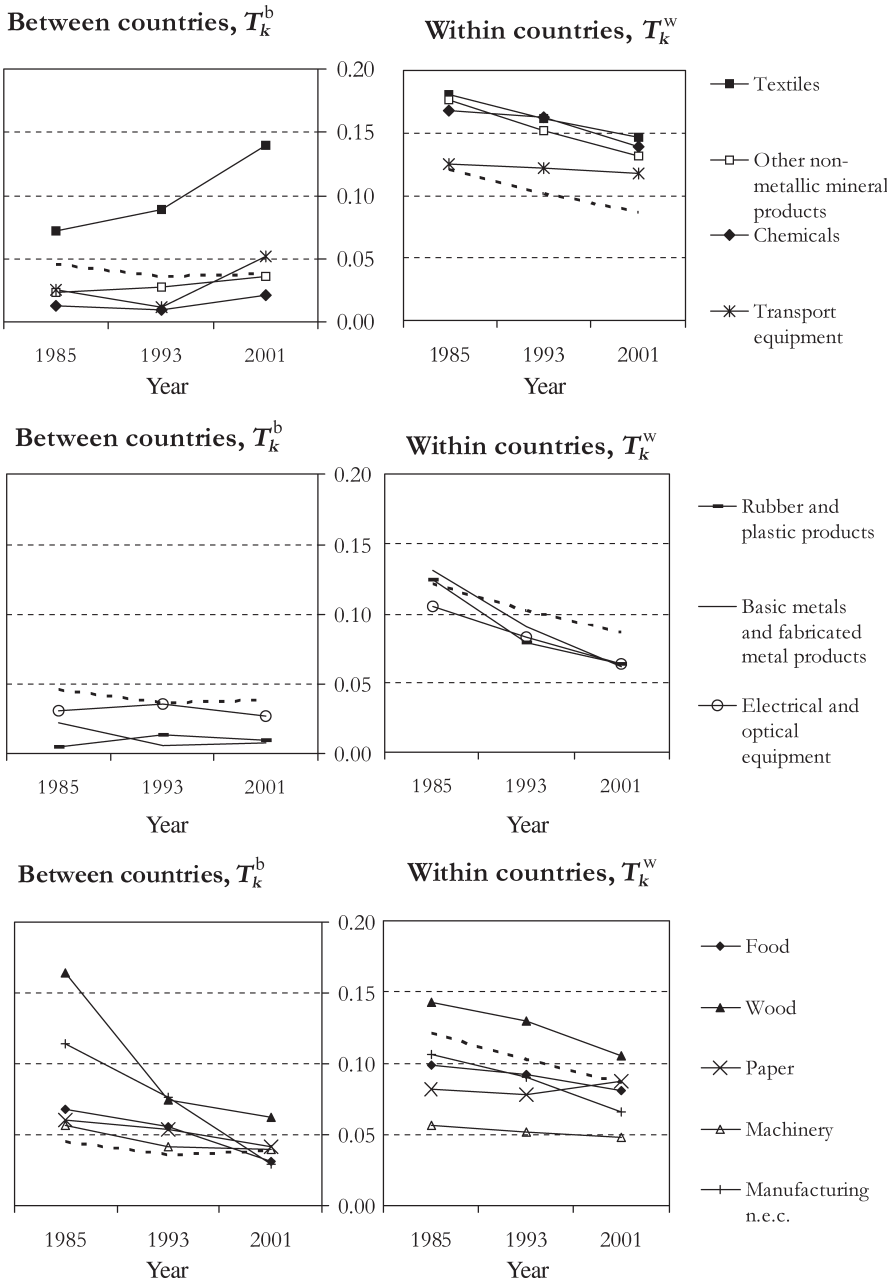

Fig. 3. Evolution of the two components of relative concentration

Notes: Dotted lines are the respective components of the *L-index:* between-country in the left graphs and within-country in the right graphs. *Source:* EUROSTAT Region-SBS (Structural Business Statistics) database employment by manufacturing sectors

More specifically, although diminishing polarization within countries is common to almost all manufacturing industries (paper is the only exception), it should be stressed that the evolution of cross-border concentration is mixed. Agglomeration between countries occurred in *no-metallic mineral products, chemicals, textiles*, and *transport equipment* (top panel of Fig. 3), although changes were significant only for the latter two industries during the 1990s (Appendix Table A7). Once the internal market was completed, the international agglomeration of *textiles and wearing apparel* was mainly due to the higher and increasing shares of Spain and Italy in European textiles employment with respect to their share in European manufacturing employment. As for transport equipment, the increasing concentration is the outcome of a manufacturing industry that remained highly embedded in Germany, despite the loss of industrial employment and deindustrialization experienced by the country during the 1990s.

In a second group of industries, the falling relative concentration was driven mostly by de-agglomeration within countries, with a low level of *between-country* concentration which remained almost unchanged. This group consists of medium- to high-technology

industries, namely *basic metals, rubber and plastic products*, and *electrical and optical equipment* (middle panel of Fig. 3). In the remaining sectors – *food, wood, machinery*, and *miscellaneous manufacturing* – the territorial organization converged on the spatial distribution of overall manufacturing both *across* countries and *within* countries (bottom panel of Fig. 3).

Internal structural changes and national patterns of specialization

The magnitude of the change over time was remarkably higher during the entire period in the peripheral and smaller countries – namely, Greece, Belgium and Luxembourg, Spain, and Finland – which had been also characterized by a higher level of dissimilarity throughout the period (Table 3). For the Mediterranean Cohesion countries – namely Greece and Spain – this trend may be regarded as an expression of the catching-up which involved the whole national economy.

By contrast, the larger countries – such as Great Britain, France, Italy, and Western Germany – did not change much in terms of their region-based specialization relative to Europe (aRS_i°). It is interesting to note that the minor falling changes experienced by these countries conceal a substantial and significant de-specialization that occurred internally, particularly in Italy and Western Germany (Table 3). These countries are characterized by a falling regional specialization which occurred simultaneously with an increasing specialization of the national manufacturing structure.

Therefore, to gain a better understanding of specialization patterns in Europe, it is useful to distinguish international trends from intra-national evolutions. In fact, as explained in the methodology section, the overall trend in specialization of an economy delimited by national boundaries is the outcome of separate, and somehow different, trends in specialization that occur simultaneously at the regional and national levels: that is, internal regional specialization does not go hand in hand with the specialization of the whole country.

There is a group of countries in which national specialization increased while internal regional specialization was declining. This group includes Germany, Italy and, to a lesser extent, France. Their regional economies became less specialized relative to the national reference, but the national manufacturing structure increasingly differed from Europe (top panel of Fig. 4). In particular, in Western Germany, national patterns were mainly the outcome of increasing specialization in knowledge-intensive industries, such as *chemicals, rubber and plastics products, metallurgy, electrical products*, and the *automobile industry*.

In the mid-1990s, Italy was a traditional light and labour-intensive producer, with significant specialization in the production of machinery. During the subsequent periods, the country constantly increased the distinctive nature of its manufacturing structure (Appendix Table A8).

Despecialization was only a national phenomenon in a second group composed of small European countries. Specifically, the pronounced downward trend in national specialization was associated with mixed trends within countries. Slight regional specialization occurred in Greece, while general internal stability characterized the cases of the Netherlands and Finland. The convergence of the Greek national manufacturing structure to Europe's is due to catching-up by the Greek economy[18] since its entry into the European Community, despite its internal core–periphery divide widened over time (middle panel of Fig. 4).

An analogous development took place in Spain, which specialized in *textiles and wearing apparel* and in *non-metallic mineral products, basic metals*, partly losing its comparative advantage in the *food* industry, the *wood* industry, and *miscellaneous manufacturing*. Spain – together with Belgium, Luxembourg, and the UK – belongs to the group of countries in which internal development replicated the national specialization patterns. This group of countries saw their manufacturing structures converge on the supra-regional reference: both regions came closer to the national manufacturing

Table 3. Specialization indices and components, 1985–2001 (average values and differences)

	aRS_i			aRS_i^w			T_i^b		
	Average	$\Delta_{1985-2001}$	Significance	Average	$\Delta_{1985-2001}$	Significance	Average	$\Delta_{1985-2001}$	Significance
Greece	0.39	*−0.13*	***	0.15	*0.02*		0.24	*−0.14*	***
Belgium and Luxembourg	0.22	*−0.13*	***	0.16	*−0.06*	***	0.06	*−0.07*	***
Spain	0.20	*−0.08*	***	0.13	*−0.04*	**	0.07	*−0.04*	*
Finland	0.19	*−0.08*		0.05	*−0.01*	**	0.14	*−0.07*	
UK	0.16	*−0.06*		0.14	*−0.04*		0.02	*−0.02*	
Netherlands	0.14	*−0.09*		0.05	*−0.02*		0.08	*−0.07*	
Italy	0.14	*−0.01*		0.10	*−0.04*	**	0.04	*0.02*	
France	0.10	*−0.01*		0.09	*−0.01*		0.01	*0.00*	
Germany (only Western Germany)	0.12	*−0.02*		0.08	*−0.03*	***	0.04	*0.02*	
Overall localization	0.14	*−0.04*	***	0.10	*−0.04*	***	0.04	*−0.01*	

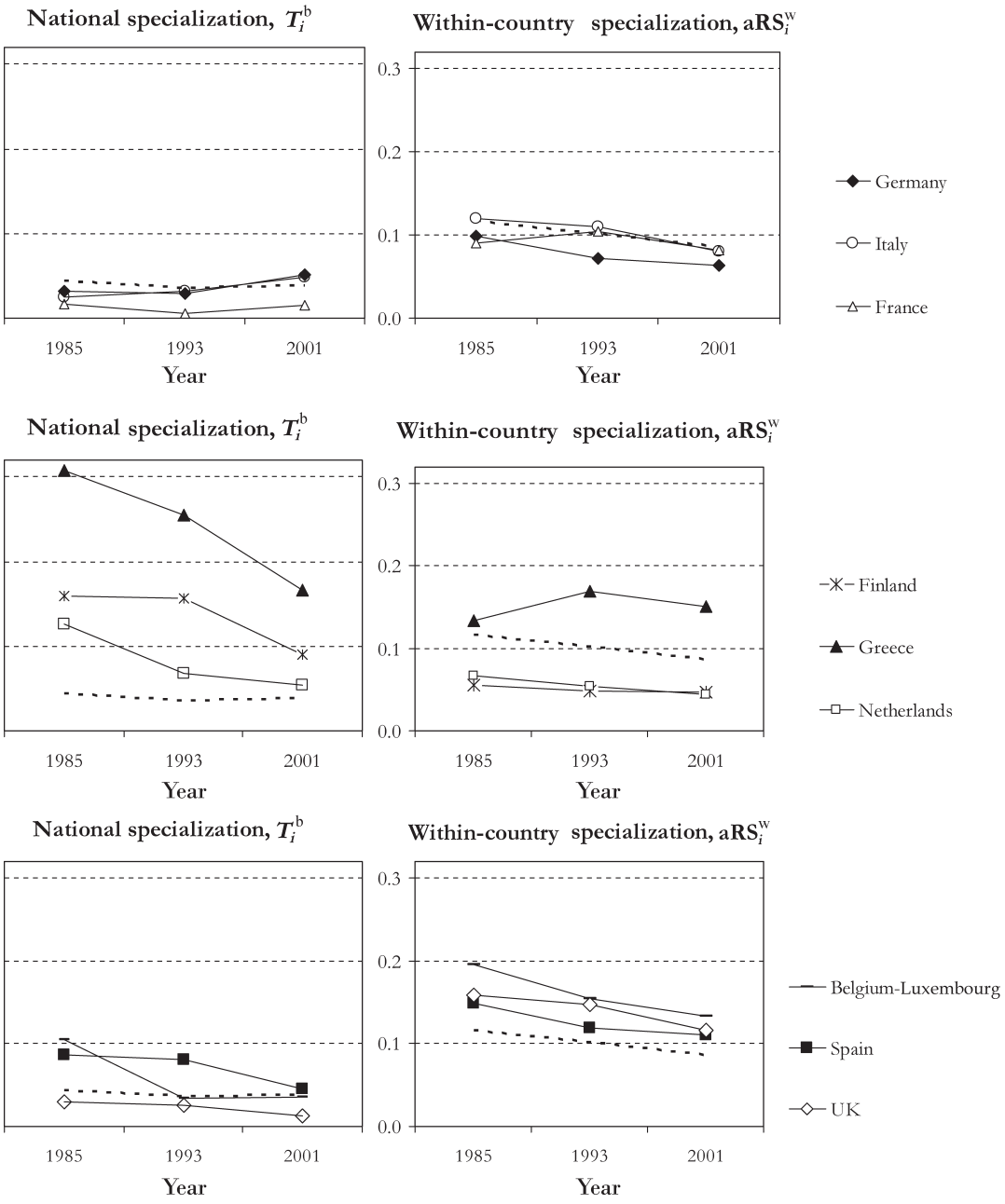

Fig. 4. *Evolution of the two components of relative specialization*
Notes: Dotted lines are the respective components of the *L-index:* between-country in the left graphs and within-country in the right graphs. *Source:* EUROSTAT Region-SBS (Structural Business Statistics) database employment by manufacturing sectors

structure and the national economy converged vis-à-vis Europe (bottom panel of Fig. 4).

Within- and between-country evolution in the context of European economic integration

With the aim of totally abolishing the 'frontier' concept, the 1985 White Paper established the legislation to be adopted by the end of 1992 in order to achieve full elimination of physical, technical, and tax frontiers. To be noted is that 90% of the legislative projects listed in the 1985 White Paper had been adopted by 1993 (EUROPEAN COMMISSION, 1996). In the following period further progress was made in the transposition of European Union legislation into national law and in its implementation – which had previously limited the full completion of the internal market by 1992.

Table 4 suggests that international restructuring (ΔT_i^b) might have been affected by the European integration process, while regional depolarization (aRS_i^w) was a generalized trend invariable to the development

of a new institutional environment. That is to say, while regional specialization declined continuously throughout the whole period, for national trends 1993 can represent a significant turning point. The present analysis confirms the first evaluation by SAPIR (1996), who suggested that the internal market programme did not produce the general increase in the specialization of European economies envisaged by KRUGMAN (1991) at least until 1992.

In fact, increasing specialization can hardly be considered a stylized fact, neither within countries nor across countries. By contrast, it was a temporary exception to the rule which occurred, before enactment of the Single Market programme, within Greece and, to a lesser extent, in France. Moreover, national specialization decreased in all the European countries in the sample between 1985 and 1993, except for Italy, which specialized throughout the entire period. It is likely that European countries, in a context of high trade barriers, protected industries not endowed with comparative advantages, and that the Single Market Programme imposed a structural change on their economies (AMITI, 1999) which gave rise to 'U'-shaped national specialization patterns. On this view, further national specialization might possibly be imminent as European Union deepening and widening proceed further. A first possible confirmation of this conjecture is provided by some of the founding members of the European Union, namely Belgium and Luxembourg, France, and Western Germany, which, according to the present analysis, experienced increasing specialization from the post-Single Market period onwards.

The evolution of specialization was matched by the agglomeration of industries across and within national borders. It has just been shown that the construction of the Single Market was dominated by international adjustments towards the decreasing specialization of countries (Table 4).

The results on decreasing national specialization are matched by the between-country variations over the period 1985–1993. Changes were generally negative, and in half of the industries they were significant. Therefore, international de-agglomeration of industries prevailed across countries, as suggested by MIDELFART *et al.* (2004), and also seems to be consistent with the geographical dispersion across countries of manufacturing industries between 1985 and 1992 (AIGINGER and PFAFFERMAYR, 2004; AIGINGER and DAVIES, 2004).[19]

By contrast, during the second period, agglomeration across national boundaries rose in additional industries (Table 5). To sum up, after a temporary adjustment to the liberalization of manufactured goods markets, from 1993 onwards founding Member States (Belgium, Luxembourg, France, Italy, and Western Germany) experienced increasing specialization which reflected significant international agglomeration in two core industries (*textiles and wearing apparel* and *transport equipment*) accompanied by rising trends in the *chemicals industry, metal products*, and *non-metallic mineral products* (Tables 4 and 5).

DISCUSSION OF THE RESULTS AND CONJECTURES

Whatever international localization will come about in the future, to date most of the structural change, particularly since completion of the Single Market Programme, has occurred in the internal geography of countries (Tables 4 and 5). In particular, industrial regional de-agglomeration within countries throughout the period confirms, and extends to further European countries, the evidence provided by previous studies on Italy, Spain, and Germany (ROMBALDONI and ZAZZARO, 1997; DE ROBERTIS, 2001; PALUZIE *et al.*, 2001; SUEDEKUM, 2006).

These results are probably due to a combination of several forces which pushed towards internal de-agglomeration. Congestion costs[20] and the tertiarization of metropolitan areas, together with the information technology revolution and advances in transportation infrastructure, may have driven the emerging trend.

Table 4. *Relative specialization: a comparison of the pre- and post-Single Market periods*

	Pre-Single Market		Post-Single Market	
	ΔT_i^b	aRS_i^w	ΔT_i^b	aRS_i^w
Belgium and Luxembourg	−0.070**	−0.041	**0.001**	−0.022
Finland	−0.003	−0.008**	−0.066	−0.001
France	−0.011	**0.015**	**0.009**	−0.024**
Greece	−0.053	**0.035****	−0.089*	−0.018
Italy	**0.008**	−0.009	**0.017**	−0.030*
Netherlands	−0.058**	−0.013	−0.014	−0.009
Spain	−0.005	−0.030*	−0.036*	−0.008
UK	−0.004	−0.012	−0.013**	−0.031**
Western Germany	−0.004	−0.027**	**0.022***	−0.008
Overall localization	−0.009**	−0.019***	**0.002**	−0.016***

Notes: Absolute changes for the pre-Single Market refers to the period 1985–1993, while the post-Single Market the period considered is 1993–2001; positive changes are emboldened.

Table 5. *Relative concentration: a comparison of the pre- and post-Single Market periods*

	Pre-Single Market		Post-Single Market	
	ΔT_k^b	ΔT_k^w	ΔT_k^b	ΔT_k^w
Rubber and plastic products	**0.008***	−0.045***	−0.003	−0.016*
Wood	−0.080**	−0.013	−0.013	−0.024**
Machinery	−0.015*	−0.005	−0.001	−0.003
Food	−0.012*	−0.007	−0.024**	−0.012*
Manufacturing n.e.c.	−0.038***	−0.016	−0.047***	−0.025***
Transport equipment	−0.014**	−0.002	**0.040****	−0.003
Textiles	**0.017**	−0.019	**0.051***	−0.015
Paper	−0.007	−0.004	−0.013	0.009
Chemicals	−0.003	−0.005	**0.012**	−0.024**
Other non-metallic mineral products	**0.005**	−0.025***	**0.008**	−0.020
Basic metals and fabricated metal products	−0.017	−0.041***	**0.002**	−0.029***
Electrical and optical equipment	**0.004**	−0.023***	−0.008	−0.019***
Overall localization	−0.009**	−0.019***	**0.002**	−0.016***

Notes: Absolute changes for the pre-Single Market refers to the period 1985–1993, while the post-Single Market period considered is 1993–2001; positive changes are emboldened.

n.e.c., Not elsewhere classified.

Moreover, falling trade barriers may have affected firms' locations, as suggested by the model of KRUGMAN and LIVAS (1996), because firms became less 'inward-looking' and the strength of congestion costs proved much more important than before.[21] The importance of congestion costs was also emphasized by the Italian literature on the development of peripheral regions in the 1970s and 1980s. Italian interregional dispersion was conceived in terms of the *filtering-down* theory (CRIVELLINI and PETTENATI, 1989) associated with the increasing congestion costs and disamenities of the main industrial area in the country. The change in the internal geography was also reinforced by lagging regions (the *Third Italy*), which subsequently grew faster than core regions, giving rise to profound changes in the previous relative positions (GAROFOLI, 1992). In addition, national industrial policies and European Regional Policy in favour of peripheral and underdeveloped regions may have contributed to the large-scale depolarization experienced in Southern Europe. In fact, Italy and Spain were among the first of six countries in terms of European Union aid and state aid to manufacturing during the period 1994–1996 (Greece, Portugal, Ireland, and Denmark were the others; MIDELFART-KNARVIK and OVERMAN, 2002, p. 334).

Moreover, at the same time as European integration increased, transportation and communication technology also improved, and industry-specific agglomeration economies were partly substituted by incentives for functional specialization within the same industry. Hence, accounting for the simultaneous development in transportation infrastructure and communication technology is essential to gain a better understanding of the underlying reasons for the new patterns in the spatial organization of industries. In fact, when the costs of coordinating the value chain decreased, firms found it easier to relocate their production units, maintaining their headquarters close to metropolitan areas so that managers were still proximate to business service suppliers. In fact, if the spreading of labour that emerges is combined with the agglomeration of value added found by comparable previous studies (BRÜLHART and TRAEGER, 2005), it is likely that regional specialization along functional lines is occurring within industry (DURANTON and PUGA, 2005), implying in its turn the concentration of high-value-added functions in core regions and the specialization of peripheral sites in routine tasks. Consequently, European economic integration should be regarded as part of the story, whilst the diffusion of 'unbounded' organizational forms might have helped forge the new inner-country economic geography. In fact, evidence of a general spreading of knowledge-intensive manufacturing industries was found in West Germany during the 1990s (SUEDEKUM, 2006) and in Italy throughout the 1970s and 1980s, particularly for the production of transport equipment (ROMBALDONI and ZAZZARO, 1997, DE ROBERTIS, 2001). In Italy, the decentralization of production tasks has continued in more recent years, because the economic crisis of the early 1990s forced Fiat to restructure its supply chain with a further relocation of routine tasks to South Italy.

A second interesting point is that once the Single Market was almost completed, only a slight polarization across national boundaries occurred, concomitant with the substantial fall in localization in the internal geography of countries. Hence, the drastic specialization of European countries, implying the greater concentration of industries (KRUGMAN, 1991), is far from being fully accomplished. One possible reason for the gap between the theory and the reality is the discrepancy between the assumptions of New Economic Geography models and the real European economic landscape. The conjecture of convergence by the European

Union to the US level of concentration was probably based on the assumption of increasing labour mobility within the European Single Market.[22] Yet, Europe and the USA continue to differ in terms of some institutional and social features relevant for the agglomeration of economic activities: notably, the low propensity of workers to migrate internationally, even though since 1985 the Shengen Agreement has established the free movement of people across national borders, and more recently (December 2007) with almost all the new Member States as well. It is, therefore, also possible that scant cross-country polarization has been the outcome of the low international mobility of workers among the European countries analysed.

CONCLUSIONS AND FURTHER DEVELOPMENTS

This paper has investigated manufacturing location patterns in Europe during a period of trade integration. The decomposition methodology of entropy indices has allowed a distinction to be made between inner-country and cross-country localization.

In contrast to the mixed empirical evidence provided by existing studies, the methodology adopted has identified a clear trend in European localization which supports the idea that, in recent decades, substantial regional spreading has occurred simultaneously with less international polarization. The paper has obtained robust results for European Union-wide regional changes, providing compelling evidence on the regional de-agglomeration of manufacturing employment among regions within European countries. Instead, once the Internal Market had been completed, there began a polarization between the supra-regional economies (that is, countries and the macro-areas defined by the North–South dichotomy).

The divergence between international patterns and domestic ones is not a contradictory finding if one considers that it has probably been driven by simultaneous dispersion and agglomeration forces acting at the different spatial scales.

The emerging opposite pattern of change may be connected with advances in European integration because, between 1993 and 2001, localization across countries slightly increased, as suggested by theoretical models. Increasing overall localization patterns across countries are explained by the international agglomeration of *textiles and wearing apparel* and *transport equipment*. Similarly, it is accounted for by the divergence of the national manufacturing structures of European founding Member States – Western Germany and Italy and, to a lesser extent, France, Luxembourg, and Belgium – from that of Europe.

The increasing polarization across wider spatial scales during the period 1993–2001 might also be explained by the slight increase in specialization in Northern Europe, and by the rise in the relative concentration of high-technology industries across the North–South divide. It is likely that peripheral countries have also benefited from the dismantling of trade barriers as they have gained better access to the market. However, it would be simplistic to conceive these changes as purely the outcome of the European Single Market because regional policy for lagging regions might have played a key role.

It is usually considered that specialization in knowledge-intensive industries is growth-enhancing since innovation and technical progress are critical determinants of productivity improvements and international competitiveness. However, the increasingly uneven distribution of innovative activities across North and South Europe may, by itself, exacerbate regional disparities. Moreover, Cohesion Policy, for the period 2007–2013, included the goals of the Lisbon Strategy to foster regional growth and competitiveness through investment in innovation. These policy directions are highly important to attain higher efficiency, but they might also deepen further the existing differences between Northern European industrial structure and the Mediterranean one. The former have more suitable specialization patterns than the latter to seize the development opportunities provided by the European Regional Policy.

Although this paper does not claim to test the validity of the New Economic Geography's predictions, some final considerations might help bridge the gap between theory and evidence. In the New Economic Geography framework a causal link is established between international integration and the location of economic activities. The empirical facts presented here show that localization has followed an unexpected path contrary to the one suggested by the theory. This evidence raises several questions. Has European economic integration not yet reached the level at which agglomeration economies should prevail? Do simultaneous overlapping changes reshape the European geography of industrial activities in a contrasting way? Are agglomeration economies within specific industries vanishing? These unresolved issues require further research.

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APPENDIX

Table A1. *Geographical coverage of the data set*

Country	Administrative partition	Number of regions included
Belgium	*Provinces* (NUTS2)	9
Luxembourg		1
Germany	*Länder* (NUTS1)	16
Spain	*Comunidades autónomas* (NUTS2)	17
Finland	*Suuralueet* (NUTS2)	3
France	*Régions* (NUTS2)	22
Greece	Development regions (NUTS2)	11
Italy	*Regioni* (NUTS2)	19
Netherlands	*Provincies* (NUTS2)	12
UK	Counties (NUTS2)	35
Total		145

Notes: Bruxelles (BE10), Vlaams Brabant (BE24) and Brabant Wallon (BE31) are clustered as a single region; Ceuta y Melilla (ES63), Åland (FI2), 'Departments d'Autre Mar' (FR91, FR92, FR93, and FR94), Voreio Aigaio (GR41), Notio Aigaio (GR42), and Trentino-Alto Adige (IT31) are excluded. Regional partition of data for UK is according to the Nomenclature des Unités Territoriales Statistiques (NUTS)-95 classification.

Table A2. *Bootstrap results for localization measures, absolute changes, 1985–2001*

	Observed difference	Bootstrap standard error	z	$P > \|z\|$
L	−0.042	0.009	−4.52	0
L^w	−0.035	0.005	−6.66	0
L^b	−0.007	0.006	−1.08	0.01

Table A3. *Bootstrap results for specialization measures, absolute changes, 1985–2001*

		Observed difference	Bootstrap standard error	z	$P > \|z\|$
Belgium and Luxembourg	aRS_i	−0.131	0.030	−4.37	0
	aRS_i^w	−0.062	0.023	−2.73	0.006
	T_i^b	−0.069	0.025	−2.74	0.006
Western Germany	aRS_i	−0.016	0.020	−0.83	0.408
	aRS_i^w	−0.035	0.012	−2.78	0.005
	T_i^b	0.018	0.012	1.56	0.118
Spain	aRS_i	−0.078	0.029	−2.68	0.007
	aRS_i^w	−0.038	0.015	−2.45	0.014
	T_i^b	−0.041	0.022	−1.86	0.064
Finland	aRS_i	−0.079	0.052	−1.52	0.128
	aRS_i^w	−0.009	0.005	−2.1	0.036
	T_i^b	−0.069	0.051	−1.35	0.178
France	aRS_i	−0.011	0.016	−0.66	0.512
	aRS_i^w	−0.009	0.011	−0.79	0.43
	T_i^b	−0.002	0.010	−0.19	0.846
Greece	aRS_i	−0.125	0.035	−3.63	0
	aRS_i^w	0.017	0.015	1.12	0.265
	T_i^b	−0.142	0.040	−3.53	0
Italy	aRS_i	−0.015	0.021	−0.71	0.476
	aRS_i^w	−0.039	0.017	−2.31	0.021
	T_i^b	0.024	0.012	2.08	0.037
Netherlands	aRS_i	−0.094	0.023	−4.11	0
	aRS_i^w	−0.022	0.010	−2.23	0.026
	T_i^b	−0.072	0.022	−3.25	0.001
UK	aRS_i	−0.061	0.015	−3.96	0
	aRS_i^w	−0.044	0.012	−3.66	0
	T_i^b	−0.018	0.008	−2.3	0.021

Table A4. *Bootstrap results for concentration measures, absolute changes, 1985–2001*

		Observed difference	Bootstrap standard error	z	$P > \|z\|$
Food	T_k	−0.054	0.016	−3.41	0.001
	T_k^w	−0.018	0.008	−2.37	0.018
	T_k^b	−0.036	0.015	−2.38	0.017
Textiles	T_k	0.034	0.034	0.99	0.322
	T_k^w	−0.034	0.019	−1.81	0.071
	T_k^b	0.068	0.025	2.72	0.007
Wood	T_k	−0.130	0.057	−2.31	0.021
	T_k^w	−0.037	0.021	−1.76	0.078
	T_k^b	−0.093	0.047	−1.97	0.049
Paper	T_k	−0.014	0.018	−0.8	0.424
	T_k^w	0.005	0.012	0.42	0.674
	T_k^b	−0.019	0.012	−1.59	0.112
Chemicals	T_k	−0.020	0.018	−1.12	0.264
	T_k^w	−0.029	0.016	−1.79	0.074
	T_k^b	0.009	0.012	0.75	0.453
Rubber and plastic products	T_k	−0.056	0.024	−2.35	0.019
	T_k^w	−0.061	0.022	−2.72	0.006
	T_k^b	0.005	0.005	0.97	0.331
Other non-metallic mineral products	T_k	−0.032	0.028	−1.17	0.241
	T_k^w	−0.045	0.020	−2.31	0.021
	T_k^b	0.013	0.015	0.82	0.411
Basic metals and fabricated metal products	T_k	−0.083	0.014	−6.15	0
	T_k^w	−0.069	0.012	−5.85	0
	T_k^b	−0.014	0.011	−1.26	0.207
Machinery and equipment n.e.c.	T_k	−0.025	0.016	−1.59	0.112
	T_k^w	−0.008	0.008	−1.06	0.29
	T_k^b	−0.017	0.011	−1.55	0.121
Electrical and optical equipment	T_k	−0.046	0.011	−4.18	0
	T_k^w	−0.042	0.010	−4.41	0
	T_k^b	−0.004	0.008	−0.53	0.595
Transport equipment	T_k	0.021	0.023	0.95	0.344
	T_k^w	−0.005	0.010	−0.47	0.635
	T_k^b	0.026	0.023	1.13	0.256
Manufacturing n.e.c.	T_k	−0.125	0.036	−3.46	0.001
	T_k^w	−0.041	0.018	−2.25	0.025
	T_k^b	−0.084	0.028	−2.98	0.003

Note: n.e.c., not elsewhere classified.

Table A5. *Bootstrap results for localization measures, absolute changes by sub-period*

	1985–1993				1993–2001			
	Observed difference	Bootstrap standard error	z	$P > \|z\|$	Observed difference	Bootstrap standard error	z	$P > \|z\|$
L	−0.028	0.005	−5.7	0	−0.014	0.006	−2.16	0.031
L^w	−0.019	0.003	−5.59	0	−0.016	0.004	−4.15	0.000
L^b	−0.009	0.003	−2.84	0.01	0.002	0.004	0.47	0.639

Table A6. *Bootstrap results for specialization measures, absolute changes by sub-period*

		1985–1993				1993–2001			
		Observed difference	Bootstrap standard error	z	$P > \|z\|$	Observed difference	Bootstrap standard error	z	$P > \|z\|$
Belgium and Luxembourg	aRS_i	−0.111	0.025	−4.43	0.000	−0.021	0.017	−1.25	0.212
	aRS_i^w	−0.041	0.021	−1.93	0.053	−0.022	0.012	−1.77	0.077
	T_i^b	−0.070	0.024	−2.92	0.003	0.001	0.009	0.11	0.914
Western Germany	aRS_i	−0.031	0.014	−2.28	0.023	0.015	0.009	1.64	0.102

(*Continued*)

Table A6. *Continued*

	aRS_i^w	−0.027	0.010	−2.85	0.004	−0.008	0.005	−1.58	0.114
	T_i^b	−0.004	0.006	−0.7	0.482	0.022	0.009	2.4	0.016
Spain	aRS_i	−0.035	0.020	−1.71	0.088	−0.044	0.017	−2.63	0.009
	aRS_i^w	−0.030	0.014	−2.18	0.029	−0.008	0.007	−1.17	0.243
	T_i^b	−0.005	0.014	−0.34	0.735	−0.036	0.015	−2.48	0.013
Finland	aRS_i	−0.011	0.015	−0.72	0.470	−0.068	0.038	−1.78	0.076
	aRS_i^w	−0.008	0.003	−2.72	0.006	−0.001	0.003	−0.59	0.558
	T_i^b	−0.003	0.016	−0.21	0.837	−0.066	0.038	−1.75	0.080
France	aRS_i	0.004	0.015	0.24	0.810	−0.014	0.006	−2.33	0.020
	aRS_i^w	0.015	0.011	1.32	0.187	−0.024	0.005	−4.8	0.000
	T_i^b	−0.011	0.007	−1.59	0.112	0.009	0.006	1.51	0.132
Greece	aRS_i	−0.018	0.034	−0.52	0.600	−0.107	0.040	−2.69	0.007
	aRS_i^w	0.035	0.013	2.65	0.008	−0.018	0.013	−1.36	0.173
	T_i^b	−0.053	0.039	−1.37	0.171	−0.089	0.046	−1.92	0.055
Italy	aRS_i	−0.001	0.012	−0.12	0.906	−0.013	0.017	−0.77	0.443
	aRS_i^w	−0.009	0.009	−1.04	0.298	−0.030	0.013	−2.29	0.022
	T_i^b	0.008	0.007	1.05	0.296	0.017	0.011	1.45	0.148
Netherlands	aRS_i	−0.071	0.022	−3.23	0.001	−0.023	0.013	−1.73	0.083
	aRS_i^w	−0.013	0.008	−1.64	0.101	−0.009	0.007	−1.42	0.157
	T_i^b	−0.058	0.021	−2.72	0.006	−0.014	0.009	−1.51	0.131
UK	aRS_i	−0.017	0.010	−1.74	0.083	−0.045	0.010	−4.56	0.000
	aRS_i^w	−0.012	0.009	−1.44	0.150	−0.031	0.007	−4.35	0.000
	T_i^b	−0.004	0.005	−0.81	0.418	−0.013	0.006	−2.34	0.019

Table A7. *Bootstrap results for concentration measures, absolute changes by sub-period*

		1985–1993				1993–2001			
		Observed difference	Bootstrap standard error	z	$P > \|z\|$	Observed difference	Bootstrap standard error	z	$P > \|z\|$
Food	T_k	−0.019	0.008	−2.32	0.02	−0.036	0.011	−3.21	0.001
	T_k^w	−0.007	0.005	−1.2	0.23	−0.012	0.006	−1.93	0.053
	T_k^b	−0.012	0.007	−1.81	0.07	−0.024	0.012	−2.07	0.039
Textiles	T_k	−0.002	0.017	−0.14	0.89	0.036	0.029	1.25	0.213
	T_k^w	−0.019	0.013	−1.44	0.15	−0.015	0.012	−1.22	0.223
	T_k^b	0.017	0.013	1.26	0.21	0.051	0.021	2.43	0.015
Wood	T_k	−0.093	0.042	−2.2	0.03	−0.037	0.031	−1.19	0.235
	T_k^w	−0.013	0.019	−0.69	0.49	−0.024	0.013	−1.82	0.069
	T_k^b	−0.080	0.039	−2.08	0.04	−0.013	0.025	−0.5	0.617
Paper	T_k	−0.010	0.010	−1.09	0.28	−0.004	0.011	−0.33	0.74
	T_k^w	−0.004	0.008	−0.5	0.62	0.009	0.007	1.23	0.218
	T_k^b	−0.007	0.007	−0.94	0.35	−0.013	0.008	−1.55	0.12
Chemicals	T_k	−0.008	0.011	−0.72	0.47	−0.012	0.015	−0.82	0.41
	T_k^w	−0.005	0.010	−0.52	0.6	−0.024	0.009	−2.52	0.012
	T_k^b	−0.003	0.007	−0.4	0.69	0.012	0.012	0.99	0.321
Rubber and plastic products	T_k	−0.037	0.016	−2.27	0.02	−0.019	0.009	−2.01	0.044
	T_k^w	−0.045	0.016	−2.89	0	−0.016	0.008	−1.91	0.056
	T_k^b	0.008	0.005	1.82	0.07	−0.003	0.004	−0.88	0.379
Other non-metallic mineral products	T_k	−0.020	0.014	−1.42	0.16	−0.012	0.016	−0.75	0.454
	T_k^w	−0.025	0.010	−2.6	0.01	−0.020	0.013	−1.6	0.11
	T_k^b	0.005	0.009	0.58	0.56	0.008	0.009	0.88	0.381

(*Continued*)

Table A7. *Continued*

		1985–1993				1993–2001			
		Observed difference	Bootstrap standard error	z	$P > \|z\|$	Observed difference	Bootstrap standard error	z	$P > \|z\|$
Basic metals and fabricated metal products	T_k	−0.057	0.010	−5.69	0	−0.026	0.008	−3.5	0
	T_k^w	−0.041	0.010	−4.18	0	−0.029	0.006	−4.9	0
	T_k^b	−0.017	0.010	−1.62	0.11	0.002	0.006	0.39	0.7
Machinery and equipment n.e.c.	T_k	−0.020	0.011	−1.88	0.06	−0.004	0.010	−0.42	0.674
	T_k^w	−0.005	0.006	−0.95	0.34	−0.003	0.006	−0.51	0.61
	T_k^b	−0.015	0.008	−1.88	0.06	−0.001	0.007	−0.22	0.826
Electrical and optical equipment	T_k	−0.019	0.007	−2.64	0.01	−0.027	0.008	−3.21	0.001
	T_k^w	−0.023	0.006	−3.88	0	−0.019	0.006	−3.24	0.001
	T_k^b	0.004	0.004	0.99	0.32	−0.008	0.007	−1.15	0.25
Transport equipment	T_k	−0.016	0.009	−1.71	0.09	0.037	0.020	1.82	0.069
	T_k^w	−0.002	0.008	−0.24	0.81	−0.003	0.007	−0.41	0.684
	T_k^b	−0.014	0.007	−2.11	0.04	0.040	0.022	1.85	0.064
Manufacturing n.e.c.	T_k	−0.054	0.017	−3.23	0	−0.071	0.027	−2.65	0.008
	T_k^w	−0.016	0.013	−1.27	0.2	−0.025	0.012	−2.05	0.04
	T_k^b	−0.038	0.015	−2.55	0.01	−0.047	0.021	−2.2	0.027

Note: n.e.c., not elsewhere classified.

Table A8. *Industry location quotients, by country*

	Germany		France		Italy	
	1985	2001	1985	2001	1985	2001
Food	0.61	0.75	1.00	1.33	0.78	0.79
Textiles	0.63	0.39	1.11	0.78	1.58	1.78
Wood	0.95	0.64	0.23	0.89	0.60	1.42
Paper	0.70	0.82	1.05	1.00	0.79	0.68
Chemicals	1.11	1.17	1.01	1.03	0.94	0.71
Rubber and plastic products	1.01	1.07	1.09	1.12	1.02	0.83
No-metal products	0.85	0.84	0.88	0.80	1.31	1.18
Basic metals and metal products	1.02	0.92	1.02	1.02	0.93	1.19
Machinery	1.39	1.38	0.67	0.74	1.00	1.13
Electrical and optical equipment	1.21	1.22	1.05	1.09	0.90	0.84
Transport equipment	1.10	1.48	1.21	0.98	0.93	0.61
Manufacturing n.e.c.	1.22	0.69	1.07	0.95	1.08	1.29

	UK		Belgium–Luxembourg		Netherlands	
	1985	2001	1985	2001	1985	2001
Food	1.26	0.98	1.57	1.27	1.36	1.42
Textiles	1.04	1.15	0.94	1.07	0.43	0.44
Wood	1.52	0.80	2.41	0.82	0.55	0.90
Paper	1.39	1.37	1.37	0.99	1.41	1.70
Chemicals	0.85	1.00	1.49	1.60	1.25	1.24
Rubber and plastic products	1.01	1.15	0.98	0.88	0.62	0.75
No-metal products	0.95	0.80	1.40	1.24	0.65	0.83
Basic metals and metal products	0.82	0.85	0.99	1.13	2.02	0.98
Machinery	0.98	0.83	0.76	0.59	0.77	0.91
Electrical and optical equipment	1.04	1.09	0.87	0.69	0.83	0.94
Transport equipment	1.02	0.97	0.25	0.91	0.52	0.62
Manufacturing n.e.c.	0.27	1.02	0.45	0.93	0.62	1.03

(*Continued*)

Table A8. *Continued*

	Spain		Greece		Finland	
	1985	2001	1985	2001	1985	2001
Food	1.71	1.23	2.00	1.92	1.23	0.81
Textiles	1.25	1.31	2.97	2.26	0.83	0.45
Wood	1.58	1.57	0.80	0.77	2.97	2.16
Paper	0.85	0.97	0.91	1.30	3.08	2.08
Chemicals	0.79	0.84	0.80	0.99	0.59	0.70
Rubber and plastic products	0.97	0.86	0.79	0.79	0.86	0.91
No-metal products	1.38	1.64	1.48	1.55	1.06	0.88
Basic metals and metal products	1.07	1.09	0.68	0.74	0.55	0.76
Machinery	0.47	0.65	0.17	0.45	1.15	1.24
Electrical and optical equipment	0.45	0.57	0.32	0.37	0.60	1.25
Transport equipment	0.85	0.83	0.54	0.56	0.73	0.64
Manufacturing n.e.c.	1.88	1.34	0.69	0.69	0.94	0.78

Note: n.e.c., not elsewhere classified.

NOTES

1. AIGINGER and DAVIES (2004) have already shown that specialization and concentration cannot diverge if relative measures are used.
2. Decreasing concentration was widespread across Spanish NUTS3 regions during the 1980s (PALUZIE *et al.*, 2001), across Italian NUTS2 regions from the early 1970s to the late 1990s (ROMBALDONI and ZAZZARO, 1997; DE ROBERTIS, 2001; CICIOTTI and RIZZI, 2003) and, more recently, also in Germany (SUEDEKUM, 2006).
3. COMBES and OVERMAN (2004) pointed out that:

> the fact that Spanish regions did not change much with respect to one another does not mean that Spanish regions did not become more specialised relative to the rest of the EU [European Union]. (p. 21)

4. For a classification of different polarization, concentration, and specialisation measures, see BICKENBACH and BODE (2006).
5. Overall localization is conceptually and analytically composed of two economic phenomena: the specialization of economies and the agglomeration of industries (CUTRINI, forthcoming 2008).
6. The model suggests that decreasing transport costs will lead to an increase in specialization and a decrease in regional concentration.
7. Today, services make up the largest sector in most European economies and there are services that are of great importance for the distribution of regional income and welfare (for example, financial services and research and development). Any full assessment of concentration and specialization in Europe should include them.
8. The sectors *manufacturing of leather and leather products* (DC, division 19) and *manufacture of coke, refined petroleum products and nuclear fuel* (DF, division 23) have been excluded from the analysis because of the overwhelming amount of missing and confidential data.
9. This study refers to the distinction between absolute and relative measures drawn by BICKENBACH and BODE (2006). Therefore, measures based on the uniform reference are considered as *absolute* measures, while those based on a non-uniform reference are labelled as *relative* measures.
10. These forces may be related to intra-industry input–output linkages, labour-market pooling, and industry-specific knowledge spillovers, but they might also indicate a high dependence on natural resources.
11. The two geographical components of the concentration index for each industry k can be easily derived by factor decomposition (for details on the formal decomposition of the localisation indices, see CUTRINI, 2006).
12. BRÜLHART and TRAEGER (2005) test for the significance of temporal changes of regional localization by relying on a block-bootstrap, that is, resampling observations from different countries separately.
13. Intermediate spatial aggregation level is defined here as the level at which the within-group component is disentangled from the between-group component. Instead, the highest level of aggregation is the macroeconomic geographical benchmark (the set of European regions).
14. Throughout the present paper, 'Europe' refers to the 145 European regions taken together.
15. The sector includes *chemicals; machinery and equipment n.e.c.; electrical and optical equipment; transport equipment; furniture, recycling; and manufacturing n.e.c.*
16. AUDRETSCH and FELDMAN (1996) showed the different propensity of manufacturing industries to generate spatial knowledge spillovers.
17. On this reasoning, the functional specialization of different localities is the aggregate outcome of a microeconomic change – induced by the decreased transportation and communication costs – in the firm's trade-off between the benefits of vertical integration and the advantages of spreading the different functions across space. When spatial transaction costs (that is, the costs of coordination and monitoring across fairly wide distances) decrease substantially, firms that used to perform managerial, research and development, and production tasks under a single roof prefer to become multi-plant organizations.
18. From 1985 onwards, Greece was characterized by increasing specialization in labour-intensive industries

(food, textiles, and wearing apparel) and in non-metallic mineral products, which is a manufacturing industry closely linked to the construction industry (Table A8).

19. Geographical dispersion is referred to in the latter two cases, since AIGINGER and PFAFFERMAYR (2004) and AIGINGER and DAVIES (2004) used absolute concentration measures and their results are not directly comparable with the present ones. Moreover, nominal value added is the activity indicator.
20. Congestion costs are a crucial dispersion force in the models of KRUGMAN and LIVAS (1996) and PUGA (1999).
21. The model of KRUGMAN and LIVAS (1996), which was inspired by the Mexican liberalization programme, suggests that falling trade barriers might affect a firm's location within each country. The fundamental idea is that, in a restrictive trade policy, forward and backward linkages foster the clustering of economic activity. As soon as protective measures are removed, the central place (usually the capital city) loses the advantage it had in a relatively closed economy, and firms, which now mainly sell to external markets, are more willing to migrate to peripheral regions, especially if relocation means better access to the international market.
22. In New Economic Geography models (for example, KRUGMAN, 1991; and PUGA, 1999), labour mobility has an important role in sustaining agglomerations; in a symmetric way, labour immobility is an important dispersion force.

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