Specialisation and Concentration from a Twofold Geographical Perspective: Evidence from Europe*

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Abstract

On the background of the complex European institutional framework, this paper aims at empirically assessing the location patterns in Europe adopting a twofold geographical perspective. Relying on dissimilarity entropy measures of overall localisation, specialisation and concentration are evaluated simultaneously through different spatial and industrial scales. Results suggest that, while dispersion took place along short distances between 1985 and 2001, after the completion of the Single Market programme polarisation increased over wider territorial scales, i.e. countries and the South-North divide. Results are confirmed varying the basic unit of analysis and the intermediate aggregation level adopted to disentangle within-groups from between-groups structural changes.

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Introduction

The patterns of change of the European territorial distribution of economic activities has become a prominent topic in the political debate and in the academic research during the last decades. The enlargement process and the Single European Market are deemed to engender drastic changes in the industrial structures of member countries and regions and in the spatial distribution of economic activities bringing about adjustment costs (Ottaviano and Puga (1998)). The increasing clustering of high-value added economic activities in high incomes regions coupled with the low-tech specialisation of lagging regions is an example of the expected territorial implications towards greater inequality which is supposed to exacerbate the existing uneven spatial distribution of income and welfare[1].

From a theoretical standpoint, in spite of the different source of specialisation, both traditional trade theories and the new trade theories envisage that countries will specialise as a consequence of international integration. Besides, drawing on the new economic geography framework, several models designed for the case of Europe predict that, when international transaction costs have fallen below a certain threshold[2], international openness is supposed to lead to regional coalescence of industrial activities within the countries (Monfort and Nicolini (2000), Paluzie (2001), Crozet and Koenig-Soubeyran (2004b), Crozet and Koenig-Soubeyran (2004a), Monfort and van Ypersele (2003)). Although inspired by the territorial changes following the Mexican liberalisation programme (Hanson (1998)), the contribution of Krugman and Livas (1996) could be adopted as a theoretical framework for the study of the European integration. The model of Krugman and Livas (1996) highlights the importance of congestion costs as centrifugal force pulling towards internal dispersion of economic activities.

International integration in the commodity markets and fragmentation of productive processes are bringing about a progressive irrelevance of national borders. In the light of globalisation processes the basic unit of analysis should become subnational economies and nested methodologies are required to understand the complexity in the structural change dynamics at the different spatial scales.

Besides, from a normative perspective, the development of rigorous methodologies to disentangle structural changes at different geographical levels of analysis are becoming important in light of the existence of overlapping institutional levels. Assessing if the distribution of economic activities is occurring mostly within countries or instead at wider distances helps

[1] The tendency of economic activities to cluster was already part of the research agenda in the contribution of the early development theorists (Myrdal (1957), Hirschman (1958)).

[2] Since Europe reached an advanced level of integration, the hypothesis behind the work is that transaction costs between European countries are minimal.

understanding how and to what extent each European national and regional policy makers have to be involved in designing appropriate policies.

The aim of this paper is to provide some clear-cut evidence on the location patterns of European manufacturing industries during the period 1985-2001 adopting a new methodology which allows for a nested analysis of both concentration and specialisation in a twofold geographical perspective.

The remainder of the paper is organised as follows. Section 1 deals with a survey of the empirical evidence on regional specialisation in Europe, with a specific focus to the main methodological issue of a multilevel analysis. Section 2 describes the data and the methodology. Section 3 is devoted to the results derived from the implementation of the methodology developed in Cutrini (2006). Finally, section 4 gives some conclusions.

1 Survey of the empirical literature

The empirical literature on the European pattern of country specialisation is copious. In spite of the different time period and the methodology adopted, the basic result is that European countries had slowly become more specialised between the 1970s and the 1990s (Brülhart and Torstensson (1996), Amiti (1999), WIFO (1999), Haaland *et al.* (1999) Midelfart *et al.* (2004), see Combes and Overman (2004) for a comprehensive survey). Nonetheless, while Amiti (1999) reports a general increase of relative specialisation in European countries from 1968 to 1990, Midelfart *et al.* (2004) suggest that the process of relative specialisation is more complex at least since the early eighties onwards.

So far the evidence of regional specialisation has been provided either in a country standpoint or taking a European-wide perspective, but always relying on a single geographical level of analysis. In the former case, the specialisation is contrasted to the country industrial structure whilst in the latter case Europe as a whole is taken as a geographical benchmark. Following a national perspective[3] empirical studies on the internal specialisation of Italian (de Robertis (2001)) and Spanish (Paluzie *et al.* (2001)) regions suggest that modifications are minimal and patchy. Although, evaluating the regional specialisation patterns relative to the country is different from assessing the regional specialisation process relative to the EU as a whole. As pointed out by Combes and Overman (2004), *'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'* (Combes and Overman (2004)).

[3]They both relied on the Gini location quotient relative to country as specialisation index.

The shortage of comparable EU-wide data at regional level has been the main reason of the few empirical studies taking a European wide perspective to evaluate regional specialisation. Besides, different results are deemed to emerge if service sectors are included in the analysis instead of just focusing on manufacturing industry. Some works reported a slow process of declining specialisation (Molle (1997), Hallet (2000), Marelli (2004)) but their results are affected by the sectoral classification adopted[4]. More specifically, the declining specialisation is deemed to be simple the result of a compositional change driven by the process of tertiarisation of European economies. A study confined to the industrial sectors have been carried out by Midelfart-Knarvik *et al.* (2002) and the picture which emerges is less clear. The analysis presented by Midelfart-Knarvik *et al.* (2002) unreveals that a slight majority of regions (53 per cent) become more specialised, with the remainder showing a decrease or no change(Combes and Overman (2004)).

On the other side, agglomeration patterns are mixed from the point of view of the geographical concentration of sectors. Adopting the region as unit of analysis leads to a contrasting descriptive evidence on concentration trends compared to the results emerging from the more common country-based studies. If one relies on national borders, the pre-Single Market period is characterized by an increasing relative concentration in a majority of sectors, especially during the eighties where several empirical results tend to agree (Brülhart and Torstensson (1996), Brülhart (1998), Amiti (1999), Haaland *et al.* (1999), Brülhart (2001), Midelfart *et al.* (2004)), while during the Post-Single Market period both absolute and relative concentration are declining (Midelfart *et al.* (2004), Aiginger and Pfaffermayr (2004)).

Instead, EU-wide concentration analysis based on regional data support empirically the idea that the completion of the Single market fostered agglomeration of industry allowing to better exploit regional localised advantages. On the basis of regional data on gross value added, Hallet (2000) suggested that concentration slightly declined during eighties while increased during the first half of the nineties. Similarly, Brülhart and Traeger (2005) found that manufacturing recorded a higher increase in concentration across regions during the second sub-period considered (1987/2000) rather than the first one (1975/1987). Instead, looking inside Southern European countries, a decline in concentration of a majority of manufacturing sectors took place across Spanish regions during the eighties (Paluzie *et al.* (2001)) and across Italian regions between 1971 and 1991 (de Robertis (2001)).

The development of region-based empirical studies has been hindered until recent years not

[4]Both Molle (1997) and Hallet (2000) used the same NACE 17 industrial classification which includes six service branches. Instead Marelli (2004) relied on the three broad sectors (agriculture, industry, services).

mainly because of the shortage of comparable regional data but also for the lack of a methodology able to disentangle the geographical clustering internal to countries from cross-country location patterns as claimed by Combes and Overman (2004). So far the the different basic unit of analysis (region or country), the different geographical benchmarks (country or Europe as a whole), and the different measures (absolute or relative) have been the main variations on the methodology adopted to measure specialisation and concentration. Economists continued to assess the location patterns at a single geographical level of analysis.

As for geographic concentration, some recent developments have been done in this direction. Brülhart and Traeger (2005) presented a nested analysis exploiting the decomposability of entropy measures across geographic subgroups for Europe, while Duranton and Overman (2005) and Marcon and Puech (2003) introduced distance-based methods and provided descriptions of the spatial distribution of French manufacturing firms at different geographic levels, simultaneously[5].

The empirical evidence was provided focusing either on specialisation or on concentration trends with a limited number of works looking at both the two sides of localisation. Mulligan and Schmidt (2005), on the basis of numerical examples, highlighted the identity between the two dimensions (specialisation and concentration) of the spatial distribution between the United States. While a general framework for the construction of polarization measures which combine concentration and specialisation measures has been presented in Bickenbach and Bode (2006). Yet, as far as I know, a nested analysis of overall localisation -with concentration on one side and specialisation on the other side- combined with the adoption of a twofold geographical perspective is still a novelty in the literature (Cutrini (2006)).

2 Description of methodology and data

2.1 The methodology

As far as the methodology, I rely on the statistical toolbox based on the use of dissimilarity entropy measures (Theil (1967), Maasoumi (1993)) and developed in Cutrini (2006) to assess overall localisation, concentration and specialisation in a twofold geographical analysis. A brief summary of the methodology follows (see Cutrini (2006) for more details on the decomposition methodology).

Overall localisation is assessed through a condensed dissimilarity index in which the log of

[5]A competing strand in measuring agglomeration is the so-called dartboard approach which allows to take into account the market structure of industries (Ellison and Glaeser (1997), Maurel and Sédillot (1999)).

Balassa indices are weighted by sectoral regional shares of the aggregate manufacturing (v^*_{ijk}):

$$L = \sum_{k=1}^{n}\sum_{i=1}^{m}\sum_{j=1}^{r_i} v^*_{ijk} \ln(B^*_{ijk}) \tag{1}$$

Since $v^*_{ijk} = \frac{L_{ijk}}{L} = v_k s_{ijk} = s_{ij} v_{ijk}$

it is possible to rewrite the average dissimilarity measure (L) as follows:

$$L = \sum_{k=1}^{n}\sum_{i=1}^{m}\sum_{j=1}^{r_i} s_{ij} v_{ijk} \ln(B^*_{ijk}) = \sum_{k=1}^{n}\sum_{i=1}^{m}\sum_{j=1}^{r_i} v_k s_{ijk} \ln(B^*_{ijk}) \tag{2}$$

Equation 3 refers to the twofold connotation of the concept of localisation. From the specialisation point of view, the aggregation gives an idea of the average dissimilarity between the regional distribution across sectors and the manufacturing structure of the supranational economy selected as benchmark. Similarly, from a concentration standpoint, the composite measure of localisation informs about the average dissimilarity between the distribution across geographical units of sectors and the location across geographical units of overall manufacturing. As a matter of fact, typical dissimilarity is a summary statistics of both relative specialisation indices and relative concentration ones, weighted by regional shares (s_{ij}) and sectoral shares (v_k) of aggregate manufacturing of the whole area, respectively:

$$L = \sum_{i=1}^{m}\sum_{j=1}^{r_i} s_{ij} T^{\circ}_{ij} = \sum_{k=1}^{n} v_k T_k \tag{3}$$

where:

$$T^{\circ}_{ij} = \sum_{k=1}^{n} v_{ijk} \ln(LQ^*_{ijk}) \tag{4}$$

and:

$$T_k = \sum_{i=1}^{m}\sum_{j=1}^{r_i} s_{ijk} \ln(LQ^*_{ijk}) \tag{5}$$

In a similar perspective, a way of condensing into a single index of specialisation two descriptive levels (regions and countries) is now introduced to investigate the mixed trend in regional specialisation which varies with geographical scale. When the dissimilarity logic is adopted, the country specialisation relative to Europe (T°_i) can be envisaged as a residual of the averaged regional specialisation relative to the same benchmark, once the divergence of the regional manufacturing structures with reference to the country has been accounted for.

In a regional viewpoint, if the country specialisation is defined as the averaged regional

specialisation indices relative to EU (aRS_i°) then it turns out to be constituted by two elements: an inner country component (aRS_i^c), which accounts for the internal regional specialisation with respect to the country, and the country bias, in other words the country specialisation relative to EU (T_i°). The following relation holds:

$$aRS_i^\circ = aRS_i^c + T_i^\circ \tag{6}$$

where:

$$aRS_i^\circ = \sum_{j=1}^{r_i} T_{ij}^\circ s_{ij}^* \tag{7}$$

and

$$aRS_i^c = \sum_{j=1}^{r_i} T_{ij}^c s_{ij}^* \tag{8}$$

In this setting, country relative specialisation to Europe (T_i°) is simply the difference between the two country-based averaged regional specialisation measures:

$$T_i^\circ = \sum_{j=1}^{r_i} (T_{ij}^\circ - T_{ij}^c) s_{ij}^* \tag{9}$$

where:

$$T_{ij}^c = \sum_{k=1}^{n} v_{ijk} \ln(LQ_{ijk}) \tag{10}$$

and

$$T_i^\circ = \sum_{k=1}^{n} v_{ik} \ln(LQ_{ik}) \tag{11}$$

with

$s_{ij}^* = \frac{L_{ij}}{L_i}$, see the appendix A for the detailed notation.

2.2 Data

The analysis relies on employment data by manufacturing sectors taken from EUROSTAT Region-SBS (Structural Business Statistics) during the years 1985, 1993 and 2001. The sample of the 145 regions considered covers almost completely the following European countries: Belgium and Luxembourg (consolidated), Finland, France, Western Germany, Greece, Italy,

Netherlands, Spain and United Kingdom. Some regions have been dropped either because of the 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 it has been referred to the NUTS 1 regions (Länder). As for Belgium, data are drawn from a dataset provided by the national statistics office and based on the previous NACE 70 classification. Therefore *Bruxelles*, *Vlaams Brabant* and *Brabant Wallon* have been clustered as a single region (for detailed information on geographical coverage see table 5).

The analysis is confined to manufacturing industries to avoid the misleading results of a declined specialisation which may arise by including service sectors (Molle (1997), Hallet (2000), Marelli (2004)). Employment data are disaggregated by 12manufacturing industries[6] 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 n.e.c.* (DK), *electrical and optical equipment* (DL), *transport equipment* (DM), *manufacturing n.e.c.* (DN).

Since results might be affected by the scale aggregation- which is an expression of the *modifiable areal unit problem* (MAUP) (Arbia (1989))- I exploit the flexibility of the methodology and assess overall localisation varying the basic unit of analysis and the intermediate aggregation level to control for the supposed sensitivity of the methodology to scale aggregation and basic geographical partition. In some applications, a set of European countries as first aggregation level of regions is used (instead of the usual national one). In this case, *Northern Europe* is composed by all the regions of the following European countries: Belgium and Luxembourg, Finland, France, Western Germany, Netherlands, United Kingdom and some regions of Northern Italy, namely Piemonte, Valle D'Aosta, Liguria, Lombardia, Friuli Venezia Giulia. The rest of Italy, Greece, and Spain are labelled as *Southern Europe*.

Different partition in the sectoral dimension should be considered since that agglomeration in the real world may arise from inter-industry linkages (i.e. linkages across the artificial boundaries of industrial classification derived from the statistical data available). Therefore, I complement the analysis on localisation based on the twelve 1-digit manufacturing sectors with a dichotomic classification based on the Sutton's taxonomy (Sutton (2000)) and adopted by OECD (2003). In this case, *chemicals, machinery and equipment n.e.c., electrical and optical equipment, transport equipment, furniture, recycling and manufacturing n.e.c.* are considered as they were a single sector labelled as *high-tech industries*. Similarly, *food, textiles,*

[6]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 missing and confidential data.

wood, paper, rubber and plastic products, other non-metallic mineral products, basic metals and fabricated metal products belong to the category *low-tech industries.*

3 Location patterns in Europe: the empirical evidence

3.1 A declining trend in overall localisation

Table 1 illustrates the overall localisation pattern in Europe during the period 1985-2001. The internal geographies of countries are much more differentiated than the European landscape evaluated on the basis of national borders. Put it differently, the spatial organisation of manufacturing industries is mostly driven by the coalescence at the regional scale, and only to a minor extent it is explained by the different national characteristics, e.g. comparative advantages. On average, the latter component accounts for less than one third of the overall localisation.

	1985		1993		2001	
	value	%	value	%	value	%
L^w	0.121	*73*	0.102	*74*	0.086	*69*
L^b	0.045	*27*	0.036	*26*	0.038	*31*
L	0.167	*100*	0.138	*100*	0.124	*100*

Table 1: Evolution of EU-wide localisation within and across country, entropy index of overall localisation, 1985-2001

The sensitivity of results on the evolution of overall localisation to the choice of the basic unit of analysis and to the choice of the intermediate aggregation level[7] is presented in table 2. Based on the same geographical benchmark (E-10), localisation has been measured adopting different spatial hierarchical structures based on administrative partitions or geopolitical entities.

The declining localisation between the regions at the smaller scale is confirmed, irrespective of the basic unit (NUTS2 or internal macroregions (NUTS1)) and intermediate aggregation level adopted. Although, it is worth noting that, after the completion of the Single European Market localisation at higher spatial aggregation saw an upward trend, either between countries or between the supranational entities identified (table 2).

[7] I define intermediate spatial aggregation level the level at which the within group localisation is disentangled from the between group localisation. Instead the highest level of aggregation is the macroeconomic geographical benchmark (EU-10).

			between 1985 and 2001			between 1993 and 2001		
geographic basic unit (n)	Intermediate aggreg. level	sectoral aggregation	L	L^w	L^b	L	L^w	L^b
NUTS2(145)	country	one-digit, NACE rev. 1	decrease	decrease	decrease	decrease	decrease	*increase*
NUTS2(145)	NUTS1	one-digit, NACE rev. 1	decrease	decrease	decrease	decrease	decrease	decrease
NUTS1(61)	country	one-digit, NACE rev. 1	decrease	decrease	decrease	decrease	decrease	*increase*
NUTS2(145)	North-South divide	high-tech/low-tech dichotomy	decrease	decrease	decrease	decrease	decrease	*increase*

Table 2: Sensitivity of results on the evolution of localisation to the choice of the basic geographic unit of analysis, spatial aggregation, sectoral aggregation; same geographical benchmark (EU-10), *weighted relative Theil*

That the regional industrial coalescence internal to countries is decreasing is a clear result. In other words, sectors should have become less localised within countries and regions more similar to their respective country in term of their manufacturing structures. Instead, industries should have become more concentrate across countries, at least in particular sectors, and in the second sub-period. Similarly, some national manufacturing structure are diverging from the European one. The trend in localisation across macroareas might also be related to an increasing relevance of the South-North divide in Europe and a rise in the geographical concentration of either high-tech industries or low-tech industries. On the background of the two sides of the concept of localisation, a detailed analysis on how the regional and national economies have driven specialisation patterns in Europe and results on the inter-sectoral differences in the territorial concentration within and between countries is presented in the following paragraphs.

3.2 Internal structural changes and national pattern of specialisation

Between the years 1985 and 2001, only 26 regions became more specialised while 119 regions (82%) converged to the European manufacturing structure (E-10). Similarly, a downward trend in internal regional specialisation is common to 122 regions (84%).

Although, the minimal change in the average regional specialisation is a common result for all the countries, it is worth noting that Italian regional manufacturing structures show the higher persistence that is a well-known feature of the Italian pattern of international specialisation (see table 3).

Regional specialisation with respect to EU-10 is mostly explained by the internal regional

	Rank	Average	**1985**	**1993**	**2001**
Belgium and Luxembourg	2	0.22	0.30	0.19	0.17
Germany	7	0.11	0.13	0.10	0.11
Spain	3	0.20	0.24	0.20	0.15
Finland	4	0.19	0.22	0.20	0.14
France	7	0.11	0.13	0.11	0.10
Greece	1	0.39	0.44	0.42	0.32
Italy	6	0.14	0.14	0.14	0.13
Netherlands	6	0.14	0.19	0.12	0.10
United Kingdom	5	0.16	0.19	0.17	0.13
L			**0.17**	**0.14**	**0.12**

Table 3: Averaged regional specialisation indices relative to E-10 by country, aRS_i^{EU}

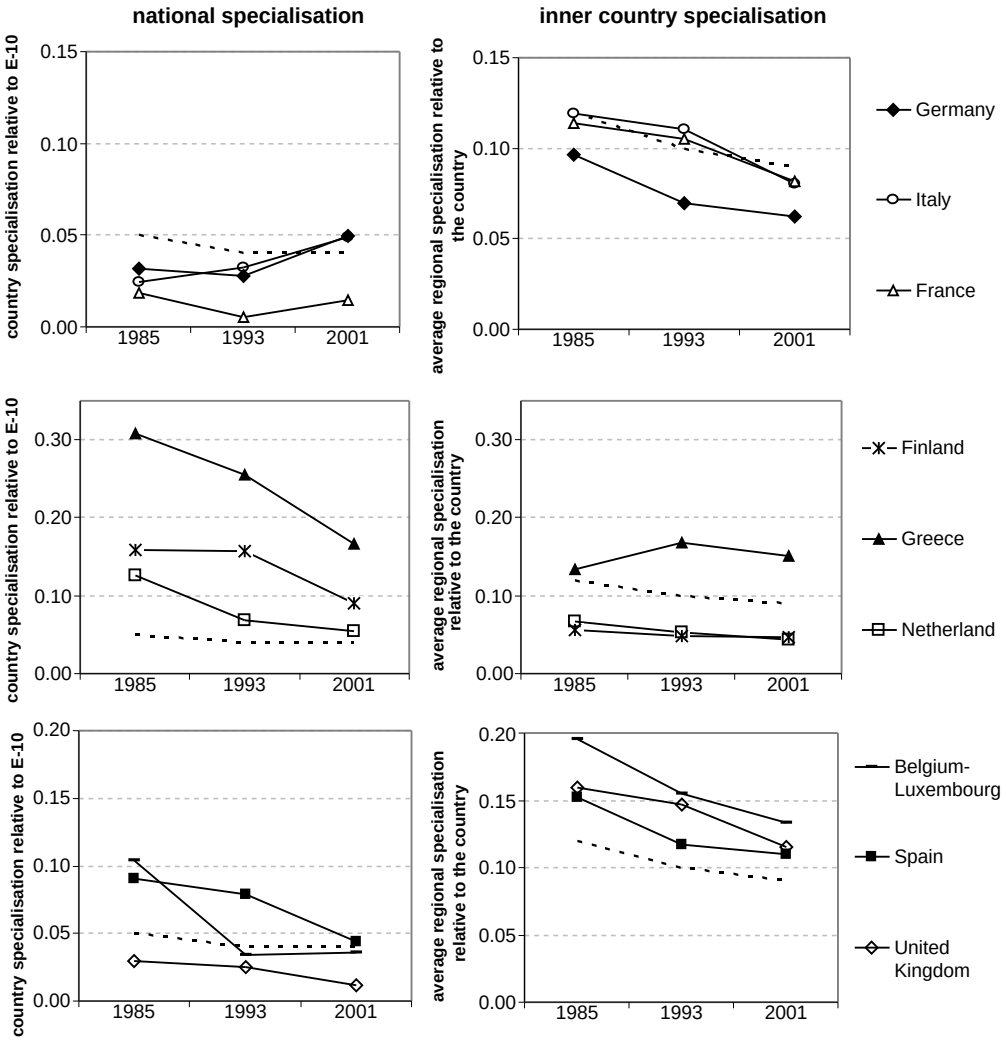
specialisation and only to a much lesser extent by the country bias related to the different structure of the reference country. It should not being surprising that, only smaller EU-10 countries such as *Greece*, *Netherland* and *Finland* exhibit a country relative specialisation higher than their average internal regional specialisation (see table 7). Regional manufacturing structure is becoming increasingly similar to both country and EU-10 manufacturing structures. The dissimilarity of country industrial structure and the EU-10 narrowed throughout the whole period but in the post-Single Market period country specialisation slightly increase on average (table 1). Throughout the period the ranking of the countries in terms of averaged regional specialisation to EU-10 did not changed. Regional specialisation is highest in *Greece*, *Belgium and Luxembourg* and *Spain*. Instead, regions located in *France*, *Netherland* and *Germany* recorded the lowest values of overall regional specialisation (see table 3).

Similar patterns are depicted for the internal regional specialisation. *Greece*, *Belgium and Luxembourg* and *Italy* are the countries with the deepest averaged internal specialisation of regions. While *Finland* and *Netherland* are characterised by the lowest internal specialisation (see table 7).

In the majority of countries the weighted internal regional specialisation decreased. Instead, Greek evolution of the internal geography seems to support Williamson (1965)'s argument. In Greece, which is characterised by the most polarised internal geography throughout the whole period, the value of the weighted internal regional dissimilarity increased. Besides Greek regions registered the highest standard deviations with regards to internal specialisation indices relative to the country (table 7).

Although, internal regional specialisation does not go hand in hand with country specialisation[8]. In Greece, the rise in the internal specialisation was associated to an increased

[8]Only in Belgium and Luxembourg, Spain and Great Britain the evolution of the internal regional speciali-



Note: T_i^{EU} and aRS_i^c on the vertical axes, the dotted lines represent the respective average dissimilarity indices (*between* and *within* countries).

Figure 1: Evolution of internal and country specialisation, *Source: SBS-region database employment by manufacturing sectors*

similarity between the Greek manufacturing structure and the E-10's one. Moreover, notwithstanding the minimal regional changes relative to the respective country experienced by Dutch and Finnish regions, Netherlands and Finland as a whole became less specialised with respect to the European manufacturing structure (middle panel of figure 1).

Similarly, the declining trends in their internal regional specialisation, Italy and Germany are diverging in terms of their industrial structure relative to the E-10 throughout the entire period. France followed a similar pattern of change, but only since the completion of the Single Market Programme (top panel of figure 1).

	Average regional specialisation relative to EU-10			Internal averaged regional specialisation within			Macro-area specialisation relative to EU-10		
	1985	**1993**	**2001**	**1985**	**1993**	**2001**	**1985**	**1993**	**2001**
Southern Europe	0.074	0.058	0.044	0.034	0.030	0.018	0.040	0.028	0.026
Northern Europe	0.027	0.022	0.024	0.025	0.021	0.022	0.002	0.001	0.002

Table 4: Evolution of relative specialisation of European macroregions

Adopting different classification schemes, a similar picture can be drawn. To measure the specialisation now I refer to a different hierarchical structure based on NUTS2 as the basic unit of analysis, and adopting a supranational macro-area[9] as the first aggregation level, while the dichotomy between high-tech and low-tech sectors is used as the industrial taxonomy. Average regional specialisation relative to the supranational area chosen as intermediate aggregation level is decreasing both in Southern and Northern Europe as well as the internal regional specialisation. Although, after the completion of the Single European Market, regional specialisation increased in Northern Europe both relative to the reference intermediate benchmark and to the EU-10 as a whole (see table 4).

sation is overlapping with the external pattern of country specialisation (bottom panel of figure 1).

[9]The supranational macro-area refers to the North-South divide in Europe as defined in the methodology.

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

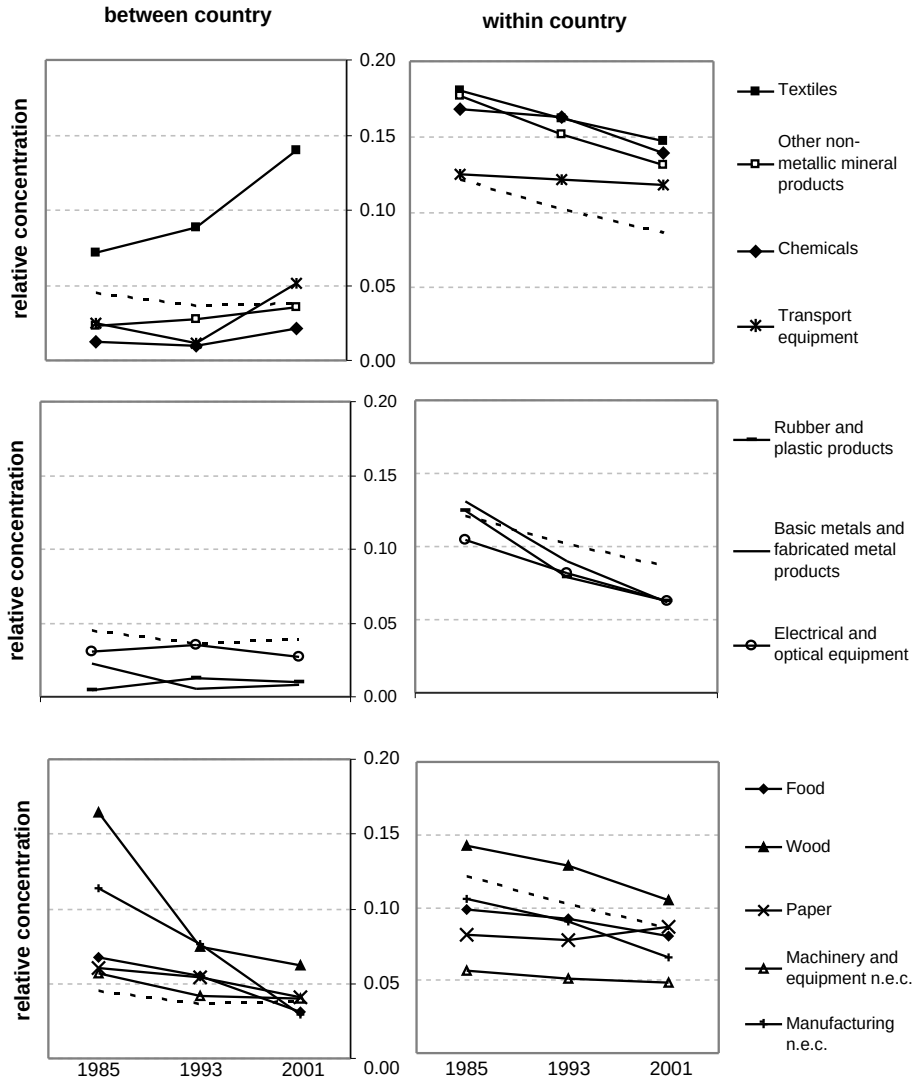
On the other side, almost all the manufacturing sectors experienced a decline in the geographical concentration during the period 1985-2001 both across and within country (figure 2). *Textiles* and *transport equipment* are exceptions to this general pattern. Indeed, they recorded an increase -even slight- in the dissimilarity with respect to the manufacturing localisation across regions (see table 6). Generally speaking, the declining trends in value of the overall measure is replicated at the within country levels. All the sectors -except *paper*- became regionally more dispersed within country.

The evolution of industrial concentration across countries are different from the internal patterns of concentration. While the direction of the inner-country redistribution is common to almost all the sectors, the evolution of the cross-border localisation is mixed. A process of increasing concentration between country occurred in *textiles* and *no-metals*, *chemicals* and *transport equipment* (top panel of figure 2).

In other sectors, namely *basic metals*, *rubber and plastic products* and *electrical and optical equipment*, the territorial redistribution is mostly driven by the declining trend in the internal coalescence, with a *between* country localisation which remained almost unchanged (middle panel of figure 2). In the remaining sectors, namely *food, wood, machinery and equipment nec, and manufacturing nec*, the territorial organisation converged to the spatial distribution of overall manufacturing both *across* country and *within* country (bottom panel of figure 2), see Cutrini (2005) for a more detailed analysis of the concentration patterns based on the region-country hierarchical structure.

As pointed out, if one focuses on the period 1993-2001, localisation over long distance, i.e. across countries and between the North-South divide, increased. It is arguable that this specific pattern of change is related to an increased agglomeration of high-tech manufacturing industries in the Northern part of Europe. As a matter of fact, while Southern regions saw a decrease in specialisation, specialisation in Northern Europe increased, irrespective of the the benchmark (both E-10 and the macro-area they belong) (see table 4)

This duality in the location patterns seems to be connected to the geographical concentration of high-tech industries. This process is driven by a rise of the high-tech polarisation within the North macro-area and the South macro-area and also between the two supranational areas. Instead, the dispersion of low-tech industries is mainly occurred internally to the North-South divide. While the distribution of low-tech industries between the Northern



Note: T_k^b and T_k^w on the vertical axes, the dotted lines represent the respective average dissimilarity indices (*between* and *within* countries).

Figure 2: Evolution of the two components of relative concentration. *Source: SBS-region database employment by manufacturing sectors*

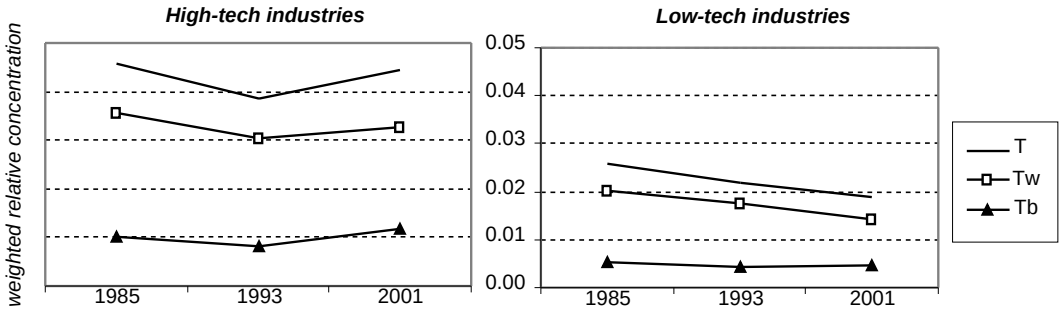


Figure 3: Relative concentration of high-tech and low-tech manufacturing industries

Europe and the Southern Europe remained unchanged (graph 3).

4 Concluding remarks and further developments

In contrast to the mixed empirical evidence provided by existing cross-section studies, the methodology adopted allows to outline a clear trend in specialisation which supports the idea that, during the European integration process, both regional and national economies converged towards the European manufacturing structure, albeit slowly. It is worth noting that, because of the classification adopted, the results on the decrease in specialisation are not affected by the structural change from industrial to service sectors. Yet, the convergence in manufacturing structures can be envisaged as an aspect of the catching up process.

The general decrease in the specialisation of regional and national economies mirrors the reduction in the internal regional coalescence and in the decreased international agglomeration for a majority of the sectors. The sensitivity analysis on the evolution of localisation to the choice of the basic unit, intermediate aggregation level, and sectoral scale provides additional support to the results on the decrease in localisation throughout the whole period both within countries and across countries.

In the second sub-period the emerging opposite pattern of change could be connected to the European integration advancements since, between 1993 and 2001 localisation slightly increased as suggested by theoretical models. Once the Internal Market was completed, polarisation between the supra-regional economies (i.e. countries and the macroareas defined by the North-South dichotomy), increased. Adopting the country-region geographical framework, this pattern is explained by the increased relative concentration between countries of textiles sector and transport equipment. On the other side, the increased localisation at the intermediate spatial aggregate finds a counterpart in the increased dissimilarity of the national manufacturing structures of Germany and Italy relative to the European one. Relying on the high-tech and low-tech taxonomy and the North-South divide, the increased polarisation across the wider spatial scales during the period 1993-2001 is explained by the slight increase in specialisation in Northern Europe and the rise of geographical concentration of high-tech industries. These emerging opposite evolutions deserves a careful examination and are left for future research.

The extent to which the changing geography of manufacturing activities has actually been the outcome of the European integration process (e.g. through the internal relocation towards border regions to get a better access to the reference international market, as suggested by **?** and Hanson (1998)) remains an open issue. Further institutional factors (e.g. national and European policies for lagging regions) might have played a prominent role in the reconfiguration

of the internal geography of European countries. The above-mentioned possible explanations should be carefully tested for a better understanding of the underlying institutional changes affecting the agglomeration of economic activities in Europe.

A Appendix

A.1 Notation

x_{ijk}	variable of main interest: number of workers in industry k (k=1,...,n) in region j (j=1,...,r_i) located in country i (i=1,...,m)
x_{ij}	total employment in region ij
x_{ik}	total employment in sector k in country i
x_i	total employment in country i
x_k	total employment in sector k at the higher level of spatial aggregation (EU-10)
x	total employment at the higher level of spatial aggregation (EU-10)
v^*_{ijk}	$:= \frac{x_{ijk}}{x}$ share of sector k of region ij in total employment
v_{ijk}	$:= \frac{x_{ijk}}{x_{ij}}$ share of sector k in total employment of region ij
v^*_{ik}	$:= \frac{x_{ik}}{x}$ share of sector k of country i in total employment
v_k	$:= \frac{x_k}{x}$ share of sector k in total EU-10 employment
s_{ij}	$:= \frac{x_{ij}}{x}$ share of region ij in total EU-10 employment
s^*_{ij}	$:= \frac{x_{ij}}{x_i}$ share of region ij in total employment of country i
s_{ijk}	$:= \frac{x_{ijk}}{x_k}$ share of sector k of country i in total employment of sector k
LQ^*_{ijk}	$:= \frac{v_{ijk}}{v_k}$ regional location quotient relative to EU-10
LQ_{ijk}	$:= \frac{v_{ijk}}{v_{ik}}$ regional location quotient relative to the country
LQ_{ik}	$:= \frac{v_{ik}}{v_k}$ country location quotient relative to EU-10

A.2 Tables and graphs

Country	Number of regions included	Administrative units	NUTS level
Belgium	9	Provinces	2
Luxembourg	1		2
Germany	16	Länder	1
Spain	17	Comunidades autónomas	2
Finland	3	Suuralueet	2
France	22	Régions	2
Greece	11	Development regions	2
Italy	19	Regioni	2
Netherlands	12	Provincies	2
United Kingdom	35	Counties	2
Total	145		

Note: Bruxelles (BE10), Vlaams Brabant (BE24) and Brabant Wallon (BE31) have been clustered as a single region; Ceuta y Melilla (ES63), Åland (FI2), 'Departments d'Autre Mar' (FR91, FR92, FR93, FR94), Voreio Aigaio (GR41) and Notio Aigaio (GR42), Trentino-Alto Adige (IT31) have been excluded. Regional breaking for United Kingdom is according to NUTS 95 classification.

Table 5: Geographical coverage of the dataset

	Taxonomy	Rank	Average	**1985**	**1993**	**2001**
Food	LT	7	0.14	0.17	0.15	0.11
Textiles	LT	1	0.26	0.25	0.25	0.29
Wood	LT	2	0.22	0.30	0.20	0.17
Paper	LT	8	0.13	0.14	0.13	0.13
Chemicals	HT	4	0.17	0.18	0.17	0.16
Rubber and plastic products	LT	12	0.10	0.13	0.09	0.07
Other non-metallic mineral products	LT	3	0.18	0.20	0.18	0.17
Basic metals and fabricated metal products	LT	10	0.11	0.15	0.10	0.07
Machinery and equipment n.e.c.	HT	11	0.10	0.11	0.09	0.09
Electrical and optical equipment	HT	9	0.11	0.14	0.12	0.09
Transport equipment	HT	6	0.15	0.15	0.13	0.17
Manufacturing n.e.c.	HT	5	0.16	0.22	0.17	0.09
L				**0.17**	**0.14**	**0.12**

Note: The sectors, whose relative concentration increased, are in bold. *HT* stands for high-tech industry, *LT* stands for low-tech industry.

Table 6: Relative concentration indices, T_k

Country	N. of regions	Country specialisation, T_i			Regional specialisation to EU-10, T_{ij}				Regional specialisation to country, T^c_{ij}			
		1985	1993	2001		1985	1993	2001		1985	1993	2001
Belgium & Luxembourg	10	**0.10**	**0.03**	**0.04**	Min=	0.17	0.10	0.11	Min=	0.12	0.08	0.08
					Max=	0.62	0.62	0.44	Max=	0.54	0.47	0.36
					aRS^{EU}=	**0.30**	**0.19**	**0.17**	aRS^{c}=	**0.20**	**0.16**	**0.13**
					Std. dev.=	0.16	0.16	0.11	Std. dev.=	0.13	0.12	0.10
Germany	16	**0.03**	**0.03**	**0.05**	Min=	0.07	0.07	0.02	Min=	0.05	0.04	0.03
					Max=	0.57	0.33	0.39	Max=	0.56	0.35	0.31
					aRS^{EU}=	**0.13**	**0.10**	**0.11**	aRS^{c}=	**0.10**	**0.07**	**0.06**
					Std. dev.=	0.16	0.09	0.09	Std. dev.=	0.16	0.09	0.08
Spain	17	**0.09**	**0.08**	**0.04**	Min=	0.05	0.04	0.03	Min=	0.04	0.06	0.05
					Max=	0.75	0.69	0.44	Max=	0.44	0.37	0.26
					aRS^{EU}=	**0.25**	**0.20**	**0.16**	aRS^{c}=	**0.15**	**0.12**	**0.11**
					Std. dev.=	0.22	0.19	0.12	Std. dev.=	0.12	0.10	0.07
Finland	3	**0.16**	**0.16**	**0.09**	Min=	0.16	0.17	0.08	Min=	0.02	0.01	0.01
					Max=	0.43	0.41	0.27	Max=	0.14	0.12	0.12
					aRS^{EU}=	**0.22**	**0.20**	**0.14**	aRS^{c}=	**0.06**	**0.05**	**0.05**
					Std. dev.=	0.15	0.13	0.09	Std. dev.=	0.06	0.06	0.06
France	22	**0.02**	**0.01**	**0.01**	Min=	0.03	0.02	0.02	Min=	0.04	0.02	0.02
					Max=	0.49	0.42	0.53	Max=	0.45	0.38	0.41
					aRS^{EU}=	**0.13**	**0.11**	**0.10**	aRS^{c}=	**0.11**	**0.10**	**0.08**
					Std. dev.=	0.11	0.10	0.12	Std. dev.=	0.12	0.10	0.09
Greece	11	**0.31**	**0.25**	**0.17**	Min=	0.23	0.17	0.13	Min=	0.06	0.10	0.08
					Max=	1.73	1.70	1.64	Max=	1.18	1.20	1.12
					aRS^{EU}=	**0.44**	**0.42**	**0.32**	aRS^{c}=	**0.13**	**0.17**	**0.15**
					Std. dev.=	0.49	0.51	0.52	Std. dev.=	0.36	0.35	0.34
Italy	19	**0.02**	**0.03**	**0.05**	Min=	0.06	0.08	0.05	Min=	0.04	0.04	0.04
					Max=	0.98	0.61	0.30	Max=	1.07	0.70	0.34
					aRS^{EU}=	**0.14**	**0.14**	**0.13**	aRS^{c}=	**0.12**	**0.11**	**0.08**
					Std. dev.=	0.20	0.12	0.09	Std. dev.=	0.23	0.15	0.09
Netherland	12	**0.13**	**0.07**	**0.05**	Min=	0.14	0.06	0.05	Min=	0.03	0.03	0.02
					Max=	0.34	0.23	0.21	Max=	0.37	0.14	0.13
					aRS^{EU}=	**0.19**	**0.12**	**0.10**	aRS^{c}=	**0.07**	**0.05**	**0.04**
					Std. dev.=	0.07	0.05	0.06	Std. dev.=	0.11	0.03	0.03
United Kingdom	35	**0.03**	**0.03**	**0.01**	Min=	0.05	0.04	0.02	Min=	0.02	0.03	0.01
					Max=	0.62	0.40	0.32	Max=	0.48	0.36	0.29
					aRS^{EU}=	**0.19**	**0.17**	**0.13**	aRS^{c}=	**0.16**	**0.15**	**0.12**
					Std. dev.=	0.13	0.10	0.07	Std. dev.=	0.11	0.09	0.07

The weighted averaged values have been calculated as follows: $aRS_i^{EU} = \sum_{j=1}^{r_i} T_{ij} s^*_{ij}$; $aRS_i^{c} = \sum_{j=1}^{r_i} T^c_{ij} s^*_{ij}$.

Table 7: A comparison of regional and country specialisation

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