



UNIVERSITÀ POLITECNICA DELLE MARCHE
DIPARTIMENTO DI ECONOMIA

TRENDS IN EUROPEAN MANUFACTURING LOCATION: COUNTRY VERSUS REGION

Eleonora Cutrini

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Comitato scientifico:

Renato Balducci

Marco Crivellini

Marco Gallegati

Alberto Niccoli

Alberto Zazzaro

Collana curata da:

Massimo Tamberi

Abstract

The purpose of this paper is to investigate whether and to what extent European manufacturing location has been driven by regional localisation or national comparative advantages during the period 1985-2001. To this end, the relative concentration pattern of each industry is disentangled into *within* and *between country* components. The methodology adopted is based on the use of the Theil dissimilarity entropy index allowing to handle two geographical levels of analysis. The evidence suggests that the agglomeration of manufacturing industries is more likely to find expression between the internal regions of each country rather than across countries. Counterintuitively, after the completion of the Single European Market the relevance of national border remains stable or even increase in the localisation of the majority of the sectors considered.

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Indirizzo: Dipartimento di Economia
Università Politecnica delle Marche
E-mail: cutrini@dea.unian.it

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Trends in European Manufacturing Location: Country versus Region

Eleonora Cutrini

1 Introduction

This paper considers the regional location of manufacturing activities in the European Union. The increase in trade and the reduction in transaction costs in Europe are expected to lead to a rupture of the existing pattern of localisation of economic activities (Ottaviano e Puga (1998)). From a theoretical standpoint, in spite of the different source of specialisation, both traditional trade theories and the new trade theory predict that countries will specialise as a consequence of international openness. Besides, drawing on the New Economic Geography framework, international openness in Europe is deemed to lead to regional coalescence of industrial activities within the countries involved (Monfort e Nicolini (2000), Paluzie (2001), Crozet e Koenig-Soubeyran (2004)).

The envisaged increase in country and regional specialisation is supposed to worsen the vulnerability of specific economies to demand and technology shocks. Besides, the tendency of economic activities to cluster may foster the divergence of welfare between countries and regions. While the empirical literature on industrial location across countries is copious, only recently the region has become the basic unit of analysis to assess the spatial distribution of economic activities. Some authors have provided evidence of the regional specialisation and concentration patterns within countries (de Robertis (2001), Paluzie *et al.* (2001)), others scholars have pioneered specialisation studies (Hallet (2000), Molle (1997)) and sectoral concentration analysis (Brühlhart e Traeger (2004)) referring to the region in a EU-wide perspective, nonetheless their analysis are confined to the pre-Single Market period. The existing fragmentated empirical literature is still at an infant stage mainly because of the shortage of data at the EU-wide regional level but also for the lack of a rigorous methodology able to disentangle the inner country trends from the across country ones (Combes e Overman (2003)). This distinction is not idle speculation. As a matter of fact, despite the huge normative development of the EU Structural Funding and the increasingly higher relevance of regions as spatial units of analysis, the country institutional level is remaining still important.

This paper empirically contributes to the study of the regional concentration of manufacturing sectors in Europe. Moreover, without pretending to be a test of the New Economic Geography models, it tries to gauge the validity of the envisaged internal territorial implications of the European economic integration process. To this end, it relies on the decomposition of dissimilarity entropy measures by subgroups. The remainder of the paper is organised as follows. Section 2 provides a survey of the empirical evidence produced so far. Section 3 is devoted to the description of the data and the methodology decomposition used to provide a combined analysis of both within country and between country location patterns. Section 4 summarises the main findings of this study. Finally, section 5 concludes the paper.

2 A brief review of the existing empirical literature

That the country is not the ideal unit to assess industrial concentration has been acknowledged in the literature (Combes e Overman (2003), Aiginger e Pfaffermayr (2004)). Although, empirical studies on the spatial dispersion of industrial activities across regions is hampered by data availability thus little evidence has been provided on agglomeration patterns taking the region as breaking territorial partition (Brülhart e Traeger (2004), Hallet (2000)) instead of countries as it was common in the previous studies (Amiti (1999), Brülhart e Torstensson (1996), Midelfart-Knarvik *et al.* (2000) among others).

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 e Torstensson (1996), Brülhart (1998), Amiti (1999), Haaland *et al.* (1999), Brülhart (2001), Midelfart-Knarvik *et al.* (2000)), while during the Post-Single Market period both absolute and relative concentration seems to decline (Midelfart-Knarvik *et al.* (2000), Aiginger e 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 suggested that concentration slightly declined during eighties while increased during the first half of the nineties (Hallet (2000)). Similarly, Brülhart e Traeger 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) (Brülhart e Traeger (2004)).

Empirical studies on the concentration across regions focused on single coun-

try provide additional evidence on the internal geography patterns. For example, during the eighties concentration across Spanish regions declined in a majority of manufacturing sectors (Paluzie *et al.* (2001)). Besides, the majority of Italian manufacturing industries are more evenly distributed across the internal regions in 1991 than they were in 1971 except for *textiles, wood, paper and electrical products* (de Robertis (2001)).

3 Data and methodology

3.1 Data

Data have been taken from EUROSTAT Region-SBS (Structural Business Statistics) which is a section of Eurostat's REGIO database. Eurostat's REGIO database is the only source providing comparable EU-wide regional data based on a standardised classification of regions (NUTS). Clearly, European economic integration is deemed to have had a significant impact on regional manufacturing location patterns. In this view, data have been considered in three separate points of time, such as 1985, 1993, 2001. The three snapshots are provided to allow for a distinction between pre-Single Market trend (85/93) and post-Single Market evolution (93/01) and to speculate about possible effects of the integration process in Europe¹.

The analysis concerns almost all the regions of the following European countries: Belgium and Luxembourg (consolidated), Finland, France, Western Germany, Greece, Italy, Netherland, Spain and UK. 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 breakdown is mainly based on the NUTS 2

¹Some of the objectives of the common market programme, launched with the Treaty of Rome in 1958 -such as customs union proper, abolition of quotas, free movement of employed persons, some tax harmonisation with the introduction of VAT- were already achieved by the beginning of the seventies. Nonetheless, the abolition of trade barriers was not completely attained by the mid-1980s. With the aim of totally removing the 'frontier' concept and ensuring the optimal allocation of human and physical resources, the 1985 White Paper established the legislation to be adopted by the end of 1992 in order to reach the elimination of physical, technical and tax frontiers. Although the 90% of the legislative projects listed in the 1985 White Paper had been adopted in 1993, some relevant legislative omissions, failure to transpose legislation and lack of implementation had limited the full completion of the internal market at the end of the pre-Single Market period. United Kingdom, Italy, Germany, Belgium and the Netherlands (which are included in the sample) are amongst the leading Member States in terms of Single Market Programme translation into national legislation by the second half of the nineties. From 1993 to the end of 2000 a series of progresses in the legislative programme and their transposition into domestic legislation occurred (European Commission (1996), see also *Principles and general completion of the internal market, European Parliament Fact Sheets*).

grid except for Germany for which it has been referred to the NUTS 1 regions (Länder) (for detailed information on geographical coverage see table 5).

Employment data² are disaggregated by 12 manufacturing industries according to NACE rev. 1 divisions: *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).

The *food* sector (divisions 15-16) encompasses the manufacture of food products, beverages and tobacco. The *textile* sector (divisions 17-18) includes the manufacture of textiles, wearing apparel, dressing and dyeing of fur. The *wood* sector (division 20) comprises manufacture of wood and products of wood and cork. The *paper* sector (divisions 21-22) includes the manufacture of pulp, paper and paper products, publishing and printing. *chemicals* (division 24) is composed by the manufacture of chemicals and manufacture of chemical and pharmaceutical products. The *rubber and plastic* sector (division 25) is the manufacture of rubber and plastic products. The *no-metal products* sector (division 26) is constituted by the manufacture of non-metallic mineral products. The *basic metals* sector (divisions 27-28) is composed by the manufacture of basic metals and fabricated metal products, except machinery and equipment which constitute a separate sector DK (division 29). The *electrical machinery* sector (divisions 30-33) encompasses the manufacture of office machinery and computers, electrical machinery and electronic components, manufacture of radio, television and communication equipment and apparatus and the manufacture of medical, precision and optical instruments, watches and clocks. The *transport equipment* sector (divisions 34-35) includes the manufacture of motor vehicles, ships, boats, aircraft. The *other manufacturing sector n.e.c.* (division 36) includes the manufacture of furniture and recycling, musical instruments, jewellery, games and toys and other activities not elsewhere classified.

Some manipulation and data construction have been required to produce useable information. 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. 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.

The remaining gaps have been filled by linear interpolation.

²Employment is the only activity indicator available in the dataset.

3.2 Decomposition methodology

Absolute concentration indices measure the degree to which the spatial distribution of a specific sector is uneven without taking into account that this specific concentration could be simply the result of a localised manufacturing sector. Relative concentration indices instead, as the one used in the present work, are more suitable to gauge industry agglomeration. As a matter of fact, relative indices measure the extent to which the distribution across space of a specific sector departs from the pattern of aggregate manufacturing.

The methodology basically relies on the use of dissimilarity entropy measures (Theil (1967), Maasoumi (1993)). Because of their decomposability, entropy indices allow to disentangle the *within* and *between countries* components of relative concentration patterns. As for the decomposition of relative concentration measures the methodology adopted is based on the work of Brühlhart e Traeger (2004), we also provide the geographical decomposition of the typical dissimilarity indicator obtained as a weighted average of relative concentration indices.

Let us first define the variables and identify the subscripts used in the analysis of sectoral concentration. X stands for an activity indicator such as value added, employment. The subscript c , r and s identify the country, the region and the sector respectively. t_c is the number of regions inside country c , m is the number of countries, n is the number of sectors.

For instance:

- X_{src} is the employment of region r in country c in manufacturing sector s
- X_{rc} is total manufacturing employment of region r in country c ($X_{rc} = \sum_{s=1}^n X_{src}$)
- X_{sc} is the employment of country c in manufacturing sector s ($X_{sc} = \sum_{r=1}^{t_c} X_{src}$)
- X_c is total manufacturing employment of country c ($X_c = \sum_{s=1}^n \sum_{r=1}^{t_c} X_{src}$)
- X_s is the employment of all regions in the area in manufacturing sector s ($X_s = \sum_{c=1}^m \sum_{r=1}^{t_c} X_{src}$)
- X is the total manufacturing employment of all regions ($X = \sum_{c=1}^m \sum_{r=1}^{t_c} X_{rc}$)

Sectoral shares are defined as follows:

$$v_{src} = \frac{X_{src}}{X_{rc}}, v_{sc} = \frac{X_{sc}}{X_c}, v_s = \frac{X_s}{X}, v_{src}^* = \frac{X_{src}}{X}, v_{sc}^* = \frac{X_{sc}}{X},$$

while country and regional shares are:

$$s_c = \frac{X_c}{X}, s_{rc} = \frac{X_{rc}}{X}, s_{sc} = \frac{X_{sc}}{X_s}, s_{src} = \frac{X_{src}}{X_s}, s_{rc}^* = \frac{X_{rc}}{X_c}, s_{src}^* = \frac{X_{src}}{X_{sc}}.$$

Finally, Location Quotients or Balassa Indices³ are defined as follows:

$$LQ_{sc} = BI_{sc} = \frac{v_{sc}}{v_s} = \frac{s_{sc}}{s_c} \quad (1)$$

$$LQ_{src} = BI_{src} = \frac{v_{src}}{v_{sc}} = \frac{s_{src}^*}{s_{rc}^*} \quad (2)$$

$$LQ_{src}^* = BI_{src}^* = \frac{v_{src}}{v_s} = \frac{s_{src}}{s_{rc}} \quad (3)$$

Thanks to the decomposition property of the dissimilarity Theil index in between and within groups components, for each sector s , it is possible to distinguish the importance of the distribution of manufacturing activities across country from the internal localisation. The location quotients defined in equations (1), (2) and (3) are considered. The following relation holds:

$$BI_{src}^* = BI_{sc} BI_{src} \quad (4)$$

The relative concentration Theil index of sector s (RC_s) is defined as follows:

$$RC_s = \sum_{c=1}^m \sum_{r=1}^{t_c} s_{src} \ln(BI_{src}^*) \quad (5)$$

The decomposition is obtained through the substitution of equation (4) into equation (5):

$$\sum_{c=1}^m \sum_{r=1}^{t_c} s_{src} \ln(BI_{src} BI_{sc}) = \quad (6)$$

³Location quotient is a particularly useful piece of information to evaluate both regional specialisation and sectoral concentration. It has been used to assess country structure of comparative advantages, with a $BI_{sc} > 1$ referring to a comparative advantage of country c in sector s or, in sectoral concentration terms, a localisation of sector s in country c .

In our analysis it has been used in a version suitable to account for both overall and *internal* regional localisation. If $LQ_{src}^* > 1$ then region rc exhibits a comparative advantage in sector s with respect to the EU area considered as a benchmark. Specularly, turning to the concentration side, this means that sector s is more localised in region rc relative to EU.

LQ_{src} are related to the internal geography of regional competitive advantages so that for example if BI_{src} takes a value higher than 1, this informs of a regional comparative advantage of region rc in sector s relative to the reference country. In other words, sector s is localised in region rc compared with the country.

$$\sum_{c=1}^m \sum_{r=1}^{t_c} s_{src} \ln(BI_{src}) + \sum_{c=1}^m \sum_{r=1}^{t_c} s_{src} \ln(BI_{sc}) = \quad (7)$$

$$\sum_{c=1}^m \sum_{r=1}^{t_c} s_{src} \ln(BI_{src}) + \sum_{c=1}^m s_{sc} \ln(BI_{sc}) \quad (8)$$

In conclusion:

$$RC_s = \sum_{c=1}^m \sum_{r=1}^{t_c} s_{src} \ln(BI_{src}^*) \quad (9)$$

$$RC_s^{wc} = \sum_{c=1}^m \sum_{r=1}^{t_c} s_{src} \ln(BI_{src}) \quad (10)$$

$$RC_s^{bc} = \sum_{c=1}^m s_{sc} \ln(BI_{sc}) \quad (11)$$

Typical entropy (E) is defined using location quotients weighted by the regional sectoral shares of EU aggregate manufacturing (v_{src}^*):

$$E = \sum_{s=1}^n \sum_{c=1}^m \sum_{r=1}^{t_c} v_{src}^* \ln(BI_{src}^*) \quad (12)$$

Substituting equation (4) into equation (12):

$$E = \sum_{s=1}^n \sum_{c=1}^m \sum_{r=1}^{t_c} v_{src}^* \ln(BI_{src} BI_{sc}) = \quad (13)$$

$$= \sum_{s=1}^n \sum_{c=1}^m \sum_{r=1}^{t_c} v_{src}^* \ln(BI_{src}) + \sum_{s=1}^n \sum_{c=1}^m v_{sc}^* \ln(BI_{sc}) \quad (14)$$

The *between country* component of typical entropy is:

$$E^{bc} = \sum_{s=1}^n \sum_{c=1}^m v_{sc}^* \ln(BI_{sc}) \quad (15)$$

The *within country* component of total entropy is:

$$E^{wc} = \sum_{s=1}^n \sum_{c=1}^m \sum_{r=1}^{t_c} v_{src}^* \ln(BI_{src}) \quad (16)$$

It is worth noting that typical entropy is interpretable as a summary statistics of relative concentration indices weighted by the sectoral share (v_s) of EU aggregate manufacturing.

$$E = \sum_{s=1}^n v_s RC_s \quad (17)$$

Therefore:

$$E = E^{bc} + E^{wc} = \sum_{s=1}^n v_s RC_s^{bc} + \sum_{s=1}^n v_s RC_s^{wc} \quad (18)$$

4 Results

4.1 An overview of regional localisation: typical entropy and its components

The evolution of typical entropy allows to have a first idea on the degree of industrial agglomeration. As explained in the methodology section, typical entropy is a summary statistics of relative concentration indices.

	1985		1993		2001		Percentage change		
							85/93	93/01	85/01
$E^{wc} = E(RC_s^{wc})$	0.12	73	0.10	74	0.09	69	-16	-16	-29
$E^{bc} = E(RC_s^{bc})$	0.05	27	0.04	26	0.04	31	-20	6	-15
$E = E(RC_s)$	0.17	100	0.14	100	0.12	100	-17	-10	-25

Table 1: Typical entropy: components and percentage change

The spatial organisation of manufacturing industries is mostly driven by the localisation at the regional scale, and only to a minor extent it is explained by the national comparative advantages. On average, the latter component accounts for less than one third of the overall typical entropy. During the whole period, the reduction in value of the overall typical entropy is replicated at the two hierarchical levels but the internal spreading of sectors (29% decrease) is higher than the cross-border dispersion (15% decrease). As a consequence, the importance of national comparative advantages slightly increase in relative terms. Indeed, the *bc* component which represented the 27% of typical entropy in 1985, accounted for 31% by 2001.

It is worth noting that, while the direction and the magnitude of change in the inner-country reallocation seems to be independent from the Market Programme development, the modification at the across-country level is deeper in the period 1985-93 as one might expect to find in relation to the more far-reaching process of market integration. Since the launching of the ‘1992 programme’ internal regional agglomeration continuously decreased both in absolute (by 16% in each period) and relative terms. Instead, the declining trend in the international component in the pre-Single Market period (by 20%) is followed by a slight increase in the second sub-period (by 6%) (see table 1).

Despite the increase of relevance of the *bc* component is minimal, this trend would seem to suggest that national borders are not becoming completely irrelevant, instead they are gaining importance. This finding contrasts with the basic argument of the *NEG* strand. According to Krugman’s hypothesis, the reduction of transaction costs associated with the process of economic integration increases trade and allows regions to specialise. The fundamental source of specialisation is

Marshallian external economies fostering increasing returns and regional comparative advantage (competitiveness). In this context, national comparative advantage should be almost uninfluential to industrial localisation.

4.2 Overall sectoral location patterns

The evolution of sectoral relative concentration allows to describe the allocation across regions of a given industry compared with the regional distribution of manufacturing as a whole. The dissimilarity in the geographical distribution of a given industry relative to total manufacturing reveals the existence of inequality in the regional allocation of comparative advantages. The relative concentration Theil index is calculated at the two-digit manufacturing employment level to identify short-run evolutions in the localisation of industries.

At the beginning of the period, the most localised industries across regions were *wood, textiles, manufacturing n.e.c., no-metals, chemicals*. Put it differently, these sectors spread more unequally across the European regions included in the analysis (see table 2). Their relative concentration Theil index ranged from 0.30 to 0.17. Instead, the least localised industries were *paper, rubber and plastic products, machinery and equipment n.e.c., electrical and optical equipment* (between 0.14 and 0.11 in value).

Bearing in mind the relatively short time period, it should not be surprising that the ranking of industries have not changed much. In 1993, the most localised industries were *textiles, wood, no-metals, manufacturing n.e.c.*, (between 0.25 and 0.17), while the least localised industries were *machinery and equipment n.e.c. and rubber and plastic products* (0.09 in value). In 2001, the most concentrated sectors were *textiles* (0.29 in value) followed by *wood, no-metals, transport equipment* (0.17 in value) and *chemicals* (0.16 in value). Instead, the least localised industries were *rubber and plastic products, basic metals and fabricated metal products, and electrical and optical equipment* (0.07).

The overall trend is characterised by a widespread decline in regional localisation throughout the entire period. *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.

It is worth noting that, in terms of the magnitude of the change, relative concentration of *basic metals and fabricated metal products* and *manufacturing nec* decrease by over 50% during the whole period. Instead, other industries are characterised by more consolidated regional comparative advantages, namely *textiles, paper, chemicals and transport equipment*. As a matter of fact, they exhibited little change in overall regional localisation (less than 20% percentage change)(table 2).

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

Note: The sectors, whose relative concentration increase, are in bold.

Table 2: Relative concentration indices, RC_s

4.3 Decomposing sectoral localisation within and across country

The modification in the overall relative concentration of each sector is partly due to the evolution of the inner-country localisation and partly explained by the patterns of national comparative advantages. 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.

From figure 1 it is clear that the results on the pattern of localisation is affected by the unit of analysis one refers to. 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* during the whole period (top panel of figure 1). The same relocation took place in *chemicals*, *basic metals*, and *transport equipment*, but only in the second sub-period (bottom panel of figure 1). Some sectors, namely *food*, *wood*, *machinery and equipment nec*, and *manufacturing nec* became more evenly distributed both across country and within country (middle panel of figure 1). Other sectors exhibited a no-linear evolution in the cross-border concentration. Although, from the present analysis, the inverted-U pattern across country, pointed out in the existing empirical literature, is rare since it is experienced by only two sectors, namely *rubber and plastic products* and *electrical and optical equipment* (bottom panel of figure 1).

The range of internal relative concentration was in 1985 between 0.06 (*machinery and equipment nec*) and 0.18 (*textiles*). Despite the process of regional

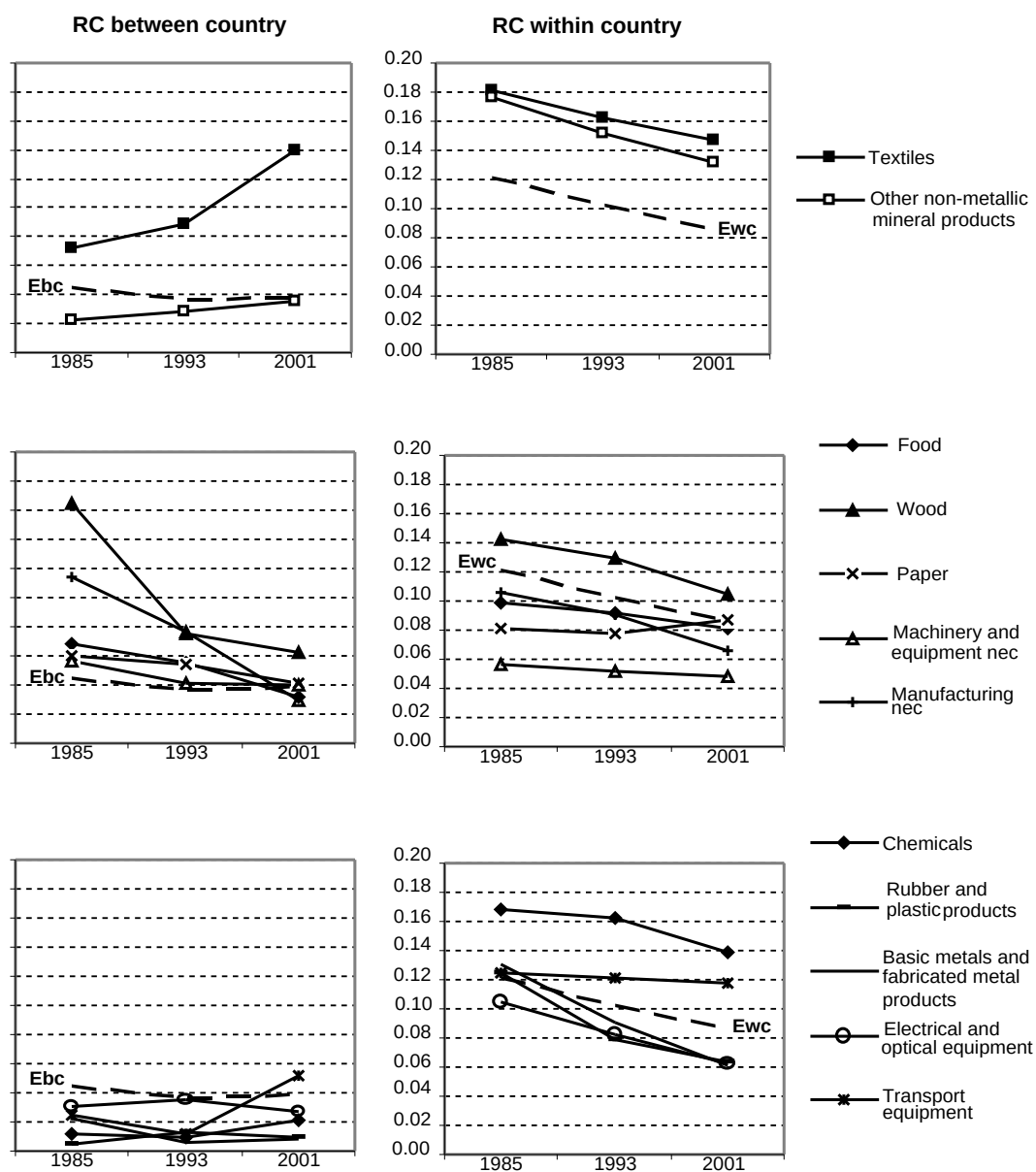


Figure 1: Geographical composition of Theil indices of localisation

spreading, again in 2001 the less concentrated industry *wc* is still *machinery and equipment nec* (0.05 in value) and *textiles* is the most localised (0.15 in value) (table 3).

	1985		1993		2001	
	RC_s^{wc}	%	RC_s^{wc}	%	RC_s^{wc}	%
Food	0.10	59	0.09	62	0.08	72
Textiles	0.18	72	0.16	65	0.15	51
Wood	0.14	48	0.13	63	0.10	63
Paper	0.08	57	0.08	59	0.09	68
Chemicals	0.17	93	0.16	95	0.14	87
Rubber and plastic products	0.12	97	0.08	86	0.06	87
Other non-metallic mineral products	0.18	89	0.15	84	0.13	79
Basic metals and fabricated metal products	0.13	85	0.09	94	0.06	89
Machinery and equipment n.e.c.	0.06	50	0.05	55	0.05	55
Electrical and optical equipment	0.10	77	0.08	70	0.06	70
Transport equipment	0.12	83	0.12	91	0.12	70
Manufacturing n.e.c.	0.11	48	0.09	54	0.07	69
$E(RC_s^{wc}) = E^{wc}$	0.12	73	0.10	74	0.09	69

Table 3: Inner country values and shares of relative concentration

Manufacturing sectors are more spatially concentrated across the various regions of each country than they are between countries. Indeed, the decomposition of the relative concentration index suggests that the *inner country* component is significantly more important than the *across country* one in a majority of sectors. In the mid-eighties, on average the sectoral localisation within country accounted for 73% of the overall spatial distribution (table 1). In particular, *chemicals*, *rubber and plastic products*, *no-metals*, *basic metals* are the sectors in which the internal agglomeration explain almost the overall localisation (more than 85%) (table 3). *Wood* and *manufacturing nec* are the only exceptions to this general feature, since they are characterised by a cross-border component of localisation which is slightly more important than the within one. Instead, the two components had a similar weight in underpinning the localisation of *machinery and equipment nec* (table 3). On the whole, the importance of the within country declined throughout the entire period. Despite all sectors exhibit a higher importance of the internal regional concentration compared with their international spatial agglomeration, by 2001, they show, on average, a *wc* component which account only for 69% of the overall localisation (table 1, table 3)).

It is noteworthy that *textiles*, where the presence of industrial districts is important, and some of the sectors in which the scale of production is a relevant factor (such as *chemicals*, and *transport equipment*) remained amongst the most localised industries within country throughout the entire period (their inner-country

localisation was always above the respective wc entropy) (figure 1). Besides, the *textile* location pattern seems to implicitly reveal a declining role of Marshallian external economies but it finds a counterpart in the evolution of the residual miscellaneous sector where the presence of industrial districts is also relevant. Indeed, the *textile* industry is the sector whose decrease of the inner-country component in relative terms is more sharply. The internal share of total relative concentration declined from 72% to only 51% during the whole period. Conversely, with only 48% in 1985 as against 69% in 2001, *manufacturing nec* recorded the highest increase of the inner-country share (table 3).

	wc share increase (bc share decrease)	wc share decrease (bc share increase)
overall RC increase		<i>Textiles</i> (72;51), <i>transport equipment</i> (83;70)
overall RC de- crease	<i>Food</i> (59; 72), <i>wood</i> (48;63), <i>paper</i> (57;68), <i>basic metals and fabricated metal products</i> (85;89), <i>machinery and equipment nec</i> (50;55), <i>manufacturing nec</i> (48;69)	<i>Chemicals</i> (93;87), <i>rubber and plastic products</i> (97;87), <i>other non-metallic mineral products</i> (89;79), <i>electrical and optical equipment</i> (77;70)

Note: the wc shares in 1985 and 2001 are shown in parenthesis.

Table 4: Overall relative concentration and its components in terms of the share

On the whole, the rise in the international component underpins the unusual upward trend in the overall relative concentration exhibited by *transport equipment* and *textiles* during the post-Single Market period. In other words, the relocation of these two sectors has been mostly between countries rather than within countries (table 4). Among the sectors which become more dispersed it is possible to draw a distinction. In a set of low-tech sectors - namely *food*, *wood*, *paper*, *basic metals and fabricated metal products*, *machinery and equipment nec*, *manufacturing nec* - the internal regional coalescence is becoming increasingly relevant. Instead, in spite of a general dispersion, national borders increasingly affects the spatial allocation of some high-tech and high-skill sectors, namely *chemicals*, *rubber and plastics*, *no-metals*, *electrical and optical equipment* (table 4). In particular, in *textiles*, *chemicals* and *transport equipment* the *bc* component rose both in absolute and relative terms (table 6).

Interestingly, it would seem that, at the end of the first period of market integration, national borders were nearly irrelevant for the localisation of some sectors

such as *chemicals, basic metals, and transport equipment* which recorded the lowest *bc* values (0.01) and shares (less than 9%) in 1993. Instead, in 1993 national comparative advantages were still important in determining the location of *food, paper, machinery and equipment nec, and manufacturing nec* (between 38% and 46%). Besides, during the pre-Single Market period the *bc* component increased in *textiles* and *rubber and plastic products*.

After eight years from the completion of the Single European Market -formally establishing the free flows of goods, persons and capitals- national borders continue to matter in European manufacturing location. The weight of national comparative advantages over the total localisation is even higher than it was in the mid-eighties (31% on average in 2001, 27% on average in 1985). At the end of the period analysed, the international component accounts for almost half the overall localisation in *textiles* (49%) and *machinery and equipment nec* (45%) (table 6). More specifically, in the second sub-period analysed, the relevance of the across country localisation remains stable or even increase in a majority of sectors. Only for the localisation of *food, paper, rubber and plastic products* and *manufacturing nec* the importance of national borders is declining.

This seemingly counterintuitive evidence turn out to be less surprising if one consider that, the removal of trade barriers may lead to a better exploitation of country comparative advantages. Besides, as stressed by Sapir, 'the liberalisation of manufactured goods markets during the period 1986-1992 may not have been as far-reaching as expected either because these markets were already largely liberalised prior the 1986, or due to delays in the implementation of the 1992 program'(Sapir (1996), p. 461).

5 Concluding remarks

The aim of this work was to investigate the patterns of manufacturing concentration in Europe both across country and internal to country. The methodology decomposition based on the use of entropy indices has served the main purpose of the analysis allowing to disentangle the relative importance of the inner-country dissimilarity from the cross-country divergence in localisation.

A first remark is suggested by the downward trend in the overall entropy. On one side, the overall declining entropy is driven by a widespread and continuous decrease in localisation for almost all the sectors. Textiles and transport equipment are the exceptions to this general tendency.

A second remark emerges as a result of the decomposition. The significantly higher weight of the within country component over the international one seems to suggest that the regional grid is a more appropriate geographical partition rather than national borders. As a matter of fact, the within country component accounts for more than two third of the overall dissimilarity in the distribution of the manufacturing activities in Europe. This evidence suggests that either external economies or intra-firm increasing returns to scale are much more important than country comparative advantages in explaining industrial agglomeration in Europe.

Nonetheless, the importance of regional clustering is decreasing throughout the period analysed (1985-01). Instead the weight of national comparative advantages slightly increase during the post Single Market period. These findings reveal that national borders instead of becoming completely irrelevant as a consequence of European economic integration, they are recovering importance especially as far as the location of some manufacturing sectors is concerned.

From a theoretical viewpoint, the declining concentration internal to country contrasts with the predictions of the NEG models focused on the relationship between country openness and internal geography in Europe. Instead, this result sounds consistent with the equilibrium of dispersion outlined by Krugman and Livas (Krugman e Livas (1996)).

Appendix

Country	Number of regions for which data are available	Administrative units	NUTS level
Belgium	9	Provinces	2
Luxembourg	1		2
Germany	16	Länder	1
Spain	17	Comunidades autónomas	2
Finland	3	Suurlaueet	2
France	22	Régions	2
Greece	11	Development regions	2
Italy	19	Regioni	2
Netherland	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 UK is according to NUTS 95 classification.

Table 5: Geographical coverage of the dataset

	1985		1993		2001	
	RC_s^{bc}	%	RC_s^{bc}	%	RC_s^{bc}	%
Food	0.07	41	0.06	38	0.03	28
Textiles	0.07	28	0.09	35	0.14	49
Wood	0.16	55	0.07	37	0.06	37
Paper	0.06	43	0.05	41	0.04	32
Chemicals	0.01	7	0.01	5	0.02	13
Rubber and plastic products	0.00	3	0.01	14	0.01	13
Other non-metallic mineral products	0.02	11	0.03	16	0.04	21
Basic metals and fabricated metal products	0.02	15	0.01	6	0.01	11
Machinery and equipment n.e.c.	0.06	50	0.04	45	0.04	45
Electrical and optical equipment	0.03	23	0.03	30	0.03	30
Transport equipment	0.03	17	0.01	9	0.05	30
Manufacturing n.e.c.	0.11	52	0.08	46	0.03	31
$E(RC_s^{bc}) = E^{bc}$	0.05	27	0.04	26	0.04	31

Table 6: Between country values and shares of relative concentration

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