REGIONAL DISTRIBUTION OF THE KNOWLEDGE BASED ECONOMY IN THE EU: TOWARDS AN OLIGOCENTRIC MODEL?

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ABSTRACT

The objective of the paper is to bring about the geography of the Knowledge Based Economy (KBE) in Europe. By taking into consideration the knowledge/technology dimension of economic activities we try to bring about the concentration patterns of the employment of six broad sectors at the EU regional level (nuts 2). These sectors are: High, Medium and Low Knowledge Intensive Services and High, Medium and Low Tech Manufacturing; the data has been collected from the REGIO database (Eurostat). Moreover we also try to capture the regional specialisation patterns. The results regarding concentration show that the higher the knowledge/technology content of the economic activity, the higher its concentration degree is. Besides we found that some services activities (the high knowledge intensive ones), present similar concentration levels than high or medium tech manufacturing. Regarding specialisation the most outstanding result is the predominance of metropolitan regions in those more knowledge/technology intensive activities (particularly in the case of services). From a general viewpoint we conclude that an oligocentric pattern survives in Europe (with southern German regions leading high and medium tech manufacturing and the English Southeast leading in high knowledge intensive services) but with an outstanding role for state metropolis (particularly capital-cities) from both northern and southern Europe.

1. INTRODUCTION

The concept of Knowledge Based Economy (KBE) tries to capture the qualitative change derived from the increasing importance of knowledge in all economic activities (and not only in those related to ICTs). It also regards "the increasing speed of the knowledge creation, accumulation and, probably, depreciation in terms of relevance and economic value" (David&Foray, 2002, 472). An important issue related to the KBE emergence is to what extent it alters the location patterns in the economy and, if it does it, what are the direction and the character (cyclical or permanent) of the trends. Does it reinforce tendencies towards concentration or towards dispersion?. The answer is crucial for the future of territorial disparities in Europe.

Certain literature focused on the potentialities of new technologies has popularised the idea that the combination of the "lean" economy and ICTs favours economic deconcentration and leads to the "end of distance" (Cairncross, 2001). Nevertheless, we think that such a simple answer does not fit with reality. Some qualifications must be assumed at the beginning. Firstly because we ignore the spatial patterns of the KBE (actually there was not consensus about those patterns in the past neither about the factors explaining them). Secondly, the KBE has not emerged suddenly in the last decade neither it derives only from the appearance of ICTs. It is rather a process that takes place all along several decades in which the role played by knowledge in production has increased, either directly by the use of high-skilled labour or by the use of material inputs embodying increasing amounts of knowledge. Thirdly, the structural change in the economy has come together with other equally important changes (globalisation, new industrial organisation, European integration, etc). Therefore it could be problematic to be restricted only to an explanatory factor, as it often happens in certain Literature centred in agglomeration effects, spill-overs, etc. And, finally, the discussion on the KBE geography must go clearly further than the spatial impact of telecommunications or Internet. This factor, taking alone or combined with others, has led certain authors to predict (or to prophesy) "the end of distance" and "the end of geography", confusing technical potentialities with really observed tendencies.

For that reason, previous to argue about explanatory factors, it is necessary to fit us with data and to shed some light into empirical trends. The paper goes as follows: previous to the empirical analysis we briefly have a look at two different contributions on economic geography. The first one refers the well-known New Economic Geography approach and the second one regards different contributions emphasizing the role of knowledge and innovation on economic location. Then, in the empirical part, we start by analysing the concentration degree of six activities (classified by their knowledge/technological content).

Later we bring about the "real geography" of the previous activities, i.e. in which EU regions they do concentrate in both absolute and relative terms and how this concentration has changed between 1994 and 2001. We also have a look at the relationship existing between the degree of relative concentration (specialisation) and the per capita GDP of EU regions.

2. THE NEW ECONOMIC GEOGRAPHY APPROACH

Classic authors like Von Thünen, Marshall, Lösch, Isard, Myrdal, Perroux and many others pointed out a wide range of factors explaining the trends of economic activities towards spatial concentration. Also the *economics mainstream,* within the framework of the so-called New Economic Geography, has recovered the interest for agglomeration. They focus on those factors counteracting the trade costs diffusing effects, particularly on increasing returns, scale economies and externalities (both pecuniary and technological ones). This has reinforced the concern by external economies as explanatory factors of industrial location, relegating traditional factors like factors costs, the market dimension, infrastructure endowments, taxes, etc. Besides externalities would be especially relevant in those industries characterized by monopolistic competition and increasing returns. Meanwhile, conventional comparative advantages would have greater relevance in those industries producing standardized goods and using homogenous inputs, that usually perform in more competitive markets (Krugman/Venables, 1996). In any case most of the New Economic Geography literature has focused only on the discussion of the different sources of external economies (like location economies derived from specialisation; urbanization economies derived from the area economic size and/or its diversity; dynamic external economies, technological economies or spillovers). Moreover, NEG has paid special attention to modelisation (a good example is Fujita & Thisse, 2002) and, as Krugman (1998) recognized, only a small part of the works in this area have tested the models empirically.

Apart from specific problems related to modelisation (for instance the treatment of technological externalities and how they are generated), this perspective presents "structural" problems. One of them is their disregard about qualitative changes in production (like the one represented by the transition to a KBE); likewise most of this literature focuses mainly on manufacturing, leaving aside services activities.[1] Finally, the technological level or knowledge content of activities is rarely considered as a central variable in their analysis.

Moreover, during the last decade the analysis of industrial concentration has been linked to the debate of specialisation. The question is to what extent an how industrial specialisation (location economies) or, on the contrary, industrial diversification (urbanization economies)

contributes to a higher regional economic growth (Landesmann, 1997). The results of the (few) empirical studies in the area are often contradictory, depending largely on both the level of sectorial disagregation (great sectors, industrial branches and/or of services) or territorial desagregation (state, regional or local) (Henderson, 2003; Viladecans, 2003). They do not offer conclusive results on the increasing of regional specialisation in manufacturing, as could be expected from the European process of integration. Neither they prove the existence of linkages between specialisation patterns and regional growth. Moreover, both the importance and the cause of agglomeration processes seem to differ from sector to sector and a clear location pattern cannot be found.

3. THE IMPORTANCE OF KNOWLEDGE AND INNOVATION IN GEOGRAPHY

Different studies have proved that academic research and R&D are key components for the production of codified and tacit knowledge and that they tend to be geographically concentrated, mainly in metropolitan regions (e.g., Feldman, 1994; Vence&Rodil, 2003). It happens something similar with the other "leg" of the KBE, i.e. different types of business services and, in general, all high-tech services: they also benefit from agglomeration and urbanization economies (Illeris, 1997; Berg&Sturm, 1999).

Although most common literature of Geography of Innovation is heterodox biased, it has been also reinforced by contributions more directly connected to the Neoclassic stream, like those focusing on "knowledge spillovers", understood to be key factors for the agglomeration of innovative companies (Jaffe, 1989; Feldman, 1994; Fedman&Audretsch, 1996). But, contrary to the Neoclassical concept of spillover without borders, in this approach the key idea is "proximity". "*Since knowledge is generated and transmitted more efficiently via local proximity, economic activity based on new knowledge has a high propensity to cluster within a geographic region*" (Audrecht, 1998, 18).

According to this viewpoint, the knowledge trend to disseminate (to spillover) locally would be the main factor explaining the trends of innovation to concentrate (to cluster) there where key knowledge inputs for are available, (so reinforcing previous inequalities in innovative capacity). Furthermore, some authors like Feldman (1994), Karlsson (1997) or Feldman and Audresch (1999) have pointed out that the agglomeration degree varies among industries

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[1] As an example, along the 465 pages of the interesting book *Economics of Agglomeration* edited by Fujita and Thisse (2002), services activities are mentioned only one time.

depending on: the product life-cycle stage,[2] their dependency on tacit knowledge, and on the higher or smaller intensity of knowledge spillovers of each of them. All this together would reinforce the hypothesis that the more knowledge intensive is an activity the stronger its tendency to agglomerate and concentrate will be.

Moreover the increasing complexity of the innovation process, the large amount and diversity of knowledge that need to be gathered in order to innovate, together with the exponential increase of available knowledge, has multiplied the number of agents specialised in diverse functions and tasks (governmental regulation, standards, marketing, engineering, financing, etc.) (Coffey&Polèse, 1987). We speak about diverse services activities that acquire, produce, assemble, store, pilot, process and analyse data, so contributing to the innovativeness of its clients. And since not all the interactions can be made through ICTs, these services tend to locate in the surroundings areas of potential clients, particularly in metropolitan areas (Coffey and Polese, 1987; Heinrich, 2001; Keeble and Nachum, 2001).[3]

The agglomerative effects of *high-tech* services and in general of knowledge intensive services, are transferred to other sectors (depending their transference degree on the interrelations density between the two activities). Thus these services contribute interactively to product and process innovation, acting as a diffusion channel of knowledge among companies. The wider the clients network, the greater will be the capacity to create, capture and accumulate tacit knowledge. And this will end up irrigating the whole local productive system and so reinforcing the cumulative dynamics of innovation, following a feed-back process.

These aspects lead us to the debate on the impact of ICTs in the economic geography, both for manufacturing and for services activities. Some works stand out that new technologies have changes the spatial organization of business activity and, in a minor extent, their location (Castells, 1995). Nevertheless, few empirical studies support the idea raised by Cairncross (2001) of "the end of geography" or "the end of distance". On the contrary, authors like Leamer and Storper (2001), Savy (1998) or Vence (1996) consider that although ICTs (in particular Internet) have increased the possibilities for remote communication, they have not considerably facilitated the transferring of tacit knowledge. Therefore, possibilities or advantages for determined services being provided at distance are smaller than usually supposed.

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[2] The trend to intense agglomeration in the activity "born" phase can be interpreted either as the output of the creation and diffusion of new knowledge critical importance (in special tacit knowledge), or by the potential economies of scale or also by the importance of spin-off phenomena at that first moment.

Therefore and summarising, we should bear in mind that there is not a single force neither a unique and linear pattern, driving changes associated to the KBE but rather there are diverse and sometimes opposed tendencies. For that reason a more in-depth empirical study of those tendencies is needed. In this sense what we try to do here is to explore a new route for empirical support that pays special attention to the knowledge/technological content of economic activities. Of course we are aware that analysing aggregated data we won't obtain precise patterns but just a balance of contradictory trends. In any case we think it can be worth value try this different way.

4. THE EMPIRICAL ANALYSIS

As we have already mentioned we will firstly analyse the concentration trends of employment in six different activities classified by their technological/knowledge content. These activities are high, medium and low knowledge intensive services (HKIS, MKIS, LKIS) and high, medium and low-tech manufacturing (HTM, MTM, LTM).[4] We will obtain two kind of indicators for each activity: one for absolute concentration and the other for relative concentration.[5]

Then we will present the real location patterns of each of these activities, i.e. in which specific EU regions they do concentrate and what are the regions with highest and lowest relative concentration (understood to be a measure for specialisation). We also correlate the regions relative concentration quotes with their GDP pc, trying to observe whether there is a positive, neutral or negative relationship. Finally we analyse the changes in concentration patterns between 1994 and 2001.

4.1. Concentration patterns of our activities

(Annex III, Table 1)

To obtain an *absolute concentration* measure we will use the index of the n first quotas.[6] For the year 2001 and for n=15, the sector showing higher concentration is MTM, followed by HKIS and HTM; LKIS and LTM are in the opposite side. On the other hand, the regional

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[3] Certainly, not all knowledge intensive services do present similar agglomeration and concentration patterns because, among other things, the importance of clients/users proximity varies enormously and also because of each service specificities (Vence&González, 2002).
[4] In annex 1 readers will find the description of each of these activities togehter with a note on the data sources.
[5] In annex 2 readers will find a brief account of the characteristics of the indexes used in the empirical analysis.
[6] See annex 2.

index of *relative concentration* for 2001 shows that: a) manufacturing is more concentrated than services, whatever the technological level, b) within manufacturing and services, the higher the technology/knowledge content of the activity the higher is the concentration degree. Thus the concentration index follows this order: HTM, MTM, LTM, HKIS, MKIS and, finally, LKIS.

Concerning the variation of the concentration degree between 1994 and 2001, we would emphasize the following aspects: a) in general there is a moderate variation, probably due to the shortness of the period; b) manufacturing register, in general, deeper variations in its patterns of concentration than tertiary activities; c) those more knowledge/technological intensive activities (HKIS and HTM), along with MTM, present the highest increase in concentration (being, in any case, a modest increase); d) however, MKIS and LKIS do not vary significantly its degree of concentration in the period.

4.2. Real geography: Absolute Concentration at EU regions

Large metropolitan regions lead the ranking of absolute quotes in all activities, outstanding Île of France, Lombardia and Stuttgart. The predominance of this type of regions is much clearer in the case of high-tech services (in comparison to manufacturing). In the case of high and medium-tech manufactures, regions with industrial tradition (particularly from the "great banana" and, within them, the German regions) are the ones leading. Finally in the case of LTM we find some old-industrial French intermediate regions, together with some others from the North of Italy and from the Spanish Mediterranean. (Annex III, Table 2)

4.3. Real geography: Relative Concentration (specialisation) at EU regions

The analysis of the geographic distribution of relative quotas allows us to know to what extent some regions outstand because of their relative sectorial specialisation (or non-specialisation).

- In the case of HKIS, metropolitan regions are the ones showing a superior specialisation. Thus in the top 15 we can find 7 capital-cities (Stockholm, Île de France, Madrid, Flevoland, London, Lazio, Uusimaa-Helsinki), a region border-line to Brussels (Vlaams Brabant) and several regions from Southeastern England, all of them close to the British capital (in fact this area seems to be the most specialized in

this sector in the EU). Regions with lower presence of HKIS are almost all of them from the southern periphery (with low levels of GDPpc), mainly Spanish (Galicia, the Canary Islands, the two Castillas, Andalusia and Aragón).

- The map of HTM specialisation differs significantly from the one of HKIS in such a way that metropolitan regions are not leading. The top group is mainly composed by regions from the European hard-Core, five from southwest Germany (the four forming the State of Baden-Würtemberg along with Mittelfranken), two from the east (Dresde and Thüringen), two Dutch (Noor Brabant and Limburg), Franco-Condado, two British (Hampshire and South Western Scotland), the Finnish Pohjois and Ireland. Regarding the bottom part of the ranking we must, previous to the description, point out the data problems in this sector, particularly for a large part of less developed regions (the ones that presumably present lower specialisation in these activities).[7] Among the ones with available data we find different kind of regions (Portuguese, Spanish, Belgian and some Italian and French).

- Concerning MKIS, it is observed that the regions with highest levels of relative specialisation are mainly Swedish (5), Dutch (4) and British (4) along with one Finn and two Belgians. A general assessment allows to say that most of these regions have a well-developed Welfare State, combined in some cases with a metropolitan character (London, Brussels, Stockholm, Zuid-Holland).

- Moreover, specialisation in MTM seems to follow a similar pattern to the HTM one but with some relevant differences. In this case an absolute predominance of German regions is observed (11; mainly from both southern states: Baviera and Baden-Württemberg), along with the two border French regions (Alsacia and Franco-Condado) and the Italian Piemonte. This area could be considered as the very Hard-Core of European manufacturing industry. In the opposite side we find quite diverse regions, from less developed ones from the south (Andalusia, North of Portugal, Sicily or Valencian Community) to some metropolitan regions (Wien, Noord and Zuid Holland, Lazio, Stockholm and Outer London).[8]

- The regions that display a superior specialisation in LKIS are almost all of them islands or seaside regions from the Spanish, French and Italian Mediterranean. At a first sight it seems they are peripheral economies, dominated by tourist activities and with a lower-middle income level. On the contrary, low specialisation rates in this sector mainly correspond to Swedish, Finnish and German regions with a high level of development.

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[7] The fact that the regions lacking data for this sector are mainly the less developed ones leads us to think that the degree of concentration of the sector is higher than the one indicate by the indexes calculated.
[8] We must consider that, like with the case of HTM, there exists an important deficiency of data for MTM which it mainly affects less developed regions.

- Finally, the specialisation in LTM is particularly important in regions from the European semiperiphery as Norte and Centro (Portugal), Castilla la Mancha and Comunidad Valenciana (Spain), Central Macedonian and Sterea Ellada (Greece) or central Italy (Toscana, Umbria, March). Besides there are also some regions of strong industrial tradition as Lombardía or the Basque Country. On the other side, the regions with a smaller relative presence of this sector are mainly big capital-cities (6) and others where HKIS and MKIS are largely present. (Annex III, Table 3)

4.4. Concentration of activities and GDP pc

An interesting issue is the measurement of the statistical relationship between specialisation and GDP pc. In this sense, if we correlate the relative quotes of concentration with the GDP pc in each regions we can observe that more developed regions (in GDP terms) show a higher presence of technology/knowledge intensive activities like HKIS, HTM, MKIS and MTM. This is statistically supported by the both positive and high values of the correlation coefficient (Pearson) between the regional concentration of those sectors and the level of the regional GDP per capita. On the contrary, the negative sign of the correlation between both LKIS and LTM and the GDP level reflects a lower relative concentration of these sectors in rich regions and a higher concentration in the intermediate or poorer ones. (Annex III, Table 4)

4.5. Real geography: Relative changes in regional quotas

Previous to start this point, we must indicate that the shortness of the period makes difficult to obtain clear-cut trends regarding structural changes. This also applies for changes in the sectorial relative concentration degree, particularly in those activities in which global concentration has not varied significantly (LKIS, MKIS and MTM). In the case of the other three activities we would emphasize the following changes:

- LTM tends to increase its relative presence in many peripheral regions (Basilicata and Abruzzo in Italy; North and Centre in Portugal; Pays of the Loire or Poitou-Charentes in France or Galicia in Spain). This fact supports the hypothesis of the "core-periphery" industrial pattern survival, in such a way that low-tech manufacturing activities diminish their presence in central regions (by delocalisation

or simply because of a lower relative growth) while the opposite happens in peripheral or semi-peripheral regions.

- In the case of HTM another interesting trend seems to (slightly) outstand: these activities reinforce their central position in some German and Austrian regions, as well as in Ireland and most of the Finnish regions.

- In the case of HKIS a certain reinforcing of its relative presence in diverse metropolitan regions can be observed as well. This would be the case of the Comunidad de Madrid, Vienna or Inner London. In any case, it is difficult to establish a precise trend in this respect.

5. CONCLUSIONS

Available statistical data for European regions (NUTS II) has made possible to group manufacturing activities according to its technological intensity (HTM, MTM and LTM) and services activities according to their knowledge intensity (HKIS, MKIS and LKIS). This has allowed us to explore into patterns of the EU KBE geography as well as its evolution in the second half of the 90s. The analysis made shows a strong concentration of the economic activity (as a whole) together with very differentiated location patterns for each sector. Results show the existence of a very unequal KBE geography in the UE.

The more technology/knowledge intensive is the sector the higher is its level of regional concentration (specially for manufacturing). All HTM, MTM and HKIS present a very high level of concentration and, in addition, they have reinforced it in the last years. However the concentration degree is quite lower in the other cases (specially for LTM) while regarding changes we could speak of spatial dispersion for LTM and stability in the case of LKIS and MKIS. The most outstanding aspect is that some services, the high-tech ones (computer services, R&D, telecommunications), present a similar concentration degree to high-tech manufacturing. This fact shows, moreover, that those highly ICT intensive activities present a very high degree of concentration, what contrasts with the hypothesis of the "end of distance" or the "end of geography".

When approaching the profile of the regions in which the different sectors concentrate we could draw some general conclusions as well. For instance, it is observed that more developed regions (in GDP terms) show a higher presence of technology/knowledge intensive activities like HKIS, HTM, MKIS and MTM. On the contrary, the negative sign of the correlation between both LKIS and LTM and the GDP level reflects a lower relative

concentration of these sectors in rich regions and a higher concentration in the intermediate or poorer ones.

An in-depth analysis has also shown relevant aspects of the different sectors geography. In the case of HKIS activities a strong concentration in great urban regions and capital cities as well as in the particular area of the English Southeast is observed. MKIS do concentrate also in large urban regions and capital cities, but in this case, along with northern European regions (with more developed Welfare States). Regarding HTM and MTM, they are highly concentrated in the European "hard-core" formed by the German regions of Baden-Württemberg and Baviera and the "Alpine belt". Particular cases of peripheral regions like Ireland and some Finnish ones, after having developed an important high-tech manufacturing industry in the last years, are present in this group as well. On the contrary, more traditional industrial activities (LTM, where Food and the Textile industry are included) are particularly present in semi-peripheral regions from southern Europe. Moreover, a large part of the Mediterranean regions economy is characterised by the specialisation in LKIS (probably because of the importance of tourist activity in those regions).

Changes occurred in the second half of the 90s seem to reinforce the geographic distribution pattern described above. Metropolitan regions increase their relative weight in services, particularly in HKIS but also in HTM. It seems that MTM industry becomes stabilized while LTM lose relative weight in these metropolitan regions.

As a general conclusion we could state that the traditional core-periphery pattern seems to survive in Europe at the regional rather than at the State level. In geographic terms we could identify a restricted centre or bicephalous hard-Core constituted by the South of Germany for high and medium-tech manufacturing and by the English Southeast for knowledge intensive services. But it would be an excessively restricted picture. The current and increasing presence of HKIS, MKIS and HTM in large metropolitan regions, normally capital-cities (from both northern and southern countries) leads us to redefine that core. The centre is not formed by a continuous and contiguous geographic area but rather by a kind of archipelago conformed by the European regions with large urban areas. In that sense we could talk about a KBE "metropolisation" following an "oligocentric" model, particularly in the case of high technology and knowledge intensive manufacturing and services activities. Therefore, the KBE development would be largely based on the configuration of inherited agglomerations, with only some recent incorporations.

Thus the explanation of the KBE concentration patterns cannot be restricted to the typical factors indicated by the New Economic Geography (pecuniary Externalities, spillovers,

increasing returns, etc). It requires understanding the historical process of birth and development of those largely urban and capital regions. Externalities can play a role once a certain agglomeration level has been achieved but they can hardly explain the origin of such agglomeration and, in any case, not as a unique factor. It requires to take history into consideration, the territorial configurations of the States, the great political decisions related to them and, specially, the historical geography of the public utilities. In this sense, the election of the capital-city seems to be a major determining factor. Likewise the traditional centralization of State public functions seems also very relevant for explaining the high concentration degree of some economic activities, particularly tertiary ones like finance, telecommunications, business services, etc. In the same way the location of public-utilities related to technologically advanced sectors (aerospace industry, military industry, etc), that in many states have been characterized by their centralization, is a factor that must be taken into account. The point is that these type of factors have not been decisive only in the past or in the origin of the process but, in someway or another, they are continuously present.

As a final remark and regarding further research on economic concentration in Europe, we think that it would be necessary to explore in depth the different aspects -sectoral and regional- playing a role in the creation of externalities and increasing returns in each activity. But it will be necessary as well to analyse the role of political and institutional factors together with the means and measures to modify them.

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ANNEX 1.

Statistical Sources

The (employment) data used in our analysis is provided by **Eurostat** (*Regio* Database). Eurostat uses the following classification: KIS (knowledge intensive services), HTS (high-tech services), HMTM (high and medium-tech manufacturing) and HerTM (Higher-tech manufacturing) together with both total manufacturing and total services. By means of a simple arithmetic operation we obtain the six sector used in our analysis that can be divided in high, medium and low knowledge/technology intensity: HKIS (HTS); MKIS (KIS minusHTS); LKIS (total services minus KIS); HTM (HerTM); MTM (HMTM minus HerTM); and LMT (total manufacturing minus HMTM).

Description of the variables used in the empirical analysis

VARIABLE	DESCRIPTION	NUMBER REGIONS WITH DATA	YEARS AND PERIOD
HKIS	High Knowledge Intensive Services	161	2001 y 1994
MKIS	Medium Knowledge Intensive Services	161	2001 y 1994
LKIS	Low Knowledge Intensive Services	202	2001 y 1994
HTM	High Tech Manufactur	110	2001 y 1994
MTM	Medium Tech Manufacturing	110	2001 y 1994
LTM	Low Tech Manufacturing	172	2001 y 1994
VARIATIONS HKIS, MKIS		154	1994-2001
VARIACIÓNES LKIS		202	1994-2001
VARIATIONS HTM, MTM		104	1994-2001
VARIATIONS LTM		166	1994-2001

Exceptions regarding the period considered:

- For German, Finisch and Austrian regions: Years 1995 and 2001
- For Swedish regions: Years 1995 and 2000
- For UK regions: Years 1996 and 2001

Activity branches (NACE Rev. 1) included in the sectors used in our classification

SECTOR	NACE (REV-1)
HKIS	64. Post and telecommunications 72. Computer and related activities 73. Research and development
MKIS	61. Water transport 62. Air transport 65. Financial intermeditation, except insurance and pension funding 66. Insurance and pension funding, except compulsory social security 67. Activities auxiliary to financial intermediation 70. Real estate activities 71. Renting of machinery and equipment without operator and of personal and household goods 74. Other business activities 80. Education 85. Health and social work 92. Recreational, cultural and sporting activities.
LKIS	50. Sale, maintenance and repair of motor vehicles, motorcycles and persoanl and household goods 51. Wholesale trade and commission trade, except of motor vehicles and motorcycles 52. Retail trade, except of motor vehicles and motorcycles; reparir of personal and household goods 55. Hotels and restaurants 60. Land, transport, storage and communication 63. Supporting and auxiliary transport activities; activities of travel agencies 75. Public administration and defence; compulsory social security 90. Sewage and refuse disposal, sanitation and similar activities

	91. Activities of membership organisation n.e.c 93. Other service activities 95. Extra-territorial organisations and bodies
HTM	30. Manufacture of office machinery and computers 32. Manufacture of radio, television and communication equipment and apparatus 33. Manufacture of medical, precision and optical instruments, watches and clocks
MTM	24. Manufacture of chemicals and chemical products 29. Manufacture of machinery and equipment n.e.c. 31. Manufacture of electrical machinery and apparatus n.e.c. 34. Manufacture of motor vehicles, trailers and semi-trailers 35. Manufacture of other transport equipment
LTM	15. Manufacture of food products and beverages 16. Manufacture of tobacco products 17. Manufacture of textiles 18. Manufacture of wearing apparel; dressing and dyeing of fur 19. Tanning and dressing of leather; manufacture of luggage, handbags, 20. Manufacture of wood and of products of wood and cork, except furniture; 21. Manufacture of pulp, paper and paper products 22. Publishing, printing and reproduction of recorded media 23. Manufacture of coke, refined petroleum products and nuclear fuel 25. Manufacture of rubber and plastic products 26. Manufacture of other non-metallic mineral products 27. Manufacture of basic metals 28. Manufacture of fabricated metal products, except machinery and equipment 36. Manufacture of furniture; manufacturing n.e.c. 37. Recycling

ANNEX 2.

Description of the indexes used in the analysis

The indicators used to measure absolute concentration has been the denominated *ratio of concentration* that is constructed by adding up the n first quotas of a distribution. The problem in this case is that it only considers the values for the selected n. We cannot use here the common Herfindahl index since this index is biased by the number of observations and, unfortunately, some regions do not count with data for some sectors (specially HKIS and HTM).

$$R.C.(n) = \sum_n Emp_{ik}$$

Regarding the measures of relative concentration a less conventional indicator has been used,. It has been constructed based on the quotas of relative sectorial concentration (RSC) of each region. These are the result of weighing the weight that a region has in the total employment of a certain sector by the weight of that region in European total employment. Values of this quota higher than 1 mean that the considered sector is relatively more concentrated in that region that the rest of sectors (and vice versa if it is lower than 1). If the value of this quota is equal to 1 it indicates that the sector is equally present in that region that the whole of the sectors. It must be said that, from the point of view of the regions, those quotas represent an index of regional specialisation.

The index of relative concentration is then constructed calculating the standard deviation of these quotas so that if that value is equal to 1 it indicates maximum concentration and if it is equal to 0, minimum concentration (that would be the case if all the regions had an RSC equal to 1). [9]

$$SD(RCS-1))/(RCS+1) \qquad RCS_{ik} = \frac{Emp_{ik} \Big/ \displaystyle\sum_i Emp_{ik}}{\displaystyle\sum_k Emp_{ik} \Big/ \displaystyle\sum_i \sum_k Emp_{ik}}$$

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[9] In order to calculate its average, the RSC has been standardized so it takes a certain superior limit (equal to 1) and an inferior one (equal to -1).

ANNEX III.

Results of the empirical analysis

Table 1. Levels and tendencies of concentration of the 6 sectors by regions, 2001

	A.C. R.C.n=15	R.C. S.D CERs	Rel.Var 94-01
HKIS	0,314	0,187	0,038
HTM	0,305	0,255	0,055
MKIS	0,268	0,091	-0,010
MTM	0,402	0,226	0,021
LKIS	0,209	0,077	-0,001
LTM	0,236	0,188	0.020

A.C. : Absolute Concentration; C.R. : Relative Concentration;
Source: Own-elaboration based on Eurostat data

Table 2. Absolute Regional Quotas, top regions 2001

	HKIS		HTM		MKIS		MTM		LKIS		LTM
fr1 Île de France	6,63%	fr1 Île de France	4,13%	fr1 Île de France	4,70%	it2 Lombardia	4,77%	fr1 Île de France	3,03%	it2 Lombardia	3,86%
uki2 Outer London	2,66%	ie Ireland	2,76%	it2 Lombardia	2,28%	de11 Stuttgart	4,37%	it2 Lombardia	1,97%	pt11 Norte	2,27%
es3 Com. Madrid	2,61%	it2 Lombardia	2,76%	uki2 Outer London	2,24%	fr1 Île de France	3,08%	es61 Andalucia	1,49%	es51 Cataluña	2,01%
it2 Lombardia	2,31%	de11 Stuttgart	2,57%	fr71 Rhône-Alpes	1,73%	es51 Cataluña	3,04%	it6 Lazio	1,43%	fr71 Rhône-Alpes	1,55%
ukj1 Berkshire,Bucks...	2,08%	de21 Oberbayern	2,28%	uki1 Inner London	1,68%	de21 Oberbayern	2,85%	dea1 Düsseldorf	1,38%	it4 Emilia-Romagna	1,46%
it6 Lazio	1,89%	de71 Darmstadt	2,06%	nl33 Zuid-Holland	1,54%	it11 Piemonte	2,84%	es51 Cataluña	1,35%	es52 Com. Valencia	1,43%
de21 Oberbayern	1,87%	de13 Freiburg	1,89%	es3 Com. Madrid	1,51%	deb1 Koblenz	2,50%	es3 Com.Madrid	1,32%	it11 Piemonte	1,40%
de71 Darmstadt	1,69%	de12 Karlsruhe	1,89%	dea1 Düsseldorf	1,49%	de71 Darmstadt	2,40%	fr71 Rhône-Alpes	1,25%	fr1 Île de France	1,39%
fr71 Rhône-Alpes	1,61%	fr71 Rhône-Alpes	1,56%	de21 Oberbayern	1,48%	dea1 Düsseldorf	2,30%	uki2 Outer London	1,21%	it51 Toscana	1,35%
uki1 Inner London	1,53%	es3 Com. Madrid	1,55%	de71 Darmstadt	1,44%	dea2 Köln	2,21%	gr3 Attiki	1,13%	dea1 Düsseldorf	1,34%
nl33 Zuid-Holland	1,45%	nl41 Noord-Brabant	1,52%	de3 Berlin	1,37%	fr71 Rhône-Alpes	2,18%	fr82 Provence-Alpes	1,10%	de11 Stuttgart	1,31%
se01 Stockholm	1,36%	ukm3 South W. Scotlan	1,51%	es51 Cataluña	1,36%	de12 Karlsruhe	2,18%	dea2 Köln	1,10%	dea5 Arnsberg	1,25%
ukj2 Surrey, East &..	1,33%	dea1 Düsseldorf	1,43%	nl32 Noord-Holland	1,34%	it4 Emilia-Romagna	2,12%	pt13 Lisboa e Vale	1,09%	deb1 Koblenz	1,09%
es51 Cataluña	1,23%	ukj1 Berkshire, Bucks	1,36%	it6 Lazio	1,34%	dea5 Arnsberg	1,81%	de21 Oberbayern	1,09%	fr51 Pays de la Loire	1,00%
ie Ireland	1,22%	es51 Cataluña	1,32%	dea2 Köln	1,33%	de14 Tübingen	1,61%	it8 Campania	1,05%	es61 Andalucia	0,97%
dea1 Düsseldorf	1,21%	de14 Tübingen	1,31%	fr82 Provence-Alpes	1,27%	ukg3 West Midlands	1,60%	it32 Veneto	1,02%	fr3 Nord-Pas-Calais	0,97%

Source: Own-elaboration based on Eurostat data

Table 3. Relative Regional Quotas, 2001

HKIS Top 15		HKIS Bottom 15		HTM Top 15		HTM Bottom 15		MKIS Top 15		MKIS Bottom 15		MTM Top 15		MTM Bottom 15	
Ukj1 Berkshire, Bucks …	2,693	es41 Castilla y León	0,496	de13 Freiburg	2,633	fr72 Auvergne	0,486	uki1 Inner London	1,674	de27 Schwaben	0,775	de11 Stuttgart	2,647	pt11 Norte	0,531
Se01 Stockholm	2,092	de73 Kassel	0,494	fi15 Pohjois-Suomi	2,609	pt11 Norte	0,449	se08 Övre Norrland	1,477	it4 Emilia-Romagna	0,773	de91 Braunschweig	2,387	es52 Com. Valencia	0,522
Ukh2 Bedfordshire, Hertf	2,023	es24 Aragón	0,491	ie Ireland	2,407	be33 Liège	0,440	nl31 Utrecht	1,411	es51 Cataluña	0,771	de22 Niederbayern	2,187	fi13 Itä-Suomi	0,501
Fr1 Île de France	1,889	ded1 Chemnitz	0,489	ukm3 S. Western Scotland	2,209	es21 Pais Vasco	0,422	nl32 Noord-Holland	1,410	it52 Umbria	0,770	de14 Tübingen	2,179	it91 Puglia	0,477
Nl31 Utrecht	1,888	it91 Puglia	0,488	de14 Tübingen	2,161	it91 Puglia	0,419	se01 Stockholm	1,402	de23 Oberpfalz	0,762	de26 Unterfranken	2,023	it6 Lazio	0,470
Es3 Com. de Madrid	1,887	be25 West-Vlaandere	0,488	fr43 Franche-Comté	2,126	be32 Hainaut	0,401	uki2 Outer London	1,364	de22 Niederbayern	0,758	fr43 Franche-Comté	1,970	se01 Stockholm	0,461
Nl23 Flevoland	1,831	es61 Andalucia	0,483	de14 Tübingen	2,092	be21 Antwerpen	0,397	se04 Sydsverige	1,356	it51 Toscana	0,754	de12 Karlsruhe	1,962	nl22 Gelderland	0,454
Be24 Vlaams Brabant	1,815	dea4 Detmold	0,473	de12 Karlsruhe	2,007	it51 Toscana	0,384	nl11 Groningen	1,320	es11 Galicia	0,753	de27 Schwaben	1,936	nl33 Zuid-Holland	0,454
Uki2 Outer London	1,813	es42 Castilla Mancha	0,468	ukj3 Hampshire & i. of Wight	1,956	pt13 Lisboa e Val...	0,365	ukj2 Surrey, E. W. Sussex	1,304	es53 Illes Balears	0,738	it11 Piemonte	1,841	at13 Wien	0,443
Fi16 Uusimaa (suuralue)	1,801	de22 Niederbayern	0,467	de25 Mittelfranken	1,943	nl33 Zuid-Holland	0,333	be1 Région Bruxelles-	1,282	es24 Aragón	0,736	de23 Oberpfalz	1,736	fr82 Provence-	0,438
Uki1 Inner London	1,706	gr12 Kentriki Makedon	0,443	de11 Stuttgart	1,833	fr3 Nord-Pas-Calais	0,275	nl33 Zuid-Holland	1,280	it11 Piemonte	0,736	de73 Kassel	1,736	nl11 Groningen	0,416
Ukj3 Hampshire & i. of Wight	1,596	es7 Canarias (ES)	0,431	nl41 Noord-Brabant	1,822	ita Sicilia	0,267	se06 Norra Mellansverige	1,280	it32 Veneto	0,732	de25 Mittelfranken	1,702	uki2 Outer London	0,375
Ukj2 Surrey, E. & W. Sussex	1,565	at34 Vorarlberg	0,425	nl42 Limburg (NL)	1,800	nl32 Noord-Holland	0,248	ukd5 Merseyside	1,274	es52 Com. Valenciana	0,731	fr42 Alsace	1,662	es61 Andalucia	0,361
It6 Lazio	1,487	es11 Galicia	0,418	ded2 Dresden	1,762	es52 Com. ValenciA	0,190	be31 Brabant Wallon	1,267	it53 Marche	0,720	ukg3 West Midlands	1,599	ita Sicilia	0,280
Ukh1 East Anglia	1,477	pt11 Norte	0,291	deg Thüringen	1,598	es61 Andalucia	0,115	se0a Västsverige	1,266	it71 Abruzzo	0,664	de21 Oberbayern	1,588	nl32 Noord-Holland	0,226

LKIS Top 15		LKIS Bottom 15		LTM Top 15		LTM Bottom 15	
Es53 Illes Balears	1,587	be25 West-Vlaanderen	0,838	pt11 Norte	2,643	it6 Lazio	0,526
Es7 Canarias (ES)	1,585	de13 Freiburg	0,837	it53 Marche	2,164	ukj1 Berkshire, Bucks & Oxford	0,526
Ita Sicilia	1,404	fi13 Itä-Suomi	0,828	pt12 Centro (P)	2,042	ukj3 Hampshire & i. of Wight	0,523
Itb Sardegna	1,379	se08 Övre Norrland	0,808	at34 Vorarlberg	1,920	ukk4 Devon	0,516
es61 Andalucia	1,367	de12 Karlsruhe	0,776	de24 Oberfranken	1,789	it93 Calabria	0,507
it93 Calabria	1,287	fi17 Etelä-Suomi	0,771	gr24 Sterea Ellada	1,783	be24 Vlaams Brabant	0,506
it6 Lazio	1,274	fi15 Pohjois-Suomi	0,768	es52 Comunidad Valenciana	1,729	es7 Canarias (ES)	0,505
it13 Liguria	1,271	fi14 Väli-Suomi	0,753	dea4 Detmold	1,716	fr81 Languedoc-Roussillon	0,495
de8 Mecklenburg-Vorpommern	1,268	de14 Tübingen	0,741	it2 Lombardia	1,712	be31 Brabant Wallon	0,473
pt13 Lisboa e Vale do Tejo	1,250	se0a Västsverige	0,738	it51 Toscana	1,674	fr1 Île de France	0,453
it31 Trentino-Alto Adige	1,249	uki1 Inner London	0,727	se09 Småland med öarna	1,630	uki1 Inner London	0,441
it91 Puglia	1,249	se04 Sydsverige	0,724	es42 Castilla-la Mancha	1,614	fr82 Provence-Alpes-	0,439
gr3 Attiki	1,239	de11 Stuttgart	0,719	gr12 Kentriki Makedonia	1,609	ukj2 Surrey, E. & W.Sussex	0,436
fr81 Languedoc-Roussillon	1,233	se06 Norra Mellansverige	0,717	it52 Umbria	1,568	de3 Berlin	0,436
at32 Salzburg	1,229	se09 Småland med öarna	0,587	fr21 Champagne-Ardenne	1,561	uki2 Outer London	0,418

Table 4. Correlations between relative concentration quotes and GDP pc, 2001

Correlaciones

		HKIS	MKIS	LKIS	HTM	MTM	LTM	PIBPC00
HKIS	Correlación de Pearson	1	,620**	-,331**	,220*	-,232*	-,575**	,403**
	Sig. (bilateral)	,	,000	,000	,023	,015	,000	,000
	N	161	161	161	107	109	154	161
MKIS	Correlación de Pearson	,620**	1	-,429**	,110	-,458**	-,668**	,249**
	Sig. (bilateral)	,000	,	,000	,260	,000	,000	,001
	N	161	161	161	107	109	154	161
LKIS	Correlación de Pearson	-,331**	-,429**	1	,064	,320**	-,018	-,145*
	Sig. (bilateral)	,000	,000	,	,506	,001	,815	,043
	N	161	161	194	110	112	174	194
HTM	Correlación de Pearson	,220*	,110	,064	1	,283**	-,135	,283**
	Sig. (bilateral)	,023	,260	,506	,	,003	,160	,003
	N	107	107	110	110	109	110	110
MTM	Correlación de Pearson	-,232*	-,458**	,320**	,283**	1	,332**	,161
	Sig. (bilateral)	,015	,000	,001	,003	,	,000	,090
	N	109	109	112	109	112	112	112
LTM	Correlación de Pearson	-,575**	-,668**	-,018	-,135	,332**	1	-,208**
	Sig. (bilateral)	,000	,000	,815	,160	,000	,	,006
	N	154	154	174	110	112	174	174
PIBPC00	Correlación de Pearson	,403**	,249**	-,145*	,283**	,161	-,208**	1
	Sig. (bilateral)	,000	,001	,043	,003	,090	,006	,
	N	161	161	194	110	112	174	202

**. La correlación es significativa al nivel 0,01 (bilateral).

*. La correlación es significante al nivel 0,05 (bilateral).

Note: GDP values refer the year 2000   Source: Own-elaboration based on Eurostat data