40th Congress of the European Regional Science Association

Barcelona (Spain) 29th August - 1st September, 2000

(preliminary draft)

The various structure of the European regions

by Enrico Marelli

Dipartimento di Scienze Economiche
Via San Faustino 74/B – 25122 Brescia – Italy
tel. ++39-030-2988828, fax ++39-030-2988837
e-mail: emarelli@eco.unibs.it

Abstract

This paper intends to investigate the differentiated economic structures of the European regions and their evolutions over time, in order to ascertain whether a convergence process has been realised. This is important not only with reference to long-run growth, but also in view of the process of economic and monetary integration within the EU and of the success of the European Monetary Union.

Initially, I analyse the distribution of employment between the main productive sectors, over the period 1983-97 and I try to verify whether some clusters of regions can be detected. Then, I try to explain the different evolutions over time and their implications. Finally, I relate the productive structures to the level of development and to convergence in per-capita incomes.

1. Introduction

Purpose of this paper is to examine the structure of the European regions, both in terms of its implications for long-run growth potentialities – also to infer some conclusions about the process of convergence among the regions of the European Union (EU) – and with reference to the short-run macroeconomic performance, which may be influenced by different types of shocks and adjustment patterns. In particular, the recently born European Monetary Union (EMU) may lead to optimal outcomes if the economic structures are converging. A pessimistic view maintains that the integration process itself causes an increasing specialisation and divergence in sectoral structures; an alternative optimistic approach considers, on the contrary, convergence as a feasible outcome.

We shall explain in Section 2 the meaning of *economic structure*, that is much wider than the mere sectoral composition of production, althoug the latter may be considered a good starting point. Although I agree that a thorough analysis should be based upon an adequate disaggregation of the sectoral mix, for this paper, I have preferred to emphasise the regional breakdown (which cannot easily made compatible with a detailed sectoral disaggregation): thus, the distinction among the three broad sectors – agriculture, industry, services – has been judged sufficient at this stage.[1]

As a matter of fact, with a similar level of sectoral disaggregation, Cuadrado-Roura *et al.* (1999, p. 50) were able to conclude that, in the Spanish case, «the main source of whatever convergence that has been achieved in the past is the gradual homogeneisation of the sectoral structures of the different regions», rather than the oft-cited mechanisms of «diminishing returns to scale and technological diffusion».

The investigation of past evolutions of economic structures of the European regions – for a period when the integration process in the EU was already under way and the European Monetary System helped achieving a certain degree of macroeconomic convergence – may be useful to provide some hints for understanding the future working of EMU and its likely effects. This is an explicit assumption stated in Section 3.

The empirical research makes use of the Regio dataset of Eurostat, over the period 1983-97. I have included the twelve EU's countries (which were members of the Union before 1995), i.e. the so-called EU12 area, and the full sample comprises 145 regions (for a limited number of regions some data are lacking for the years before 1986

or 1988). The main economic variable I have used is *employment*, which has been disaggregated into the three broad economic sectors.

In addition to describing the basic characteristics of national and regional sectoral structures (Section 4), by means of a number of statistical indices, I have also related the structural variables to the level of economic development, by making use of different econometric methods, especially panel data estimations (Section 5). Section 6 presents some conclusions as well as possible directions for future research; in particular, I am planning not only to analyse a more disaggregated sectoral structure, in order to understand more specifically the different specialisations within the manufacturing sector, but also to use some other techniques (such as shift-share analysis and cluster analysis).

2. Motivation and related research

A satisfactory degree of *nominal convergence* has been achieved in the EU, and especially in *Euroland*, thanks to the Maastricht parameters and to the subsequent requirements imposed by the Stability and Growth Pact. But if we look at the *real* working of the European economies – growth capabilities, competitiveness, labour market performance, etc. – we can notice that the situation in Europe is far from being completely homogeneous.

Real convergence may be defined as the process leading to similar economic structures and can be grasped at two levels[2]:

1. in the long run, real convergence implies the narrowing of differences in the structural conditions of different countries (or regions), thus allowing the achievement of *similar steady states* and equal rates of growth (as maintained by the "conditional convergence" hypothesis in the economic growth literature);
2. in the short run, real convergence facilitates the *macroeconomic adjustment* after (symmetric or asymmetric) shocks and is thus reflected in *similar reactions* of real variables to economic shocks.

As to the first level of analysis, in addition to the recent growth literature, we should recall the pioneeristic works of development economists, who tried to understand the most important regularities of structural change - such as Colin Clark, Chenery, A.G. Fisher, Hirschman, Kaldor, Kuznets.[3] National and regional economies may differ in their level of development because of their different productive specialisations.

Sectors may, in turn, differ because of differences in capital intensity, scale economies, intersectoral linkages, technical progress as well as (according to more recent theories) the use of human capital, the "knowledge" intensity and the "tradablity" characteristics. To simplify, the well-known *three sectors law* is a good starting point of my analysis. Just think that in many regions of Southern Europe there is still a large primary sector (which hides an abundant amount of surplus labour); furthermore, while most European regions have started long time ago their process of tertiarisation, in some other regions the industrialisation stage has not yet been completed.[4]

To understand the second dimension of "real convergence", remember that in a monetary union, the traditional monetary and exchange-rate policies cannot be implemented anymore at the national level; fiscal policies are limited as well, because of the restrictions imposed by the "Pact for Stability and Growth". In addition, fiscal policies are deficient as well at the community level, due to the absence of a centralised European fiscal policy and to the lack of a system of automatic fiscal transfers from the EU budget.

In this context, a shock may produce *real effects* – on production, real income, employment and unemployment – that are more or less pronounced according to the characteristics of the *economic structure*. The latter includes elements such as[5]:

a) the nominal flexibility of the system (in terms of prices and wages);
b) the international and interregional mobility of resources: capital and especially labour;
c) the openness degree of the economies;
d) the sectoral composition of production (together with the diversification or concentration of industries);
e) the institutional organisation of markets, especially of the labour market;
f) the fiscal structure (including the system of fiscal transfers), along with the implementation of industrial, regional, educational, and other structural policies.

If the economic system is rigid, the mobility of resources is low, etc. some adverse real consequences may arise from different types of shocks: either demand-side or supply-side, symmetric or asymmetric. For example, following an *asymmetric shock*, production and employment may rise in certain economic systems and fall in some other economies; but even *symmetric shocks* may lead to differentiated responses in various countries or regions, at least in terms of the intensity of the effects, due to the

different economic structures (such as sectoral specialisations, nominal rigidities, labour mobility, structural policies and heterogeneous institutions).

In the case of idiosyncratic shocks, the asymmetry is automatically extended from *sectors* to *countries*, or more likely to *regions*, given the higher degree of openness and the greater specialisation of regions. It is common to recognise that regions, in contrast to countries, are normally characterised by a greater concentration of production and by the operation of regional specialisation effects, such as the external (localisation and agglomeration) economies.[6]

As far as regional evolutions are concerned, what have been past trends in Europe? Let me present, at this point (before describing my own empirical analysis), a synthetic review of previous researches on *regional disparities* in Europe. A first consideration is that interregional disparities in per capita incomes in the EU are not only much deeper than international ones but also greater in comparison with some areas of the same extension (such as the Usa). Over time, interregional disparities have decreased from the '50s to the '70s, while the pattern has become less clear in the '80s.[7]

The rate of convergence was not, even in the convergence period, particularly high (2 per cent per year was the estimated value of *β-convergence*), a speed unsatisfactory for many European regions, if one important objective of the EU is economic cohesion; moreover, *within-countries* convergence has been generally slower in the Southern European regions. An interesting result obtained for the '80s is that regional convergence in Europe either disappeared or was substituted by *club convergence* (for example, convergence clubs, as well as polarisation and stratification effects, have been found in Europe by Quah 1996).

Coming now, more specifically, to the likely evolution of regional disparities in the EMU setting and to their links with the structural problems, a first rather pessimistic view, sustained by Krugman, maintains that economic integration will lead to increased *specialisation*, diverging economic structures, and widening differences in growth rates. «The penalty is that regional economies, being less diversified, are more subject to technology and demand shocks. This leads to a greater risk of severe region-specific recessions. It also leads, in the presence of high factor mobility, to large divergences in long-term growth rates» [8].

On the other side, at least three counter arguments can be provided[9]:

1. so far, it seems that specialisation has been decreasing in European regions, at least if we consider broad economic sectors (as confirmed by the empirical analysis carried out in this research);
2. the degree of similarity will be enhanced by the increased competition (thanks to the 1992 Single Market, the liberalisation of capital flows and EMU itself);[10]
3. institutions and economic policies are substantially the same for all regions in the same nation and this may have a dampening effect.

In any case, the most accepted view is that – even in the absence of the traditional tools of economic policy – some reforms of product, labour and capital markets, may be necessary to minimise the negative effects of shocks. Such reforms are especially needed in the "deviating" countries. Of course, the policy response should be designed to overcome the negative effects of adverse shocks, especially when the market response and the market adjustment mechanism are lacking.

Thus, some authors have focused their attention on the alternative *adjustment mechanisms*: wage flexibility, labour mobility, change in participation rates, etc. In some previous studies, I have myself considered the role of the productive structure on the working of some adjustment mechanisms. Suppose that a national economy is adversely affected by a structural shock (e.g. a shift from the goods produced in one sector toward the output of another sector), then the existence of rigidities in the labour market and of corresponding frictions in the adjustment mechanisms (including the degree of labour mobility) may slow the growth of employment even in the expanding sectors, with negative effects on aggregate employment too: this is the famous Lilien's theory of *sectoral shifts*. In particular, I have attempted an empirical test of this theory both in the case of Italian sectors, by using a disaggregation into 16 productive sectors (Marelli, 2000a), and through an extension to the regional case, by considering a panel of 81 European regions over 14 years (Marelli, 2000b).

3. Assumptions, data-set and technical specifications

Before presenting my empirical research, I think it is useful to clarify the main working assumptions:

a) the investigation of recent *past evolutions* may provide some insights into the future; although some researchers maintain it could be wrong to infer from previous tendencies some indications for the future working of EMU, it should be specified

that I limit my investigations to the '80s and '90s, a period when the process of economic integration was already well under way in Europe;

b) I focus on the *regional* dimension, in consideration of the mentioned greater concentration of production in the regions and because the distinction (in a monetary union like EMU) between regions and countries has become blurred;

c) I concentrate on *employment*, both because of its signalling value of market unbalances and for its intrinsic importance in economic policy goals (jointly with unemployment),

d) I simplify the long list of variables characterising the economic structure (see Section 2) by emphasising the *sectoral mix* of production and by considering, specifically, the three broad economic sectors: agriculture, industry, services.

The empirical research makes use of the Regio dataset of Eurostat, over the period 1983-97. As already stated, the main economic variable which has been used is *employment*, which has been disaggregated into three economic sectors: agriculture, industry, services. The first sector includes forestry and fishery products; the second refers to manufacturing, mining and construction; the services include both private and public services. Some other economic variables which have been considered are the employment rates (employment over working age population) and real per capita income (at purchasing power parities).

I have considered the twelve countries, which were members of the European Union till 1995 (i.e. the so-called EU12 area) and the full sample comprises 145 regions.[11] They correspond to the NUTS-2 level region of Eurostat's classification. Eastern regions (länders) have not been included in the case of Germany and, because of a change in the regional classification, eight regions only are considered for the United Kingdom.

The following ratios and indices have been computed (for simplicity I leave aside the time subscript):

a) *sectoral share*: employment (*L*) in sector *i* of region *r* divided by total employment in region *r*, where *i* = *A* (agriculture), *M* (industry), *S* (services):

$$\lambda_{i,r} = L_{i,r} / L_r \qquad (1)$$

b) *normalised share* (sometimes called location coefficient): share of sector *i* in region *r* divided by the corresponding sectoral share in EU12:

$$\mu_{i,r} = \lambda_{i,r} / \lambda_{i,EU} \qquad (2)$$

c) *specialisation coefficient*: sum over all sectors of the absolute differences between sectoral shares in region *r* and the corresponding sectoral share in EU12 (divided by two):

$$(3) \qquad \sigma_r = \left(\sum_i \left| \lambda_{i,r} - \lambda_{i,EU} \right|\right)/2 \qquad \text{one for each region } r$$

(similar specialisation coefficients can be computed by comparing the regional shares with the national ones or the national shares with the EU12 average);

d) *inequality index*: sum over all regions of the squared differences between sectoral shares in region *r* and the corresponding sectoral share in EU12 (where *n* is the total number of regions, in our case n=145):

$$(4) \qquad \rho_i = \sum_r \left(\lambda_{i,r} - \lambda_{i,EU}\right)^2 / \, n \qquad \text{one for each sector } i \text{ ;}$$

moreover, a *total inequality index* can be computed by adding up the inequality indices pertaining to the individual sectors; in our case:

$$(5) \qquad \rho_T = \rho_A + \rho_M + \rho_S$$

4. Convergence in productive structures

Convergence in productive structures – in terms of employment distribution – in Europe will be evaluated at different levels. First, I shall look at the evolution of the sectoral mix in the European Union as a whole (as usual the EU12 aggregate is considered) and in the individual countries. Second, I shall examine the distribution of European regions according to their sectoral structure and the evolution of such distribution over time. Finally, some composite indicators – such as specialisation coefficients and inequality indices – will be analysed.

4.1 *Structure of production in European countries*

The evolution of the structure of production in the EU and in each single country of the Union is presented in Figs. 1-4. Three sectors are considered: agriculture, industry and services. The yearly data have been grouped in four 4-year (or 3-year) time intervals: 1983-86, 1987-90, 1991-93, 1994-97. The time breaks have been chosen also in order to ascertain a possible cyclical behaviour, by distinguishing the recession period (1991-93).

By focusing, first of all, on the *EU as a whole*, we can see (Fig. 1) that the share of agriculture has fallen - from the initial to the final sub-period - from 8% to 5%, that of industry from 34% to 30%, while the services have risen from 58% to 65%.

The weight of *agriculture* has been reduced everywhere. It is around or less than 3% in Germany, Luxembourg, Belgium and the United Kingdom. It remains significant in the Mediterranean countries (Greece, Portugal, Spain) plus Ireland, but even there it has moved close to or below 10% (Greece is the only exception). In absolute terms, the reduction in the shares has been large in the three mentioned Mediterranean countries and concentrated in the three initial sub-periods (much less in 1994-97). In relative terms, the shares of agriculture have been more or less halved – in about a decade – in Germany, France, Spain and Portugal.

Also the *industrial* sector has been regressing in all countries, because of the widespread tertiarisation processes. It remains significant in Germany, in Italy and in Portugal (36%, 32% and almost 32% are the corresponding shares): in all other countries, the share is below the European average; the lowest shares are found in Greece and the Netherlands. Over time, the largest reductions have been recorded in Luxembourg and the United Kingdom (about one fourth); the smallest ones in the Mediterranean countries (Italy, Spain, Portugal) as well as in Denmark and Ireland. In many countries, the biggest reductions in industrial shares have been concentrated in the 1994-97 sub-period, after the downturn of the early '90s and the restructuring phase of the manufacturing sector: this is the case, in particular, of Germany, France, the United Kingdom and Spain.

The *services* reach in every country at least 60% of total employment, but the share is now close or above 70% in the countries of North-Central Europe (France, Belgium, Luxembourg, the Netherlands, Denmark, and the United Kingdom). The lowest shares are recorded in Portugal and Greece (around 56%), despite the fastest growth (an increase of more than one fourth in the shares) in both countries. The process of tertiarisation has continued till the most recent sub-period, even in the countries with the biggest initial shares in the tertiary activities.

4.2 Structure of production in European regions

In consideration of Quah's observation of the importance of examining complete distributions and in order to preserve the highest degree of information, I have assembled Tables A.2-A.3-A.4 (in the Appendix), which represent the two-way regional

distributions of European regions according to their sectoral shares (one sector for each table), respectively in the initial subperiod (1983-86) and in the final one (1994-97).

In each year, the 145 European regions are distributed across the four quartiles (whose range is allowed to change from the initial to the final period, since I am interested in the *relative* position of each region in comparison to the European average). Tables A.2-A.3-A.4 include, in addition to the regional codes (the list of regions and countries is in Table A.1 in the Appendix), the normalised shares computed for the final sub-period with a formula similar to (2): $\mu_{i,r} = \lambda_{i,r} / \lambda_{i,X}$; as we can note, differently from (2), the reference area is each single country *X* (instead of the EU as a whole).

Thus, by considering the distribution across quartiles the mentioned tables provide some information about the relative position of regions in Europe as a whole; on the contrary, by looking at the numerical values of the normalised shares (μ's), we can infer the relative position of regions *within* countries.

- Agriculture

The two-way distribution relative to *agriculture* is in Table A.2. As to the regional distribution in the initial period (1983-86), the quartile ranges are delimited by the following shares: 5%, 8%, 15%. Thus, according to the initial shares in agriculture ($\lambda_{A,r}^{1}$, where *1* refers to the initial period), four groups of regions - presented in the first column of Table 1 - can be identified, according to their specialisation or de-specialisation (high or moderate, for both situations) in agriculture. In other words, Table 1 (similarly to Tables 2 and 3) provides a comment and a "guided tour" to the analytical tables in the appendix.

Let me now turn to a description of the second dimension of Table A.2 (which should be read along the columns), still relative to *agriculture*, but showing the regional distribution in the final period (1994-97). The shares delimiting the quartile ranges are now the following: 3%, 5%, 10%; comparing these shares with the previous ones (1983-86 sub-period) we have a corroboration of the decreasing weight of agriculture, on average, in *all* regions of Europe.

But I am interested, again, in *relative specialisation*. As a general observation, the *persistence* of the specialisation pattern emerges from the data, as confirmed by the agglomeration of regions along the main diagonal of Table A.2. Despite the full sample period refers to more than a decade, the transitions from one group to another group are

rare (although it must be added that the number of classes considered is rather small). Then, on the basis of the final shares in agriculture ($\lambda_{A,r}^{2}$, where *2* refers to the final period), the groups of regions listed in the second column of Table 2 can be distinguished (I focus my comments here on the *changes* relative to the initial distribution, i.e. on the transitions from one class to another). In general, agriculture seems concentrated in the Mediterranean regions.

Table 1 - Specialisation of European regions in Agriculture

Initial specialisation (1983-86)	Final specialisation (1994-97)
highly specialised in agriculture ($\lambda_{A,r}^{1}$>15%): eleven Greek regions, ten Spanish regions, five Portuguese regions, seven Italian regions (located in Mezzogiorno), five French regions and Ireland; the normalised shares, relative to the national averages, are in all cases greater than one;	*highly specialised in agriculture* ($\lambda_{A,r}^{2}$>10%): most of the regions were in this class in the initial period; however, an upward transition can be found in a few Mediterranean regions, which leave their initial group and become highly specialised in agriculture; in the final period, the highest shares in agriculture, above 30% (and even 40%), can be found in some Greek regions, while between 20% and 30% there is also one Portuguese region (PT2);
moderately specialised in agriculture (8%<$\lambda_{A,r}^{1}$<15%): in addition to some Mediterranean regions, some regions of Central Europe (French, German, Dutch) are here represented; the μ's, of course, are large and greater than one for the latter regions only;	*moderately specialised in agriculture* (5%<$\lambda_{A,r}^{2}$<10%): while three French regions and one Italian region leave the previous category of high specialisation in agriculture, two Spanish regions, one Belgian region and Northern Ireland increase moderately their specialisation in agriculture;
moderately de-specialised in agriculture (5%<$\lambda_{A,r}^{1}$<8%): many regions of Central Europe are included in this group (in addition to two British regions and Denmark), as well as few Italian and Spanish regions;	*moderately de-specialised in agriculture* (3%<$\lambda_{A,r}^{2}$<5%): a certain number of regions from Central Europe (especially Germany) reduce their relative specialisation and become moderately de-specialised, while some regions in Northern Europe (in addition to Lombardy, in Italy) reduce over time their strong de-specialisation;
highly de-specialised in agriculture ($\lambda_{A,r}^{1}$<5%): we find in this category most regions of Central and Northern Europe (German, Belgian, Dutch, British), as well as the regions incorporating the capital cities, either political or economic (FR1 Île de France, ES8 Comunidad de Madrid, GR10 Attiki, IT4 Lombardia); the μ's are greater than one in some British and Belgian regions, which confirms the very low specialisation in agriculture of the two countries as a whole.	*highly de-specialised in agriculture* ($\lambda_{A,r}^{2}$<3%): some French and German regions increase their de-specialisation in agriculture and reach this category; in the final period, the lowest shares, below 1%, can be found in the capital-city regions of Paris, Bruxelles, Berlin as well as in Bremen and in Ceuta y Melilla (Spain).

- Industry

Considering, at this point, Table A.3, relative to the *industrial sector*, the four rows refer to the regional distribution in the initial period (1983-86) and the quartile ranges are identified by the following grid: 28%, 34%, 39%. Again, four groups of

regions can be identified, according to the initial shares in industry ($\lambda_{M,r}^{1}$), and are listed in Table 2.

Table 2 - Specialisation of European regions in Industry

Initial specialisation (1983-86)	Final specialisation (1994-97)
highly specialised in industry ($\lambda_{M,r}^{1}$>39%): as expected, we find here eighteen German regions (more than half of the total number of regions), two British regions, one French region (FR11, Franche-Comté), but also some Mediterranean regions (five from Northern and Central Italy, one from Portugal and three from Spain, including Cataluña) are included; the normalised shares are greater than one, but of similar magnitude in all the mentioned regions;	*highly specialised in industry* ($\lambda_{M,r}^{2}$>34%): the transitions to this group refer to a number of regions (two from Spain, one each from Italy, France, Germany) which come from the moderately specialised category and one (ES10, Castilla-la Mancha) rises up from the moderately de-specialised group; in the final period, shares above 40% are recorded in nine German regions, in three Italian regions (Piemonte, Lombardia, Veneto), in one Spanish region (Comunidad Foral de Navarra) and in one Portuguese one (Norte);
moderately specialised in industry (34%<$\lambda_{M,r}^{1}$<39%): this group includes many regions from France, Belgium, Germany, plus Scotland, Wales, and, again, four Spanish regions, three Italian regions and one Portuguese one; the μ's are somehow greater than one;	*moderately specialised in industry* (29%<$\lambda_{M,r}^{2}$<34%): a German region (DE23 Köln), was previously higly-specialised in industry, while the highest number of transitions is from below (this is the case of many Mediterranean and French regions, that shift to the "highly specialised" group)
moderately de-specialised in industry (28%<$\lambda_{M,r}^{1}$<34%): this group is the most heterogeneous from a geographic point of view, since it includes regions from Southern Europe, from Central Europe and from the North too (for example many British and Dutch regions are in this group);	*moderately de-specialised in industry* (24%<$\lambda_{M,r}^{2}$<29%): some regions (including two British regions) shift their position from moderately specialised to moderately de-specialised, but many Italian regions (especially of Mezzogiorno), some French and Spanish regions, as well as Denmark, move toward this group coming from a complete de-specialisation situation;
highly de-specialised in industry ($\lambda_{M,r}^{1}$<28%): two types of regions are assembled in this group, many Mediterranean regions specialised in agriculture (of Italy, Spain, Portugal, Greece) and some regions of Central Europe (Belgium, the Netherlands, Denmark and also some French regions) specialised in service activities; in all cases, the μ's are less than one.	*highly de-specialised in industry* ($\lambda_{M,r}^{2}$<24%): despite the high persistence characterising this category, two French regions (including the capital city) and an Italian one reach this group; industrial shares very low, below 15%, in the final year, refer to the regions of Kriti (GR13), Ceuta y Melilla (ES17), Corse (FR22).

As to the second dimension of Table A.3, the four big columns refer to the distribution of European regions, according to their *industrial* share in the final period (1994-97). The grid delimiting the quartile ranges is the following: 24%, 29%, 34%; comparing these limiting shares with the previous ones (1983-86 sub-period) the de-industrialisation, on average, of *all* European regions is confirmed. Moreover, also in the case of industry, a *persistence* of the specialisation pattern seems to emerge from the data (see again the agglomeration of regions along the main diagonal of Table A.3), although the transitions seem more likely at the bottom range of the scale. Thus, by looking at the final shares in industry ($\lambda_{M,r}^{2}$), the European regions can be grouped in

the classes shown in the second column of Table 2. It seems that industry tends to be prevailing not only in Central Europe (Germany, Eastern France) but also in adjacent clusters of different countries.

- Services

Turning now to Table A.4, referring to the *services*, the four rows, corresponding to the regional distribution in the initial period (1983-86), define the quartile ranges based on the following grid: 50%, 56%, 60%. According to the initial shares in the services ($\lambda_{S,r}^{1}$), the group of regions of Table 3 can be determined.

Table 3 - Specialisation of European regions in the Services

Initial specialisation (1983-86)	Final specialisation (1994-97)
highly specialised in the services ($\lambda_{S,r}^{1}$>60%): in addition to the capital-city regions (Bruxelles, Berlin, Attiki, Comunidad de Madrid, Île de France, Lazio), this group includes most Belgian and Dutch regions, as well as some other regions from different countries; the μ's are normally greater than one, but not too much, which testifies the more equilibrated distribution of services among countries;	*highly specialised in the services* ($\lambda_{S,r}^{2}$>69%): most of the regions were in the same category a decade before, but there are two shifts upward (one of them refers to the capital-city region of Lisboa e Vale do Tejo); in the final year, the highest shares, above 75%, are recorded in the capital-city regions, in some other Belgian and Dutch regions, and finally in some touristic-oriented regions (like Provence-Alpes-Côte d'Azur);
moderately specialised in the services (56%<$\lambda_{S,r}^{1}$<60%): in this group, we find, again, many regions of Central and Northern Europe, but also five Italian regions, one Spanish region, one Portuguese and a Greek one; the μ's are around the value of unity;	*moderately specialised in the services* (63%<$\lambda_{S,r}^{2}$<69%): the transitions refer both to eight regions (especially of Germany and the United Kingdom), that have shifted downward from the category of highly specialised regions, and to nine regions (mainly of France and the United Kingdom) that have moved upward from the group of moderately de-specialised regions;
moderately de-specialised in the services (50%<$\lambda_{S,r}^{1}$<56%): this group includes not only many German industrialised regions, but also some regions from many other countries (France, Italy, Spain, the United Kingdom), specialised in industry as well;	*moderately de-specialised in the services* (57%<$\lambda_{S,r}^{2}$<63%): some German and French regions have reached this category by decreasing their specialisation in the services, but there also some regions (especially of Spain) that have increased their specialisation, leaving the last group of "highly de-specialised" regions;
highly de-specialised in the services ($\lambda_{S,r}^{1}$<50%): in this group we can find both some heavily-industrialised regions (especially of Germany and Italy) and many agriculture-oriented regions (of Spain, Portugal, and Greece); in all cases, the μ's are barely less than one.	*highly de-specialised in the services* ($\lambda_{S,r}^{2}$<57%): in this group we can detect one of the highest degrees of persistence, but two regions have reached this group by diminishing their tertiary specialisation, one of them (GR11, Voreio Aigaio) coming down from the category of moderately specialised regions; very low shares, below 50% in the final year, refer to some agricultural regions of Portugal, Spain and, especially, Greece.

By looking instead at the distribution of European regions according to their final share in the *services* (1994-97), the quartile ranges are delimited by following shares: 57%, 63%, 69%; if we compare these values with the previous ones (1983-86 sub-period) the tertiarisation of *all* European regions is clearly confirmed. A *persistence*

of the specialisation pattern is shown, again, by the data (see the concentration of regions along the main diagonal of Table A.4). The final shares in the services ($\lambda_{S,r}^2$), allow to group the European regions in the classes shown in the second column of Table 3. Services are particularly present either in the regions hosting the central government (or also important local authorities) or in regions with a clear orientation toward tourism.

4.3 Synthetic indices of specialisation

In order to discern, in a synthetic way, the changing pattern of specialisation, the *specialisation coefficients* relative to the European average have been computed according to formula (3) - both for the European countries (σ_c) and also for the individual regions (σ_r).[12] The first ones are shown in Table 4 in correspondence with the country's names; as to the latter, only the mean values for each country as well as their standard deviations (s.d.) and coefficients of variations (c.v.) are presented. The four traditional sub-periods are considered.

At the *country* level (σ_c), the highest specialisation coefficients can be found both in agriculture-oriented countries (Greece, Portugal) and in countries specialised in service activities (the Netherlands); Germany, because of its specialisation in the industrial sector, exhibits the greatest σ among the five biggest countries of Europe. France has the smallest σ, thus its sectoral structure can be assumed as an "ideal" European structure; however, in the final period, both Italy and Spain have almost reached the French value (for the two countries, some compensations between different types of regions have been probably at work).

Over time, in most countries there has been a fall in the national specialisation, especially where the initial coefficients were significantly high; in other cases, a steady situation can be detected (the only cases of rising coefficients are France and Italy, limited to the '90s in the latter country). As to the *regional* σ_r, the numerical values of the coefficients are greater than the previous ones (of course, the more disaggregated are the spatial units, the higher is the degree of specialisation), but they are all decreasing (including the French and Italian regions, on average).[13]

The dispersion of the σ_r within countries (as measured by the c.v.'s) has been steady or decreasing, thus confirming the convergence of the sectoral structures *within* countries: the only exceptions are provided by the French and Belgian regions (as well

as by many other European regions if we restrict our attention to the most recent sub-period, 1994-97).

In any case, the correlation between each period's regional specialisation coefficients and the initial ones (last row of Table 4) is quite high, which confirms the persistence of the pattern of specialisation across the 145 European regions of my sample. The same conclusion can be drawn from Fig. 5, where the final specialisation coefficients are related to the initial ones; the figure shows two important points:

a) the most specialised regions in 1994-97 more or less coincide with the most specialised regions in 1983-86 (i.e. the above mentioned persistence in the specialisation pattern);

b) for all regions, on average[14], the specialisation is however decreasing over time (the slope of the regression line is less than one).

The fall in the degree of specialisation, particularly in the countries and regions exhibiting initially high specialisation indices, has been found also in previous research (see, for example, Marelli 2000b). Even at a finer level of sectoral disaggregation, the decreasing specialisation of the European regions, especially since the mid-'80s, is confirmed by a recent research by OECD (1999).[15] Besides, it seems that structural convergence and diversification in production seem to be important forces which sustain employment growth in the European regions.[16]

It is worth noticing that the positive effect of structural convergence upon employment growth, which in the case of less-developed regions is related to the shift of labour from agriculture toward other sectors, does not exclude a similar positive effect on productivity growth, a result obtained in some other empirical studies. As a matter of fact, it seems that *aggregate convergence* in regional productivity in many cases (see for example Cuadrado-Roura et al. 1999, for the case of Spain) can be achieved thanks to structural change and to the mix effect, even in the absence of convergence in the individual sectors.

In terms of *shift-share analysis*, some researches (see for example Molle 1997) have shown that - as far as the productivity levels are concerned - the initial structure (the *share* component) invariably benefits the central regions of Europe, while the *shift* component favours the peripheral ones; from a dynamic point of view, the *reallocation* of labour from the low productive sectors (such as agriculture, the most important sector in poor regions) toward more productive ones is one important force leading to convergence in productivity and per-capita incomes.[17]

Finally, following Cuadrado-Roura et al. (1999, p. 44), I have also computed an *index of inequality in productive structures* (ρ_i), for the three sectors and for the total economies of the 145 European regions. If we look at Fig. 6, we can observe a clear decreasing trend both in the sectoral indices and in the total one, thus confirming the progressively more homogeneous productive structures of the EU regions.

The reduction has been more significant in the final part of the '80s, in the case of agriculture and in the services, while it has been slightly more important after 1992 in the industrial sector (whose level of inequality is in any case the lowest among the three broad sectors): probably because of the effects of the economic downturn of 1992-93 and of the subsequent restructuring phase (with firms' downsizing in some old-industrialised regions).

5. Income convergence and productive structures

After having examined the main characteristics of the productive structures of the European regions (and nations) and their evolution over time, let us now consider the links between economic growth and sectoral structure of production. I will start with the traditional analysis of income convergence, in terms of the study of sigma and beta convergence and of the analysis of complete distributions; then, I will focus on the effects of economic growth upon the productive specialisation of regions.

5.1 Regional per-capita incomes dispersion and distribution

The traditional analysis of the empirical growth literature considers both the so-called *sigma* and *beta* approaches.[18] While I will contemplate the second approach in the next section, the sigma approach consists of an analysis of the evolution over time of the dispersion of the regional (per-capita) incomes; as measures of dispersion, I have considered (instead of the more common standard deviations of the log income levels):

a) the coefficient of variation (mean divided by standard deviation);
b) the *sigma* coefficient (where $y_{r,t}$ is per-capita income and *ln* stands for logarithm):

(6) $$sigma_t = \left[\sum_r (\ln y_{r,t} - \ln y_{x,t})^2 / n\right]^{1/2}$$ for each period *t*

(*r* denotes a generic region, while *x* corresponds to EU or to an individual country).

The two dispersion measures are presented in Fig. 7. Data are once more taken from the Regio data set and refer, in this case, to the 1983-96 period. Per capita income is expressed in purchasing power parities. The c.v.'s and the sigma's are computed both

for the EU as a whole and for the individual countries; the results for the four big countries (Germany, France, Italy, Spain)[19] are shown in Fig. 7.

As to both dispersion measures, we can notice a steady trend in France and Germany, a slightly decreasing trend in Spain and a clearly rising trend in Italy, which clearly exhibits the greatest interregional dispersion. For the EU as whole, two inverted-U cycles seem to emerge, with the maximum values around the mid-'80s and the early part of the '90s.

Thus, *sigma* convergence seems to be absent for Europe as a whole; a different result will be obtained, in the next section, by referring to *beta* convergence (we know that the latter is a necessary but not sufficient condition to have the former). However, after Quah's (1996) suggestion to analyse the dynamics of complete distributions – since the beta-convergence approach fails, according to him, to account for the changes in regional inequalities – but preferring to adhere to a simple approach, I have prepared Fig. 8, where the cross-region distribution of an index of per-capita income (EU12=100) of all European regions is shown for three years: 1983, 1990, 1996. It is apparent a convergence toward the mean, particularly of the extreme regions located at the two tails of the distribution.[20]

5.2 Beta convergence in regional per-capita incomes

Since my aim, here, is to compare the *level of development* of different European regions and its evolution over time, rather than providing any empirical evidence in favour of against a particular theoretical model (neoclassical, endogenous growth, or other), income per capita[21] can be considered as a suitable variable.

The traditional beta-convergence approach requires to estimate a regression of the following type (where n=13 is the number of years):

$$(7) \qquad (\ln y_{r,96} - \ln y_{r,83})/ n = \alpha + \beta \ln y_{r,83} + \varepsilon$$

The Regr. 1, whose results are shown in Table 5, exhibits an estimated value of the β coefficient which is negative and significant, implying a speed of convergence slightly above 1% per year; however, the goodness of fit is rather low. The goodness improves significantly if – coming close to a *conditional convergence* approach – we add (see Regr. 2) some dummy variables (which turn out to be significant for all countries but Spain, France and Greece). The β coefficient, which remains negative and significant, increases its value from –0.013 to –0.056.

Thus, it seems that European regions are converging both to a common (EU12) steady-state level and also along local (national) paths; such paths in some countries (Italy, the U.K., the Netherlands, Portugal) are below the European average and in some others (Germany, Belgium) above it.

An "extended" beta convergence approach[22], that to some extent implies that each region may converge toward its own steady-state and exploits the full time-series information, is shown in Regr. 3, which is based on the equation:

$$(8) \qquad (\ln y_{r,t} - \ln y_{r,t-1}) = \alpha + \beta \ln y_{r,t-1} + \varepsilon$$

The equation has been estimated as a pooled regression, with fixed effects, and using as $y_{r,t}$ the normalised per-capita income (i.e. regional per-capita income divided by the average EU12 per-capita income): in this way, the lack of time-specific fix effects can be justified (without jeopardising the stationarity of the random disturbances). The β coefficient is still negative and significant.

A still different approach, i.e. a conditional convergence approach with the addition of some structural explanatory variables, or the estimation of separate convergence equations, one for each sector, has been followed by some other researchers.[23] It emphasises the role of the productive specialisation in the determination of the (relative) level of development.

In particular, many researchers have conformed to Kaldor's laws (1966) focusing on the manufacturing sector as the *engine of growth*, since it is able to exploit dynamic increasing returns to scale, an intensifying division of labour and to absorb surplus labour from other sectors. Thus, they have assumed the centrality of manufacturing for the growth of the aggregate economic system. However, many recent researches have found a positive and large effect coming from the services too.[24]

5.3 The explanation of sectoral shares

Differently from the above approach, we ask now – along the lines of C. Clark's *three sectors law* – how the sectoral shares are determined by the level of development as measured by per-capita income.

Regressions 4, 5, 6 (still presented in Table 5) relate the regional shares in agriculture, industry, and the services ($\lambda_{A,r}$, $\lambda_{M,r}$, $\lambda_{S,r}$), to the regional per-capita incomes (y_r). While the slope coefficients turn out – after estimating some pool regressions with fixed effects also in this case – significantly positive in the case of

service activities and significantly negative for agriculture, in the case of industry a quadratic form[25] resulted the best specification: the coefficients of both explanatory variables (y and y^2) are significant. As we know, the share of industry initially increases with the level of development and then begins to fall. The goodness of fit is high in all cases.

Regressions 7, 8, 9 substitute the regional fixed effects with national dummies (see Table 5). The numerical values of the estimated coefficients change (if compared with regressions 4, 5, 6): the slope coefficients are still negative for agriculture, positive for the services, and the quadratic form remains the best specification in the case of industry.[26] Although the overall goodness of fit decreases (if compared with the regional fixed effects case), the results interestingly show the positive coefficients of the country dummies in the case of industry, the negative ones for agriculture (with the exception of Italy) and negative for the services too (here the exception is the U.K.).[27]

6. Conclusions

In this paper, I have examined the evolution of the productive structures of 145 regions of the EU, based on three broad economic sectors. A firm result is that *specialisation* of European regions has been *decreasing* over time (1983-97), although I have also found *persistence*: the most specialised regions in the final period more or less coincide with the initially most specialised regions. Persistence is also confirmed by the rare transitions between quartiles of each sector's regional distribution. However, also the index of *inequality* in the regional distributions has diminished for all sectors.

The fall in the specialisation of European regions is related, of course, to the generalised process of tertiarisation. The analysis of *clusters* of individual regions, based on the quartiles of each sector's distribution, is useful to identify not only the regions which are more industrialised or still specialised in agriculture (relative to the European average), but also the individual regions that have augmented their specialisation in such sectors.

The examination of specific cases (from Tables 1-3) shows, for example, that a relative industrialisation can be found in many Mediterranean regions (though the absolute shares are still higher in Germany), thus confirming C. Clark's "three sectors law". In econometric terms, this law is verified by the regressions relating the shares of each sector to per-capita income.

As to *income convergence*, it seems validated by some regressions based on the *beta*-convergence approaches as well as by the investigation of complete distributions; the *sigma* dispersion index, on the contrary, exhibits a stationary trend.

How can the overall convergence in economic structures and the lack of convergence in incomes of European region coexist? This is possible if some other factors are working in opposite directions. Consequently, it becomes more important to study the other elements of the *economic structure* (see Section 2) or, at least, to consider a finer disaggregation of the sectoral structure. For instance, the persistence of the specialisation patterns, within manufacturing, of European regions (and also countries) has been stressed by many authors.[28]

This study is the task of my future research, in addition to the application of some other techniques (such as cluster analysis and shift-share analysis). Remember, to conclude, that all these issues are relevant also for the working and success of EMU and for the design of appropriate economic policies, to ease the adjustment processes following different types of shocks.

Notes

[1] For a finer sectoral disaggregation, based on 17 branches, see Molle (1997), who considers a longer time span (1950-90), but a smaller number of regions, relative to my research.
[2] See Marelli (2000b).
[3] See, for example, the works by Clark (1940), Hirschman (1958), Kaldor (1966) and the more recent reviews and refinements in Chenery, Robinson and Syrquin (1986).
[4] See Paci and Pigliaru (1999).
[5] As specified by the literature on *optimum currency areas* (briefly summarised in Marelli, 2000b).
[6] Remember also that increasing returns to scale are one of the distinguishing features of both the "new growth theory" and the "new trade theory".
[7] See, among others, Sala-i-Martin (1996).
[8] Krugman (1993), p. 247.
[9] See again Marelli (2000b).
[10] Some recent studies devoted to the European Monetary System's experience (see, for example, Artis and Zhang 1999) have found that the business cycles of the EMS countries have become more synchronised, probably because of increased international trade, openness of financial markets and growing capital flows. EMU, from this point of view, will probably lead to a further synchronisation, thus contrasting, to some extent, the negative possibly effects caused by an increasing degree of specialisation and stressed by Krugman.
[11] For certain disaggregated variables and some countries, a number of regional data were lacking for the years before 1988 (this is the case of many Greek regions), 1986 (Spain and Portugal), 1985 (some regions in the Netherlands).
[12] A similar coefficient has been used also by Krugman (1993), who has shown in this way that European nations are less specialised than US regions.
[13] From a geographical point of view, Molle (1997) found that the highest specialisation coefficients can be found either in the most central or in the most peripheral European regions.
[14] In only 24 regions, out of 145, there was an increase in specialisation, but in all cases it was a minor one, in any case referring to regions with an initial low value (smaller than 0.15) of the coefficient.
[15] On the other hand, if we use output (instead of employment) and if we compute the specialisation coefficients across countries (instead of regions), an increasing specialisation pattern seems to emerge.

[16] Some previous results (Marelli 2000b) seem to show that employment growth tends to be negatively associated with initial employment rates and positively associated with the change in the specialisation index.
[17] Of course, the two variables should be further distinguished. In the case of Italian regions, disparities in per-capita incomes (*y*), which harm the Mezzogiorno's regions, come from large differences in productivity levels (*Y/L*), wide differentials in activity rates (*LF/POP*) and even greater gaps in employment rates (*L/LF*), as confirmed by the huge disparities in unemployment rates (notice that: $Y/L * L/F * LF/POP = Y/POP = y$). See Marelli (1989).
[18] See Barro and Sala-i-Martin (1995).
[19] The U.K. has been excluded because the data for some regions were not available for the full period.
[20] Notice that some regional data were missing in the initial year (1983).
[21] Instead of the more correct "labour productivity" variable (see Paci 1997).
[22] The equation, initially proposed by Raimond, has been applied by Cuadrado-Roura *et al.* (1999), who has shown, on one hand, the presence of *catching-up* effects, but, on the other hand, the exhaustion of possibilities of convergence among the Spanish regions. See also Tondl (1999).
[23] Paci (1997) found, for 109 European regions, a beta-convergence in the industrial and tertiary sectors alone, not in agriculture.
[24] See for example Paci and Pigliaru (1999).
[25] With the addition of a trend variable.
[26] A quadratic specification (with the coefficients of y and y^2 significantly different from zero, positive and negative respectively) is confirmed also by a cross-section, across the 145 European regions, between the industrial shares in the final year and per-capita income in the same year (1996); national dummies are significant also in this regression and the Adj. R^2 is equal to 0.268.
[27] In the case of the services, a trend variable is also significant.
[28] Molle (1997) emphasises the lack of convergence in the structure of manufacturing.

References

Artis, M. J., Zhang, W. (1999), "Further evidence on the international business cycle and the ERM: is there a European business cycle?", *Oxford Economic Papers*, 51, 120-32.

Barro, R.J. and Sala-I-Martin, X. (1995), *Economic Growth*, New York, McGraw Hill.

Chenery, H.B., Robinson, S., and Syrquin, M. (eds.) (1986), *Industrialization and Growth*, Oxford University Press, Oxford.

Clark, C. (1940), *The Conditions of Economic Progress*, London (Macmillan, 1957).

Cuadrado-Roura, J. R., Garcìa-Greciano, B., Raymond, J.L. (1999), "Regional convergence in productivity and productive structure: the Spanish case", *International Regional Science Review*, 22, 35-53.

Hirschman, A.O. (1958), *The Strategy of Economic Development*, Yale University Press, New Haven.

Kaldor, N. (1966), *Causes of the Slow Rate of Economic Growth of the United Kingdom*, Cambridge University Press, Cambrige.

Krugman, P. (1993) "Lessons of Massachusetts for EMU", in: Torres F., Giavazzi F. (eds.), *Adjustment and Growth in the European Monetary Union*, Cambridge University Press, pp. 241-261.

Marelli, E. (2000a), "Aggregate and structural aspects of employment growth: the case of Italy, in: M.A. Landesmann, K. Pichelmann (eds.), *Unemployment in Europe*, The MacMillan Press, pp. 268-305.

Marelli, E. (2000b), "Convergence and asymmetries in the dynamics of employment: the case of the European regions", *Jahrbuch fur Regionalwissenschaft/Review of Regional Research*, v. 20, iss. 2, forthcoming.

Marelli, E. (1989), "Crescita, produttività e cambiamento strutturale nelle regioni italiane", *Rivista di Politica Economica*, v. 74, n. 5, pp. 55-127.

Molle, W. (1997) "The regional economic structure of the European Union: an analysis of long-term developments", in: K. Peschel (ed.), *Regional growth and regional policy within the framework of European integration*; proceedings of a conference on the occasion of 25 years Institute for regional research at the University of Kiel 1995, Heidelberg, Physica-Verlag, pp. 66-86.

OECD (1999), *EMU: Facts, Challenges and Policies*, Paris.

Paci, R. (1997), "More similar and less equal: economic growth in the European regions", *Weltwirtshaftliches Archiv*, 4, 605-634.

Paci, R. and Pigliaru, F. (1999), "European regional growth: do sectors matter?", in: J. Adams and F. Pigliaru (eds.), *Economic Growth and Change. National and Regional Patterns of Convergence and Divergence*, E. Elgar, Calthenham.

Quah, D. (1996), "Empirics for economic growth and convergence", *European Economic Review*, 40, 1353-1375.

Sala-I-Martin, X. (1996), "Regional cohesion: evidence and theories of regional growth and convergence", *European Economic Review*, 40, 1325-1352.

Tondl, G. (1999), "The Changing Pattern of Regional Convergence in Europe", *Jahrbuch fur Regionalwissenschaft/Review of Regional Research*, 1999, v. 19, iss. 1, pp. 1-33.

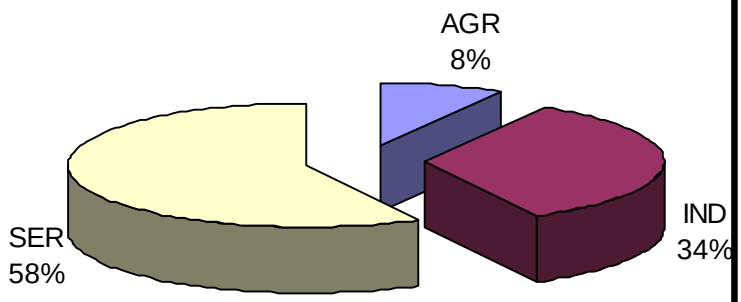
Table 4 - Specialisation coefficients and related statistics

	1983-86	1987-90	1991-93	1994-97
BE*	0.064	0.057	0.050	0.044
reg. mean	0.093	0.091	0.084	0.081
s.d.	0.050	0.048	0.051	0.050
c.v.	53.9	52.3	61.1	61.4
DK*	0.078	0.068	0.057	0.044
DE*	0.068	0.072	0.071	0.057
reg. mean	0.092	0.092	0.090	0.077
s.d.	0.042	0.043	0.040	0.038
c.v.	45.9	47.0	44.0	49.0
GR*	0.209	0.185	0.158	0.151
reg. mean	0.306	0.289	0.263	0.253
s.d.	0.120	0.118	0.103	0.105
c.v.	39.2	40.7	39.0	41.3
ES*	0.079	0.064	0.046	0.038
reg. mean	0.147	0.135	0.117	0.111
s.d.	0.081	0.069	0.057	0.053
c.v.	54.8	51.1	48.2	47.4
FR*	0.018	0.029	0.031	0.036
reg. mean	0.079	0.069	0.064	0.059
s.d.	0.042	0.043	0.037	0.041
c.v.	53.7	61.7	57.7	69.7
IE*	0.085	0.084	0.076	0.065
IT*	0.033	0.024	0.029	0.039
reg. mean	0.098	0.094	0.085	0.083
s.d.	0.047	0.044	0.039	0.029
c.v.	47.8	46.7	45.8	35.1
LU*	0.061	0.069	0.057	0.075
NL*	0.083	0.086	0.090	0.082
reg. mean	0.071	0.074	0.077	0.069
s.d.	0.062	0.057	0.060	0.053
c.v.	87.2	77.2	77.9	77.4
PT*	0.132	0.144	0.086	0.087
reg. mean	0.166	0.172	0.136	0.129
s.d.	0.080	0.080	0.049	0.054
c.v.	48.1	46.5	36.0	42.1
UK*	0.059	0.053	0.056	0.058
reg.mean°	0.061	0.056	0.048	0.042
s.d.	0.021	0.013	0.011	0.014
c.v.	34.8	23.2	22.8	34.4
correlation**		0.981	0.961	0.940

Notes: * specialisation coefficient of whole country vs. EU12
reg. mean: mean of regional specialisation coeff.s for each country
s.d.: standard deviations of above coefficients
c.v.: coefficient of variation.
** correlation of 145 reg.spec.coeff. of each period with initial ones
° only some regions of the whole country.

Table 5 - Beta convergence in European regions and explanation of sectoral shares									
Depend. variable:	*growth rate of per-capita income (y)*		*log difference of per-cap. inc. (y)*	*agric. share*	*industr. share*	*serv. share*	*agric. share*	*industr. share*	*serv. share*
	REGR.1	**REGR.2**	**REGR.3**	**REGR.4**	**REGR.5**	**REGR.6**	**REGR.7**	**REGR.8**	**REGR.9**
Period:	1983-96	1983-96	1983-96	1983-96	1983-96	1983-96	1983-96	1983-96	1983-96
Obs.incl.:	133	133	1817	1828	1818	1828	1828	1818	1828
Method:	OLS	OLS	Pool LS	Pool LS	Pool LS	Pool LS	Pool LS	Pool LS	Pool LS
Expl.vars.:									
const.	0.006*	0.255*					31.84*	-0.126*	41.10*
trend					-0.363*				0.616*
other:	*log initial (83) y*		*log lagged y*	*per-capita income (y)*			*per-capita income (y)*		
	-0.013*	-0.056*	-0.306*	-4.933*	14.406*	5.457*	-21.50*	50.06*	16.86*
	(-5.68)	(-18.22)	(-19.70)	(-5.88)	-6.31	(4.33)	(-30.65)	(19.2)	(20.75)
					(y^2)			*(y^2)*	
					-3.99*			-20.28*	
					(-5.07)			(-17.85)	
Dummies:			fixed eff.	fixed effects not reported					
DE		0.011*	not report.				-1.94*	9.85*	-8.88*
ES		0.003					-2.45*	4.69*	-2.62*
FR		-0.003					-1.78*	1.83*	-1.00
IT		-0.009*					1.02	1.64*	-3.4*
UK		-0.031*					-8.9*	4.81*	2.87*
BE		0.025*							
GR		0.005							
NL		-0.009*							
PT		-0.019*							
* significant at 5% (t-stat. in parentheses)									
Adj. R2	0.192	0.748	0.234	0.943	0.959	0.879	0.432	0.450	0.280
S.E.	0.008	0.004	0.045	2.235	1.643	3.356	7.069	5.996	8.187
F-stat	32.25	39.88					232.3	213.1	102.7

Fig. 1 - Sector shares in EU12 (1983-86)



(1994-97)

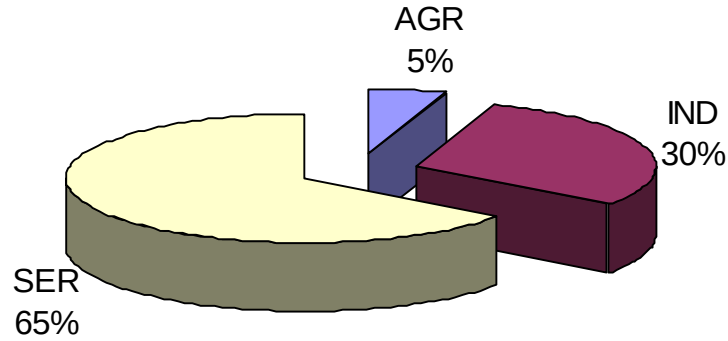


Fig. 2 - Sector shares: FR, DE, UK, IE (1983-86, 87-90, 91-93, 94-97)

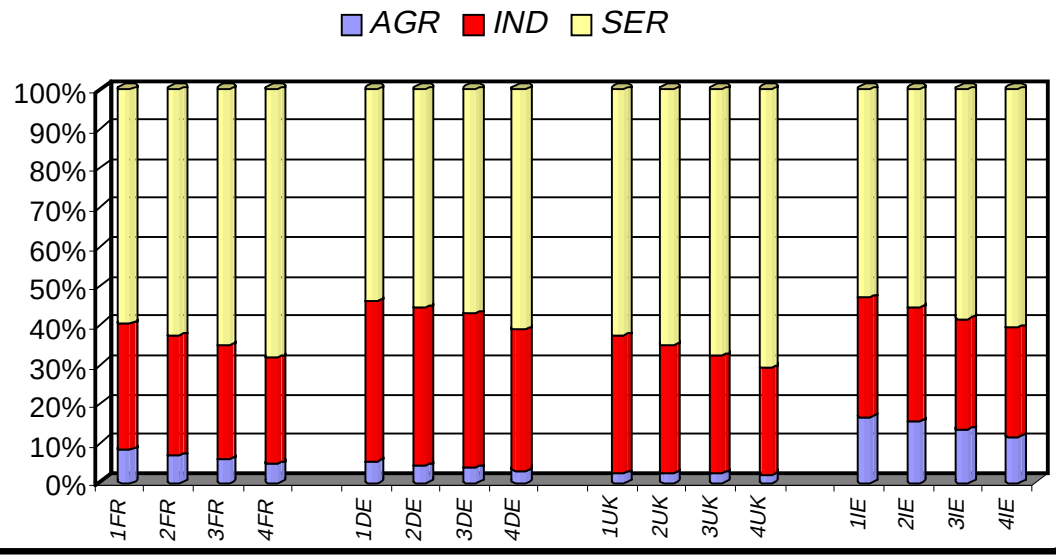


Fig. 3 - Sector shares: IT, ES, PT, GR
(1983-86, 87-90, 91-93, 94-97)

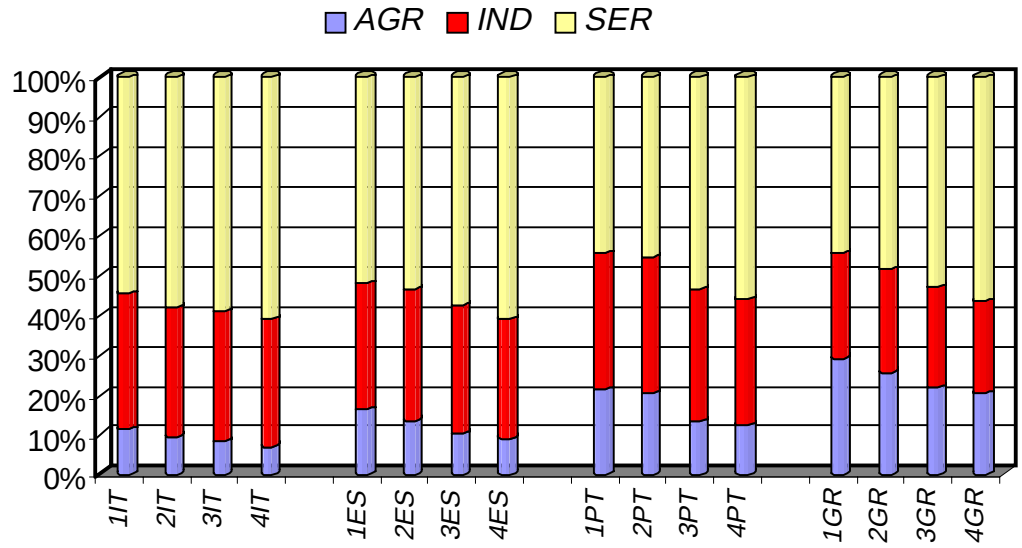


Fig. 4 - Sector shares: BL, NL, LU, DK
(1983-86, 87-90, 91-93, 94-97)

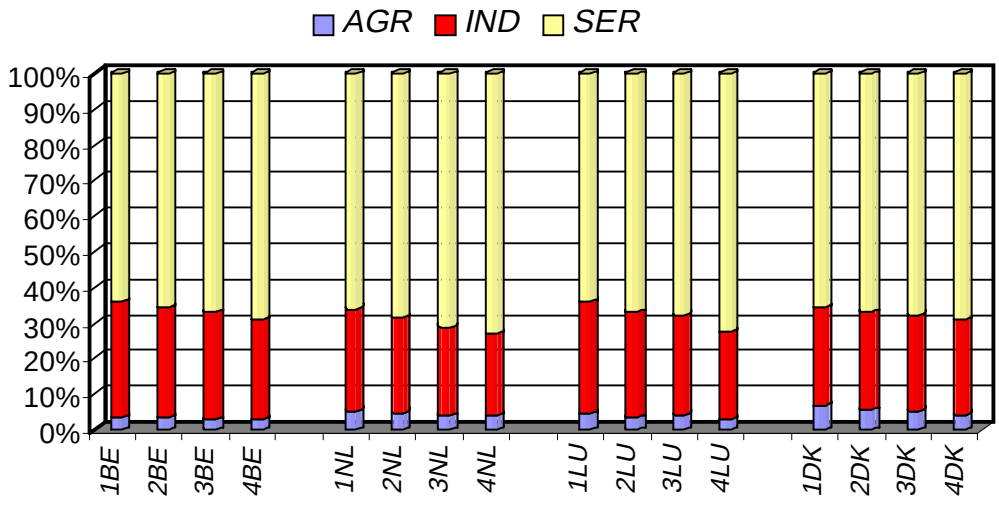


Fig. 5 - Specialisation coefficient in 145 EU regions: 1994-97 vs. 1983-86

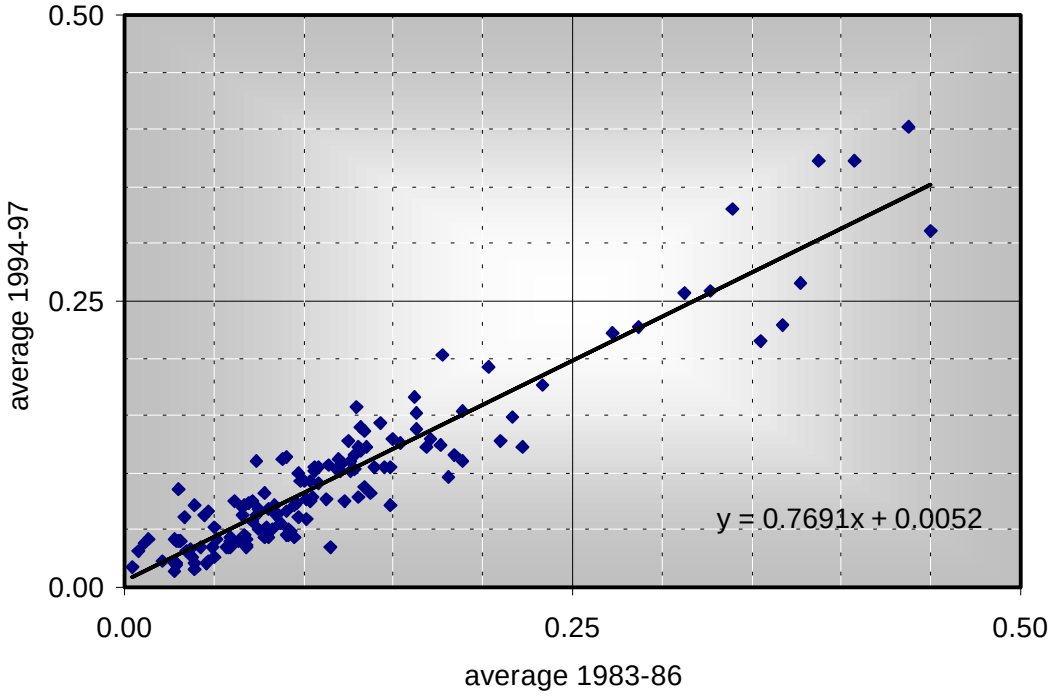
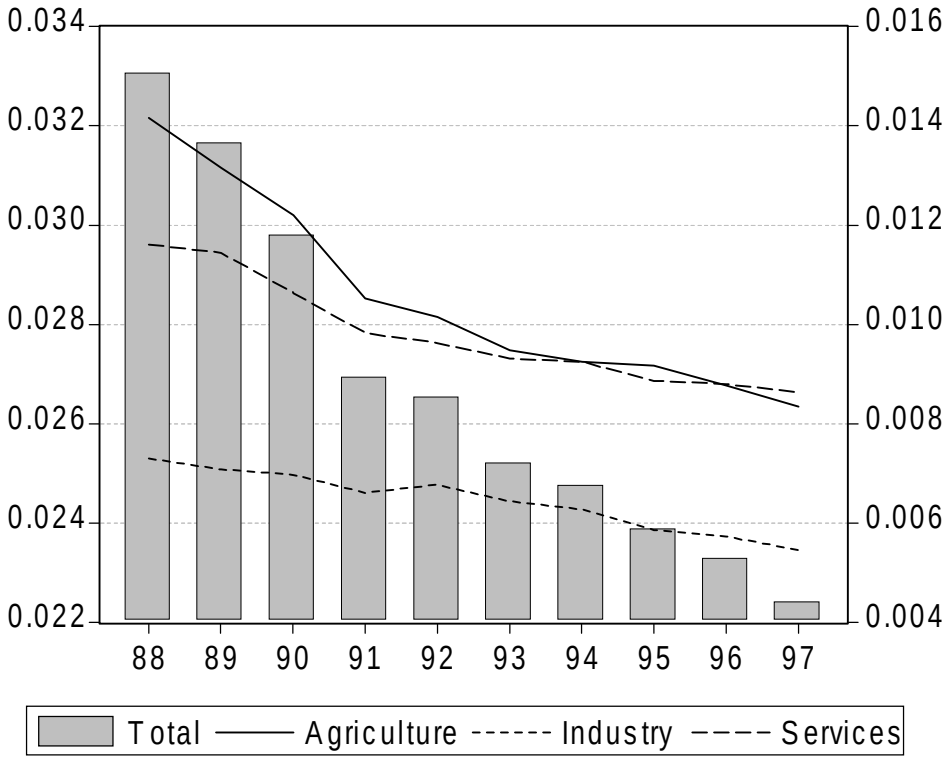


Fig. 6 - Inequality index (145 EU regions): total index (left scale) and by components (right scale)



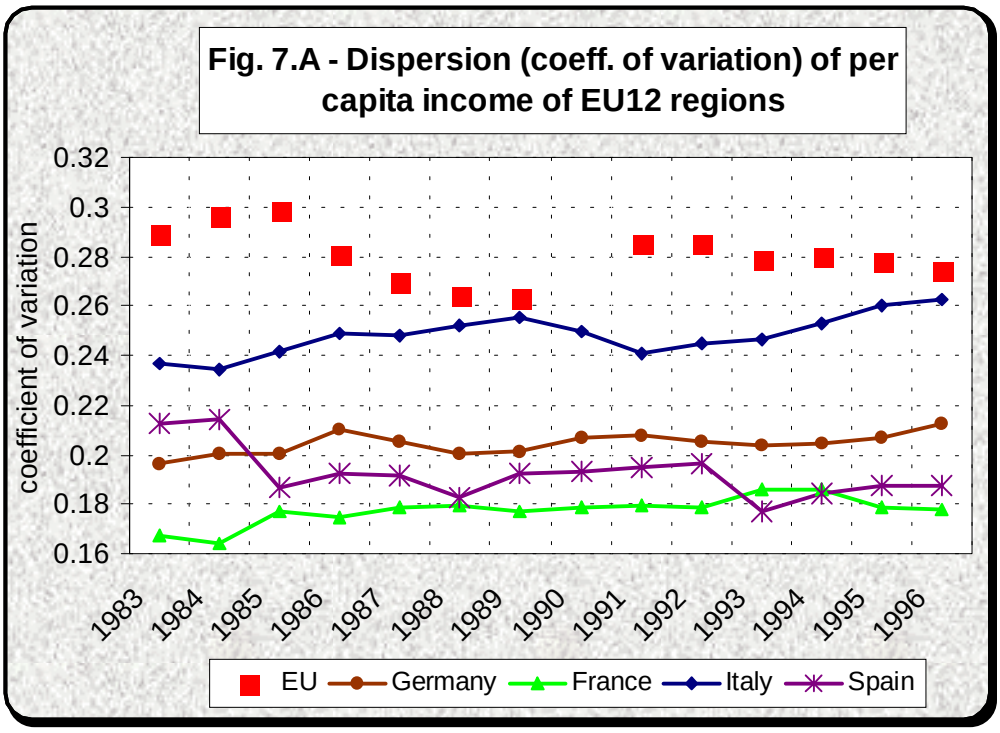


Fig. 7.A - Dispersion (coeff. of variation) of per capita income of EU12 regions
coefficient of variation
0.32
0.3
0.28
0.26
0.24
0.22
0.2
0.18
0.16
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
EU
Germany
France
Italy
Spain

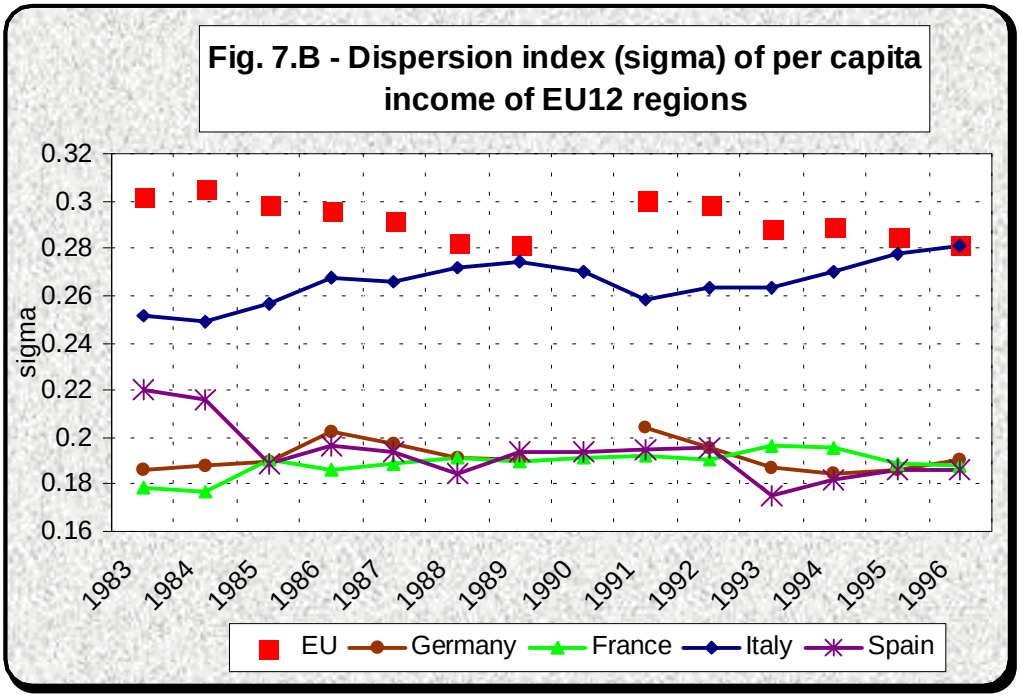
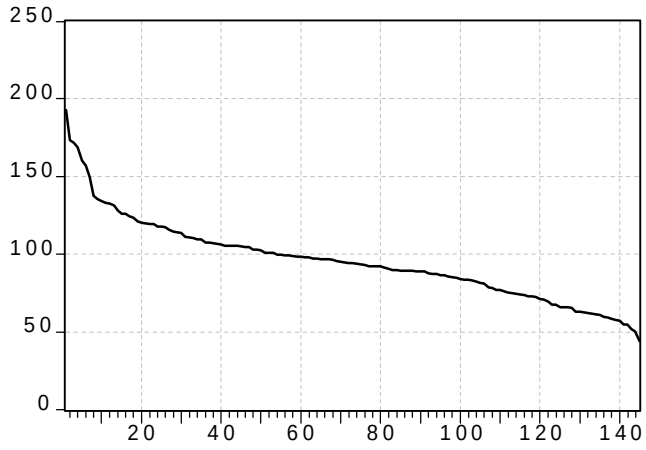


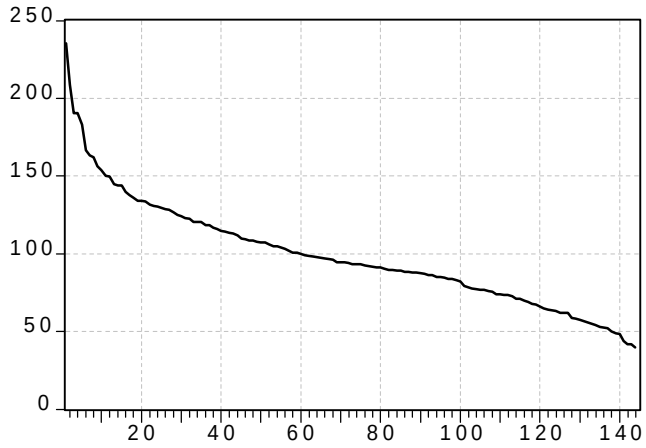
Fig. 7.B - Dispersion index (sigma) of per capita income of EU12 regions
sigma
0.32
0.3
0.28
0.26
0.24
0.22
0.2
0.18
0.16
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
EU
Germany
France
Italy
Spain

Fig. 8 - Distribution of 145 EU regions - Per capita income (ppp, EU12=100)

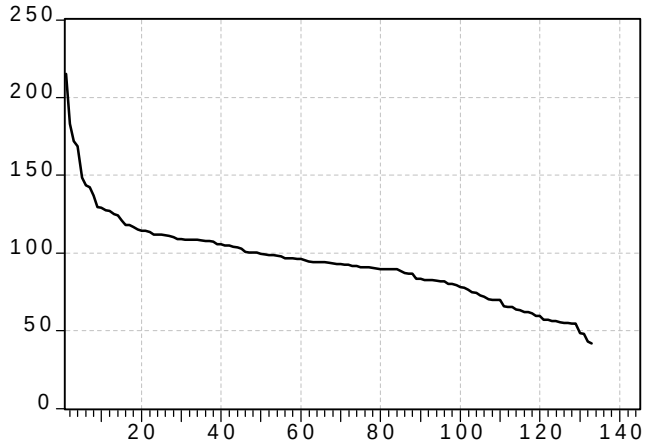
1996



1990



1983



APPENDIX

Table A.1 - Countries and regions in our sample

	Countries	DE28	Trier	FR19	Auvergne
BE	Belgium	DE29	Rheinhessen-Pfalz	FR20	Languedoc-Roussill.
DK	Denmark	DE30	Saarland	FR21	Prov.-Alpes-Côte d'A.
DE	Fed.Rep. of Germany	DE31	Schleswig-Holstein	FR22	Corse
GR	Greece	GR1	Anatoliki Maked., T.	IE	Ireland
ES	Spain	GR2	Kentriki Makedonia	IT1	Piemonte
FR	France	GR3	Dytiki Makedonia	IT2	Valle d'Aosta
IE	Ireland	GR4	Thessalia	IT3	Liguria
IT	Italy	GR5	Ipeiros	IT4	Lombardia
LU	Luxembourg	GR6	Ionia Nisia	IT5	Trentino-Alto Adige
NL	Netherlands	GR7	Dytiki Ellada	IT6	Veneto
PT	Portugal	GR8	Sterea Ellada	IT7	Friuli-Venezia Giulia
UK	United Kingdom	GR9	Peloponnisos	IT8	Emilia-Romagna
	Regions	GR10	Attiki	IT9	Toscana
BE1	Région Bruxelles	GR11	Voreio Aigaio	IT10	Umbria
BE2	Antwerpen	GR12	Notio Aigaio	IT11	Marche
BE3	Limburg (B)	GR13	Kriti	IT12	Lazio
BE4	Oost-Vlaanderen	ES1	Galicia	IT13	Abruzzo
BE5	Vlaams Brabant	ES2	Princip. de Asturias	IT14	Molise
BE6	West-Vlaanderen	ES3	Cantabria	IT15	Campania
BE7	Brabant Wallon	ES4	Pais Vasco	IT16	Puglia
BE8	Hainaut	ES5	Com.Foral de Navarra	IT17	Basilicata
BE9	Liège	ES6	La Rioja	IT18	Calabria
BE10	Luxembourg (B)	ES7	Aragón	IT19	Sicilia
BE11	Namur	ES8	Comunidad de Madrid	IT20	Sardegna
DK	Denmark	ES9	Castilla y León	LU	Luxembourg
DE1	Stuttgart	ES10	Castilla-la Mancha	NL1	Groningen
DE2	Karlsruhe	ES11	Extremadura	NL2	Friesland
DE3	Freiburg	ES12	Cataluña	NL3	Drenthe
DE4	Tübingen	ES13	Comun. Valenciana	NL4	Overijssel
DE5	Oberbayern	ES14	Baleares	NL5	Gelderland
DE6	Niederbayern	ES15	Andalucia	NL6	Flevoland
DE7	Oberpfalz	ES16	Murcia	NL7	Utrecht
DE8	Oberfranken	ES17	Ceuta y Melilla (ES)	NL8	Noord-Holland
DE9	Mittelfranken	ES18	Canarias (ES)	NL9	Zuid-Holland
DE10	Unterfranken	FR1	Île de France	NL10	Zeeland
DE11	Schwaben	FR2	Champagne-Ardenne	NL11	Noord-Brabant
DE12	Berlin	FR3	Picardie	NL12	Limburg (NL)
DE13	Bremen	FR4	Haute-Normandie	PT1	Norte
DE14	Hamburg	FR5	Centre	PT2	Centro (P)
DE15	Darmstadt	FR6	Basse-Normandie	PT3	Lisboa e Vale do Tejo
DE16	Gießen	FR7	Bourgogne	PT4	Alentejo
DE17	Kassel	FR8	Nord - Pas-de-Calais	PT5	Algarve
DE18	Braunschweig	FR9	Lorraine	PT6	Açores (PT)
DE19	Hannover	FR10	Alsace	PT7	Madeira (PT)
DE20	Lüneburg	FR11	Franche-Comté	UK1	Yorkshire, Humber
DE21	Weser-Ems	FR12	Pays de la Loire	UK2	East Midlands
DE22	Düsseldorf	FR13	Bretagne	UK3	West Midlands
DE23	Köln	FR14	Poitou-Charentes	UK4	East Anglia
DE24	Münster	FR15	Aquitaine	UK5	South West
DE25	Detmold	FR16	Midi-Pyrénées	UK6	Wales
DE26	Arnsberg	FR17	Limousin	UK7	Scotland
DE27	Koblenz	FR18	Rhône-Alpes	UK8	Northern Ireland