Specialisation and Convergence
of European Regions

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Abstract

The purpose of this paper was to analyze *specialization* and *convergence* of European countries and regions, within the framework of integration in the EU. This is important not only for long-term real convergence processes, but also for a proper functioning of the monetary union (in the line of research on the OCA's criteria, asymmetry of shocks and synchronization of business cycles). The position of new member states is particularly delicate, also considering the forthcoming adoption of the euro by some of them. As indicated by the EU Treaty, economic growth should be balanced with economic and social cohesion that includes a careful consideration of regional disparities.

Our empirical investigation focuses on the regions of EU25, further broken up into other relevant groupings (EU15, EMU, and the new members' EU10 group), over the period from 1980 (or 1990 for EU10) to 2005. This paper considers a rather fine regional disaggregation (NUTS-2 level), counting 250 regions.

The analysis of different *indices of specialisation* point to a prevalent increase of homogeneity of sector structures across European regions, although in some cases (especially in the industrial sector and in some services) specialisation has increased.

For convergence, a *sigma convergence*'s analysis confirms a reduction of disparities, both at a country and regional level. However, a trade-off between fast national growth and internal distribution has emerged in the early stages of development, as in the case of new members.

Moreover, *beta convergence* has also been established – regarding per capita income, employment and productivity – for almost all territorial aggregates (excluding the new members since 1999). The addition of structural variables, following a *beta-conditional* approach, indicates a positive role for services and a negative impact of agriculture. Finally, some preliminary results have been obtained by the innovative inclusion of specialisation indices within convergence regressions.

JEL Classification: R11, P52, O52

Keywords: regional economies, European regions, growth and convergence, specialisation

1. Introduction

Europe has recently experienced wide ranging and in depth integration. Considering the *deepening* aspect, the European Economic and Monetary Union (EMU) in 1999 and the circulation of the new common currency – the *euro* – since 1.1.2002 are the most momentous achievements, although some dark clouds have appeared since the arrest of the ratification process of the new Constitutional Treaty. Concerning the *widening* process, the 2004 enlargement was the most conspicuous in the EU's history. The ten new members are now adequately integrated in the single market and some of them are almost ready to adopt the euro as well.

The final goal of the EU[2] – to be achieved through the *common market* and the *economic and monetary union* – also includes *economic and social cohesion*, both between

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members (as the mention of *solidarity* would indicate) and within themselves. This is testified by the weight given to *regional policy*[3] and structural funds; and so regional convergence is an additional objective of EU.

The links between the two concepts – economic and monetary union (EMU) and economic and social cohesion (in particular regional convergence) are two-ways. On one hand, the EMU may be an instrument to achieve economic and social cohesion (but what is the evidence of the integration process so far?). On the other hand, economic convergence is also a prerequisite to accomplish an effective EMU.

Here, we do not refer to *nominal convergence* requirements (*à la* Maastricht), but rather to *real convergence* of European countries (and regions) as a condition to realize an advantageous EMU, as shown in the literature on *optimum currency areas* (OCA). We do not mean that real convergence – in per capita incomes, productivity, production and employment structures – is a prerequisite for the euro's adoption[4], but rather that real convergence helps the effective working of EMU and raises net benefits of the union.

To appraise such links empirically, this paper focuses on the European integration process, distinguishing separate time intervals: the '80s (before the Single Market of 1992), the '90s (the decade of the run-up to EMU) and recent years since 1999. From a spatial point of view, a first distinction between *old* and *new* member states is self-evident, but it is important to differentiate between the eurozone and the remaining EU's members as well (thus the EU25, EU15, EU10 and EU12 aggregates will be used).

Given the importance to account for the *regional* and national dimension, about 250 "NUTS-2 level" regions will be considered. The analysis will be directed towards the following variables: income, employment, and productivity. The data, for all countries and regions, were taken by the Cambridge Econometrics data set.

Methodologically, the empirical analysis will follow two main directions. The first one is the *long run convergence* process, from 1980 (for old member states) or 1990 (for new ones) up to now: we will consider standard "*sigma*" and "*beta*" convergence estimates, for both countries and regions; conditional convergence will be assessed by referring to the employment shares of the main productive sectors. An interesting extension of this analysis is to assess the links between the aggregate performance of countries and the internal interregional variation.

The second theme is the co-movement of national and regional economies. However, given the difficulty to assess the correlation of output across countries

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[2] *'The Community shall have as its task, by establishing a common market and an economic and monetary union and by implementing common policies or activities referred to in Articles 3 and 3a, to promote throughout the Community a harmonious, balanced and sustainable development of economic activities, a high level of employment and of social protection, equality between men and women, sustainable and non-inflationary growth, a high degree of competitiveness and convergence of economic performance, a high level of protection and improvement of the quality of the environment, the raising of the standard of living and quality of life, and economic and social cohesion and solidarity among member states.'* (art. 2 of the Treaty establishing the European Community, as amended by the Treaty of Amsterdam).

[3] *'The Community shall aim at reducing disparities between the levels of development of the various regions and the backwardness of the least favoured regions or islands, including rural areas'* (art. 128 of the mentioned Treaty).

[4] This is firmly rejected by Buiter (2004), who however plays down also the role of inflation and interest convergence, and of exchange rate management (e.g. within the ERM-II): such nominal targets are, according to him, too many and inconsistent; just fiscal sustainability is a decisive requirement.

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with our databank, we have focused on the convergence analysis in national and regional *economic structures*. In fact, the process of "structural homogenisation" is, on one hand, an important feature of real convergence and on the other hand, one of the determinants of the asymmetry of shocks (hence also of macroeconomic performance in the short run). The evolution of economic structures is measured by some simple, but interesting, specialisation indices.

The structure of this paper is as follows. In section 2 there is a review of the relevant literature, with reference first of all to the different dimensions of convergence (subsection 2.1), then to the empirical studies concerning the integration process in Europe and the synchronicity of business cycles (2.2). The importance of sector homogenisation for real convergence is stressed in 2.3, while the regional dimension is introduced in 2.4. We present our empirical research in section 3 , which follows some distinct but interconnected lines of argument. After some hints about the data (subsection 3.1), the *sigma* convergence of European countries is illustrated in 3.2; the analysis of the interregional distribution is dealt with in 3.3 and the results concerning the indices of specialisation, for both countries and regions. are given in 3.4. Subsection 3.5 then provides econometric estimates following a *beta* convergence approach, both *absolute* and *conditional* (on regional specialisation or on specific sector weights). Section 4 concludes.

2. Economic and monetary integration in Europe: a review

2. 1 Convergence: nominal vs. real, long run vs. short run

The final stage of EMU began in 1999 and since then, the *monetary union* has worked properly. Its success is confirmed by the aspiration of many new member states to join the euro-zone as soon as possible: as a matter of fact, some of them will join as soon as 2007. The admission of new countries to the *euro* club is conditioned by the compliance with the Maastricht criteria, concerning inflation rate, interest rate, exchange rate, public sector debt and deficit; for incumbent members, the public sector requirements are also endorsed by the Growth and Stability Pact.

All of these are nominal criteria: if a country was (will be) able to achieve such *nominal convergence*, it would (will) be admitted to the club. In the past, the formerly deviating countries have been "punished" for earlier vices (undisciplined public finances, inflation-prone behaviour, etc.) and the stringency of the new conditions has slowed their growth rates, but they have also been rewarded by the benefits of EMU itself, some of which have been almost immediate (disinflation, lower interest rates and debt service).

According to economists close to the EU Commission (e.g., Buti and Sapir, 1998), nominal convergence gradually leads to real convergence, owing to the benefits of macroeconomic stability, the removal of exchange-rate risk, the reduction of uncertainty concerning inflation and interest rates (as well as the levels of these variables in formerly deviating countries), the spur of investment and international trade, and finally stronger economic growth, which may even become permanent thanks to dynamic scale effects.

Nevertheless, in Europe, even within the euro area, *real convergence* is far from complete. Real convergence, on one hand, can be evaluated in terms of the similarity of final outcomes for real economic variables: production, income, employment, etc.

For instance, differences in development level, competitiveness and labour

market performance may reveal the degree of real convergence. On the other hand, convergence in outcomes is more likely if economics structures are more similar.

These links have been investigated in two different lines of economic study:

1. in the *long term*, real convergence implies the narrowing of differences in the structural conditions of different countries or regions, thus allowing for example the achievement of similar steady states, as maintained by the "conditional convergence" hypothesis;
2. in the *short term*, real convergence makes economic shocks more symmetric and is thus reflected in the similar reaction of real variables to shocks.

For the first approach, the pioneering work of the leading development economists (Chenery, Clark, Hirschman, Kaldor) should be noted.[5] According to these contributions, there is a close relation between the level (or stage) of development of national and regional economies, on one hand, and their productive structure, on the other. Sectors may in turn differ because of differences in capital intensity, the scale of economies, inter-sector links and technical progress. According to more recent theories, the different use of human capital, knowledge intensity and certain tradability characteristics are also worth mentioning. However, the well-known *three sectors law* is a good starting point to understand the importance of the sectoral structure. Indeed, in many lagging regions of Southern and Eastern Europe there is still a large primary sector and in addition, whilst in some regions of Europe the tertiarisation process has been continuing for decades, in others the peak of industrialisation has not yet been reached.

Long-run growth problems and structural change have also been tackled in new theories of economic growth. Many empirical studies have been carried out, both at the national and at the regional level, following the well-known approaches of *absolute* and *conditional convergence* (Barro and Sala-I-Martin, 1995). Conditional convergence models show that when the structural conditions of economic systems become progressively similar, then the steady states will also be equalised, e.g., for per capita output. Only in certain endogenous growth models are increasing specialisation and diverging paths for different economic systems possible.

Turning now to the *short run* or business cycle view of real convergence, according to the well-known OCA theories, the real effects of economic shocks within a monetary union depend on the degree of asymmetry of shocks and (after the shock has occurred) on the degree of flexibility of markets or the effectiveness of other adjustment mechanisms (price and wage flexibility, labour mobility, fiscal transfers, etc.). The first element (asymmetry of shocks) concerns primarily the sector structure; e.g., sector shocks, common to many countries, may lead to different responses in diverse countries or regions, at least in terms of effect intensity, precisely due to different economic structures.

2. 2 European integration and synchronicity of business cycles

Have shocks become more symmetric in European countries? One way to answer this question is to investigate the synchronicity of national business cycles, by

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[5] For a concise review see Marelli (2004).

looking at correlations of output, GDP, industrial production or employment (but also exports, consumption, services, etc., in more specific studies).[6]

In general, possible determinants of the degree of synchronicity between countries include the following: homogeneity of sector structures and specialisation level, international trade deepening, coordination of macroeconomic policies, structural indicators (e.g., competitiveness), institutional agreements (tariff and non-tariff barriers), exchange rate regimes, existence of a common border, as well as variables suggested by gravity models (relative size and geographical distance between countries).

If we observe past trends, the similarity of economic systems in Europe seems to have increased, by virtue of the *coordination of macroeconomic policies* and the attainment of the Single Market, in the '80s and early '90s: an improved co-movement of business cycles of the European Monetary System (EMS) countries is shown, for example, in Artis and Zhang (1999).

Frankel and Rose (1998) however emphasize – considering a large sample of industrialised and developing countries – the positive effects of increasing foreign trade on the degree of synchronicity, proposing the oft-cited argument of the *endogeneity of OCA's criteria*: even if the latter are not satisfied ex-ante, they come to be validated (endogenously) ex-post.

In the case of EU integration, the link would be from EU's *integration process* to *trade deepening*[7] and then to *cycle correlation*. It is true that interaction between institutional integration and trade deepening appeared well before the currency union: former examples are given by the custom union, the single market, EMS (with reduced exchange rate volatility), the coordination of economic policies. However, the monetary union is the final step in institutional integration, since it is a "serious and durable commitment".

At this stage, a dramatic immediate surge of trade is unlikely, both because trade has continuously risen over the last 50 years and because, as shown by theoretical studies (De Grauwe and Mongelli, 2005), it takes time (about 15-20 years) to appreciate the trade creating effects of a monetary union. The empirical evidence is however that after the introduction of the euro, intra-euro trade has already risen by five to ten percent, without any evidence of trade diversion (Mongelli and Vega, 2006).

The endogeneity argument has been extended in later studies, from trade deepening to institutional convergence, flexibility of product and labour markets (with effects on wages' moderation), equalization of prices (or convergence in inflation rates), fiscal integration, financial convergence (direct and portfolio investments may benefit from convergence in interest rates).

On the other hand, Imbs (1999) plays down the impact of trade and focuses on the role of bilateral differences in sector structures (together with differences in GDP levels). Specialisation may be important because a high degree of specialisation (following Krugman's assumption) causes increased *inter-industry trade* and then asymmetric shocks may appear, the opposite will result from lower specialisation and

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[6] Of course, appropriate de-trending methods must be used (e.g. Hodrik-Prescott or Band-Pass or Baxter-King filters); more recently, structural VAR procedures have been extensively used. Moreover, it is important to distinguish between *shocks* and *reactions* to them.

[7] Mongelli et al. (2005) demonstrate that the link between *institutional integration* and *trade deepening* runs both ways, although the link departing from institutional integration is more pronounced.

intra-industry trade. As a matter of fact, the latter is the type of trade that has developed most after introduction of the euro (Böwer and Guillemineau, 2006).

The results of studies on synchronisation are mixed, since they depend on data sets, time intervals and investigation methods. A firm conclusion is nevertheless that euro area countries correlate amongst themselves more than with the rest of the world, despite the emergence of a *world business cycle* due to globalisation. Recent studies have shown that synchronisation has increased in certain "peripheral" countries (therefore making the concept of a "core" of European countries less meaningful). Furthermore, output variance within the euro area is mainly explained by common shocks, while idiosyncratic shocks although persistent tend to be small: stabilization policies at the national level do not have a large role to play (Giannone and Reichlin, 2006).

Empirical studies have shown that synchronicity has increased not only within the euro-zone or EU15, but also between "old" and "new" Europe. In particular, trade deepening of new members developed even before the official EU accession.

As to the *new member states*, it is important to note that recently they have had a good rate of nominal convergence (inflation, interest rates, debt/GDP ratios, but with some imbalances in deficit/GDP ratios), as well as growing trade openness (greater and more uniform than that of many "old" EU countries), trade integration with EU15, significant reforms in labour markets (with high degrees of flexibility) and in institutions, and finally increasing business cycle synchronicity with the euro area. However, the record is mixed concerning real convergence (growth, productivity, price levels), output specialisation and delays in the modernisation of financial systems (Angeloni et al., 2005). While waiting for full monetary integration with the adoption of the euro, some exchange rate flexibility may be a useful shock absorber.

In particular, Hungary, Poland and Slovenia have correlated the most with the euro area, comparably to some "core" EU15 countries and more than EU15 peripheral countries (Greece, Portugal, Spain, Ireland, and Finland). The lowest correlations, close to zero, are found in the Baltic states (Darvas and Szapáry, 2005; Fidrmuc and Korhonen, 2006). More specific studies, by distinguishing between supply and demand shocks, demonstrate that the latter have converged, thanks to the endogeneity processes, while asymmetries have prevailed in supply shocks (Babetskii, 2005).

2.3 Sectoral structure and specialisation

The relation between the European integration process and the convergence of economic structures has been assumed to be mainly negative by economists such as Krugman (1993). The economic integration process itself is likely to lead – owing to scale economies, externalities, agglomeration effects etc., – to *increased specialisation*, diverging economic structures, asymmetric developments, and widening differences in growth rates. The theoretical base is provided by "endogenous growth" models with many sectors and international trade, or by the spatial models of the new economic geography. Assuming increasing returns (or agglomeration economies) firms of one industry will tend to cluster in a particular region, e.g., where the final market for a certain product is larger.

Three main *counter-arguments* can be provided to tackle this pessimistic view. First, the degree of similarity of economic systems has been (and will be) enhanced by increased competition and integration of markets, thanks to the single market, the liberalisation of capital flows and the working of EMU itself: this is the *endogeneity* explanation. Second, the prevalent *empirical evidence* is that specialisation has been actually decreasing in European countries and regions (Hallet, 2002; Marelli, 2004).

Third, the consequences of (potential) asymmetric shocks may be counteracted by an increasing flexibility of the markets and by an appropriate policy response. Fiscal policy and also structural measures, including reforms of product, labour and capital markets (at the community level an appropriate use of structural and cohesion funds may help) would be useful not only to ease the short term macroeconomic adjustments following asymmetric shocks, but also to homogenise institutions and structural conditions, thus sustaining long term growth rates and helping real convergence too.

Looking at the second argument, a recent empirical study (Böwer and Guillemineau, 2006) concludes that *trade specialisation* is more important than overall *productive specialisation* in determining the symmetry of business cycles. They note that high trade openness and low trade specialisation create a high degree of intra-industry trade. While broad economic structures have not converged[8], differences in trade specialisation have declined dramatically and continuously. These different evolutions are mainly explained by non-tradables and the increasing importance of services (that now account for 70% or more of GDP in many countries).

For trade specialisation, it is worth noting the recent evolution in some of the new member states. These have been able to change their specialisation rapidly toward medium and high-tech products (including machinery and transport equipment), for which the world demand is growing quickly. Those countries could take advantage of high skilled labour force, huge FDI inflow, restructuring in production and modernisation of the capital stock (Zaghini, 2005).

Considering, at this point, specialisation in a *long term perspective*, many empirical studies conclude that national and regional specialisations are an important factor for economic growth, while being themselves influenced by the level of development. These structural relations can normally change only in the long term and may explain the persistence of European income disparities.

More specifically, structural convergence and diversification of production are important forces behind the dynamics of employment, output and productivity. Some specific techniques are sometimes used: e.g., *shift-share analysis* finds that the initial structure (share component) is important in determining the productivity advantage of the richest regions of Central Europe, while the peripheral regions take advantage of the dynamic (shift) component. However, if structural change is included in the analysis, the narrowing disparities in productivity are accounted for to a large extent, by labour shifts from low-productivity sectors to high-productivity ones (Molle, 1997).[9]

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[8] It is not even clear whether EMU has favoured or prevented specialisation (Giannone and Reichlin, 2006). More specific results about specialisation evolutions are presented in subsection 3.5.

[9] The importance of the sector mix in explaining regional employment growth rates has been found, by using shift-share analysis, also by Marelli (2006).

2. 4 Convergence at the regional level

Here a number of questions arise.

First question: how are regional disparities related to the aggregate (national) level of development? As well known, Kuznets (1955) found a negative relationship between per capita income's level and inequality in income distribution; although in subsequent studies Kuznets himself assumed an *"inverted U-shaped"* relation, many empirical studies have considered disparities in regional incomes rather than inequalities in individual (or family) incomes. For example, Williamson (1965) showed that, even in a neoclassical framework, regional disparities can increase in the early stages of development, thus confirming the inverted-U curve.

Second question: what are the dominant results of econometric convergence studies? If we take Boldrin and Canova (2001) as a good example, *interregional disparities* in per capita income or productivity are wider in the EU than in the USA. They decreased from the '50s to the mid-'70s, but quite slowly, - 2% was the annual reduction in the β-convergence estimations; an unsatisfactory pace given the goal of economic and social cohesion set by the EU's institutions. After this, the trends have become even more unclear, with convergence limited to certain sub-groups of countries (club convergence) and specific time intervals, and was in any case, still weaker. Interregional disparities seem to be substantial compared to other economic variables, such as the unemployment rate or employment growth rates (see subsection 3.4 for a discussion).

Third question: how specialised are regions? To begin with, regional economies are *more open* than national ones, so they are more vulnerable to external shocks, generated by national dynamics or by world economic trends. Regions are also *more specialised* than national economic systems in certain sectors or activities. Even when the average productive structures of two countries appear similar, regional specialisations may be very different. As a consequence, the probability that sector-specific shocks are asymmetric is much higher at a regional level (see e.g. De Nardis et al., 1996). Many economists are willing to concede that Krugman's hypothesis of growing sector specialisation is more realistic regionally than nationally. In general, the smaller the spatial unit analysed, the more specialised they are, with asynchronous movements. Moreover, persistence in specialisation is more likely in small territorial units, and in its turn affects the persistence of income disparities.

Fourth question: is regional synchronisation important? *Synchronicity* has been evaluated also at the regional level, reaching conclusions similar to those concerning the national economic systems (see subsection 2.2 above): regional growth – in particular in terms of employment – is more synchronised when regions look alike in the sectoral structure, where the latter can be analysed by using synthetic "similarity indicators" (see Belke and Heine, 2004). The importance of regional dimension, also for *business cycles* investigations, has previously been stressed by many authors, e.g., Fatàs (1997) discovered that a rising correlation of national cycles in Europe matches declining co-movements across regions.

Last but not least (fifth question), in addition to sectoral structure, many other *structural transformations* and also *institutional reforms* may affect the evolution of regional disparities. A good case in point is given by the new member states. The transition to a market economy has implied heavy restructuring processes, reallocation of labour between sectors (particularly from old sate-owned branches to new private activities), with net job destructions along with a "transitional" (or transformational) recession in the early stages of

transition. Of course, such structural changes had differentiated impacts across the various countries and regions (Boeri and Terrel, 2002, among others).

3. An empirical analysis of convergence in European countries and regions

3. 1 Data

Our empirical analysis refers to EU regions, over the period 1980-2005. The regions of EU15 are included for the full period, while data for the new member states (as well as Eastern German *landers*) are available after 1990. For certain elaborations, data after 1992 are considered for such regions, due to data incompleteness.

The full sample of regions includes 250 NUTS-2 level regions. Cyprus, Estonia, Latvia, Lithuania, Luxembourg, Malta and Slovenia are considered one-region countries.[10] The list of the 25 countries can be found in Table 4 and the list of the 250 regions is available upon request.

The data on EU regions are taken from Cambridge Econometrics' European regional databank, which is based on the Eurostat series. Cambridge Econometrics fill gaps by interpolation, establish consistency with national series, and deflate by using the national deflators, in the absence of regional deflators[11]; we have used such data up to the year 2005, although forecasts for most variables are available until 2009.

3. 2 Convergence of per-capita income, productivity and employment in European countries

First of all, let us look at the *convergence of countries*, in terms of *per capita GDP*. Figures 1-5 show the evolution of the index numbers for five distinct groups of countries: for the first three groups the period is 1980-2005 (and the index is EU15=100) and for the other two, groups of new members, 1990-2005 (with an index EU25=100).

Fig 1 - GDP per capita (ppp) - Richest EU15 countries

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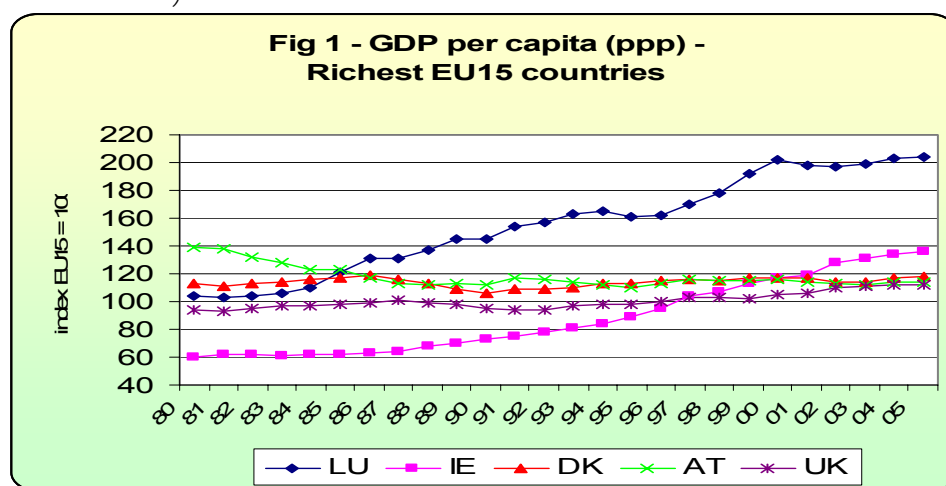
[10] Germany does comprise Eastern *lander* since 1991. The outermost regions of France (*Departement d'Outre Mer*: Guadeloupe, Martinique, Guyane, Reunion) and Portugal (Açores, Madeira) have been excluded from the sample. One Dutch region, Flevoland, does not have certain data for the initial period.

[11] See also Basile et al. (2001).

The groups are the following: (1) the *richest* (with reference to the final year's distribution) countries of EU15: Luxembourg, Ireland, Denmark, Austria, the United Kingdom; (2) the *middle* income EU15 countries: the Netherlands, Sweden, Belgium, Finland, France; (3) the *poorest* EU15 countries: Germany, Italy, Spain, Greece, Portugal; (4) the *richest* EU10 new member countries: Slovenia, Cyprus, Malta, Czech Republic, Hungary; (5) the *poorest* EU10 new member countries: Slovak Republic, Estonia, Lithuania, Poland, Latvia.

Fig 2 - GDP per capita (ppp) - Middle EU15 countries

Fig 3 - GDP per capita (ppp) - Poorest EU15 countries
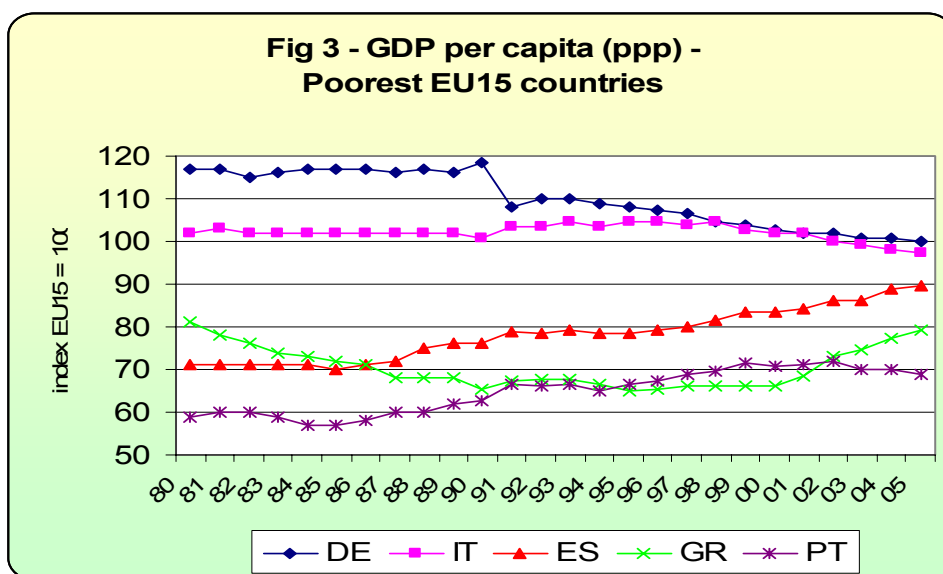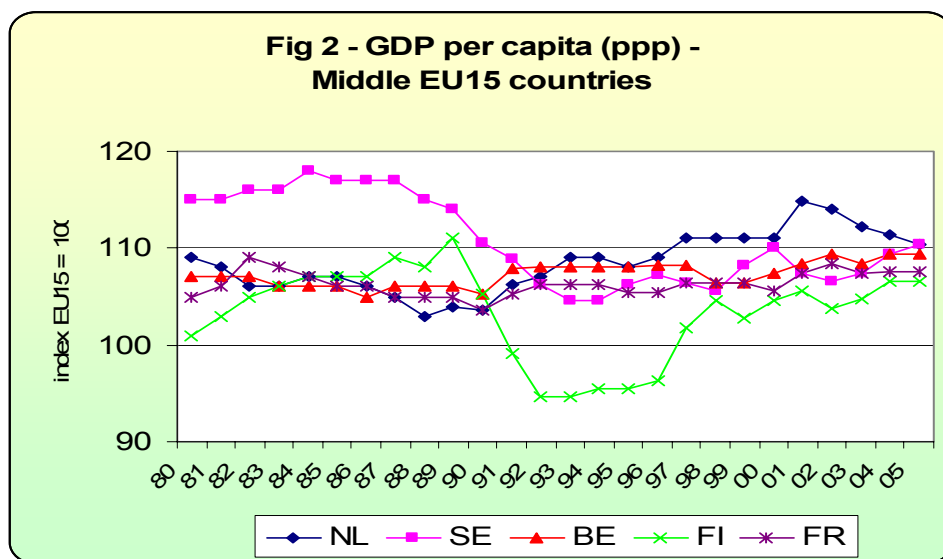
The first impression is that an *overall convergence* has indeed been achieved, since some initially (relative) poor countries have grown faster than the EU15 average: the most astonishing case is Ireland, but also Spain, Greece and Portugal (though with alternate long-run cycles) have shown a similar progression. Convergence is also confirmed by the fact that some relatively rich countries have reduced their initial advantage. This is the case of Sweden (especially in the '80s) and

Germany (here the problems began with German reunification and because of the sluggish growth of the last decade). Finally, two big countries of EU15 have exhibited opposite trends: the United Kingdom from slightly below to just above the European average, Italy in the opposite direction.

This impression seems to contradict the conclusion of some recent studies (Giannone and Reichlin, 2006), according to which gaps in per capita output of European countries (and US states) have persisted between 1970-2003, with the exception of catching-up countries (Ireland and possibly Spain). The dispersion in real growth rates has also remained close to its historical average, even during the EMU convergence period.

Most new members have grown rapidly, substantially reducing the gap with "old" Europe. This is especially true for the poorest countries of the group (Figure 5), since they all reached at least 50% of per capita GDP of EU25 in the final year. The richer countries (Figure 4) progressed less, due to higher initial levels (especially so for the two Mediterranean islands) and the transitional recession of the early '90s (see evolutions in Hungary and in the Czech Republic).

Fig 4 - GDP per capita (ppp) - Richest EU10 countries

Fig 5 - GDP per capita (ppp) - Poorest EU10 countries
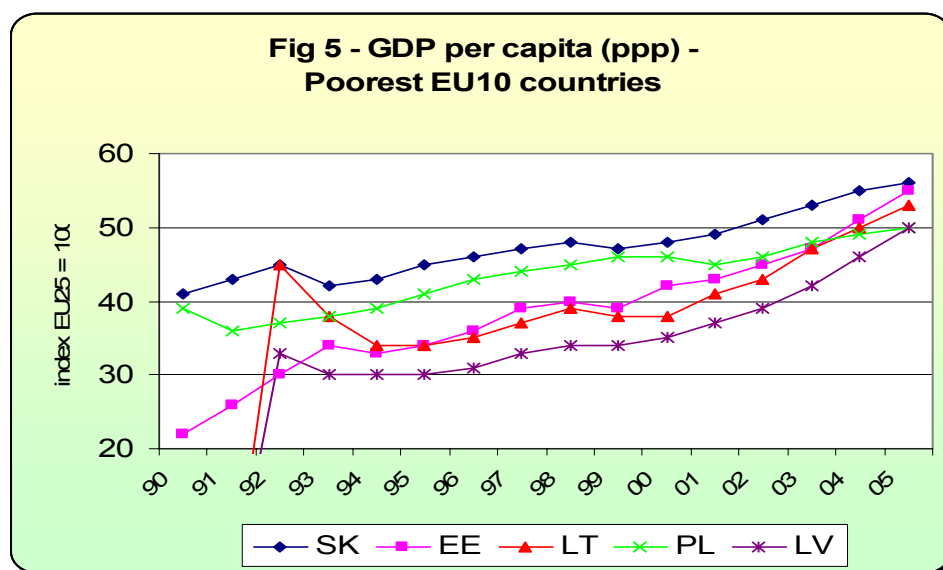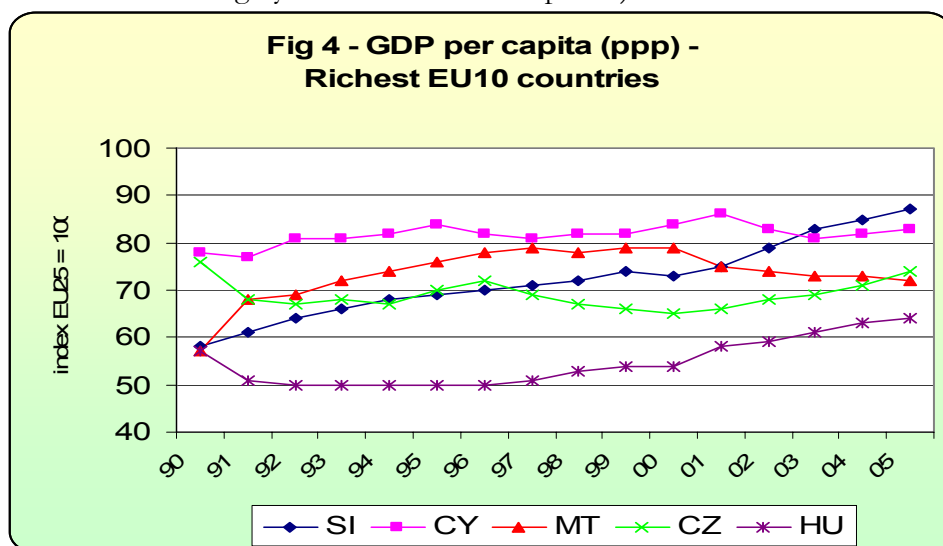
Given that *productivity* is a key variable in many growth theories, let us examine – at national level – the dynamics of productivity, i.e. value added (at constant prices) per employed person. Here we have followed a different approach: instead of considering the annual figures, let us focus on the different decades (Figures 6-8). In Figure 6, relative to the '80s for the EU15 countries, the positions of countries in 1989 compared to 1980 was relatively persistent; the scatter diagram clearly shows the two group of countries, above and below the mean values.
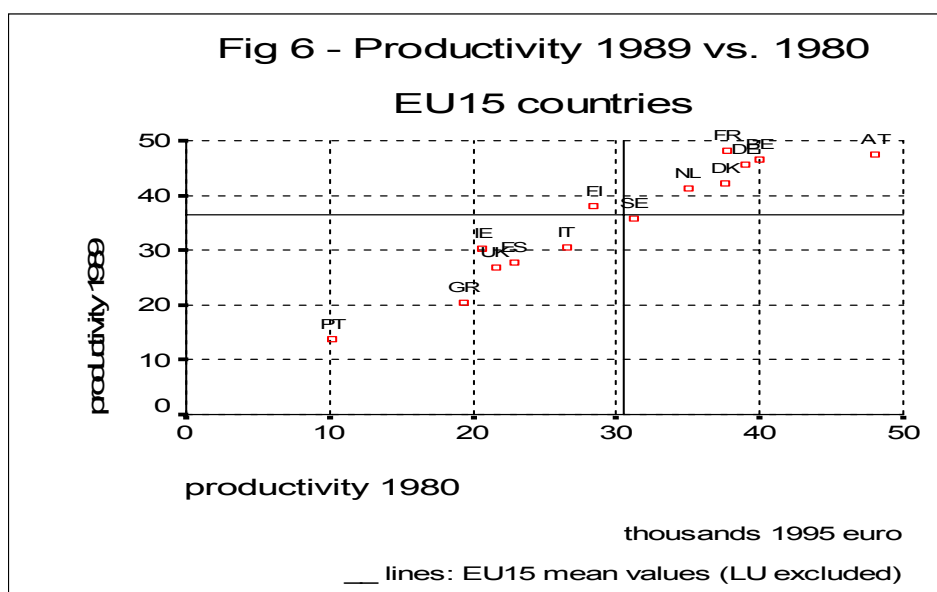
Persistence continued in the '90s: see Figure 7, which refers to EU25. In the final year (1999) less-than-average productivity can be found for all new members as well as in the three southern countries (Spain, Greece, Portugal).
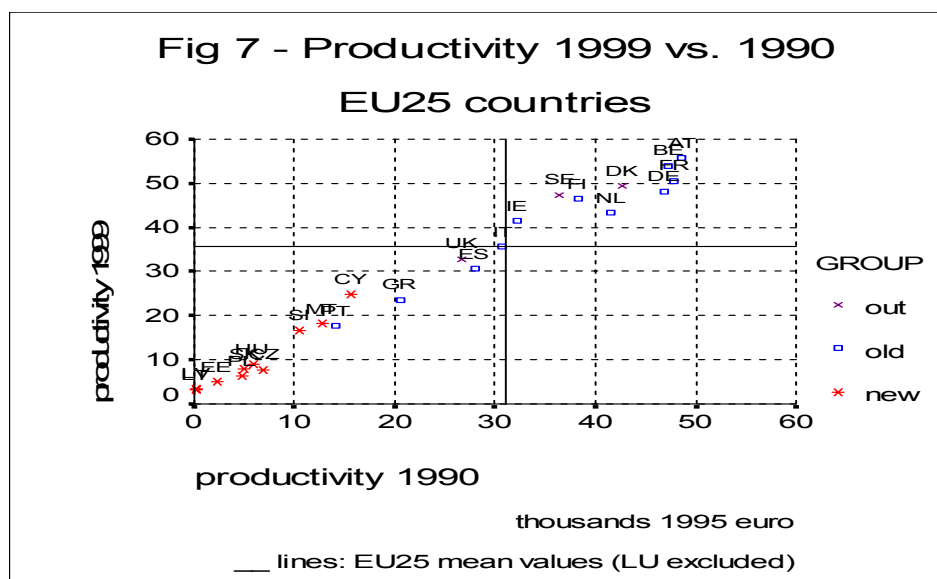
Most of new members had in 2005 (Figure 8) a lower level of productivity than 1/3 of the European average (the only exceptions were Cyprus, Malta and Slovenia).

Fig 8 – Productivity 2005 vs. 1999
EU25 countries
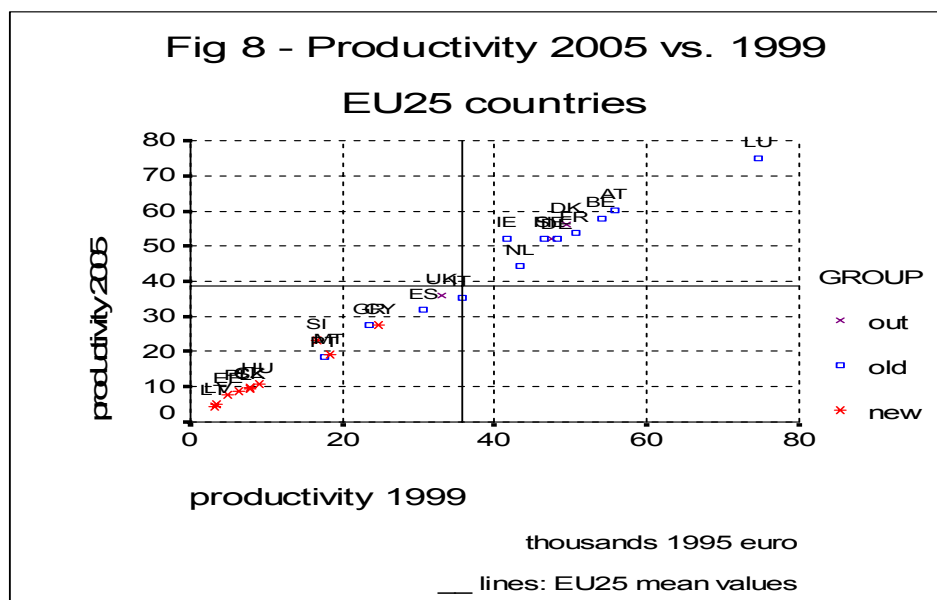
Some interesting points can be gained by comparing employment growth with growth of value added. The scatter diagrams in Figures 9-11, relative to these three periods, show the two variables on the two axis. Of course, if value added growth is greater than employment, then productivity is increasing and vice-versa.

Fig 9 – Value added vs. employment:
1980 to 1989 – EU15 countries
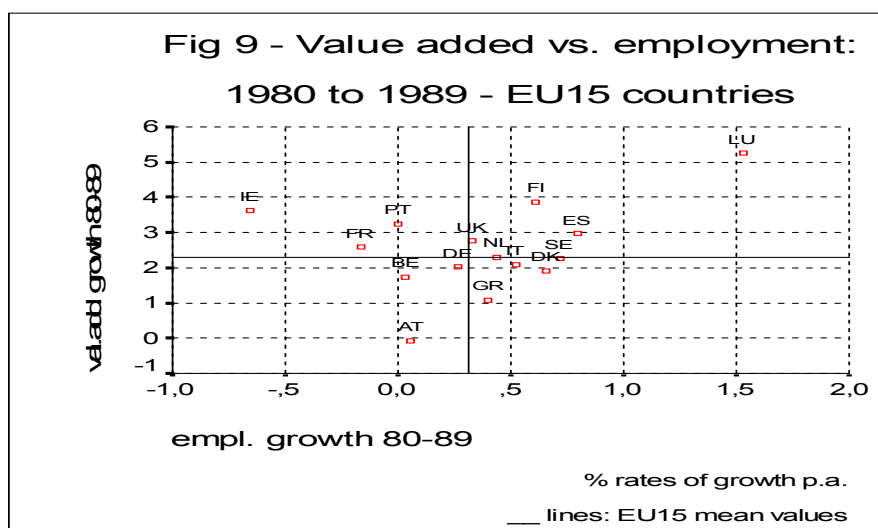
Different "models" of growth can be seen:
- an *intensive* model, with large productivity gains, even at the expense of employment, as in the '80s in Ireland and France; in the '90s in many new members (Estonia, Slovenia, Cyprus, Slovak Republic), and recently (1999-2005) again in many new members (especially Poland);

- an *extensive* model, with significant improvement in employment, despite moderate (or even negative) growth rates and so at the detriment of productivity, in the '80s in Greece, in the '90s in Luxembourg and recently in Italy;
- a *virtuous* model, characterised by significant increase in employment, but even larger value added (and productivity) gains, in the '80s in Luxembourg, Spain and Finland; in the '90s in Ireland and the Netherlands and recently in Ireland, Spain, Greece as well as many new members (Cyprus, Latvia, Slovak Republic and some others).

Fig 10 – Value added vs. employment: 1990 to 1999 – EU25 countries

Fig 11 - Value added vs. employment: 1999 to 2005 - EU25 countries
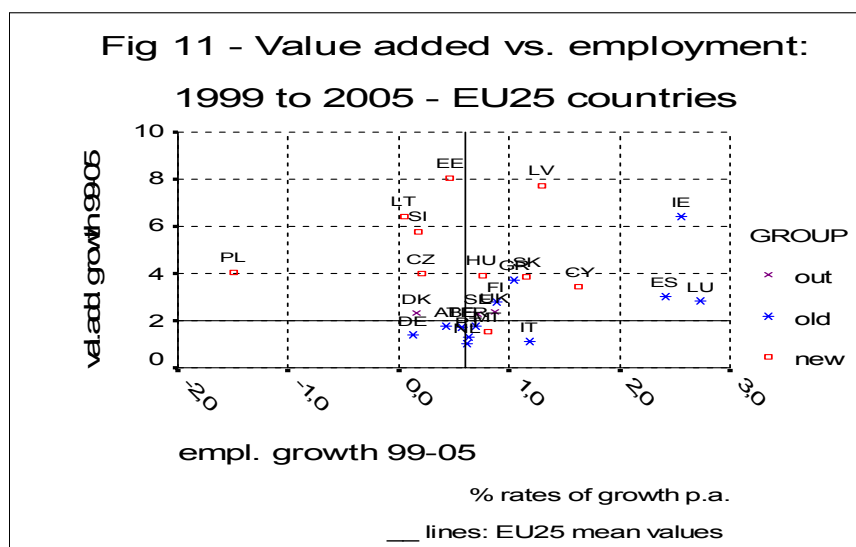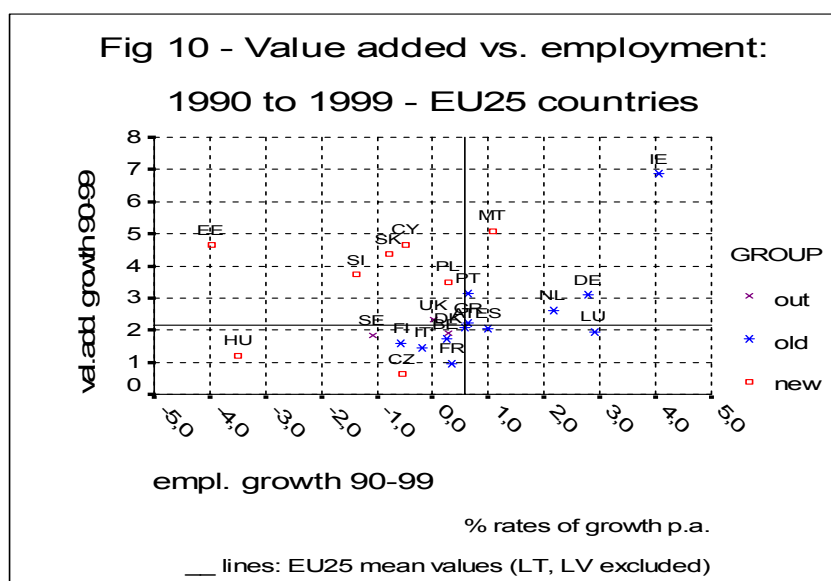
The relation between employment growth and output (value added) growth is influenced by many variables[12], but has been certainly affected by the institutional

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[12] The theoretical studies started with Okun's law; subsequent empirical investigation aimed at calculating employment growth intensities as well as co-movements between GDP and employment (Perugini and Signorelli, 2005).

changes and recent reforms in many European countries, to make goods and labour markets more flexible and "market-friendly", sometimes at the expense of productivity levels and quality of labour.

3. 3 Convergence of per-capita income: countries and regions

Before considering the sigma convergence of European regions, let us investigate the overall relation between aggregate income levels (and growth rates) of European countries and their internal regional distribution.[13] Regional dispersion is measured by the *coefficient of variation of regional per-capita incomes*. This dispersion measure appears to correlate negatively in 2005, with the country's income level (per capita GDP index with EU25=100) (see Figure 12). In other words, the poorest countries exhibit in general a relatively higher regional dispersion. This is true for all new members, but also for Portugal and – to some extent – for Italy as well. This seems to once gain corroborate Kuznets and Williamson's curves.

Fig 12 - GDP level and regional dispersion
EU25 countries - 2005
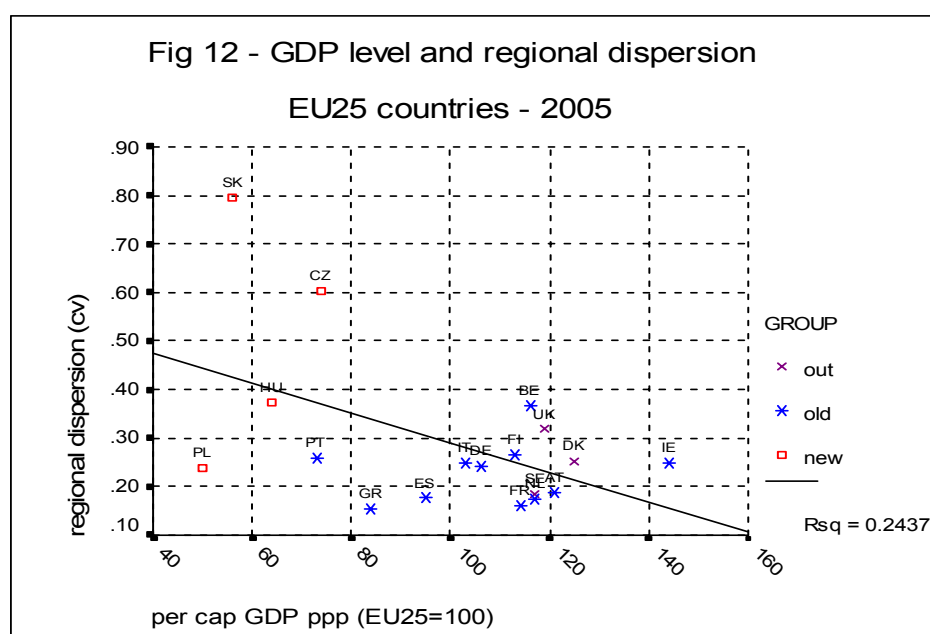
Even more interesting is to look at the two variables from the point of view of changes over time. Is a large increase in per-capita income (relative to the European average: we still consider changes in index numbers) associated with an increasing or decreasing regional dispersion? With reference to the '80s (Figure 13, with only "old" members), the relationship seems positive. In other words, the countries that have improved their relative position nationally (e.g., Ireland, Finland) have also shown a deterioration in regional distribution, whereas at the opposite side, we can find the Netherlands. After the '90s, when there was no significant relationship, a positive relation between expanding national incomes and increasing regional disparities appeared again between 1999-2005 (Figures 14 and 15). This especially reflected the development in the new members but is disconfirmed by

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[13] Only four new member countries are included, since for the remaining there is no regional breakdown.

some fast growing old members (Ireland, Greece and also Spain), whose regional disparities have not changed.

Fig 13 – GDP level and regional dispersion
EU15 countries – Changes 1980-1989

Fig 14 – GDP level and regional dispersion
EU15 countries – Changes 1990-1999

Fig 15 – GDP level and regional dispersion
EU15 countries – Changes 1999-2005
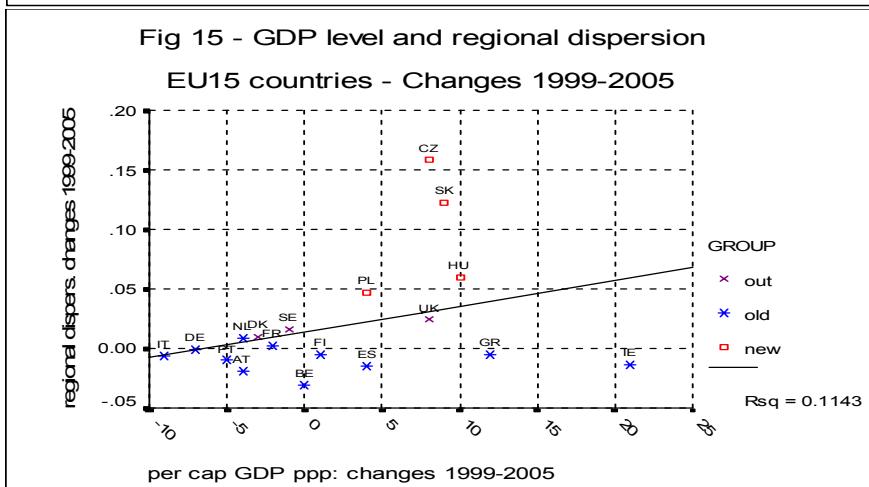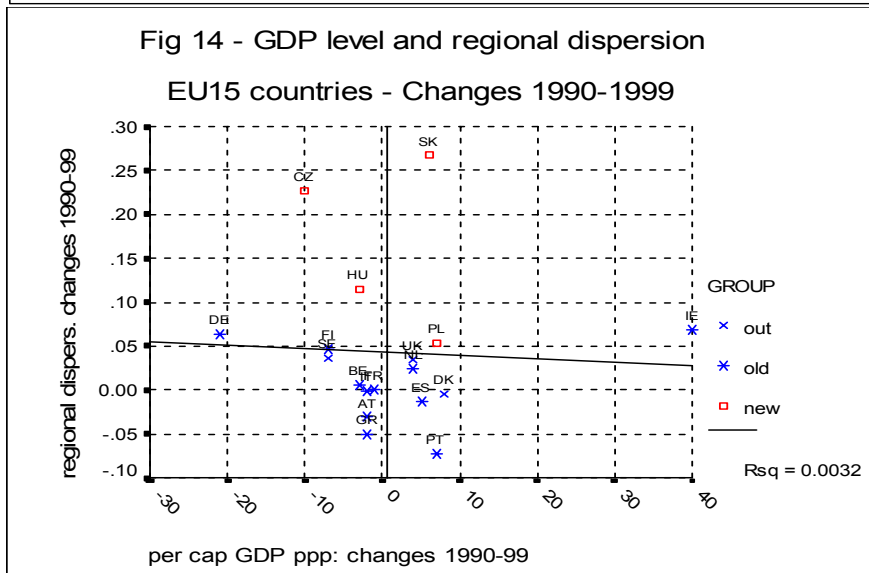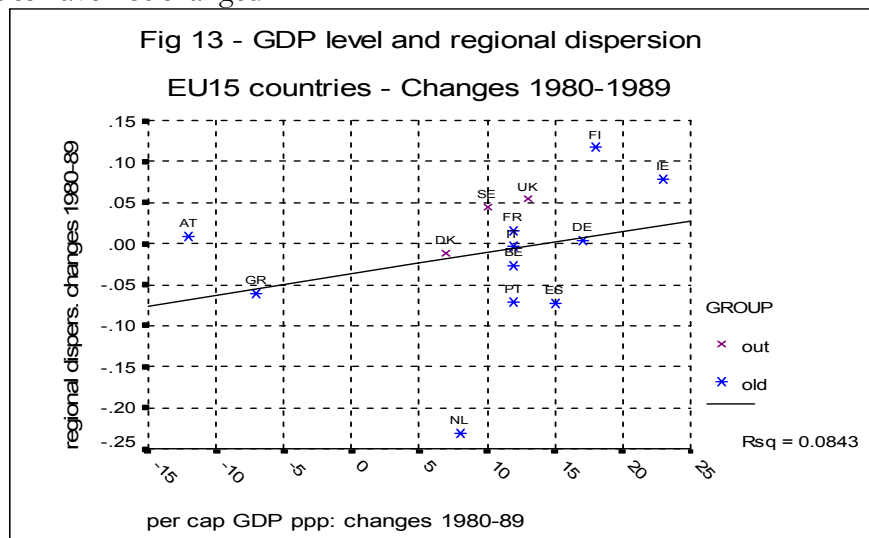
On the whole, it seems that increasing regional disparities characterise the early stages of growth for many countries. It is likely that a poor country *catching up*

implies some concentration of production, at least in the initial stages, to exploit agglomeration economies, thus benefiting the richest regions. It is in these stages that *a trade-off between international convergence and interregional convergence* is likely to appear.

Now, we are ready to illustrate our *sigma convergence* exercise. Figure 16 exhibits the evolution of a dispersion index (coefficient of variation) of regional income per capita for four territorial aggregates. The dispersion coefficient has been declining since 1980 (with a temporary upsurge at the beginning of the '90s) both in EU15 and in EMU groups. In the latter, the decline over the last 15 years seems more pronounced and therefore the run-up to and advent of *the euro does not seem to have increased regional disparities*. In the wide EU25 area, regional disparities have decreased as well, despite a clear rise in the EU10 new members.

Fig 16 – GDP per capita (ppp): regional dispersion: groups of countries (coefficient of variation)
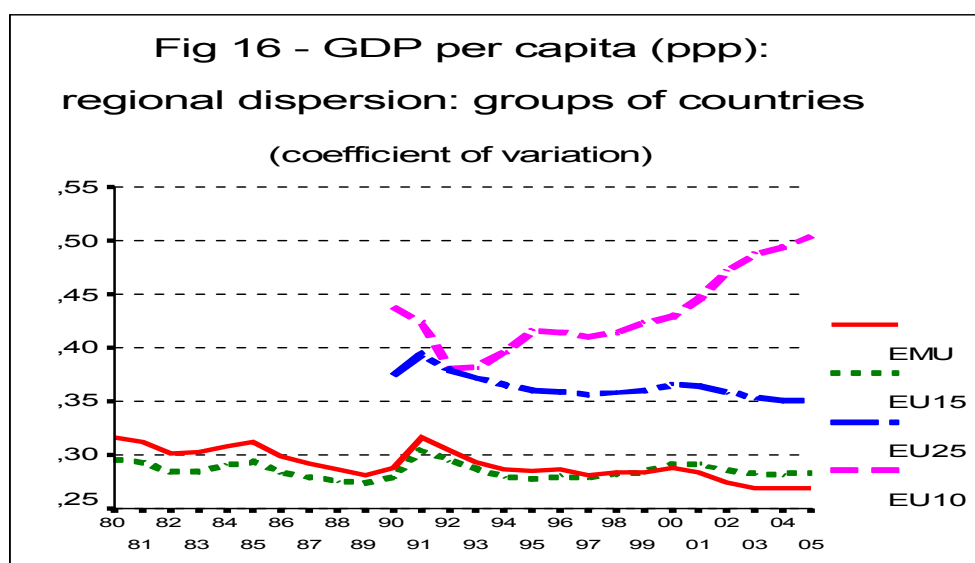
Considering the national evolutions, Figure 17 refers to the five largest European countries.

Fig 17 – GDP per capita (ppp): regional dispersion: groups of countries (coefficient of variation)
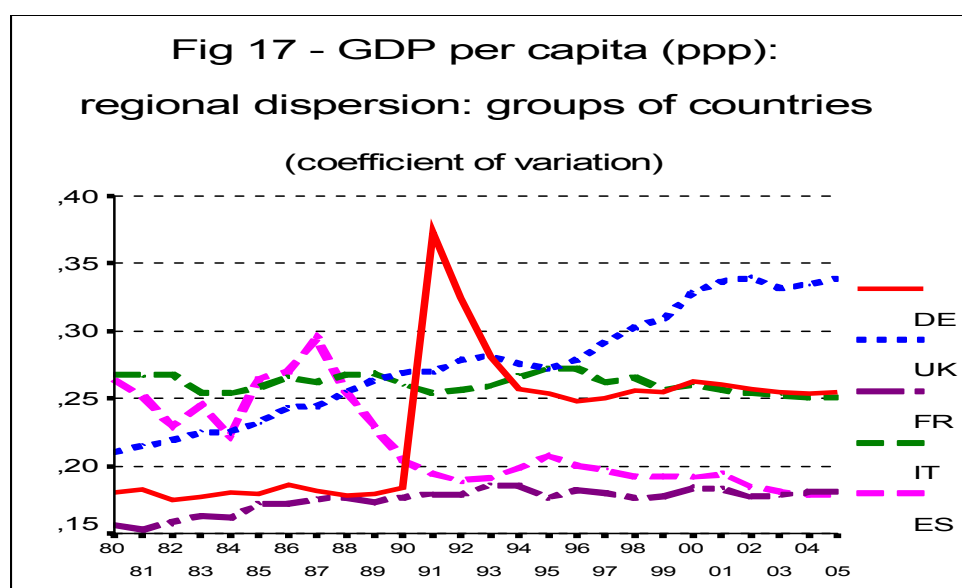
In contrast to convergence *between* countries (above discussed), convergence *within* countries does not appear to have changed much. In fact, in Germany regional disparities rose clearly after German reunification like in the United Kingdom where they have have also risen (to a lesser extent and limited to the '80s) and in France. Only in Spain was there a noticeable fall, soon after she joined the EU. In the middle size "old" EU countries (Figure 18) the reduction in regional disparities is more generalised with the exception of Sweden. Therefore, regional disparities have increased more in countries *out* of the euro area (Sweden, UK) than in EMU. Finally, in all new members (Figure 19) regional dispersion has been increasing.[14]

Fig 18 – GDP per capita (ppp): regional dispersion: groups of countries (coefficient of variation)

Fig 19 – GDP per capita (ppp): regional dispersion: single countries (coefficient of variation)

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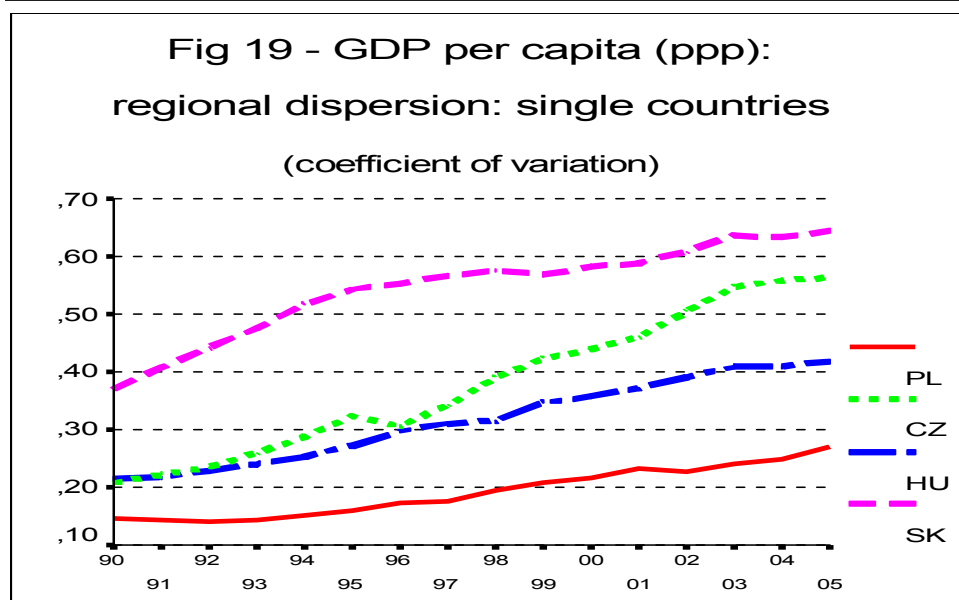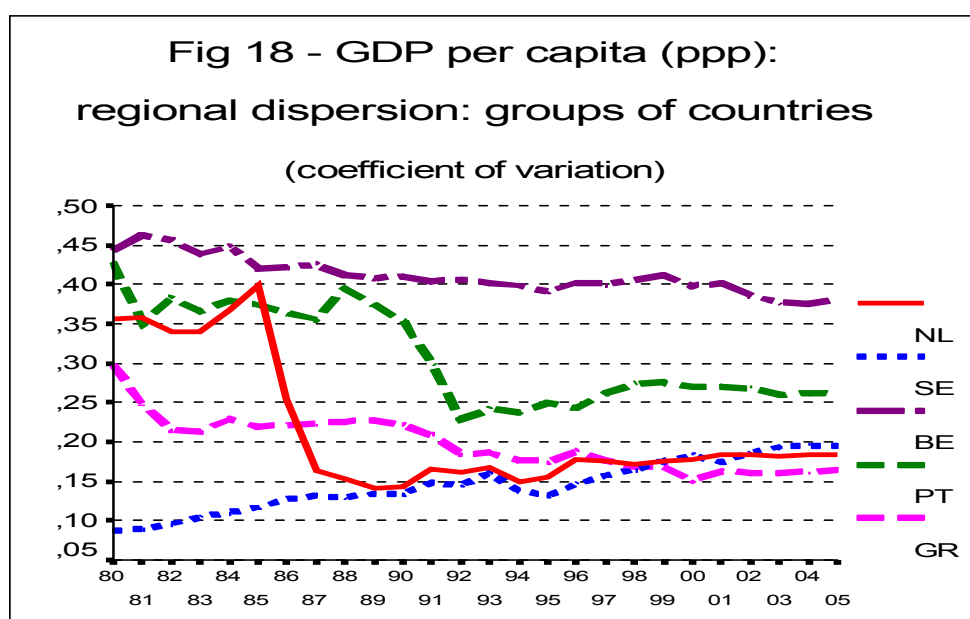
[14] Notice that the EU10 rising trend in Figure 16 is more pronounced because it includes also the "between countries" variation.

3. 4 Specialisation of European regions

One of the initial aims of this empirical work was to estimate the correlation coefficients between employment or production (value added) in the different European regions. However, firstly, this task has been accomplished by a number of recent studies (see section 2.2 for a review), at least nationally and secondly, the availability of annual data (in our databank) provided us with insufficient observations to calculate meaningful correlations (in the case of new members we have only 13 or 15 data points).

Nevertheless, we have seen that sector specialisation is one of the most important determinants of output correlations and business cycle synchronicity. The purpose of this section is to assess whether production (or employment) structures have converged[15], thus guaranteeing a sufficient degree of homogenisation relevant for the monetary union to work properly.

We should note the conclusions of two recent studies (in addition to the discussion of subsection 2.3): Giannone and Reichlin (2006) found an *increasing* specialisation in production since the '70s for EU countries, while export specialisation has decreased thanks to the growing importance of intra-industry trade; a declining trade specialisation was also noted by Böwer and Guillemineau (2006), in contrast to a *stable* economic specialisation based upon broad economic sectors.

Here, we wanted to check the robustness of such findings, by analysing specialisation in *employment*. Employment data are better than value added data, because they are less sensitive to valuation problems (current and constant prices, exchange rates, etc.). To quantify the degree of homogeneity of production structures of European regions, we used two different indicators, for sensitivity analysis[16]:

- a specialisation coefficient, here defined as *Krugman*[17] *specialisation index*, that can be calculated for each region r

$$KSI_r = \Sigma_i \left| s_{i,r} - s_{i,0} \right|$$

where $s_{i,r}$ is the share of sector i out of total employment in region (or country) r and $s_{i,0}$ is the corresponding share in the reference region (or country), in our case the euro-zone. Its numerical value can range from 0 (both regions have the same sector structure) to 2 (the sector structure is totally different);

- a *dissimilarity index*, that is the complement to one of the sum of the minima of the sectoral shares of two regions[18]:

$$DIS_r = 1 - \Sigma_i \min(s_{i,r}, s_{i,0})$$

Table 1 shows the KSI index and Table 2 the DIS index. They have been calculated for four years: 1980, 1992, 1999 and 2005. Although the calculations have been made for all 250 regions, the tables show the national indices (hence r corresponds to a country and 0, as said before, to the euro-zone) and only the coefficients of variation (*c.v.*) of the indices elaborated regionally (for countries where a regional breakdown is meaningful). The countries considered are the 25 EU countries, with the addition of Norway and Switzerland (for comparison purposes).

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[15] The structure of employment, considering three sectors and 145 European regions over the period 1983-97, was previously investigated in Marelli (2004).

[16] Each individual index may present some drawbacks (for a discussion, see Combes and Overman, 2003).

[17] The same index was used by Krugman (1993), who was able to show in this way that European nations are less specialised than US regions.

[18] This sum, a measure of similarity, is sometimes called the "Finger-Kreinin index" (see Belke and Heine, 2004).

Table 1 - Krugman specialisation index (KSI):
mean of regional values (1st row) and coefficient of variation (2nd row)

	Total Employment				*Industrial sector*				*(Market) Services*			
	1980	*1992*	*1999*	*2005*	*1980*	*1992*	*1999*	*2005*	*1980*	*1992*	*1999*	*2005*
BE	0.248	0.273	0.279	0.291	0.181	0.210	0.230	0.260	0.278	0.352	0.353	0.372
	0.41	0.31	0.38	0.40	0.34	0.29	0.31	0.28	0.22	0.19	0.22	0.22
DK	0.248	0.150	0.131	0.128	0.312	0.311	0.313	0.324	0.116	0.070	0.147	0.157
DE	0.103	0.082	0.054	0.064	0.205	0.196	0.204	0.203	0.176	0.050	0.045	0.073
	0.33	0.35	0.35	0.33	0.10	0.15	0.05	0.06	0.35	0.51	0.45	0.41
GR	0.377	0.313	0.264	0.236	0.419	0.448	0.426	0.414	0.218	0.228	0.292	0.321
	0.36	0.32	0.33	0.30	0.41	0.39	0.44	0.49	0.35	0.35	0.24	0.25
ES	0.183	0.096	0.099	0.123	0.145	0.136	0.124	0.106	0.123	0.170	0.236	0.253
	0.42	0.51	0.44	0.43	0.48	0.48	0.43	0.52	0.36	0.39	0.36	0.37
FR	0.097	0.099	0.110	0.095	0.126	0.169	0.213	0.247	0.090	0.125	0.100	0.108
	0.47	0.38	0.31	0.35	0.57	0.48	0.51	0.51	0.35	0.49	0.50	0.52
IE	0.122	0.094	0.116	0.145	0.392	0.246	0.257	0.362	0.117	0.158	0.167	0.191
IT	0.073	0.038	0.067	0.073	0.170	0.225	0.240	0.247	0.159	0.104	0.112	0.096
	0.37	0.40	0.30	0.29	0.55	0.33	0.31	0.32	0.43	0.38	0.38	0.41
LU	0.245	0.319	0.328	0.334	0.921	0.582	0.381	0.362	0.178	0.238	0.251	0.292
NL	0.235	0.153	0.168	0.160	0.257	0.278	0.296	0.318	0.378	0.241	0.361	0.317
	0.45	0.58	0.64	0.45	0.28	0.44	0.59	0.66	0.09	0.14	0.17	0.21
AT	0.071	0.054	0.061	0.063	0.250	0.241	0.247	0.236	0.190	0.183	0.201	0.188
	0.30	0.27	0.35	0.42	0.05	0.04	0.03	0.04	0.36	0.36	0.38	0.46
PT	0.286	0.217	0.182	0.141	0.414	0.425	0.433	0.394	0.266	0.226	0.272	0.235
	0.36	0.26	0.19	0.15	0.46	0.37	0.35	0.38	0.33	0.34	0.31	0.40
FI	0.069	0.110	0.120	0.126	0.224	0.283	0.329	0.365	0.087	0.139	0.149	0.158
SE	0.164	0.147	0.099	0.111	0.500	0.260	0.192	0.229	0.147	0.134	0.103	0.121
	0.56	0.49	0.46	0.43	0.15	0.22	0.35	0.28	0.16	0.20	0.22	0.28
UK	0.280	0.308	0.303	0.296	0.138	0.102	0.110	0.165	0.194	0.210	0.167	0.135
	0.25	0.31	0.41	0.41	0.48	0.46	0.42	0.39	0.41	0.38	0.46	0.50
CY		0.325	0.243	0.228						0.319	0.359	0.420
CZ		0.274	0.265	0.248						0.203	0.276	0.276
		0.13	0.13	0.11						0.29	0.26	0.25
EE		0.336	0.162	0.163						0.349	0.359	0.221
HU		0.161	0.188	0.129						0.291	0.299	0.262
		0.31	0.36	0.32						0.18	0.25	0.24
LT		0.423	0.306	0.328						0.389	0.501	0.514
LV		0.294	0.243	0.199						0.318	0.422	0.438
MT		0.155	0.205	0.211						0.235	0.355	0.436
PL		0.375	0.460	0.508						0.339	0.313	0.301
		0.45	0.39	0.37						0.22	0.19	0.25
SI		0.390	0.320	0.296						0.146	0.189	0.195
SK		0.276	0.212	0.116						0.197	0.352	0.447
		0.17	0.34	0.43						0.24	0.45	0.41
NO	0.154	0.134	0.060	0.071	0.374	0.417	0.417	0.415	0.301	0.308	0.246	0.204
	0.50	0.70	0.64	0.56								
CH	0.231	0.216	0.152	0.116	0.456	0.417	0.382	0.364	0.221	0.213	0.169	0.187
	0.32	0.36	0.46	0.55								

Source: elaborations on Cambridge Econometrics data

Table 2 - Dissimilarity index (DIS)
mean of regional values (1st row) and coefficient of variation (2nd row)

	Total Employment				*Industrial sector*				*(Market) Services*			
	1980	*1992*	*1999*	*2005*	*1980*	*1992*	*1999*	*2005*	*1980*	*1992*	*1999*	*2005*
BE	0.124	0.136	0.139	0.145	0.090	0.105	0.115	0.130	0.139	0.176	0.176	0.186
	0.41	0.31	0.38	0.40	0.34	0.29	0.31	0.28	0.22	0.19	0.22	0.22
DK	0.124	0.075	0.065	0.064	0.156	0.156	0.157	0.162	0.058	0.035	0.074	0.079
DE	0.052	0.041	0.027	0.032	0.102	0.098	0.102	0.101	0.088	0.025	0.022	0.036
	0.33	0.35	0.35	0.33	0.10	0.15	0.05	0.06	0.35	0.51	0.45	0.41
GR	0.188	0.156	0.132	0.118	0.210	0.224	0.213	0.207	0.109	0.114	0.146	0.160
	0.36	0.32	0.33	0.30	0.41	0.39	0.44	0.49		0.35	0.24	0.25
ES	0.092	0.048	0.050	0.062	0.072	0.068	0.062	0.053	0.062	0.085	0.118	0.127
	0.42	0.51	0.44	0.43	0.48	0.48	0.43	0.52	0.36	0.39	0.36	0.37
FR	0.048	0.050	0.055	0.048	0.063	0.085	0.106	0.124	0.045	0.063	0.050	0.054
	0.47	0.38	0.31	0.35	0.57	0.48	0.51	0.51	0.35	0.49	0.50	0.52
IE	0.061	0.047	0.058	0.073	0.196	0.123	0.128	0.181	0.058	0.079	0.083	0.096
IT	0.037	0.019	0.033	0.037	0.085	0.112	0.120	0.124	0.080	0.052	0.056	0.048
	0.37	0.40	0.30	0.29	0.55	0.33	0.31	0.32	0.43	0.38	0.38	0.41
LU	0.122	0.160	0.164	0.167	0.461	0.291	0.191	0.181	0.089	0.119	0.125	0.146
NL	0.117	0.076	0.084	0.080	0.128	0.139	0.148	0.159	0.189	0.121	0.180	0.159
	0.45	0.58	0.64	0.45	0.28	0.44	0.59	0.66	0.09	0.14	0.17	0.21
AT	0.036	0.027	0.031	0.031	0.125	0.120	0.124	0.118	0.095	0.091	0.100	0.094
	0.30	0.27	0.35	0.42	0.05	0.04	0.03	0.04	0.38	0.51	0.57	0.66
PT	0.143	0.108	0.091	0.070	0.207	0.212	0.217	0.197	0.133	0.113	0.136	0.118
	0.36	0.26	0.19	0.15	0.38	0.32	0.33	0.36	0.33	0.34	0.31	0.40
FI	0.034	0.055	0.060	0.063	0.112	0.142	0.165	0.183	0.044	0.070	0.074	0.079
SE	0.082	0.074	0.050	0.055	0.250	0.130	0.096	0.114	0.074	0.067	0.051	0.060
	0.56	0.49	0.46	0.43	0.15	0.22	0.35	0.28	0.16	0.20	0.22	0.28
UK	0.140	0.154	0.152	0.148	0.069	0.051	0.055	0.083	0.097	0.105	0.084	0.067
	0.26	0.31	0.41	0.41	0.48	0.46	0.42	0.39	0.41	0.38	0.46	0.50
CY		0.163	0.122	0.114						0.160	0.179	0.210
CZ		0.137	0.132	0.124						0.101	0.138	0.138
		0.13	0.13	0.11						0.29	0.26	0.25
EE		0.168	0.081	0.082						0.175	0.180	0.111
HU		0.081	0.094	0.064						0.146	0.150	0.131
		0.31	0.36	0.32						0.18	0.25	0.24
LT		0.212	0.153	0.164						0.194	0.251	0.257
LV		0.147	0.121	0.099						0.159	0.211	0.219
MT		0.078	0.103	0.105						0.118	0.178	0.218
PL		0.187	0.230	0.254						0.169	0.156	0.151
		0.45	0.39	0.37						0.22	0.19	0.25
SI		0.195	0.160	0.148						0.073	0.095	0.098
SK		0.138	0.106	0.058						0.099	0.176	0.223
		0.17	0.34	0.43						0.24	0.45	0.41
NO	0.077	0.067	0.030	0.035	0.187	0.209	0.209	0.208	0.150	0.154	0.123	0.102
	0.50	0.70	0.64	0.56								
CH	0.115	0.108	0.076	0.058	0.228	0.208	0.191	0.182	0.110	0.106	0.084	0.093
	0.32	0.36	0.46	0.55								

Source: elaborations on Cambridge Econometrics data

Additionally, the indices have been calculated for *total employment* (sector shares refer to: agriculture; energy and manufacturing; construction; market services; non-market services), for the *industrial sector* (including: mining and energy supply; food, beverages and tobacco; textiles and clothing; fuels, chemicals, rubber and plastic products; electronics; transport equipment; other manufacturing), and for *market services* (including: wholesale and retail; hotels and restaurants; transport and communications; financial services; other market services).

As to *total employment*, KSI shows (Table 1) a falling trend in most countries of *"old" Europe*, especially in those where the initial structure was initially more dissimilar (Greece, Portugal) due to the heavy specialisation in agriculture; decreasing specialisation can be found at the regional level as well. The only exceptions to the declining trend are given by Ireland, Finland, Belgium, Luxembourg and the United Kingdom[19]. In the latter three countries, the index level is also particularly high. This is related to the quickly expanding service sector and so explains the relative distance from the "average European structure".

The DIS index (Table 2) shows a broadly similar picture. In case of both indices, the run-up and the advent of the euro does not seem to have influenced previous tendencies. Finally, by looking at the c.v.'s, the internal structure of individual countries seems to have become more homogeneous in certain cases (France, Italy, Portugal, Sweden) and more differentiated in others (Austria, UK).

Examining the situation in *new members*, the KSI index is higher everywhere – relative to the average situation of EU15 – with the exception of Hungary and Malta, where the economic structure is more similar to that of the euro area. However heterogeneity is decreasing in all new member states[20], except Malta and Poland. These trends are worrying in the latter case, because of the exceptional level of KSI reached in 2005.[21]

An important warning, concerning the *regional level*, is that out of a total of 250 regions, between 1992 and 2005, 90 were increasingly specialised and in the remaining 160 there was a decreasing trend. In all cases the increasing trends were minor and concerned mainly regions with an initial low index value (excluding some Polish regions). In the full period (1980-2005), out of 197 regions, 139 had a *decreasing specialisation* not considering EU10 regions and the German eastern regions.

Now considering employment in the *industrial sector* (no disaggregated data are available for the new states), the KSI specialisation index showed the highest levels not only in Greece and Portugal, but also in Luxembourg and Sweden. However, in these countries, the index was decreasing, while it increased in many other countries: e.g., Belgium, France, Italy, the Netherlands, Finland (in many of these countries the interregional differentiation is however falling). Neither the single market of 1992 nor the euro seem to have improved homogeneity within the industrial sector. Thus, in

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[19] The specialisation level of the UK turns out to be low in one study (discussed by Combes and Overman, 2003) covering 14 EU countries over the 1970-1997 period with a disaggregation in 36 industries; it is however confirmed that Ireland and Greece are the most specialised.

[20] A *slow convergence* in employment specialisation, is also obtained by Angeloni et al. (2005): the final degree of specialisation is lower, on average, in new members than in Greece or Portugal. However, if Krugman's index is based on total valued added in real terms (disaggregated into five sectors), a roughly constant dissimilarity is obtained for the period 1995-2003.

[21] No particularly different evidence emerges from the DIS index. As to the internal differentiation in economic structures, this is only increasing in the Slovak Republic. In all other case, the dispersion (measured by the *c.v.*'s of the indices) has not changed much.

the final year (2005), the composition within the industrial sector seems rather differentiated in general (with the exceptions of Spain and the UK), with growing heterogeneity relative to the '80s, though without the extreme specialisation patterns of some countries 25 years ago. The distance relative to the European "average" seemed to be pronounced both in the "peripheric" countries (Ireland, Finland, Greece, Portugal) and in some "core" countries (Benelux, Denmark).

Also in some case of *market services*, in some countries there was homogenisation and in others growing differentiation. In the final year, Benelux and of Southern countries (Greece, Spain, Portugal) were the more distant from the European (eurozone) average .[22]

Regionally, homogenisation of productive structures was less evident when we considered a more disaggregated structure. In the case of the internal composition of the industrial sector, about 2/3 of regions had *increasing specialisation*. Concerning services, regions seemed split into two equally numerous groups. On average, however, increases in regional specialisation were small.

All in all, though some caution is needed, e.g., concerning the low level of sector disaggregation[23], the evidence is mixed: *structural convergence* is a widespread phenomenon across European countries and regions, but this is not true in all countries, in all branches and over all sub-periods. In particular, the sector mix within the manufacturing sector seems to have become more differentiated across European countries and regions.

3. 5 Beta convergence estimates for European regions

Turning back to the issue of convergence, we consider both an *absolute* and a *conditional beta convergence* approach, the latter in order to find the likely effects of regional specialisation on regional growth.

An *absolute β-convergence* approach implies the estimation of a regression of the following type:

$$(\ln y_{r,t+\tau} - \ln y_{r,t})/\tau = \alpha + \beta \ln y_{r,t} + \varepsilon$$

i.e., a cross-section, for a sample of n regions ($r=1,\dots,n$), where the regional growth rate of per capita income (at constant prices) in a certain period ($t, t+\tau$) is regressed on the initial level of per capita income ($y_{r,t}$).

A *conditional β-convergence* approach includes some additional explanatory variables in the estimation:

$$(\ln y_{r,t+\tau} - \ln y_{r,t})/\tau = \alpha + \beta \ln y_{r,t} + \gamma x_{r,t} + \varepsilon$$

where $x_{r,t}$ is a "structural" variable. In this case, convergence of each region is toward its own steady-state characterised by structural variables (in the initial studies

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[22] As in the case of total employment, the KSI index is generally higher in *new members* (EU10) than in EU15 (Slovenia is the relevant exception). Differently from total employment, however, the index is rising in many countries, reaching particularly high levels in the Baltic states, in Slovakia and in the two Mediterranean islands (Cyprus and Malta). Again, the DIS index provides almost similar results.

[23] We have already seen that trade specialisation is more important than broad economic specialisation in determining synchronicity of business cycles (Böwer and Guillemineau, 2006): specific product specialisation, in particular in tradable goods and services (the size of the industrial sector and machinery are the most significant variables), may be more important. On the other hand, there are many studies of specialisations based on broad economic sectors (see Angeloni et al., 2005, among others) and – what is more important – at the regional level a finer sector disaggregation is not available.

propensity to save, population growth, rate of technical progress, R&D expenditures, human capital endowments, etc.).

Table 3 shows the results of OLS estimates of *β-convergence in regional per capita incomes*, by considering different aggregates (EMU, EU15, EU25, EU10) and distinct time intervals (1980-2005, 1990-2005, 1990-1999, and 1999-2005); the full sample period (1980-2005) is considered for the EMU aggregate alone.[24]

Table 3 − Absolute beta convergence: gross domestic product (ppp) per capita

eq.	regions	periods	obs.	β, t-test	adj. R^2	F-test
1.1	EU15	1980-2005	197	-0.53*** (-8.7)	0.276	75.75***
1.2	EU25	1990-2005	250	-0.55*** (-10.4)	0.301	108.47***
1.3	EMU	1990-2005	161	-0.69*** (-12.2)	0.479	147.87***
1.4	EU15	1990-2005	209	-0.61*** (-11.0)	0.366	121.22***
1.5	EU10	1990-2005	41	-0.32** (-2.1)	0.077	4.33**
1.6	EU25	1990-1999	250	-0.33*** (-5.5)	0.105	30.07***
1.7	EMU	1990-1999	161	-0.47*** (-6.6)	0.211	43.80***
1.8	EU15	1990-1999	209	-0.38*** (-5.9)	0.142	35.32***
1.9	EU10	1990-1999	41	-0.36** (-2.4)	0.108	5.86**
1.10	EU25	1999-2005	250	-0.46*** (-8.2)	0.210	67.05***
1.11	EMU	1999-2005	161	-0.44*** (-6.1)	0.186	37.62***
1.12	EU15	1999-2005	209	-0.33*** (-5.1)	0.106	25.73***
1.13	EU10	1999-2005	41	0.11 (0.7)	-0.014	0.046

t-stat. in parentheses; significance levels: 1%***, 5%**, 10%*
Source: elaborations on Cambridge Econometrics data

In almost all cases the estimated *β* is negative and significant, proving convergence in European regions. The only exception is new members over the period 1999-2005 (model 1.13), thus confirming our previous hypothesis[25]. The recent fast convergence of new (EU10) states has been at the expense of internal interregional distribution. By looking at the magnitude of the coefficients, we can add that convergence was more intense in the euro area (EMU) than in EU15 or, even more so, in EU10. For the EMU group, we can also notice the high degree of total variance explained by the regression (see model 1.3 relative to 1990-2005), in contrast with the low *adj. R^2* statistics in many other equations. In any case, there was no significant difference in the periods before and after 1999.

Table 4 provides β-convergence estimates of *employment rates*. As a matter of fact, several recent studies looked at regional disparities in terms of employment, rather than income or production. Not only is labour market performance an

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[24] East German regions are considered from 1991; the three Baltic countries are included starting from 1992.

[25] Quite similar results for almost all territorial aggregates are obtained by Perugini and Signorelli (2005), despite some slight differences in the sample periods.

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important goal of economic policy, as confirmed by the Lisbon strategy, but the use of employment indicators has to be preferred to the unemployment rate.[26] The structure of Table 2 is identical to Table 1 and the results are also quite similar. β-convergence can be found in all periods and for almost all territorial aggregates, except EU10 countries in 1999-2005 (model 2.13).[27]

Table 4 – Absolute beta convergence: employment rates

eq.	regions	periods	obs.	β, t-test	adj. R²	F-test
2.1	EU15	1980-2005	197	-0.40*** (-6.0)	0.153	36.28***
2.2	EU25	1990-2005	250	-0.33*** (-5.5)	0.106	30.68***
2.3	EMU	1990-2005	161	-0.29*** (-3.8)	0.078	14.55***
2.4	EU15	1990-2005	209	-0.34*** (-5.2)	0.110	26.67***
2.5	EU10	1990-2005	41	-0.28* (-1.8)	0.056	3.4*
2.6	EU25	1990-1999	250	-0.31*** (-5.1)	0.090	25.72***
2.7	EMU	1990-1999	161	-0.13* (-1.6)	0.011	2.72*
2.8	EU15	1990-1999	209	-0.21*** (-3.1)	0.041	9.90***
2.9	EU10	1990-1999	41	-0.59*** (-4.5)	0.328	20.56***
2.10	EU25	1999-2005	250	-0.18*** (-2.9)	0.028	8.19***
2.11	EMU	1999-2005	161	-0.34* (-4.6)	0.113	21.36***
2.12	EU15	1999-2005	209	-0.32*** (-4.9)	0.099	23.84***
2.13	EU10	1999-2005	41	0.12 (0.8)	-0.010	0.60

t-stat. in parentheses; significance levels: 1%***, 5%**, 10%*
Source: elaborations on Cambridge Econometrics data

The results of β-convergence in *productivity*, which is the most significant variable according to growth theories, are shown in Table 5. Productivity is calculated as value added per employee. In this case, in addition to absolute β-convergence, we have estimated some models of conditional β-convergence, where the structural variables are identified in:

(a) either the indices or specialisation (KSI or DSI) or their change over the period considered (ΔKSI, ΔDIS); or

(b) the sector shares (agriculture, industry or services) on total employment.

Table 6 shows, in column (a), the estimated coefficients of the KSI index on total employment[28] (initial level or percent change over the period) and, in column (b), those of the sector shares in the most significant regressions[29]. For robustness checks, the estimated *β* coefficients in these conditional regressions are also reported.

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[26] See Marelli (2004), Perugini and Signorelli (2004) among others.

[27] On the contrary, over the period 1990-1999 convergence in employment rates was evident also in this group (model 2.9), with a relatively high degree of explained variance. In all other cases, the fit of the estimated relations is rather low.

[28] The results relative to the DIS index are not reported due to space, but they are almost identical.

[29] The employment shares in regressions of Table 6 are relative to the starting date. They are reported only if significant at 5%: these sectors are agriculture, industry (i.e., manufacturing and energy), and

Table 5 – Absolute beta convergence: productivity (value added per employee)

eq.	regions	periods	obs.	β, t-test	adj. R²	F-test
3.1	EU15	1980-2005	197	-0.62*** (-11.0)	0.380	121.27***
3.2	EU25	1990-2005	250	-0.72*** (-16.2)	0.511	260.91***
3.3	EMU	1990-2005	161	-0.57*** (-8.7)	0.318	75.63***
3.4	EU15	1990-2005	209	-0.54*** (-9.2)	0.288	85.34***
3.5	EU10	1990-2005	41	-0.44** (-3.1)	0.174	9.46***
3.6	EU25	1990-1999	250	-0.55*** (-10.4)	0.302	108.65***
3.7	EMU	1990-1999	161	-0.59*** (-9.3)	0.349	86.84***
3.8	EU15	1990-1999	209	-0.56*** (-9.7)	0.309	94.19***
3.9	EU10	1990-1999	41	-0.31** (-2.1)	0.075	4.22**
3.10	EU25	1999-2005	250	-0.69*** (-14.9)	0.471	222.45***
3.11	EMU	1999-2005	161	-0.14* (-1.7)	0.013	3.05*
3.12	EU15	1999-2005	209	-0.14** (-2.1)	0.015	4.25**
3.13	EU10	1999-2005	41	-0.36** (-2.4)	0.110	5.94**

t-stat. in parentheses; significance levels: 1%***, 5%**, 10%*
Source: elaborations on Cambridge Econometrics data

As to the *absolute β-convergence in productivity*, in general, significant and important convergence occurred across all European regions, even when compared to convergence in per capita income or employment rates. Moreover, recently (1999-2005), the exception was no longer the EU10 group, but rather the euro area regions (the coefficient of model 3.11 is negative but not significant).

Convergence conditional on the indices of specialisation or on the initial sectoral shares improved the fit in almost all cases, without altering the sign or the statistical significance of the *β* parameters. A general impression is that the initial specialisation, when significant, positively contributed to regional growth (KSI coefficient > 0). The only exception was the new members (see eq. 3.5a, relative to1990-2005, with KSI coefficient < 0).

On the other hand, the increase over time in regional specialisation generally produced a negative impact on growth (ΔKSI coefficient < 0). The only exceptions being the old members in the full period (1980-2005) and the new members in the recent period (1999-2005).

Moreover, considering the impact of specialisation in individual sectors, *agriculture* had a negative impact on productivity growth (save for the EMU regions in recent years). However, *services* always played a positive role also in the case of the EU10 group.[30]

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services (i.e. market services) identified by A, I, S respectively. (In the whole table, the t-statistics are replaced, by the Adj. R², but the significance levels are still shown next to the coefficients: 1%***, 5%**, 10%*).

[30] In this group of new members *industry* had a negative impact recently; but, also for all (EU25) European regions, a high specialisation in the industrial sector had, especially in the '90s, a dampening effect on productivity convergence.

Table 6 – Conditional beta convergence (productivity)
(a) on specialisation index; (b) on sectoral shares: A (agriculture), I (industry), S (services)

eq.	regions	periods	obs.	(a) specialisation index		(b) sectoral shares	
				coeff (KSI or ΔKSI), adj. R²	β	coeff (A,I,S), adj. R²	β
3.1 a, b	EU15	1980-2005	197	KSI$_{80}$: 0.03 (0.378)	-0.60***	S: 0.12** (0.392)	-0.64***
				ΔKSI: 0.17*** (0.405)	-0.65***		
3.2 a, b	EU25	1990-2005	250	KSI$_{92}$: 0.06 (0.512)	-0.69***	I: -0.12*** (0.522)	-0.73***
				ΔKSI: -0.12*** (0.523)	-0.72***	S: 0.12** (0.520)	-0.77***
3.3 a	EMU	1990-2005	161	KSI$_{92}$: 0.24*** (0.356)	-0.44***		
				ΔKSI: -0.18*** (0.347)	-0.54***		
3.4 a	EU15	1990-2005	209	KSI$_{92}$: 0.25*** (0-333)	-0.42***		
				ΔKSI: -0.13** (0.301)	-0.52***		
3.5 a, b	EU10	1990-2005	41	KSI$_{92}$: -0.35** (0.259)	-0.59***	A: -0.31** (0.230)	-0.59***
				ΔKSI: -0.13 (0.171)	-0.43***	S: 0.58*** (0.405)	-0.75***
3.6 a, b	EU25	1990-1999	250	KSI$_{92}$: 0.01 (0.299)	-0.55***	A: -0.15** (0.317)	-0.62***
				ΔKSI: -0.09* (0.307)	-0.55***	I: -0.13** (0.315)	-0.56***
						S: 0.16*** (0.319)	-0.62***
3.7 a, b	EMU	1990-1999	161	KSI$_{92}$: 0.03 (0.346)	-0.58***	A: -0.21*** (0.376)	-0.72***
				ΔKSI: -0.02 (0.346)	-0.59***		
3.8 a, b	EU15	1990-1999	209	KSI$_{92}$: 0.07 (0.310)	-0.52***	A: -0.19*** (0.336)	-0.63***
				ΔKSI: 0.03 (0.307)	-0.57***		
3.9 a, b	EU10	1990-1999	41	KSI$_{92}$: -0.38** (0.177)	-0.48***	A: -0.37** (0.159)	-0.49***
				ΔKSI: -0.36** (0.185)	-0.27*	S: 0.53*** (0.262)	-0.59***
3.10 a	EU25	1999-2005	250	KSI$_{99}$: 0.15*** (0.485)	-0.62***		
				ΔKSI: 0.05 (0.471)	-0.69***		
3.11 a, b	EMU	1999-2005	161	KSI$_{99}$: 0.43*** (0.161)	-0.04	A: 0.38*** (0.100)	0.08
				ΔKSI: -0.11 (0.019)	-0.13		
3.12 a, b	EU15	1999-2005	209	KSI$_{99}$: 0.39*** (0.145)	-0.01	A: 0.16** (0.031)	-0.08
				ΔKSI: -0.12* (0.026)	-012*		
3.13 a, b	EU10	1999-2005	41	KSI$_{99}$: -0.08 (0.091)	-0.40**	I: -0.38*** (0.242)	-0.34**
				ΔKSI: 0.51*** (0.356)	-0.33**	S: 0.47** (0.208)	-0.69***

Source: elaborations on Cambridge Econometrics data

A preliminary conclusion is that neither a high specialisation nor its increase over time – i.e., lack of structural convergence – is negative, per se, for regional

growth. It depends on the specific sector in which the regions are specialised (a finer sector breakdown, especially within industry, would be convenient).

4. Conclusions

The *integration* process in the EU is now advanced. EMU is a real conquest and the euro has been with us for more than seven years, however, economic and social cohesion is far from achieved, thus exacerbating the structural and growth problems of many European countries. The need for real convergence – in addition of being a desirable goal per se – is also connected to the good working of the monetary union itself. This is also applicable to the new member states.

Economic and social cohesion includes reducing regional disparities. There has been convergence across countries, including the new members recently, despite certain imbalances. In some countries income growth has benefited employment, in others productivity. Also a regional reduction in disparities (as results from the *sigma* approach) seems prevalent. An opposite trend is found in the EU10 of new members; in particular, increasing regional disparities characterise the first stages of growth of individual countries, thus producing a trade-off between international convergence and interregional convergence.

The analysis of two *specialisation* indices revealed a prevalent decreasing specialisation across European countries and regions. This result also included the new countries, whose regions are becoming progressively more similar – despite an initially high heterogeneity – to "old Europe" (a partial exception is the Polish regions). Within the industrial sector and within market services, however, specialisation trends are more mixed: regions with decreasing specialisation are about half in services and only 1/3 in manufacturing and energy.

Summing up, *structural convergence* is a widespread phenomenon across European countries and regions, but this is not true in all countries, in all branches and over all sub-periods.

Finally, *regional convergence* is confirmed by the *absolute beta convergence* estimates of per capita incomes. In the EMU area this was established also over the period after the adoption of the euro.[31] Growing disparities can be noticed once more in the EU10 group, especially recently; it has been a difficult period for the new members also concerning convergence in employment rates. The *conditional beta convergence* shows generally positive effects on convergence due to specialisation in services and negative from agriculture. On the other hand, overall specialisation is not unambiguously related to regional growth.

With reference to short term themes, although the previous results concerning specialisation might imply a potential risk of asymmetric shocks, the progressive opening of all national and regional economies, the growing integration of markets of goods, services, and factors of production, the documented increase in the synchronicity of business cycles (as illustrated in section 2.2) make the *euro* a good opportunity to exploit and/or to pursue, for all members. The run-up as well as the adoption of the euro do not seem to have caused any negative effects on regional

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[31] For EMU countries, convergence results are less robust for productivity.

convergence[32]. However, appropriate economic policies must be designated and implemented whenever economic and social cohesion risk being affected.

References

Angeloni I., Flad M., Mongelli F.P. (2005), 'Economic and monetary integration of the new member states: Helping to chart the route', *Occasional Paper Series,* 36, European Central Bank.

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., Sala-I-Martin X. (1995), *Economic growth*, New York, McGraw Hill.

Babetskii I. (2005), 'Trade integration and synchronization of shocks: Implications for EU enlargement', *Economics of Transition*, 13, 105-138.

Basile R., de Nardis S., Girardi A. (2001), 'Regional inequalities and cohesion policies in the European Union', ISAE, Istituto di Studi e Analisi Economica.

Belke A., Heine J.M. (2004), 'Specialisation patterns and the synchronicity of regional employment cycles in Europe', *IZA Discussion Paper,* 1439.

Boldrin M., Canova F. (2001), 'Inequality and convergence in Europe's regions: Reconsidering European regional policies', *Economic Policy*, 32, 205-45.

Boeri T., Terrel K. (2002), 'Institutional determinants of labour reallocation in transition', *Journal of Economic Perspectives*, **16**, 51-76.

Böwer U., Guillemineau C. (2006), 'Determinants of business cycle synchronisation across euro area countries', *Working Paper Series,* 587, European Central Bank.

Buiter W.H. (2004), 'To Purgatory and beyond: when and how should the accession countries from Central and Eastern Europe become full members of EMU?', *CEPR Discussion Paper Series*, 4342.

Buti M., Sapir A. (eds) (1998), *Economic Policy in EMU*, Oxford, Clarendon Press.

Combes P.P., Overman H. (2003), 'The spatial distribution of economic activities in the EU', *CEPR Discussion Paper Series*, 3999.

Cuadrado Roura J.R. (2001), 'Regional convergence in the European Union: from hypotheses to actual trends', *The Annals of Regional Science*, 35, 333-356.

Darvas Z., Szapáry G. (2005), 'Business cycle sychronization in the enlarged EU', *CEPR Discussion Paper Series*, 5179.

De Grauwe P., Mongelli F.P. (2005), 'Endogeneities of optimum currency areas: What brings countries sharing a single currency closer together?', *Working Paper Series,* 468, European Central Bank.

De Nardis S., Goglio A., Malgarini M. (1996), 'Regional specialization and shocks in Europe : some evidence from regional data', *Weltwirtschaftliches Archiv*, 132, 197-214.

Fatàs A. (1997), 'Countries or regions? Lessons from the EMS experience', *European Economic Review*, 41, 743-755.

Fidrmuc J., Korhonen I. (2006), 'Meta-analysis of the business cycle: Correlation between the Euro area and the CEECs', *CESIFO Working Paper*, 1693.

Frankel J., Rose A.K. (1998), 'The endogeneity of Optimum Currency Area criteria', *Economic Journal*, 108, 1009-1025.

Gardiner B., Martin R., Tyler P. (2004), 'Competitiveness, productivity and economic growth across the European regions', miemo, Cambridge Econometrics.

Giannone D., Reichlin L. (2006), 'Trends and business cycles in the euro area: how much heterogeneity and should we worry about it?', *Working Paper Series*, 595, European Central Bank.

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[32] However, strong empirical conclusions are not possible because the time span since the start of EMU is not long enough, as recognized in the review of Mongelli and Vega (2006).

Hallet M. (2002), 'Regional specialisation and concentration in the EU', in Cuadrado-Roura J. and Parellada M. (eds), *Regional convergence in the European Union*, Berlin, Springer.

Imbs J. (1999), 'Co-fluctuations', *CEPR Discussion Paper Series,* 2267.

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

Kuznets S. (1955), 'Economic growth and income inequality', *American Economic Review*, 45, 1-28.

Marelli E. (2004), 'Evolution of employment structures and regional specialisation in the EU', *Economic Systems,* 28, 35-59.

Marelli E. (2006), 'Regional employment dynamics in the EU: structural outlook, co-movements, clusters and common shocks', in Caroleo F.E. and De Stefanis S. (eds) T*he European labour market. Regional dimensions,* Physica-Verlag, 89-122.

Molle W. (1997), 'The regional economic structure of the European Union: an analysis of long-term developments', in Peschel K. (ed) *Regional growth and regional policy within the framework of European integration*, Physica-Verlag, Heidelberg, 66-86.

Mongelli F.P., Dorrucci E., Agur I. (2005), 'What does European institutional integration tell us about trade integration?', *Occasional Paper Series*, 40, European Central Bank.

Mongelli F.P., Vega J.L. (2006), 'What effects is EMU having on the Euro area and its member countries? an overview', *Working Paper Series*, 599, European Central Bank.

Perugini C., Signorelli M. (2004), 'Employment performance and convergence in the European countries and regions', *The European Journal of Comparative Economics*, 1, 243-278.

Perugini C., Signorelli M. (2005), 'Growth and employment in EU countries and regions', 20th AIEL Conference, Rome.

Williamson J.G. (1965), 'Regional inequality and the process of national development: a description of the pattern', *Economic Development and Cultural Change*, 13, 3-45.

Zaghini A. (2005), 'Evolution of trade patterns in the new EU member states', *Temi di discussione,* 568, Banca d'Italia.