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**Lisbon vs. Maastricht: Real and Nominal Convergence in EU Countries**

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**Abstract**<sup>1</sup>

Purpose of this paper is to assess real and nominal convergence within the EU countries; both processes have been largely shaped by the advances in institutional integration: the Lisbon strategy and Maastricht's Treaty are the clearest examples. The first part of the paper summarizes the different meanings of *real convergence* and *nominal convergence* for a group of countries that are proceeding toward a deeper economic integration, ultimately ending with an economic and monetary union. This theoretical framework, which emphasizes the manifold links between real and nominal convergence, is then applied to the case of the EU. *Real convergence* is investigated through a long run (1990-2007) analysis (sigma and beta convergence approaches) of unemployment and employment rates, productivity, per-capita incomes, industrial specialisation. *Nominal convergence* is mainly based on the study of Maastricht's criteria.

In order to investigate how the process of institutional integration (such as Maastricht's convergence and euro adoption) has affected real convergence, we have computed (and included in the regressions), in a rather innovative way, an "*integration index*", which takes into account the progressive steps toward closer integration followed by individual countries. From this analysis we can infer whether institutional/nominal convergence may have helped in achieving real convergence, in accordance with the well-known hypothesis of "endogeneity of OCA's criteria".

The results show that in EMU countries real convergence is well established (in terms of labour market indicators, productivity, output correlations); only the pattern of convergence in economic structures and in per-capita income is not so clear. On the other hand, the New Members have shown, despite some difficulties in respecting nominal conditions, a generalised catching-up in terms of productivity and per-capita income; possible concerns refer however not only to the still different specialisations and consequently low output correlations, but also to persisting problems in labour market performance. Such problems have been greatly amplified by the current financial and economic crisis.

Key words: real convergence, nominal convergence, European integration, old and new Europe

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## 1. Introduction

A decade has already elapsed since euro's birth. Its success has been confirmed by the recent events following the financial and economic crisis of 2008. Most of EMU's members have been able to outlive the deepest phase of the crisis (despite some concerns about the most vulnerable countries) and the macroeconomic and financial instability has been worse in non-EMU countries. On the other hand, economic growth has been lower in Europe in all years of the new century (as was already in the 1990s) compared to other countries, such as the USA, not to speak of China, India and other emerging countries.

In the last decade, some other major events occurred in Europe. Besides the completion of the Single Market – with a closer trade integration within the EU – the two enlargements of 2004 and 2007, the widest in EU's history, led to a close integration of Central and Eastern European countries (CEEC) with the European “core”. Some New Members (NMS) have already entered the EMU (Slovenia, Cyprus, Malta, Slovakia), although the question of the proper time of entry in the ERM-II firstly and in EMU afterwards is lively debated (as we shall see later).

The links between real convergence and nominal convergence are rather complex, can go in both directions, and may be different in the short-run vs. the long-run. The literature's review comprehends such different aspects as long-run economic evolutions and convergence (in per-capita incomes and productivity), convergence in labour markets, homogenisation of economic structures. The latter is relevant also for short-run economic performance, e.g. because of the effects on the symmetry of economic shocks; in fact, synchronisation of business cycles and closer trade integration are two additional aspects of real convergence. It is likely that the process of institutional integration enhanced such a real convergence, as maintained by the OCA's endogeneity hypothesis. A last issue is whether the mentioned process – including the final step of nominal convergence: euro's adoption – favours the implementation of market reforms (which in turn affects economic performance).

In this paper we illustrate the main features of both real and nominal convergence in the EU. We consider first some descriptive statistics, including an analysis of sigma and lowess-beta convergence. Then we run some regressions concerning the beta (unconditional and conditional) convergence analysis of: employment and unemployment rates, productivity, industrial specialisation; an investigation of output correlations concludes the empirical section. The most original feature of our econometric estimates is the inclusion in the regressions of an “integration index”, specifically computed, which tries to quantitatively summarise the progressive steps of institutional integration in Europe.

According to our results, the degree of real convergence seems satisfactory in EMU countries: this is the outcome of (sigma and beta) convergence in productivity and labour market indicators and of the analysis of output correlations; the only exceptions to this pattern of real convergence refer to the convergence (or divergence) in economic structures and in per capita income. On the other hand, the NMS have shown a generalised catching-up in terms of productivity and per-capita income toward the European average; this convergence is however obscured by the still different specialisations and consequently low output correlations, in addition to persisting problems in labour market performance. Moreover, these countries have encountered (in some cases) various difficulties in respecting nominal conditions of convergence, e.g. the Maastricht's criteria (these weaknesses have some implications for the proper time of euro's adoption).

Before ending this section, we must add that the most recent data, from the time when the financial and economic crisis peaked at the end of 2008, show a deeply deteriorated situation for many CEEC countries – both NMS and outside the EU – especially in terms of rising interest rates (because of considerable increases in default risks), growing deficits and debts, unbalances in foreign accounts, and depreciation of exchange rates. The consequences on real variables – GDP, production, employment, etc. – have also been terrible; but we cannot argue that disparities within the enlarged EU have really augmented, since also West-Europe (Old members) countries have also been deeply affected.

The structure of the paper is the following. In Section 2 there is a review of the theoretical and empirical literature, focusing on the institutional process of integration in Europe – with particular reference to the Maastricht’s Treaty and to the Lisbon’s strategy – , on the different aspects of real convergence (emphasizing labour market issues), on the links between real, nominal and institutional convergence. A preliminary descriptive analysis of real and nominal convergence is in Section 3, including sigma and lowess-beta analysis of some important “real” variables (employment and unemployment rate, productivity, per capita GDP, sectoral specialisation) and the investigation of the long-run evolution of nominal convergence (Maastricht’s parameters). The econometric investigations are presented and commented in Section 4: they comprehend beta-convergence of employment and unemployment rates, beta-convergence of productivity and economic structures (including an “extended” beta-convergence approach), and an analysis of output correlations. Policy conclusions are drawn in Section 5.

## **2. Real and Nominal Convergence in the EU: Theories and Empirical Assessments**

In this Section we present a review of the main theoretical and empirical literature on nominal and real convergence issues, by highlighting the links between the two processes, in the context of EU integration, processes that in the literature are usually analysed in separate fields of study.

### **2.1. The Integration Process in Europe**

The integration process in the European continent has been wide-ranging and deep, although not always continuous and linear over time (as the halt in the processes of ratification of the Constitutional Treaty in 2005 and of the Lisbon Treaty in 2008 testifies). With reference to the *widening* process, starting from a community of six in 1958, we arrived – through the 2004-07 enlargements – to a community of 27, encompassing now most of the countries of the continent. The new (twelve) members underwent in the ‘90s a process of accession, after being formally considered as “candidate” countries.

Concerning the *deepening* aspect – after the common market and customs union, the single market (focusing on the “four” liberalisations of goods, services, capitals and people) – the European Economic and Monetary Union (EMU) established in 1999, with the circulation of the new common currency (the *euro*) since 2002, represents the most momentous achievement. An intermediate step toward the monetary union is represented by the Exchange rate mechanism (ERM) of the European Monetary System, which was launched in 1979 and, after the big crisis of 1992-93, still survives (as ERM-II) for the countries waiting to join the euro-zone.

According to the art. 2 of the Treaty establishing the European Community (as amended by the Treaty of Amsterdam, 1997):

*‘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.’*

The final goals of the EU include – as clearly specified in this article – *convergence of economic performance* and *economic and social cohesion*. This refers to convergence both between members (as the mention of solidarity indicates) and within individual countries, thus justifying regional policy measures. The instruments explicitly mentioned to achieve such goals include the *common market* and the *economic and monetary union*. It must be added that convergence in

economic performance includes, especially since the launch of the European Employment Strategy and the ensuing Lisbon Agenda, *convergence in labour markets*.

On one hand, the EMU is officially viewed as an instrument to achieve “real” convergence, i.e. convergence in economic performances. On the other hand, we can add that economic convergence is also a prerequisite to accomplish an effective EMU, as shown in the literature on “optimum currency areas” (OCA): *real convergence*, for instance in economic structures, rendering more symmetric the economic shocks, makes unnecessary the exchange rate instrument and raises the net benefits of EMU. This prerequisite goes beyond to the *nominal convergence* requirements established by the Maastricht Treaty as a pre-condition for candidate countries to enter the EMU.

Thus, it is already apparent that the links between real and nominal convergence are multiple and can go both ways.

## 2.2. Maastricht and Nominal Convergence

The Maastricht Treaty was signed in February 1992 and entered into force in November 1993. Its main goal was the establishment of a European and Monetary Union (EMU) within the EU. This task was accomplished in January 1999, with the third and final stage of the monetary integration, which gave birth to a new common currency, the euro (its circulation among the participating countries appeared in 2002).

Since 1999, the European Central Bank (ECB), together with the European Monetary System, is the sole responsible for the conduct of monetary policy in the Eurozone. It is considered one of the most independent central banks in the world. It is also “conservative”, in the sense that it places “price stability” at the top among its final aims. The current specification of price stability is to have an inflation rate lower but close to the 2% target.

To be admitted to the Eurosystem, a country has previously to satisfy some *nominal convergence criteria*: (i) an inflation rate not exceeding the rate of the best three performing countries plus an allowance of 1.5%; (ii) a nominal interest rate (on long-term public bonds) not exceeding the interest rate of the three best performing countries (in terms of inflation) plus an allowance of 2%; (iii) a ratio between public deficit and GDP not exceeding 3% (apart from exceptional and temporary situations); (iv) a ratio between public debt and GDP not exceeding 60% (or diminishing toward the reference value); (v) the permanence of the national currency for at least two years within the normal band of the EMS (without any devaluation).

It is known that such convergence criteria were, for the first time, verified at the beginning of May 1998, allowing to define a list of eleven members that in January 1999 gave birth to the euro. The subsequent tests for other countries resulted in further enlargements of the Eurozone, to Greece (2001), Slovenia (2007), Cyprus and Malta (2008), Slovakia (2009).

Even after the start of EMU, EU members have to satisfy nominal criteria concerning fiscal policy and public budgets, as specified in the Growth and Stability Pact (signed in 1997). In particular, public deficit cannot exceed 3% of GDP (apart from exceptional circumstances), otherwise an “excessive deficit procedure” is applied. Moreover, in the medium run the public budget should reach a balanced situation. It should be recalled that the Growth and Stability Pact has been reformed in 2005, after the great difficulties of some large countries (especially Germany and France) in respecting the time and conditions for “excessive deficit procedure”.

The EU members not yet adopting the euro (but Denmark and the UK) are subject to a periodic revision about the “progress in the fulfilment of the requirements concerning the realization of EMU”: to this end, both the EU Commission and the ECB prepare every two years specific “Convergence Reports”. The ECB report includes an analysis, country by country, of convergence in prices, in public finances (deficit and debt), in exchange rates, in long-term interest rates, plus a discussion of progress in legislation harmonisation (e.g. relative to central bank independence).

It is interesting to note that many EMU members have in some cases relaxed their respect for the nominal criteria after adopting the euro (also because the previous threat of exclusion

disappeared). As to the NMS, they initially showed a good rate of nominal convergence: inflation, interest rates, debt/GDP ratios, but with some imbalances in deficit/GDP ratios; this was accompanied by a growing trade openness, trade integration with EU15, significant reforms/changes in labour markets (with relatively high degrees of flexibility) and in institutions, and finally increasing business cycle synchronicity with the euro area. This account<sup>2</sup> must be completed by mentioning that the record is more mixed concerning some aspects of real convergence (growth, productivity, price levels), output specialisation and delays in the modernisation of financial systems.

In the latest (2008) ECB Convergence Report, a critical situation emerged with reference to the inflation condition (only three countries out of ten had an inflation rate lower than the reference value), while it was better in the case of long-term interest rates (three countries out of ten exceeded the reference value). Also the situation of public finances – traditionally more critical in some countries of Central Europe – has been improving: four countries were under the “excessive deficit procedure”, but only one (Hungary) presented in 2007 a deficit/GDP ratio greater than 3% and also a debt/GDP ratio greater than 60%. Concerning the exchange-rate, four countries (out of ten) joined the ERM-II agreements.

Before ending this section, we anticipate that the rationale underlying the nominal convergence criteria will be clarified later (section 2.6), where the positive long-run effects on real convergence will be emphasized. However, after the adoption of the Maastricht Treaty many authors highlighted the possible negative impact in the short run, especially the deflationary consequences of restrictive monetary and fiscal policies. For example, De Grauwe (2007) recalls<sup>3</sup> the low growth rate in Europe in the ‘90s – in contrast with the sustained US growth – and the rising unemployment, which initially increases because of aggregate demand problems and deflationary policies, then remains high because of rigidities typical of European labour markets (but also in the case of unemployment the long run evolution has been more positive).

### **2.3. European Employment Strategy and Lisbon Agenda**

Once the momentous goal of European and Monetary Union was achieved, in 1999, the EU countries realized that many other problems remained to be solved, the main ones being the persistent high unemployment and the low rate of growth. The clearest institutional response to these problems was the Lisbon agenda adopted in 2000. But even before some steps were launched to tackle labour market problems: from Delors’ White Book (1994) to the Treaty of Amsterdam (1997), and the contemporaneous European Employment Strategy (EES).<sup>4</sup>

The EES is an open-method of coordination of employment policies<sup>5</sup> aimed to achieve conditions for full employment; it is based on an effective combination of “flexibility and security” approaches and benefits from financial instruments like the European Social Fund. Since its launch in 1997, the EU-15 countries experienced a generalized improvement in labour market performance, notwithstanding the low economic growth<sup>6</sup> (as shown in section 3.1).

The strategic EU’s goal established later, at the Lisbon Council in 2000, for the following decade was: *“to become the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion”*. Practically, the aim was to raise the scant EU economic growth closer to the US pace, i.e. around 3% per annum.

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<sup>2</sup> See Angeloni et al. (2005), who argue that, while waiting for full monetary integration with the adoption of the euro, some exchange rate flexibility may be a useful shock absorber. Concerning labour markets, also Boeri and Garibaldi (2005) argue that the NMS are not more rigid than the old member states, despite the persistence of some structural problems and large pools of unemployment; in particular, the Baltic states exhibit high degrees of labour market flexibility.

<sup>3</sup> This was much more evident in the former editions of the book.

<sup>4</sup> The European Employment Strategy (EES) was launched in the Luxembourg Council (1997) for changing the persistent “jobless-growth” of many European countries characterised by high (total and long-term) unemployment rates and low employment rates.

<sup>5</sup> Each year the EU countries present a Report on the national and regional labour policies adopted (according to the European general and specific guidelines) and on the “convergence” towards the specified quantitative objectives.

<sup>6</sup> See Perugini and Signorelli (2007).

This objective had to be attained through the completion of the Single Market, the spur of competition and innovation, investment in (physical and human<sup>7</sup>) capital, R&D<sup>8</sup>, new energies and for a “sustainable development”, measures to improve the business environment, etc. The labour market targets are also specified (to be reached by 2010): (i) an employment rate of 70%; (ii) a female employment rate of 60%; (iii) an employment rate for the elders (55-64 years) of 50%. To achieve these targets an “open method of coordination” and the transferability of “good practices” (also thanks to the exchange of information between EU member states) are the basic procedures: this is a different approach from the fulfilment of the “rigid” Maastricht’s criteria.

An intermediate appraisal and a simplification of Lisbon’s targets have been realised in 2005. The need to sustain the increase of participation and employment rates, especially for women and the elderly, to facilitate the access and permanence of young people in regular employment, to uphold investments in education and human capital (which are generally recognized as the key factors of economic growth) has been confirmed. Moreover, the European Employment Guidelines included in the 2005 “Jobs and Growth” package, beyond promoting more and better investments in human capital, include specific targets for reducing early school leaving and promoting hiring of unemployed young people.<sup>9</sup>

The current Financial Perspectives (2007-2013) approved by the EU institutions include a new objective “competitiveness for growth and employment” (whose weight on total budget should increase from 8% to 16%), to complement the former and more traditional “convergence” objective, primarily aimed at the reduction of regional disparities. In this context, the Commission’s strategic guidelines for cohesion, for the period 2007-2013, together with the new European Social Fund regulation, devote particular attention to employment and unemployment issues.

Also the current financial and economic crisis has posed new challenges to EU (as well as to most countries in the world). The Commission has put forward key priorities and actions to preserve jobs and help those facing difficulties while paving the way for recovery. The recently approved “Shared Commitment for Employment” strategy<sup>10</sup> adopts extraordinary measures, such as providing consistent financing (€19 billion of planned European Social Fund expenditure) to support people hit by the economic crisis; moreover, co-financing by Member States will not be necessary for 2009-2010. New EU loans facilities, also through the European Investment Bank, will be set up to provide micro-credits whenever difficulties for accessing the necessary funds should appear.

## 2.4. Convergence in Labour Market Performance

In this section we briefly highlight some (empirical, policy and theoretical) reasons for considering - within the real convergence analysis - key variables of labour market performance.

First of all, it is useful to recall that per capita GDP may be decomposed into productivity (GDP/E) and employment rate (ER=E x 100/ P<sub>15-64</sub>) (plus a residual demographic indicator, P<sub>15-64</sub>/P), in both static and dynamic frameworks.

$$\frac{GDP}{P} = \frac{GDP}{E} \times \frac{E}{P} = \frac{GDP}{E} \times ER \times \frac{P_{15-64}}{P} \times \frac{1}{100}$$

In dynamic terms, considering a group of countries (or regions), per capita GDP changes and per capita GDP convergence/divergence trends can be the result of many different and complex combinations in the dynamics and convergence/divergence processes of both labour productivity<sup>11</sup> and employment rate (ER). Within the context of the European Employment Strategy (EES), the Lisbon Council (2000) and Stockholm Council (2001) defined the three quantitative objectives

<sup>7</sup> An example of quantitative target refers to young people (20-24 years), who must reach higher education levels: at least 85% of them should achieve a secondary school degree.

<sup>8</sup> The target in this case is a ratio between R&D expenditure and GDP equal to 3%.

<sup>9</sup> Concerning youth unemployment, see Perugini and Signorelli (2010).

<sup>10</sup> To be presented to EU leaders for their agreement at the European Council on 18-19 June 2009. See European Commission (2009).

<sup>11</sup> In addition, labour productivity may be decomposed into hourly productivity (GDP/H) and the average working time per employed person (H/E), obtaining:  $\frac{GDP}{P} = \frac{GDP}{H} \times \frac{H}{E} \times ER \times \frac{P_{15-64}}{P} \times \frac{1}{100}$  ; with  $ER = \frac{E \times 100}{P_{15-64}}$  ; E=Employment.

above mentioned. The EES general and specific guidelines are especially addressed to the improvement of the worst performing countries in order to produce a process of convergence towards the ER objectives by 2010<sup>12</sup>.

Considering the traditional labour market performance indicator, i.e. the unemployment rate (UR), and its definition<sup>13</sup>, it is not immediate to derive its dynamic and convergence processes simply by those of ER, due to the role of the participation rate (PR) variable. So, ER and UR do not necessarily exhibit opposite dynamics; also the convergence/divergence processes may be significantly different.

Some empirical studies highlighted different aspects of real convergence/divergence processes, with a “long period of prevailing job-less growth and divergent labour market performance dynamics in EU countries” (Bean, 1994; Padalino and Vivarelli, 1997; Solow, 2000; Garibaldi and Mauro, 2002; Sapir, 2004; Blanchard, 2005; Perugini and Signorelli, 2004 and 2007; Marelli, 2000 and 2007) and a “more recent dynamics characterised by a job-rich (low-)growth and prevailing (beta) convergence trends in EU-15 labour market performance” (e.g. Perugini and Signorelli, 2004 and 2007; Marelli, 2007; Signorelli, 2008).

However, from a theoretical point of view, while the idea of per capita GDP and productivity *beta* convergence is well rooted in economic theory, starting from Solow's contribution, and a lively debate on the topic is still one of the core issues of development economics, the transfer of this conceptual framework to labour market dynamics is not simple and the derivation of a theory of employment/unemployment beta convergence has not been attempted, and is clearly beyond the scope of this paper<sup>14</sup>. Partially different considerations may be made with reference to a theoretical background for *sigma* convergence of labour market performances, considering that institutional harmonisation and employment policy coordination, together with labour mobility and wage flexibility, could contribute to theoretically explain the possible tendency towards a reduction of performance disparities.

Obviously, there are many other fields of theoretical and empirical literature that explicitly consider the complex dynamic relationships between per capita GDP (and/or productivity) from one side and (un)employment indicators from the other side. Here we just recall the theoretical debate around the so-called “Okun law” and the empirical investigations on the role of institutions, wage/price and policies as determinants of co-movements and feedbacks regarding GDP, productivity and (un)employment.

In addition, the theoretical debate on OCA has also been focused on the labour market pre-conditions (mobility and wage flexibility<sup>15</sup>) for realising an effective monetary union. Then, a decade of evidences on the EMU can be useful for assessing if the endogeneity of OCA's criteria

<sup>12</sup> It should be noted that, since the Lisbon Council, the ER became the favourite labour market performance indicator rather than the UR, but long-term UR still maintains a remarkable importance. For a discussion on the labour market performance indicators and their relations, see Perugini and Signorelli (2007).

<sup>13</sup> 
$$UR = \frac{U \times 100}{LF} = \left(1 - \frac{ER}{PR}\right) \times 100 \quad ; \quad \text{with } PR = \frac{(E + U) \times 100}{P_{15-64}} \quad ; \quad E = \text{Employment and } U = \text{Unemployment. It should be noted the}$$

importance of an additional investigation of the weight and dynamics of long-term unemployment rate (LTUR), since the same unemployment rate can be the result of (very) different combinations of short and long term URs, due to differences regarding "inflows", "outflows" and "average permanence" in unemployment status.

<sup>14</sup> In this direction, a preliminary condition would be the definition and acceptance of a concept, corresponding to the “steady state” in growth theory, of a common long-term labour market equilibrium. This concept is of course copiously available in the literature (see the so-called “natural rate of unemployment” in its many versions), but its validity may be challenged from many perspectives. Following Solow (1990), we reject the restrictive hypotheses of the existence of a single long-term unemployment rate in favour of the more realistic possibility of a range of values that unemployment (and employment) rates may assume, across countries/regions, even in the long term, according to the effects of several economic, social and institutional factors and policies. We argue that the above hypotheses on the existence of a range of “equilibrium” (un)employment rates (according to countries/regions and over time) allows us to analyse the dynamics of labour market performance, rejecting the strict assumption of convergence to a single “natural equilibrium”, but without excluding the possibility of a more general convergence process.

<sup>15</sup> On this point, the situation in NMS is various. According to a recent paper by Moore and Pentecost (2006), wage flexibility is higher in Hungary and the Czech republic compared to Poland and Slovakia; however, the degree of wage flexibility of the latter countries is similar to the Italian one.

proposition (see section 2.5) could be extended, in a certain sense, also to the labour market flexibility.

So, considering some of the above empirical and theoretical reasons, we argue that the extension of (sigma and beta) real converge analysis to ER and UR is very useful and, at least, functional in: (i) highlighting the contribution of labour market performance to a wider real convergence<sup>16</sup> and (ii) assessing the process of convergence towards EU employment policy objectives.

## 2.5. Other Features of Real Convergence

One important goal of the EU is, as already seen (section 2.1), “convergence of economic performances”. Thus, a first meaning of *real convergence* evaluates it in terms of the similarity of final outcomes for real economic variables: production, income, employment, productivity, etc. In more general terms, differences (and changes over time) in development levels, competitiveness, macroeconomic and labour market performance, etc. may reveal the degree of real convergence.

Convergence in outcomes is more likely if economic and institutional structures are (or become) more similar. A *long-run view* of real convergence implies the narrowing of differences in the structural conditions of different countries (or regions), thus allowing the achievement of similar performances of real variables; or, more precisely, a catching-up – in the transition period – of backward countries, in terms of standard of living, productivity, etc. The theoretical and empirical model of “conditional convergence”<sup>17</sup> is appropriate in this case: the narrowing of structural conditions means that the steady-states become closer, thus permitting similar performances in the long run. The most recent empirical investigations show that, while a convergence process has characterised national developments, absence of convergence or even divergence has been found at the national level: a trade-off between international convergence and interregional divergence has been a common outcome (especially among the NMS).<sup>18</sup>

A *short-run view* of real convergence stresses, on the contrary, the business cycle features of (comparative) economic growth of different countries. The above mentioned OCA theories maintain that the real effects of economic shocks within a monetary union depend on the degree of asymmetry of shocks; furthermore, after the shocks have occurred, the degree of flexibility of markets or the effectiveness of other adjustment mechanisms (labour mobility, fiscal transfers, etc.), alternative to the exchange-rate instrument, become a key factor.

The (a)symmetry of shocks depends, in turn, on the similarity of sectoral structures; e.g., sectoral shocks, common to many countries, may lead to different responses in diverse countries when structures differ, at least in terms of the intensity of the (direct and indirect) effects. If shocks are more symmetric across countries, then real variables tend to respond more similarly: this can be evaluated considering the degree of synchronisation of business cycles between countries (see below).

*Structural convergence* was analysed, following the long-run approach, in development economics (Chenery, Clark, Hirschman, Kaldor). In fact, there is a close relation between the stage of development, on one hand, and the productive structure of each country, on the other: the well-known *three sectors law* is a good starting point to understand the importance of the sectoral structure.<sup>19</sup> More sophisticated investigations of sectoral structures distinguish economic sectors in terms of differences in capital intensity, economies of scale, inter-sector links, technical progress, use of human capital, knowledge intensity, and many other features.

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<sup>16</sup> Boldrin and Canova (2001) stress how the gap between the various convergence/divergence theories (predicting labour productivity dynamics) and empirical tests (which broadly adopt per capita incomes) is simply bridged by assuming full employment, neglecting the roles played by labour market performance dynamics.

<sup>17</sup> 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*. See Barro and Sala-I-Martin (1995).

<sup>18</sup> See Martin (2006), Marelli (2007), Marelli and Signorelli (2009).

<sup>19</sup> Even today, in many lagging regions of Southern and Eastern Europe there is still a large primary sector; at the same time, while in some regions of Europe the tertiarisation process has been continuing for decades, in others the peak of industrialisation has not yet been reached. See Marelli (2004).



Even in a short-run approach, the process of “structural homogenisation” is both an important feature of real convergence and one of the determinants of the symmetry of shocks. But how is structural convergence related to the process of economic (and monetary) integration? According to Krugman (1993) such relation is mainly negative: economic integration is likely to lead – because of scale economies, externalities, agglomeration effects, etc.<sup>20</sup> – to *increased specialisation*, diverging economic structures, asymmetric developments, and widening differences in growth rates.

This “pessimist” view has been opposed by the consideration that 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. Furthermore, the *empirical evidence* on structural convergence is mixed<sup>21</sup>, despite the notable changes in productive specialisations.<sup>22</sup> Thus, we should not be too pessimist about structural convergence or divergence. After all, even if Krugman’s assumption should be confirmed, the asymmetric shocks could be counteracted, in the monetary union, by the market adjustment mechanisms (price flexibility and labour mobility) and by appropriate economic policies (fiscal transfers and the like).

In any case, structural differences are important for short-run macroeconomic performance. An interesting empirical investigation is provided by Imbs (1999), who focuses on the role of bilateral differences in sector structures (together with differences in GDP levels). Specialisation may be important also because a high degree of specialisation causes increased *inter-industry trade* and then asymmetric shocks may appear; the opposite will result from lower specialisation and *intra-industry trade*.<sup>23</sup>

We mentioned before, when discussing the short-run view, the importance of the empirical studies on the synchronisation of business cycles. These studies usually analyse, first of all, correlations of output, GDP, industrial production or employment; in some cases, correlations of exports, consumption, services are also investigated. An increasing correlation of real variables would mean that shocks have become more symmetric across European countries. Possible determinants of the degree of synchronicity between countries include the following elements: (i) homogeneity of sectoral structures and specialisation<sup>24</sup>, (ii) additional structural indicators (e.g. competitiveness), (iii) international trade deepening, (iv) existence of a common border and the variables suggested by gravity models (relative size and geographical distance between countries), (v) exchange rate regimes and coordination of macroeconomic policies, (vi) institutional agreements (tariff and non-tariff barriers).

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<sup>20</sup> If we assume increasing returns (or agglomeration economies), firms of one industry tend to cluster in a particular country or region, e.g. where the final market for a certain product is larger. The theoretical explanations follow the “endogenous growth” models with many sectors and international trade, or the spatial models of the new economic geography. The probability that sector-specific shocks are asymmetric is much higher at a regional level, since regions are much more specialised than countries.

<sup>21</sup> See Hallet (2002) and Marelli (2007). The former study, by following a shift-share approach, discovers that – if structural change is included in the analysis – the narrowing disparities in productivity are largely accounted for by labour shifts from low-productivity sectors to high-productivity ones. In the latter study, the evolution of simple specialisation indices (like the Krugman index presented in section 4.1) is investigated, providing at an aggregate level an outcome of prevalent decreasing specialisation across European countries (and regions); but considering a detailed breakdown, within the industrial sector and within market services specialisation trends are more mixed.

<sup>22</sup> The dramatic evolution in some NMS is a good example: they 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. These countries can take advantage of high skilled labour force, huge FDI inflow, restructuring in production and modernisation of the capital stock (Zaghini, 2005).

<sup>23</sup> Luckily enough, it is the latter type of trade that seems to develop most after introduction of the euro (Böwer and Guillemineau, 2006). According to the authors, *trade specialisation* is more important than *productive specialisation* in determining the symmetry of business cycles; while broad productive structures have not converged in Europe, differences in trade specialisation have declined dramatically and continuously: these different evolutions can be explained by the presence of non-tradables and the increasing importance of services (that now account for 70% or more of GDP in many countries).

<sup>24</sup> Even at the regional level, it has been found that regional growth (e.g. 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).

In the recent decades, synchronisation in Europe has increased thanks to the coordination of macroeconomic policies and the attainment of the Single Market, in the '80s and early '90s. In the case of EU integration, the link is probably from EU's *institutional integration* to *trade deepening* and then to *cycle correlation*. The interaction between institutional integration and trade deepening appeared well before the currency union: in fact, we can go back to the impact of the custom union, the Single Market, the EMS (with reduced exchange rate volatility), the coordination of economic policies.<sup>25</sup> Of course, the monetary union is the final step in the institutional integration process (so far), since it represents a serious and durable commitment.

As to the empirical studies, the results on synchronisation are mixed, since they depend on data sets, time intervals and investigation methods.<sup>26</sup> A firm conclusion is nevertheless that euro area countries correlate amongst themselves more than with the rest of the world (despite the recent emergence of a world business cycle due to globalisation). 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 the EU15 group, including some "peripheral" countries (therefore making the concept of a "core" of European countries less meaningful), but also between "old" and "new" Europe. In particular, trade relations of NMS developed significantly even before the official EU accession, thanks to their robust growth rates, the large economic weight of the euro area and the geographical proximity (Bussière et al., 2005)<sup>27</sup>. Concerning output correlations, Hungary, Poland and Slovenia are the most correlated 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 for the Baltic states (Darvas and Szapáry, 2005; Fidrmuc and Korhonen, 2006).<sup>28</sup>

The OCA theories argue that the benefits of a monetary union augment with the increasing openness of the countries and with their (reciprocal) *trade integration*: thus, fully or highly integrated countries are in the best condition to grasp the benefits of the monetary union. But also in this case the link is sometimes reversed: the *endogeneity of OCA's criteria* proposition maintains that even if such criteria are not satisfied ex-ante, they come to be endogenously confirmed ex-post, following the creation of a monetary union.

Frankel and Rose (1998), followed by Rose (2000), considering a large sample of industrialised and developing countries and using gravity models (controlling for geographic, historical, linguistic and other determinants of bilateral trade), emphasized the positive effects of the establishment of monetary unions on the increase of foreign trade and consequently on the degree of synchronicity of business cycles.<sup>29</sup>

The original source of "real integration" between countries may even be the process of institutional integration. In fact, Mongelli et al. (2005) have shown that the link between *institutional integration* and *trade deepening* runs both ways, although the link departing from institutional integration is more pronounced. Thus, trade integration has been the final outcome of the custom union, the Single Market, the EMS and the coordination of economic policies.

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<sup>25</sup> A stronger co-movement of business cycles within the European Monetary System (EMS) has been detected by Artis and Zhang (1999).

<sup>26</sup> In addition to simple (linear) correlations, structural VAR procedures have been extensively used in recent research.

<sup>27</sup> The authors use an extended *gravity model* as a benchmark of what would constitute "normal" trade relationships, to gauge the potential for further trade integration. Notice that for the largest CEEC trade with the euro area is already nearly 60% of their total trade (there is scope for further strengthening only for the Baltic countries and the South-Eastern European countries).

<sup>28</sup> This rank is confirmed by many other empirical studies; sometimes, in addition to the three mentioned countries (Hungary, Poland and Slovenia), also the Czech Republic is found to exhibit high correlations. 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).

<sup>29</sup> According to the critics (e.g. Frankel, 2008), the magnitude of Rose's effect – whereby trade among union members can augment threefold – depends on the small size of the countries (the small countries are much more trade dependent) belonging to the monetary unions in his sample.

## 2.6. Real, Nominal and Institutional Convergence

There are different definitions of *real and nominal convergence*. If we refer to standard macroeconomic models, real variables generally refer to real output or income (Y) and related variables, nominal variables to the price level (P) or the inflation rate. The relative weight put on the latter variables compared to the former – in the central bank’s function – distinguishes the conservative central banks from the “wet” ones.

In some empirical studies, the interdependences between the two types of convergence have been investigated. For example, Carré (1997), by adopting both a sigma-convergence and a beta-convergence analysis (with two equations representing the nominal and real convergence processes), found that in the ‘80s nominal and real convergence were negatively correlated (with real divergence and nominal convergence), while in the ‘90s they were characterised by simultaneous convergence movements.<sup>30</sup>

Coming now to the studies closer to the monetary union literature, referring to *real convergence* as convergence in economic structures and defining *nominal convergence* as the ultimate adoption of a common currency, we have already seen that the OCA theories suggest that the former (real or structural convergence) may facilitate the establishment of a successful monetary union.

Nevertheless, in the institutional process leading to the creation of EMU, the link *between nominal convergence and real convergence has been reversed*. In fact, the admission of European countries to the *euro* club was (and is) conditioned by the compliance with the “Maastricht’s criteria” of nominal convergence; for incumbent members, the public sector requirements are also endorsed by the Growth and Stability Pact. What is the rationale behind this approach, i.e. the relation between *nominal convergence* and *real convergence*?

According to economists close to the EU Commission (e.g., Buti and Sapir, 1998), nominal convergence gradually leads to real convergence, thanks to the advantages of macroeconomic stability (price stability and fiscal discipline), the removal of the exchange-rate risk, the reduction of uncertainty concerning inflation and interest rates, the spur of investment and international trade, all benefits finally leading to stronger economic growth (which may even become permanent thanks to dynamic scale effects). Because such benefits may be more important for formerly “deviating” economies (characterised by greater macroeconomic instability) or lagging countries, a real convergence is likely to occur in the long run.

It is worth to stress the importance of the *time horizon* in assessing real and nominal interdependences. In the candidate countries, especially in formerly deviating countries, the stringency of the nominal conditions slowed *in the short run* their growth rates; in this way, such countries have been punished for their previous “vices” (undisciplined public finances, inflation-prone behaviour, etc.), with the ultimate threat of being left out of EMU. However, the same countries have been simultaneously rewarded by the gains of EMU itself: disinflation, lower interest rates and debt service (in addition to the common benefits of monetary unions in terms of lower transaction costs, smaller uncertainty, reinforced competition, etc.): such benefits are important for a sustained growth *in the long run*.

We must also say, at this point, that not all the economists view the Maastricht’s criteria as necessary or even sensible prerequisites for the euro’s adoption. For example, Buiters (2004) underplays the role of inflation and interest convergence, and of exchange rate management (e.g. within the ERM-II in the case of the NMS aiming to join the euro): such nominal targets are, according to him, too many and inconsistent; just fiscal sustainability is a decisive requirement.

A specific issue, widely discussed in the literature, refers to the implications of the *Balassa-Samuelson* effect. The lagging EU countries, with particular reference to the NMS, characterised by lower per-capita income levels and consequent strong catching-up processes, will inescapably have – in the transition to EMU and in the first period of euro adoption – higher *inflation* rates (because

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<sup>30</sup> If this is true, the implication is that Maastricht’s nominal convergence criteria – applied in the ‘90s – have *not* negatively affected real economic convergence.

of productivity differences between sectors and high inflation in the non-tradable sector). Hence for such countries the inflation criterion should be abandoned; alternatively according to De Grauwe and Schanbl (2005), who emphasize the conflict between nominal and real convergence during the run-up to EMU, the required *real appreciation* can be achieved by a nominal appreciation of the exchange rate, thus discarding the condition about stability of *exchange rates*.<sup>31</sup> Appreciations of the exchange rates have also been enhanced by capital inflows associated with the huge FDIs (which compensate for the current account deficits).

The NMS, which at the beginning of the '90s had some kind of soft pegs, moved in recent years to either flexible exchange rate regimes with inflation targeting (the big countries) or to currency boards or hard pegs (the small ones).<sup>32</sup> It is interesting to note that the big countries – such as Poland, Hungary and the Czech Republic – which do exhibit the highest output correlations with the European “core”, have not yet entered the ERM-II and will have to wait much longer for euro adoption.<sup>33</sup>

Many theoretical and empirical studies have also examined the joint concepts of growth, (real) convergence and *institutional change*. In the case of the EU, a possible question is whether (and how) economic growth and convergence have been affected by the steps toward an increasing institutional integration. In the literature, we can find many works devoted to the links between institutional integration, trade deepening and then business cycle synchronisation.

In particular, in the case of EMU, we can establish a link between nominal convergence (the satisfaction of Maastricht's criteria), institutional convergence (admission to the Eurosystem) and real convergence (e.g. trade deepening), as maintained by the “endogeneity” argument. Of course, it is too early to infer definite trends, because of the limited horizon (ten years since EMU's birth) and the lags in data availability. Earlier studies (e.g. De Grauwe and Mongelli, 2005) considered unlikely a dramatic surge of trade in the immediate period after EMU's start, both because trade had already risen over the last 50 years and for the reason that 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). A positive trade effect around 10-20%, which however has levelled off in the recent (2003-06) years, is confirmed for a long (eight-year) period by the latest investigation of Frankel (2008).<sup>34</sup>

The endogeneity argument has been extended in later studies, also focusing on the changes in the flexibility of product and labour markets (with effects on wages' moderation), the process of equalization of prices (or convergence in inflation rates), fiscal integration and financial convergence (direct and portfolio investments may benefit from convergence in interest rates), and many other features. Institutional change, from this point of view, is important for all countries, including the “old” EU countries, because there might be feedbacks from the process of European integration to changes in laws, regulations and institutions at the national level: this is the case of “market reforms” leading to liberalisations or increased competitiveness in specific markets.

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<sup>31</sup> The empirical evidence presented by De Grauwe and Schanbl (2005) shows that the magnitude of real appreciations – achieved by either higher inflation or nominal exchange-rate appreciations – is inversely related to the initial level of development: for instance, it has been lowest for Cyprus, Malta and Slovenia. For many NMS (joining the EU in 2004) differences in terms of both GDP per-capita and the price level are still large (both variables are less than half than the EU15 level): as a consequence, in the future the catch-up and convergence processes will take a long period of time.

<sup>32</sup> Flexible exchange-rate regimes have been chosen by Poland, Hungary and the Czech Republic; four countries have joined the ERM-II agreements (the three Baltic states and Denmark, of course in addition to the countries, like Slovenia, Slovakia, Cyprus and Malta, now adopting the euro); Estonia, Lithuania, partially Latvia (and in the past Slovenia) have opted also for hard pegs to the euro (with a narrow bandwidth). See also Rinaldi-Larribe (2008).

<sup>33</sup> Another recent paper devoted to NMS is by Michelis and Koukouritakis (2007): the authors try to assess whether NMS (since 2004) are ready to join the EMU, by investigating common trends of the *nominal convergence* criteria (the five Maastricht's criteria) as well as two specific *real variables*: real exchange rates and real per capita GDPs. They adopt cointegration analysis and use France and Germany, the two “core” euro countries, as a benchmark. According to their results, these countries are partially ready to join the eurozone, although they need further adjustments in their fiscal policies (only for the deficit/GDP and debt/GDP ratios the results indicate lack of cointegration).

<sup>34</sup> The much lower impact compared to the original Rose's estimates (and more similar in magnitude to the results of Micco et al., 2005) is mainly justified by the sample size (Frankel uses a large sample with many countries and a long period, 1948-2006).

Some authors have tried to verify whether such reforms are affected by the process of institutional EU integration. For example, a recent paper by Alesina et al. (2008), after reviewing the theoretical arguments that may link the adoption of the euro and “structural reforms” (e.g. incentives to reform and so gain competitiveness in the absence of devaluations), have found that the adoption of the euro has been associated with an acceleration of the pace of structural reforms in the product markets (deregulations), while no significant connection has been detected in case of labour market reforms (either liberalizations or deregulations).<sup>35</sup>

Institutional change has obviously been more important in NMS, i.e. in “transition countries”. The complexities and peculiarities of the transformations occurred in Central and Eastern European Countries since the collapse of the Berlin Wall in 1989 are illustrated in a long-term historical/comparative perspective by Kornai (2006). The transition process to a market economy has implied heavy restructuring in many industries, reallocation of labour between sectors (particularly from old state-owned branches to new private activities), with net job destructions accompanied by a “transitional” (or transformational) recession in the early stages of transition. In the first decade, market reforms have been beneficial to economic growth and convergence, to productivity levels and dynamics but with a negative impact on employment; in the long run, however, employment dynamics seems positively related to institutional change.<sup>36</sup>

### 3. Real and Nominal Convergence in the EU: A Preliminary Analysis

In this section we shall illustrate and discuss some preliminary evidences on real and nominal convergence. We shall consider, on one hand, the main variables related to real convergence (unemployment and employment rate, productivity, per capita GDP, specialisation index) and, on the other hand, the four Maastricht’s criteria. The analysis refers mostly to the 1992-2007 period.

#### 3.1. Real Convergence: Some Evidences

Empirical reasons together with the recent European policy-making framework – as specified in section 2.4 - suggest the consideration, first of all, of key labour market performance variables (especially ER, but also UR and LTUR) in addition to traditional ones (per capita GDP and productivity) for a better understanding of the multidimensional features of real convergence dynamics; we focus also on the evolution of a specialisation index (KSI). In particular, we investigate sigma<sup>37</sup> and (lowess) beta<sup>38</sup> convergence/divergence dynamics for the main EU aggregates since the early 1990s.

Considering sigma convergence/divergence of labour market indicators (Graphs 1 and 2), the EMU-12 and EU-15 aggregates show: (i) significant sigma convergence in unemployment rate, but only after 1999, and (ii) remarkable sigma convergence in employment rate since early 1990s.

Differently, the aggregates EU-8-east (and EU-10-east in parenthesis when different) experiment: (i) a persistence in UR disparities during the 1990s, followed by a 2-3 years of divergence, although sigma convergence clearly prevail in more recent years, (ii) persistent disparities in ER in recent years.

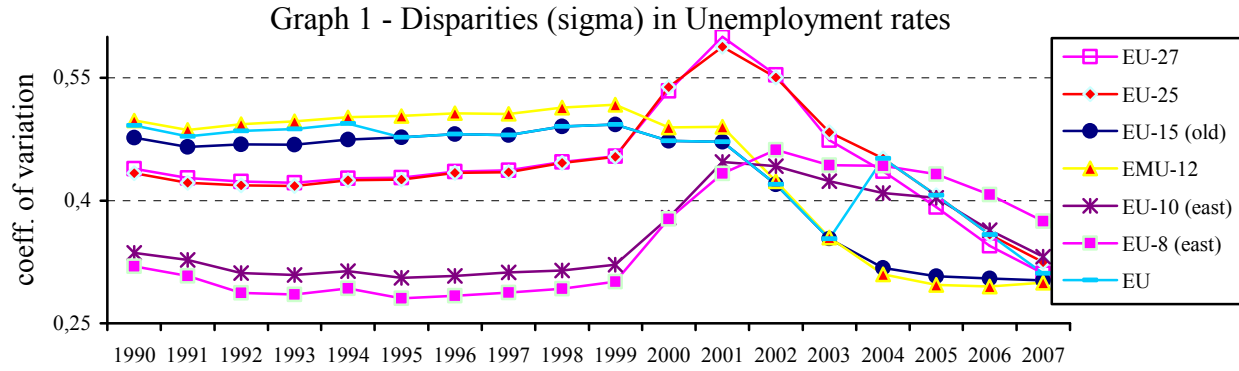
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<sup>35</sup> Similar results were previously found in other papers (reviewed by Alesina et al.) concerning the effects of the European Single Market.

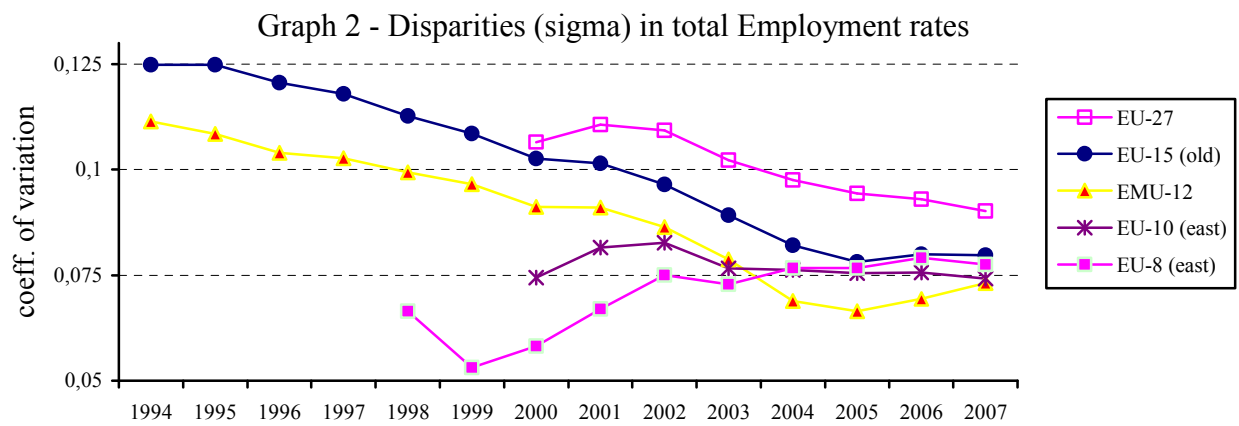
<sup>36</sup> Marelli and Signorelli (2009), in addition to featuring a thorough review on the relations between institutional change and economic performance, considering the regions of eight CEEC found that *institutional change* (as measured by the EBRD synthetic transition index) had positive effects on economic convergence and in the recent period (after 2000) also on employment. This result is confirmed in Marelli and Signorelli (2010), since in a sample of EU27 countries the same proxy contributes (together with human capital and some other control variables) in explaining differences in productivity levels across countries; among the other control variables, also the “global competitiveness index” (published by the World Economic Forum) exhibits a positive effect on productivity (this is interesting because it means that market reforms have been important for economic performance in all European countries, old and new).

<sup>37</sup> Sigma convergence is usually measured by considering the (decreasing) trend in the coefficient of variation (standard deviation divided by the mean).

<sup>38</sup> Lowess beta investigations permit a graphical analysis of beta convergence and highlight the position of each country. It should be recalled that the existence of beta convergence is a necessary but not sufficient condition for sigma convergence.

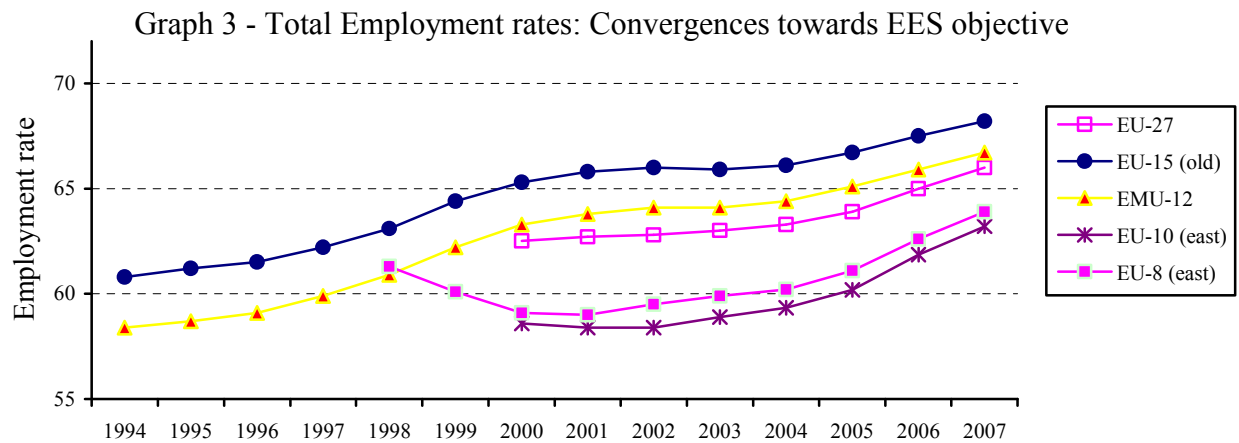


Source: our elaboration on CE and Eurostat database. Legend: EU-15 (old) = EU members before 2004; EMU-12 members of monetary union (11 in 1999 plus Greece); EU-10 (east) = new eastern EU members (2004 and 2007); EU-8 (east) = new eastern EU members (2004); EU = 12 (1990-94), 15 (1995-2003), 25 (2004-2006) e 27 (2007).



Source: our elaboration on Eurostat database. Legend: EU-15 (old) = EU members before 2004; EMU-12 members of monetary union (11 in 1999 plus Greece); EU-10 (east) = new eastern EU members (2004 and 2007); EU-8 (east) = new eastern EU members (2004).

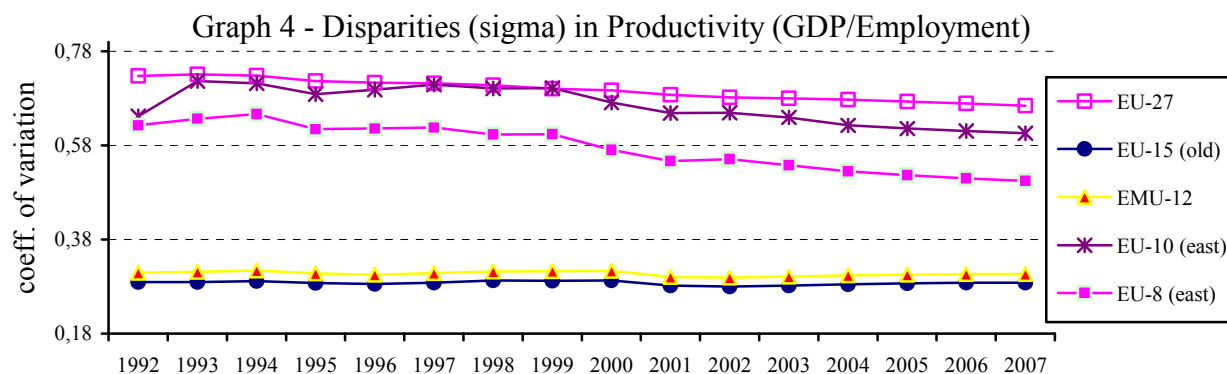
Concerning the employment rate (ER), it is also useful to analyse convergence towards the main quantitative objective of the European Employment Strategy (EES): a clear convergence emerges (Graph 3) for EU-15 and EMU-12 since mid 1990s, and for Eastern aggregates in more recent years<sup>39</sup>.



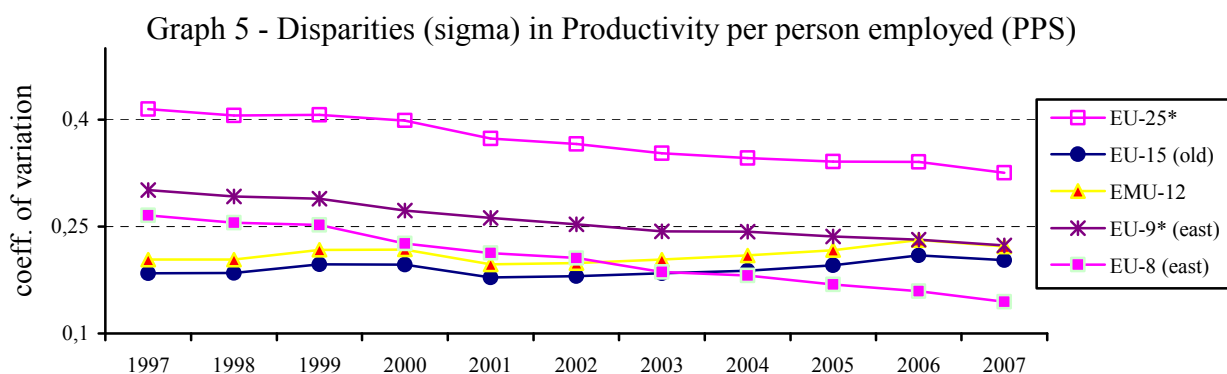
Source: our elaboration on Eurostat database. Legend: EES objective=70%; EU-15 (old) = EU members before 2004; EMU-12 members of monetary union (11 in 1999 plus Greece in 2001); EU-10 (east) = new eastern EU members (2004 and 2007); EU-8 (east) = new eastern EU members (2004).

<sup>39</sup> As for EU-8 (east) and EU-10 (east) aggregates, the ER decreases in early stage of transition have been followed by a partial recovery. As for the “U shaped” ER dynamics, see Perugini and Signorelli (2004).

Graphs 4 and 5 refer to convergence in productivity, defined as the ratio between GDP and employment in the first case and GDP (in PPS) per person employed in the second case.

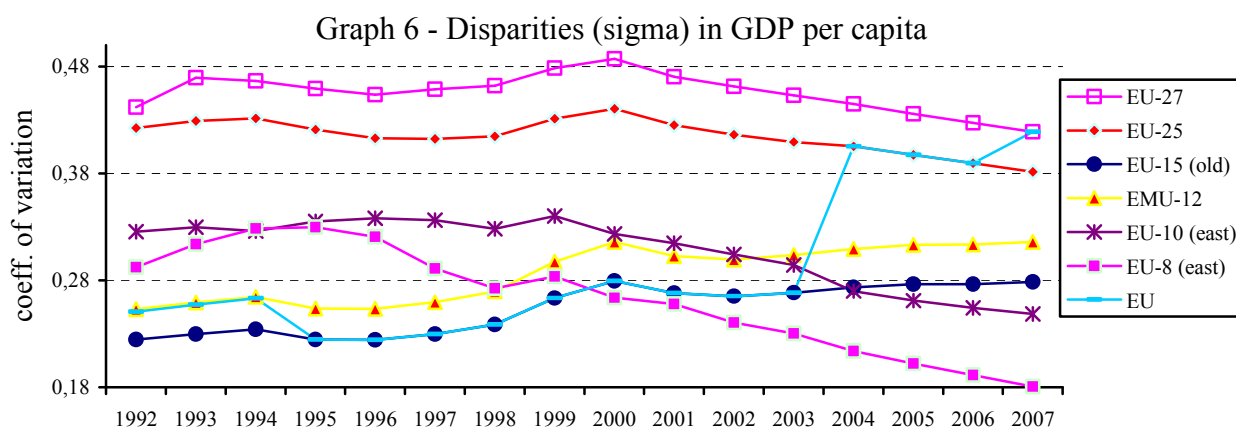


Source: our elaboration on CE database. Legend: EU-15 (old) = EU members before 2004; EMU-12 members of monetary union (11 in 1999 plus Greece); EU-10 (east) = new eastern EU members (2004 and 2007); EU-8 (east) = new eastern EU members (2004).

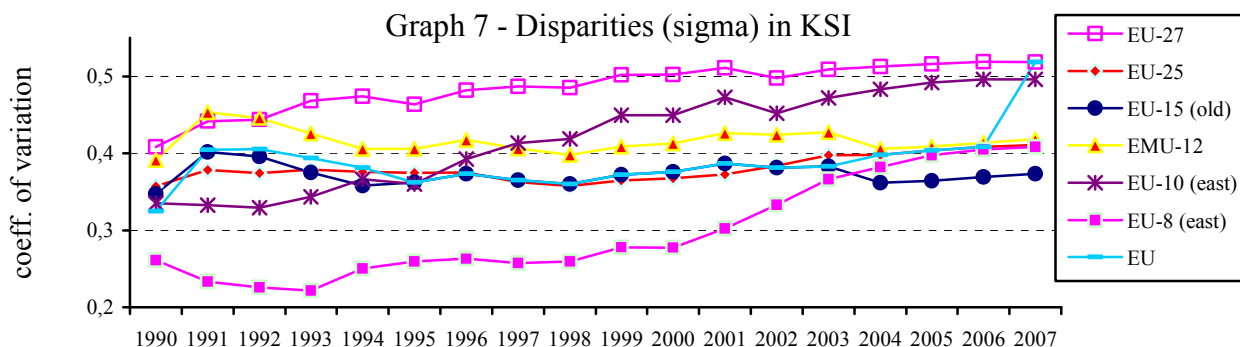


Source: our elaboration on Eurostat database. Labour productivity per person employed - GDP in Purchasing Power Standards (PPS) per person employed relative to EU-27 (EU-27 = 100). Legend: EU-25\* = EU-27 minus Romania and Malta; EU-15 (old) = EU members before 2004; EMU-12 members of monetary union (11 in 1999 plus Greece); EU-10 (east) = new eastern EU members (2004 and 2007); EU-8 (east) = new eastern EU members (2004).

Finally, Graphs 6 and 7 illustrate sigma convergence in GDP per capita and in the specialisation index (the KSI index defined in section 4.1).



Source: our elaboration on Cambridge Econometrics (CE) database. Legend: EU-15 (old) = EU members before 2004; EMU-12 members of monetary union (11 in 1999 plus Greece); EU-10 (east) = new eastern EU members (2004 and 2007); EU-8 (east) = new eastern EU members (2004); EU = 12 (1990-94), 15 (1995-2003), 25 (2004-2006) e 27 (2007).



Source: our elaboration on Cambridge Econometrics (CE) database. Legend: KSI = Krugman specialisation index; EU-15 (old) = EU members before 2004; EMU-12 members of monetary union (11 in 1999 plus Greece); EU-10 (east) = new eastern EU members (2004 and 2007); EU-8 (east) = new eastern EU members (2004); EU = 12 (1990-94), 15 (1995-2003), 25 (2004-2006) e 27 (2007).

The following trends are worth mentioning. For EMU-12 and EU-15: (i) a weak sigma divergence in national per capita GDP (especially in the period 1996-2000 and in more recent years), (ii) low but persisting disparities in productivity and KSI. Concerning EU-8-east (and EU-10-east): (i) a significant sigma convergence<sup>40</sup>, since 1994, in per capita GDP (but only after 1999 for EU-10-east); (ii) a convergence in productivity, especially since 1999; (iii) a remarkable increase in the disparities in the specialisation index.

Obviously the dynamics in disparities for EU-25 and EU-27 aggregates reflects the above various trends. In particular: (i) the persistence in UR disparities in the 1990s was interrupted by a two-year divergence and a remarkable convergence since 2001; (ii) since 2001 a clear sigma convergence in ER emerged; (iii) a sigma convergence in productivity occurred in the whole period; (iv) a sigma convergence in per capita GDP emerged only since 2000 (obviously, a remarkable increase in disparities occurred in the EU aggregate as consequence of the 2004 enlargement); (v) an increase in the disparities regarding the KSI (especially for EU-27 aggregate).

As for the lowess-beta convergence/divergence, the results can depend on both the initial year and the aggregate considered. With reference to the whole available period (usually 1990 or 1992 as initial year, but 2000 for ER), the EU-27 aggregate shows a clear convergence in all the considered variables, but some interesting outlier emerge (Graph A1).

### 3.2. Nominal Convergence: Some Evidences

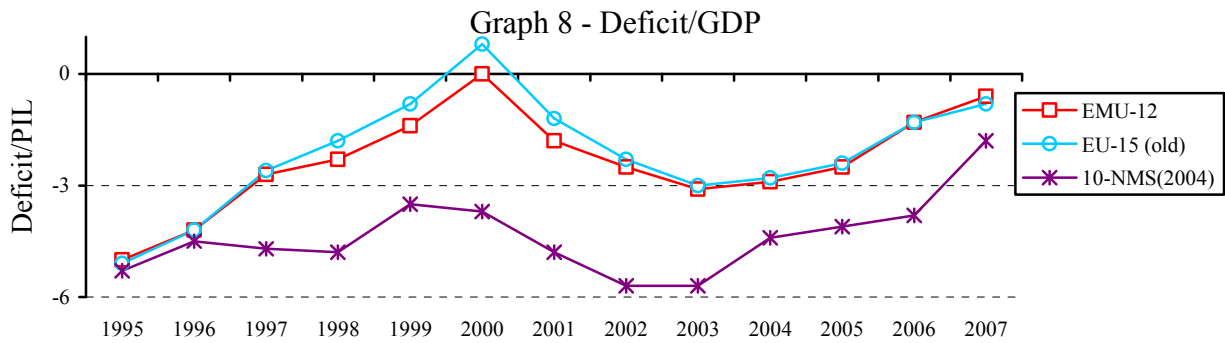
Since the early 1990s, the advent of the Maastricht's Treaty and subsequent developments, the European debate has been dominated by *nominal convergence*, as defined by (see section 2.2): (i) the Maastricht's criteria for entering into the Monetary Union (EMU); (ii) the "Growth and Stability Pact" conditions; and (iii) the ECB inflation target. In this section we briefly present the key evidence on nominal convergence by considering the four indicators of the Maastricht criteria for few EU aggregates, especially for the euro area<sup>41</sup>.

Considering the first Maastricht parameter (Graph 8) for the EMU-12 aggregate, a remarkable reduction in the *deficit/GDP* ratio occurred in the second half of 1990s (from 5% in 1995 to 0% in 2000), followed by a significant worsening in the first three years of the new Century (up to 3% in 2003) and, finally, a new reduction in this parameter occurred in the years 2003-2007. The EU-15 aggregate showed a very similar trend. As for the aggregate of 2004 NMS (10-NMS-2004), the deficit/GDP ratio showed a significantly different dynamics, remaining for the whole period (last year excluded) in the range from 3 to 6%; however, a significant reduction occurred since 2003 and especially in 2007.

<sup>40</sup> As for the existence of convergence between countries accompanied by regional divergence within countries, see Marelli and Signorelli (2009).

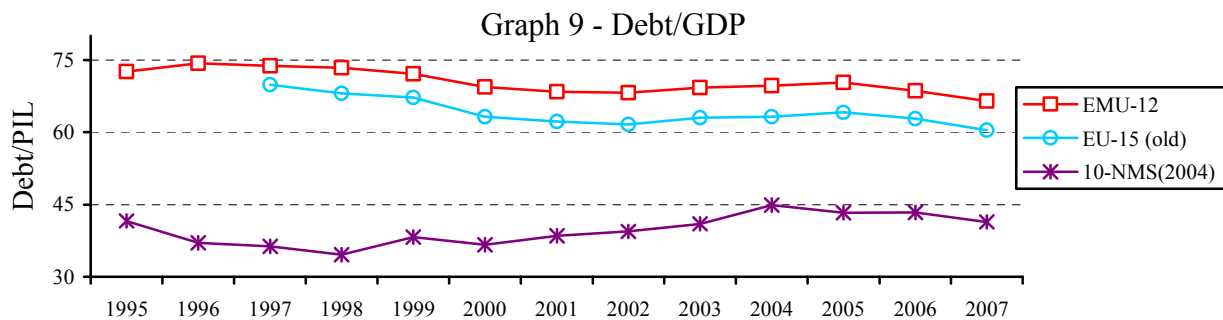
<sup>41</sup> EMU includes now 16 members. 11 countries created EMU in 1999, followed by Greece in 2001, Slovenia in 2007, Cyprus and Malta in 2008 and Slovakia in 2009.





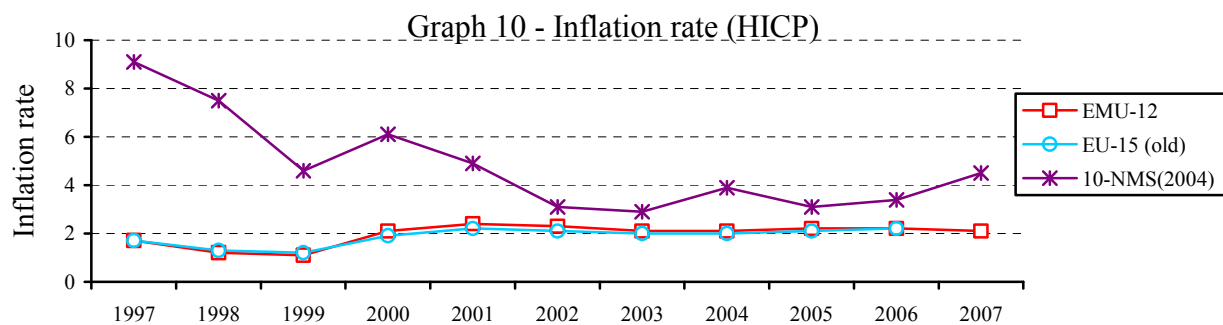
Source: our elaboration on Eurostat database. Net lending (+)/Net borrowing (-) under the EDP (Excessive Deficit Procedure) - General government - Percentage of GDP. Legend: EMU-12 (the aggregate include the 11 members of monetary union in 1999 plus Greece); EU-15 (old) = EU members before 2004; 10-NMS(2004) = new EU members in 2004.

The trends in the second parameter (Graph 9) reflect the strict relations with the first Maastricht condition. In the EMU aggregate the *Debt/GDP* ratio decreased in 1996-2002 and, after three years of increase, in the period 2005-2007. The EU-15 aggregate shows a similar dynamics and a level (near 5% of GDP lower than EMU-12) that declined up to 60% in 2007. The level of 10-NMS (2004) remained below 45% for the whole period, but a gradual reduction of the remarkable distance with "old-EU members" was interrupted only in more recent years.



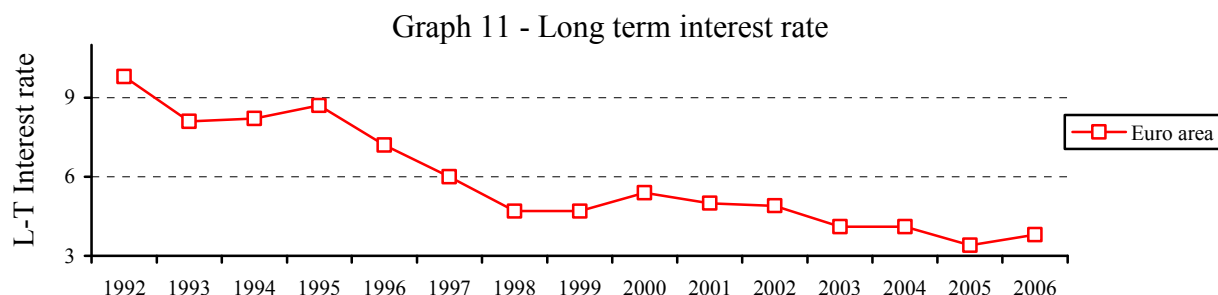
Source: our elaboration on Eurostat database. Legend: EMU-12 (the aggregate include the 11 members of monetary union in 1999 plus Greece); EU-15 (old) = EU members before 2004; 10-NMS(2004) = new EU members in 2004.

The *inflation rate* (Graph 10) in EMU-12 and EU-15 aggregates remained very similar and quite stable around 2% for the whole period (1997-2007), with some country differences. As for the 10-NMS(2004) aggregate, the remarkable decline of the 1990s was followed by a stabilisation around 3-4% since 2002.



Source: our elaboration on Eurostat database. Legend: EMU-12 (the aggregate include the 11 members of monetary union in 1999 plus Greece); EU-15 (old) = EU members before 2004; 10-NMS(2004) = new EU members in 2004.

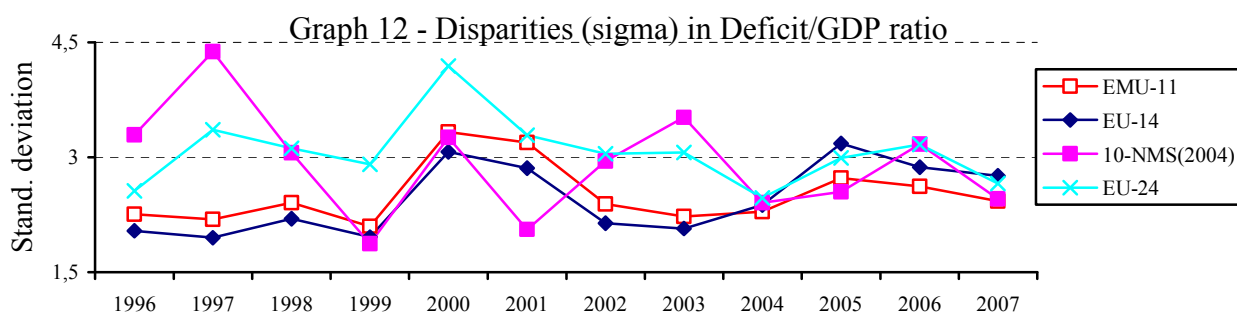
Finally, the long-term *interest rate* (Graph 11) for the Euro-area declined from a value higher than 9% in 1992 to a level close to 3% in 2006, with a strong reduction in the period 1995-1998.



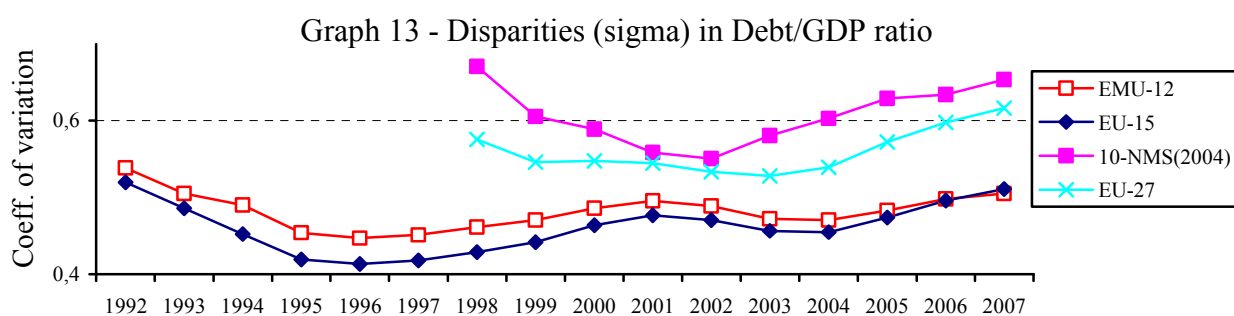
Source: our elaboration on Eurostat database. Legend: Euro area (countries member of European monetary union).

The above tendencies of the four Maastricht's parameters for the main EU aggregates have been the result of quite different national dynamics.<sup>42</sup>

Considering now sigma convergence of the nominal parameters (see Graphs 12, 13, 14 and 15), the following evidences can be briefly highlighted: (i) high (but decreasing) instability over time appears in deficit/GDP ratios disparities, without clear tendencies (a significant convergence trend occurred only for the larger EU aggregate, i.e. EU-24, from 2000 to 2004); (ii) sigma divergence in debt/GDP ratios emerged in recent years for all the main EU aggregates, while in the previous periods opposite tendencies prevail for EU-27 (1998-2003), 10-NMS-2004 (1998-2002), EU-15 and EMU-12 (especially from 1992 to 1996); (iii) remarkable sigma convergence in national inflation rates occurred in EU-27 countries and, less evidently, for EU-15 and EMU-12 aggregates; (iv) significant reductions in the disparities in long term interest rates emerged for EMU aggregate(s) in the 1990s.

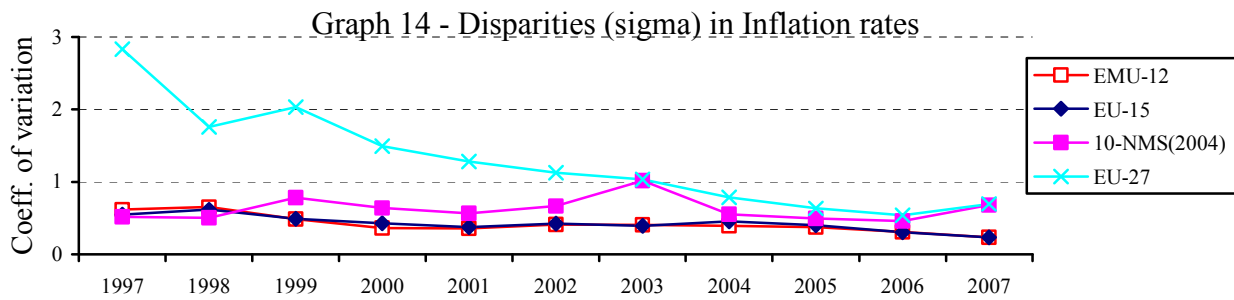


Source: our elaboration on Eurostat database. Standard deviation of country data. Legend: EMU-11 (11 members of monetary union in 1999); EU-14 (old) = EU members before 2004 (Greece excluded); 10-NMS(2004) = new EU members in 2004. EU-24 = EU-27 (Greece, Cyprus and Bulgaria excluded). Note: the existence of both positive and negative values suggested to use standard deviation data.

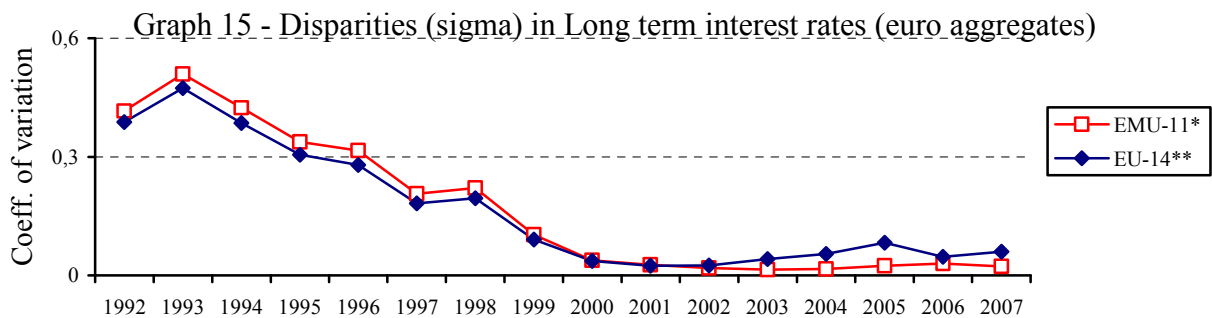


Source: our elaboration on Eurostat database. Coefficient of variation of country data. Legend: EMU-12 (11 members of monetary union in 1999 plus Greece); EU-15 (old) = EU members before 2004; 10-NMS(2004) = new EU members in 2004.

<sup>42</sup> Detailed tables were included in previous versions of this paper and can be requested to the authors.



Source: our elaboration on Eurostat database. Coefficient of variation of country data. Legend: EMU-12 (11 members of monetary union in 1999 plus Greece); EU-15 (old) = EU members before 2004; 10-NMS(2004) = new EU members in 2004.



Source: our elaboration on Eurostat database. Coefficient of variation of country data. Legend: EMU-11\*= EMU-12 (LU excluded due to lack of data); EU-14\*\*= EU-15 (LU excluded due to lack of data).

We can also add that EMU members experimented a strong lowess-beta convergence in all the four parameters (Graph A2), but especially in inflation rate and long term interest rate. A clear lowess-beta convergence in inflation rates emerged also for EU-27 countries, but this aggregate did not showed a significant beta convergence in the first two parameters (Graph A2).

#### 4. Real and Nominal Convergence: Some Econometric Investigations

After the illustration of some basic data about real and nominal convergence, including an analysis of both sigma-convergence and lowess-beta convergence of the most significant variables, we present in this section the results of some econometric investigations. They refer especially to different aspects of *real convergence*, but will be indirectly useful to assess – e.g. by considering a specific institutional integration index – how real convergence may be affected by nominal or institutional convergence.

We shall start with an investigation of *beta convergence in labour market indicators (employment and unemployment)*, which as we have seen are also important in terms of economic policies. Then, we analyse *convergence in productivity* levels, which is probably the most important variable suitable to summarize “real convergence” in the long run. *Convergence in economic structures* is a third key element, as suggested by OCA theories: if there is convergence, the likelihood of asymmetric shocks diminishes and so a monetary union can be more effective. Finally, the analysis of *output correlations* is a simple way to assess whether real convergence is achieved in the short run, i.e. from a business cycles point of view.

##### 4.1 Data and Sources

The empirical investigations refer the *EU27 countries*. The period of the analysis depends on data availability: in some investigations includes the full 1990-2007 period, in some others it is restricted to the period after 2000.

The data concerning *employment* and *unemployment rates* are from Eurostat. *Value added* (at constant prices) and *employment* are taken from Cambridge Econometrics (CE).<sup>43</sup> Employment data from CE have also been used at a sectoral level, particularly to compute the “*Krugman specialisation index*” (KSI):

$$KSI_j = \sum_i |s_{i,j} - s_{i,0}|$$

where  $s_{i,j}$  is the share of sector  $i$  out of total employment in country  $j$  and  $s_{i,0}$  is the corresponding share in the reference country, in our case the EU-27 average.<sup>44</sup> Its numerical value ranges from 0 (the country has the same sector structure as the European average) to 2 (the sector structure is totally different).

As a proxy for *human capital* we have used Eurostat’s “Total population (aged 25-64) having completed at least upper secondary education”.<sup>45</sup>

Finally, we propose an “*institutional integration index*”. This is an index (I) whose numerical values are between 0 and 1; it has been computed as follows:

- a) I = 0 for non-EU members,
- b) I = 0.25 for non-EU members formally recognized as “candidate” countries,
- c) I = 0.5 for EU members,
- d) I = 0.75 for EU members belonging the ERM (or ERM-II) agreements,
- e) I = 1 for Eurozone members.

In the regressions we have used both the index computed in this way and an “*adjusted*” index, where some linear interpolations have been considered, in particular between 0.25 and 0.5 (a candidate country must show progresses toward full membership) and between 0.75 and 1 (the ERM members progressively satisfy the Maastricht’s criteria to adhere to EMU).

#### 4.2 Beta Convergence of Employment and Unemployment Rates

Considering the two main indicators of labour market performance, i.e. the employment rate (ER) and the unemployment rate (UR), we illustrate here the results of a beta convergence analysis for different periods and EU aggregates. The equation to be estimated for the first variable is the following<sup>46</sup>:

$$1/n \log(ER_{it}/ER_{i0}) = \alpha + \beta \log(ER_{i0}) + \varepsilon$$

General and highly significant beta convergence dynamics emerge for both indicators, various aggregates and periods (Table 1)<sup>47</sup>.

Table 1 – Absolute convergence: ER (1994-2007 and 2000-2007)

	[a]	[b]	[c]	[d]	[e]
Aggregate	EU-27	EU-15	EU-10-East	EU-15	EMU-12
Period	2000-2007	2000-2007	2000-2007	1994-2007	1994-2007
n. obs.	27	15	10	15	12
Initial ER+	-0.036***	-0.035***	-0.074(*)	-0.038***	-0.044***
Adj. R2	0.236	0.482	0.213	0.591	0.552

Note: Change in employment rate: dependent variable. + in logs. Significance levels: 1%\*\*\*, 5%\*\*, 10%\*, constant not reported. (\*) Significance level = 10.1%

<sup>43</sup> In the case of *productivity* data for the full period (1992-2006), we have followed a mixed procedure. From Eurostat we have taken the index numbers (EU-27=100) of *labour productivity* (per worker), available since the mid ‘90s; then, we used Cambridge Econometrics data (gross value added divided by employment), both to estimate the 1992 index numbers (whenever missing data were found for some countries) and to compute the nominal values (in constant euros).

<sup>44</sup> The KSI index has been computed considering the most detailed sectors available for each country: generally, they are 15, but Bulgaria and Cyprus (9 sectors) and Romania (5 sectors only). Moreover, for the period 1990-91 (or 1990-92 for some countries), the number of available sectors is less than 15, generally 9, for many other CEEC countries (Czech Republic, Estonia, Latvia, Lithuania, Hungary, Slovenia).

<sup>45</sup> Since for some countries and some years (especially the new members in the ‘90s) the data were missing, they were estimated according to the trends resulting from the Barro-Lee data (<http://www.cid.harvard.edu/ciddata/ciddata.html>).

<sup>46</sup> In specifications without logarithms and/or the division by n of the dependent variable, we obtain almost identical results.

<sup>47</sup> The only partial exception regards the EU-10-East aggregate for which the beta convergence in ER is almost significant.

The equation in the case of the unemployment rate<sup>48</sup> is the following:

$$1/n \log (UR_{it} / UR_{i0}) = \alpha + \beta \log (UR_{i0}) + \varepsilon$$

and the results are in Table 2.

Table 2 – Absolute convergence: UR (1994-2007 and 2000-2007)

	[a]	[b]	[c]	[d]	[e]	[f]
Aggregate	EU-27	EU-15	EU-10-East	EU-10-East	EU-15	EMU-12
Period	1990-2007	1990-2007	1990-2007	2000-2007	2000-2007	2000-2007
n. obs.	27	15	10	10	15	12
Initial UR+	-0.034***	-0.031***	-0.0392**	-0.0963**	-0.062***	-0.066***
Adj. R2	0.567	0.587	0.344	0.489	0.586	0.648

Note: Change in unemployment rate: dependent variable. + in logs. Significance levels: 1%\*\*\*, 5%\*\*\*, 10%\*; constant not reported.

After the previous interesting results, showing convergence between EU countries in labour market indicators, we turn now to an analysis of beta-convergence of the most frequently used (especially in economic growth studies) real variable: labour productivity. As we shall see, for this variable we have followed different specifications.

### 4.3 Beta Convergence of Productivity

A key aspect of real convergence in the long run refers to the economic performance of economic systems, e.g. in terms of GDP per-capita or productivity (the latter variable is to be preferred according to many studies in the empirical literature on convergence). The question is: is productivity of different countries converging to a unique level? (this is the absolute convergence approach). A similar question is: is productivity of different countries converging to a steady-state level, taking into account the structural differences of individual countries? (this is the conditional convergence approach).

The regression can be specified as follows (following a *cross section* method of estimation where *i* is the individual country):

$$1/n \log (Q_{it} / Q_{i0}) = \alpha + \beta \log (Q_{i0}) + \gamma Z + \varepsilon$$

where *Q* is productivity (in our case real value added divided by employment), 0 is the initial year, *t* is the final year and *n* is the number of years from 0 to *t*. If *Z* is not in the equation and  $\beta$  is negative and significant, then there is *absolute convergence*. The variable *Z* identifies one (or more) control variables: if the latter are included, a negative and significant  $\beta$  means that there is *conditional convergence*. Results are in Table 3.

Table 3 – Absolute and conditional convergence: productivity per worker (1992-2006 and 2000-2006)

	[a]	[b]	[c]	[d]	[e]	[f]
Period	1992-2006	1992-2006	1992-2006	1998-2006	1998-2006	1998-2006
n. obs.	27	27		27	27	27
Explanatory variables:						
Initial productivity <sup>+</sup>	-0.028***	-0.025***	-0.028***	-0.027***	-0.024***	-0.028***
Education <sup>+</sup>		0.012**	0.014***		0.014**	0.017***
Integr.index			0.016*			0.016
Adj. R2	0.722	0.753	0.762	0.510	0.567	0.569

Note: Change in productivity: dependent variable. + in logs. Significance levels: 1%\*\*\*, 5%\*\*\*, 10%\*; constant not reported.

Table 3 shows that in the case of the EU-27 countries productivity has indeed converged, both in the 1992-2006 period and in the more recent 1998-2006 period (regressions [3a] and [3d]): in fact, the  $\beta$  coefficient is negative and highly significant in the absolute convergence case. It

<sup>48</sup> As for UR, we have used CE data for the 1990-99 period and Eurostat data for the 2000-2007 period.

means that productivity growth over time is negatively related to the initial productivity level. This is in accordance with previous empirical results concerning convergence in Europe, especially at the country level.<sup>49</sup>

Turning now to a  $\beta$ -conditional approach, a possible control variable is *human capital*, i.e. the education level. In fact, in many growth models education is a key element in explaining productivity growth; moreover empirically, we can observe that backward countries or regions suffer in general for a lack of human capital; lastly, on the policy side, EU's institutions – starting from the Lisbon's strategy – emphasize knowledge and education as the main instruments for achieving growth and competitiveness.<sup>50</sup> By adding in the regressions this control variable, we obtain the results [3b] and [3e] for the two sub-periods. Education<sup>51</sup> turns out to be positive and significant, and the convergence outcome still holds.

If we add a second control variable, i.e. the *integration index*<sup>52</sup>, we obtain the results [3c] and [3f]. We can see that the effect of institutional integration within the EU is positive, but it is statistically significant only for the full period (not for the recent 1998-2006 years).

A different approach can be followed by using the annual data. This is the so-called “*extended beta convergence approach*”<sup>53</sup>, which tries to exploit the full time-series information of the panel and implies, in a certain sense, that each country may convergence to its own steady-state. The equation to be estimated is the following:

$$\log(Q_{it}/Q_{i,t-1}) = \alpha + \beta \log(Q_{i,t-1}) + \varepsilon$$

In this case, all the annual observations (for the 2000-06 period) are used in a *pooled estimation*, with fixed effects. The results are presented in Table 4. Convergence in productivity in European countries is confirmed if we control for education and institutional integration: the effect of the latter variables is confirmed to be positive and highly significant.

Table 4 – Extended beta convergence: productivity per worker (2000-2006)

	[a]	[b]	[c]	[d]
n. obs.	27*6	27*6	27*6	27*6
Explanatory variables:				
Initial productivity <sup>+</sup>	0.003	-0.030**	-0.047***	-0.076***
Education <sup>+</sup>		0.0013***		0.0011***
Integr.index			0.044***	0.042***
Adj. R2	0.793	0.738	0.807	0.779

Note: Change in productivity: dependent variable. + in logs. Significance levels: 1%\*\*\*, 5%\*\*\*, 10%\*, constant and fixed effects not reported.

#### 4.4 Convergence in Economic Structures

Concerning convergence in economic structures, we have already seen – from lowess-beta convergence – that they do not convergence in all aggregates of countries and for all periods. Now we can apply the above *extended beta convergence* procedure to the Krugman specialisation index (KSI). This index has been computed on *employment data*, for the full period and for the sectors already specified (see section 4.1). The equation to be estimated (pool with fixed effects) is the following:

<sup>49</sup> At the *regional* level the pattern is less clear. Although an absolute  $\beta$ -convergence in productivity across all the NUTS-2 regions of EU25 was found in Marelli (2007), the statistical significance becomes lower in the most recent period. Moreover, in the CEEC, new EU members in 2004, divergence takes places in the recent years, particularly at the NUTS-3 level (see Marelli and Signorelli, 2009). Thus, *convergence across countries* may coexist with *divergence across regions* within the same countries.

<sup>50</sup> The role of human capital in the explanation of productivity differences across EU27 countries has been investigated in Marelli and Signorelli (2010).

<sup>51</sup> The education level refers to 1998 (no better results are derived by considering the 1990 or 2006 levels).

<sup>52</sup> The adjusted integration index is used in all the following regressions.

<sup>53</sup> It has been used in the past by Canova-Marcet (1995), Tondl (1999), Marelli (2004).

$$\log (KSI_{it} / KSI_{i,t-1}) = \alpha + \beta \log (KSI_{i,t-1}) + \varepsilon$$

Table 5 – Extended beta convergence: specialisation (1990-2007)<sup>o</sup>

	[a]	[b]	[c]	[d]	[e]
Aggregate	EU27	EU15	CEEC10	EMU12	EMU12 recent <sup>o</sup>
n. obs.	27*17	15*17	10*17	12*17	12*17
Explanatory variables:					
Initial specialisation <sup>+</sup>	-0.19***	-0.24***	-0.14***	0.10**	0.052
Adj. R2	0.210	0.212	0.165	0.044	0.136

Note: Change in KSI: dependent variable. + in logs <sup>o</sup>(1999-2007). Significance levels: 1%\*\*\*, 5%\*\* , 10%\*; constant and fixed effects not reported.

The results are shown in Table 5. Convergence in sector structures is well established for the entire EU, for old members (EU15) and for the new CEEC members. For the EMU countries a divergence in sector structures seems to emerge for the full period; for a check, we have run the regression for a shorter period (1999-2007), i.e. after the start of EMU: since the coefficient is not significant, we can conclude that within EMU the pattern of structural convergence is unclear.

#### 4.5 Output Correlations

A final aspect of real convergence refers to the business cycle performance of the different countries, in order to see whether the cycles of individual countries are correlated with a “European” cycle. We can start with the computation of correlation coefficients between real output (in our case *value added*) of individual countries and EU27’s output (total value added for the EU27 countries at constant prices).

In some empirical studies, the reference country or area is sometimes Germany or, more often, EMU. We prefer to consider EU27 to identify an “average” cycle for all EU.<sup>54</sup> Table 6 shows, in the left column, the correlation coefficients computed on the *output levels*; the countries are shown in a descending order. The highest correlations can be found in the “old” European countries, with some exceptions<sup>55</sup> (all the coefficients are statistically significant, but Romania and Bulgaria).

From a business cycle perspective is more useful to compute correlation coefficients on *output differences* over time. The right column of Table 6 shows a rather different pattern (also the statistical significance is achieved for a smaller number of countries). The first ten countries comprehend only “old” European countries (with Germany leading the group), and nine out of ten are EMU’s countries (the only exception being Sweden). The last ten countries in the table include mostly the “new” members, plus Denmark and the United Kingdom, two countries not yet adopting the euro (in fact the UK business cycle is traditionally considered rather asymmetric); the real exception is however Luxembourg.<sup>56</sup>

We can perhaps conclude by saying that the EMU has actually been launched including a group of rather “integrated” countries, paying full respect – from this point of view – to OCA’s criteria: real convergence has thus justified the subsequent steps toward nominal convergence (euro adoption and the related criteria). A different explanation, more in accordance with OCA’s endogeneity theories, is that nominal convergence – euro adoption and the satisfaction of Maastricht’s criteria – has led to a better real integration of EU countries, which reaches the highest values (e.g. in terms of output correlations) in the EMU’s group. We think that both explanations

<sup>54</sup> Moreover, the difference between EU27’s GDP and EU15’s GDP (another aggregate sometimes used as a reference area) is just about 10% in terms of levels (probably insignificant in terms of changes over time).

<sup>55</sup> Slovenia and Cyprus are in the first group; Italy, France and the Netherlands are rather low in the ranking.

<sup>56</sup> The tiny size of its GDP perhaps amplifies changes over time and possible measurement errors.

are relevant to understand economic performances and evolutions in the EU over the two last decades.

Tab. 6 – Output correlations

Correlations on real value added <i>levels</i> (1992-2007)		Correlations on real value added <i>changes</i> (1993-2007)	
	<i>Correl. coeff. (and sign. level)</i>		<i>Correl. coeff. (and sign. level)</i>
Belgium	0.998634***	Germany	0.966017***
Germany	0.997486***	Belgium	0.910347***
Sweden	0.997103***	France	0.871988***
Spain	0.996558***	Sweden	0.870159***
Ireland	0.996313***	Spain	0.838866***
Slovenia	0.995633***	Italy	0.830866***
Cyprus	0.995269***	Austria	0.788153***
United Kingdom	0.994871***	Portugal	0.763854***
Finland	0.994474***	Finland	0.758146***
Luxembourg	0.993945***	Greece	0.731194***
Denmark	0.992891***	Bulgaria	0.716843***
Austria	0.992609***	Netherlands	0.711544***
Hungary	0.991795***	Hungary	0.693873***
Italy	0.991086***	Slovenia	0.679699***
France	0.985734***	Ireland	0.656603***
Greece	0.984819***	Malta	0.592743**
Netherlands	0.982732***	Cyprus	0.502705*
Portugal	0.979127***	Latvia	0.493134*
Poland	0.978168***	Denmark	0.482378*
Slovakia	0.977203***	Lithuania	0.386387
Estonia	0.976623***	United Kingdom	0.365782
Lithuania	0.975838***	Czech Republic	0.236564
Latvia	0.975049***	Poland	-0.08836
Czech Republic	0.951609***	Slovakia	-0.09452
Malta	0.920593***	Estonia	-0.15134
Romania	0.416466	Romania	-0.28936
Bulgaria	-0.41894	Luxembourg	-0.29896

Note: Significance levels: 1%\*\*\*, 5%\*\*\*, 10%\*. Source: elaboration on CE database.

## 5. Conclusions

In the review section of this paper, we have seen how complex are the relations between real and nominal convergence, and how many issues they involve. Afterwards, in the empirical part of the paper, we have illustrated and discussed the two sorts of convergence in the case of EU, initially in separate sections; then, in the econometric estimates, they have been connected to each other by means of indirect methods, in particular thanks to the inclusion in the real convergence analysis of an “integration index”, originally proposed and applied in this paper.

Considering *real convergence*, the analysis of sigma convergence/divergence showed for the EMU-12 and EU-15 aggregates: (i) significant sigma convergence in both employment and unemployment rates (but only after 1999 in the latter case); (ii) low but persisting disparities in productivity and industrial specialisation; (iii) a weak sigma divergence in national per capita GDP (although not constant over time). This contrasts, in some way, with the tendencies in the New Members: (i) persistent disparities in employment and unemployment rates (although sigma convergence prevails in more recent years in the latter case); (ii) significant sigma convergence in both per capita GDP and productivity; (iii) remarkable increases in the disparities in the specialisation index. The analysis of lowess-beta convergence/divergence has allowed to derive



more specific results, depending on the period considered and on the aggregate of countries, but the EU-27 aggregate showed a convergence in all the considered variables. As for the other aggregates, a beta convergence in unemployment rate emerged for all the aggregates, and a strong beta convergence in employment rates emerged only for the EMU and EU-15 aggregates.

As to *nominal* variables, a satisfactory degree of *convergence* has been achieved in the EU, at least in the last fifteen years. In particular, the *deficit/GDP* ratio has improved in the EMU countries in the second part of the 1990s, followed by a significant worsening in the first three years of the new century and by a new reduction in the subsequent years; higher levels of the ratio are exhibited by the New Members, although significant reductions occurred since 2003 and especially in 2007. Similar tendencies are shown by the *debt/GDP* ratio: in this case, we should mention the much lower levels in the New Members, although a gradual reduction of the remarkable distance with “old-EU members” was interrupted in more recent years. The *inflation rate* remained quite stable (around 2%) in both the EMU-12 and EU-15 aggregates; as to the NMS, the significant decline of the 1990s was followed by a stabilisation (around 3-4%) in the new century (but still in 2007 seven countries out of ten did not respect the Maastricht parameter). Concerning the long-term *interest rate*, the Euro-area aggregate declined from a value higher than 9% in 1992 to a level close to 3% in 2006, with a strong reduction in the immediate period before EMU’s birth. As to the *exchange rate* condition, the three Baltic states (in addition to Denmark) adhere at present to the ERM-II agreements, as did Slovenia, Slovakia, Cyprus and Malta before adopting the euro. The inter-country *dispersion* of the nominal variables has generally decreased, save for the ambiguous trends in public finance parameters.

*Regression analysis* provides robust results for absolute convergence of labour market indicators (employment and unemployment rates). Beta-convergence across the EU-27 countries emerges also for productivity: this refers both to absolute and conditional (e.g. controlling for education) convergence; convergence in productivity is confirmed considering an “extended beta-convergence” approach (making use of annual observations for the recent period), in which case our “*integration index*” turns out to be positive and significant as well. The same approach has been applied to convergence in industrial specialisation, which seems verified in the EU-27 aggregate (less clear is the result in the case of EMU countries): remember that this type of convergence is important for the probability of occurrence of (a)symmetric shocks.

Finally, the analysis of output correlations – especially those referred to valued added changes – shows that in a rank of countries according to the size of correlations, on one side the first ten countries (whose correlation coefficients are all statistically significant) comprehend exclusively “old” European countries (with Germany leading the group) and nine of them are EMU’s countries (the additional country being Sweden); on the other side, the last ten countries include the NMS as well as Denmark and the United Kingdom, two countries not adopting the euro.

We can conclude by recognizing that EMU has been launched in a group of rather integrated countries (at least in comparison with other European countries), as shown by output correlations, convergence in productivity and labour market performance. We could add that integration itself has probably been enhanced by convergence to EMU and the ensuing euro’s adoption (as maintained by OCA’s endogeneity theories). In old members, and particularly in EMU countries, only the pattern of convergence in economic structures and in per capita GDP is not so clear. So some risks could persist in the future, particularly if the (more or less) continuous respect of nominal conditions (Maastricht’s and Stability Pact’s parameters) will not be accompanied by the realization of structural reforms, the execution of all reforms launched by the Single Market and new progresses in the implementation of the Lisbon’s strategy.

Concerning the NMS, they generally had more difficulties in respecting nominal conditions, but have shown a widespread catching-up – in terms of productivity and per-capita GDP – toward the average EU levels; they are also well integrated, in terms of trade links, with Western Europe. The major problems they experience refer not only to the persisting disparities in labour market indicators, to the still different specialisation and consequently low output correlations; but also to

the conflicts emerging by the attempts to simultaneously satisfy the nominal conditions (we have discussed in the review section the trade-off between inflation and exchange-rate Maastricht's criteria). Although all these countries will probably benefit from entering EMU in the long run, the real question for some of them is *when* and *how* to proceed toward this final step of integration.

More immediate policy measures refer to the need to tackle the persisting labour market problems and unemployment levels, which are unfortunately bound to increase because of the present recession. But the current economic crisis is a widespread challenge which is distressing nominal and real convergence of all European countries (new and old) as well as of most countries in the world.

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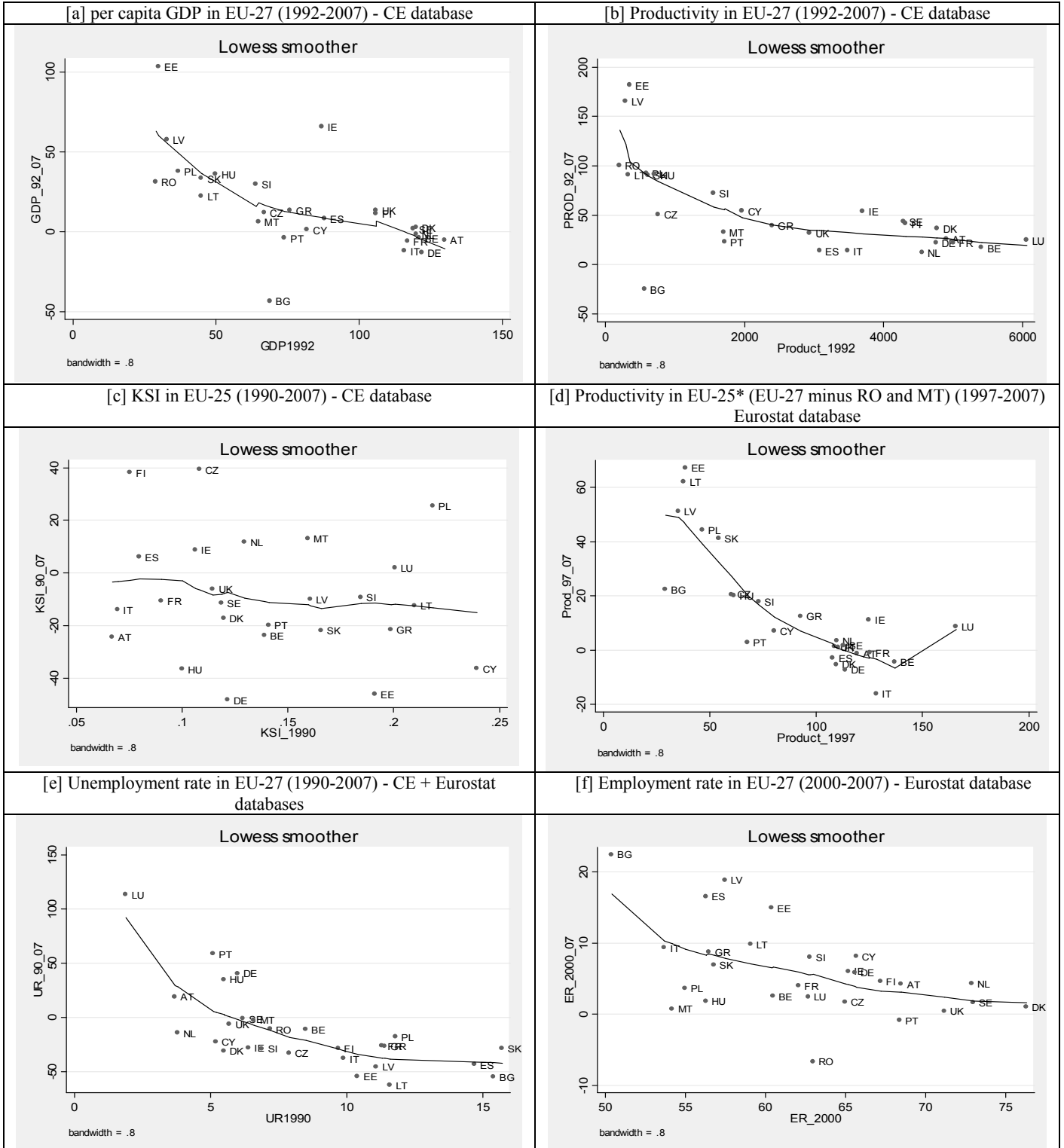
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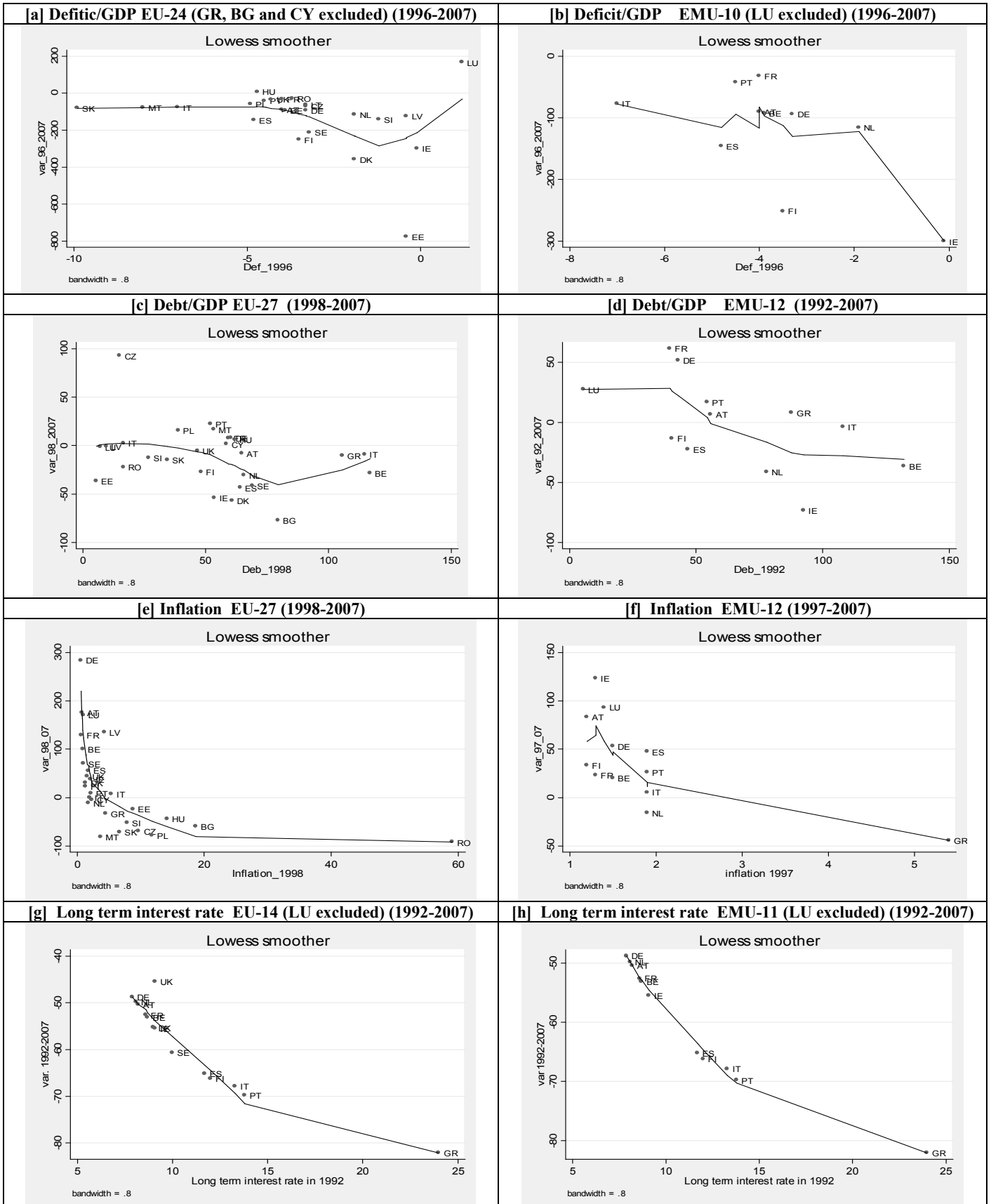
# Appendix

## Graph A1 - Real Lowess beta convergence



Source: elaboration on Cambridge Econometrics and Eurostat databases.

Graph A2 - Nominal Lowess beta convergence



Source: our elaboration on Eurostat database.

Table A1 - Institutional Integration Index

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Austria	0.25	0.3	0.35	0.4	0.45	0.75	0.82	0.88	0.94	1	1	1	1	1	1	1	1	1
Belgium	0.75	0.75	0.75	0.79	0.82	0.86	0.89	0.93	0.96	1	1	1	1	1	1	1	1	1
Bulgaria	0	0	0	0	0	0	0	0	0	0	0.25	0.29	0.32	0.36	0.4	0.44	0.47	0.5
Cyprus	0	0	0	0	0	0	0	0	0.25	0.29	0.33	0.37	0.41	0.46	0.5	0.75	0.83	0.92
Czech Republic	0	0	0	0	0	0	0	0	0.25	0.29	0.33	0.37	0.41	0.46	0.5	0.5	0.5	0.5
Germany	0.75	0.75	0.75	0.79	0.82	0.86	0.89	0.93	0.97	1	1	1	1	1	1	1	1	1
Denmark	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Estonia	0	0	0	0	0	0	0	0	0.25	0.29	0.33	0.37	0.41	0.46	0.75	0.75	0.75	0.75
Spain	0.75	0.75	0.75	0.79	0.82	0.86	0.89	0.93	0.97	1	1	1	1	1	1	1	1	1
Finland	0.25	0.3	0.35	0.4	0.45	0.5	0.5	0.75	0.88	1	1	1	1	1	1	1	1	1
France	0.75	0.75	0.75	0.79	0.82	0.86	0.89	0.93	0.97	1	1	1	1	1	1	1	1	1
Greece	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.75	0.83	0.92	1	1	1	1	1	1	1
Hungary	0	0	0	0	0	0	0	0	0.25	0.29	0.33	0.37	0.41	0.46	0.5	0.5	0.5	0.5
Ireland	0.75	0.75	0.75	0.79	0.82	0.86	0.89	0.93	0.97	1	1	1	1	1	1	1	1	1
Italy	0.75	0.75	0.75	0.5	0.5	0.5	0.5	0.75	0.88	1	1	1	1	1	1	1	1	1
Lithuania	0	0	0	0	0	0	0	0	0	0	0.25	0.31	0.37	0.44	0.75	0.75	0.75	0.75
Luxembourg	0.75	0.75	0.75	0.79	0.82	0.86	0.89	0.93	0.97	1	1	1	1	1	1	1	1	1
Latvia	0	0	0	0	0	0	0	0	0	0	0.25	0.31	0.37	0.44	0.5	0.75	0.75	0.75
Malta	0	0	0	0	0	0	0	0	0	0	0.25	0.31	0.37	0.44	0.5	0.75	0.83	0.92
Netherlands	0.75	0.75	0.75	0.79	0.82	0.86	0.89	0.93	0.97	1	1	1	1	1	1	1	1	1
Poland	0	0	0	0	0	0	0	0	0.25	0.29	0.33	0.37	0.41	0.46	0.5	0.5	0.5	0.5
Portugal	0.75	0.75	0.75	0.79	0.82	0.86	0.89	0.93	0.97	1	1	1	1	1	1	1	1	1
Romania	0	0	0	0	0	0	0	0	0	0	0.25	0.29	0.32	0.36	0.4	0.44	0.47	0.5
Sweden	0.25	0.3	0.35	0.4	0.45	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Slovenia	0	0	0	0	0	0	0	0	0.25	0.29	0.33	0.37	0.41	0.46	0.75	0.83	0.92	1
Slovakia	0	0	0	0	0	0	0	0	0	0	0.25	0.31	0.37	0.44	0.5	0.5	0.75	0.82
United Kingdom	0.75	0.75	0.75	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

Note: "Institutional Integration Index" is an index whose numerical values are between 0 and 1; we first computed the values as follows: (i) I = 0 for non-EU members; (ii) I = 0.25 for non-EU members formally recognized as "candidate" countries; (iii) I = 0.5 for EU members; (iv) I = 0.75 for EU members belonging the ERM (or ERM-II) agreements; (v) I = 1 for Eurozone members. Starting from the above values, some linear interpolations have been considered, in particular between 0.25 and 0.5 (a candidate country must show progresses toward full membership) and between 0.75 and 1 (the ERM members progressively satisfy the Maastricht's criteria to adhere to EMU).