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Institutional, nominal and real convergence in Europe

Abstract

The purpose of this paper is to assess nominal and real convergence within the EU countries; both processes have been largely shaped by the advances in institutional integration. The review section provides a theoretical framework to investigate the manifold links between real, nominal and institutional convergence.

After a descriptive analysis of sigma-convergence of selected real variables, in order to econometrically investigate how the process of institutional integration has affected real convergence, we have computed (and included in the regressions) an “ad hoc” integration index, which takes into account the progressive steps toward closer integration followed by EU countries. The empirical results – concerning the EU-27 countries (mostly for the period of 1990-2007) – show that in EMU countries real convergence is well established in terms of productivity, labor market indicators, output correlations; only the pattern of convergence in economic structures is not so clear. On the other hand, the New Members have shown a generalized catching-up in terms of productivity, but some difficulties in respecting nominal conditions; moreover, possible concerns refer to the still different specializations and consequently low output correlations.

Moreover, in a specific section there is an examination of the impact of the recent financial and economic crisis that has caused not only greater instability and deteriorated real performances, but also “divergence” in key nominal and real variables. Some policy solutions to cope with the post-crisis uncertain scenario are finally discussed.

Keywords: European integration, nominal convergence, real convergence, institutional convergence, old and new Europe.

JEL Classification: O47, O52, P27, P51, F43, F55.

Introduction

More than a decade has already elapsed since euro’s birth. Its general success has been confirmed by the overall macroeconomic stability realized in the last decade, although some tensions have recently appeared also in the euro area, as a consequence of the economic and financial crisis (2007-08) and global recession (2008-09). Most of EMU’s members have been able so far to outlive the deepest phase of the crisis (despite some concerns about the most vulnerable countries, as discussed in Section 4) and the macroeconomic and financial instability has been generally worse in non-EMU or even non-EU countries (in fact some countries like Iceland would like to join now the EU).

Two key questions arise at this point. The first one is to analyze *nominal convergence* prior to the recent crisis, e.g., since the EMU’s birth (1999) or even before (during the process that in the ‘90s led to building of EMU). The second question is to assess the links between nominal convergence – which is also *institutional* (since monetary integration has been achieved through the institutional steps toward a deeper integration) – and *real convergence*.

The answer to the first question is that nominal stability (and convergence) has been satisfactory in the pre-crisis period: e.g., the inflation rate has been for about ten years very close to the 2% target (even in

countries that in the ‘90s had normally much higher inflation); however, a more precise account on other features of nominal convergence – e.g., interest rates, public deficits and debt, exchange rates – is needed (this is the first task of this paper).

Concerning the second question, it is true that 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 US, not to speak of China, India and other emerging countries. But is this a consequence of nominal convergence? Also on this account, a more precise investigation of *real convergence*, of its multifaceted *features* (including per capita income, productivity, labor market or industry indicators, trade links, business cycle behavior, etc.) and especially of its *relations with nominal/institutional convergence* is required.

In the last decade, some other major events – beyond the process of economic integration between the “old” EU countries – occurred in Europe. As a long-run consequence of the fall of the Berlin Wall, 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” and some New Members (NMS) have already entered the EMU. Hence, in the empirical part of the paper a special attention will be sometimes devoted to this group of countries, although most of the investigation refers to the full set of EU-27 countries.

The structure of the paper is the following. In Section 1 there is a review of the theoretical and empirical literature, focusing on the institutional process of integration in Europe, on the different aspects

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of real convergence, on the links between real, nominal and institutional convergence. An empirical analysis of nominal and real convergence in the EU-27 group of countries, following the sigma-convergence approach, is then presented in Section 2, while various econometric investigations (incorporating an “ad hoc” integration index) are discussed in Section 3. The impact of the recent economic crisis and global recession and the policy implications are discussed in Section 4. The conclusions are drawn in the last Section.

1. Institutional integration, nominal and real convergence in the EU

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; such processes in the literature are usually analyzed in separate fields of study. In the first case (*nominal convergence*), we find many studies on the justification and effects of nominal convergence criteria (a critical assessment is provided by Buiters, 2004).

The literature on the second field (*real convergence*) comprehends such different aspects as long-run economic evolutions (and convergence) in per-capita incomes and productivity (following the sigma and beta convergence approaches: see Barro and Sala-i-Martin, 1995), convergence in labor markets, homogenization of economic structures (some specific studies are devoted to growth and competitiveness in accordance with Lisbon agenda). Convergence in economic structures is also relevant for short-run economic performance, e.g., because of the effects on the (a)symmetry of economic shocks; in fact, synchronization of business cycles and closer trade integration are two additional aspects of real convergence. It is likely that the process of institutional integration enhanced real convergence, as maintained by the OCA’s endogeneity hypothesis and discussed in the next sections.

We can, however, anticipate that 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.

1.1. 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 time¹. 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” liberalizations of goods, services, capitals and people) – the European Economic and Monetary Union (EMU) established in 1999 represents the most momentous achievement².

The final goals of the EU include – as clearly specified in article 2 of the Treaty – *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*.

Then, the EMU is officially viewed as an instrument to achieve “real” convergence, i.e. convergence in economic performances. On the other hand, according to economic theories, economic convergence is 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 Treaty³ as a pre-condition for candidate countries to enter the EMU.

To be admitted to the Eurosystem, a country has previously to satisfy some *nominal convergence criteria*⁴. 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 European Economic and Monetary Union (EMU). The subsequent tests

² 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 eurozone.

³ Signed in February 1992 and entered into force in November 1993.

⁴ (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).

¹ As testified by the halt in the processes of ratification of the Constitutional Treaty in 2005 and by the difficulties in the approval of the Lisbon Treaty, finally obtained at the end of 2009.

for other countries resulted in further enlargements of the Eurozone, to Greece (2001), Slovenia (2007), Cyprus and Malta (2008), and Slovakia (2009)¹.

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 (public deficit cannot exceed 3% of GDP apart from exceptional circumstances and in the medium run the public budget should reach a balanced situation).

After the adoption of the Maastricht Treaty many authors highlighted the possible negative short-run impact on real economic growth, because of the deflationary consequences of restrictive monetary and fiscal policies (e.g., De Grauwe, 2007). As a matter of fact, after 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 2000².

A more integrated EU, with higher economic growth, better performance of labor markets, more competitive business sector should make easier the working of the EMU, in a context of macroeconomic and nominal stability. Thus, it is already apparent that the links between real and nominal convergence are multiple and can go both ways.

1.2. Main features of real convergence. One important goal of the EU is “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 labor 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”³ is appropriate in this case⁴: 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 characterized developments *between* countries, absence of convergence or even divergence has been found *within* countries: a trade-off between international convergence and interregional divergence has been a common outcome (especially among the NMS)⁵.

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. 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 synchronization of business cycles between countries (see below).

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. – to *increased specialization*, 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 liberalization of capital flows and the working of EMU itself. Furthermore, the *empirical evidence* on structural convergence is mixed⁶.

¹ Circulation of *euro* among the participating countries appeared in 2002 and since 1999 the European Central Bank (ECB) is the sole responsible for the conduct of monetary policy in the eurozone. ECB 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).

² But even before some steps were launched to tackle labor market problems: from Delors’ White Book (1994) to the Treaty of Amsterdam (1997), and the contemporaneous European Employment Strategy (EES).

³ 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) and Marelli and Signorelli (2010a).

⁴ *Structural convergence* was also analyzed in development economics (Chenery, Clark, Hirschman, Kaldor). In fact, there is a close relation between the stage of development and the productive structure of each country: the well-known *three sectors law* is a good starting point to understand the importance of the sectoral structure. See Marelli (2004) for an empirical investigation at the regional level.

⁵ See Martin (2006).

⁶ See, for example, Hallet (2002) and Marelli (2007). 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 labor 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). Specialization may be important also because a high degree of specialization causes increased *inter-industry trade* and then asymmetric shocks may appear; the opposite will result from lower specialization and *intra-industry trade*¹.

We mentioned before, when discussing the short-run view, the importance of the empirical studies on the synchronization of business cycles. These studies usually analyze, 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. 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 policies². A firm conclusion of empirical studies on cycle correlation in the EU is, however, 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 globalization). Empirical studies have shown that synchronicity has increased not only within the eurozone 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" Europe³.

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*. 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 industrialized and developing countries, 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. Thus, the original source of "real integration" between countries may be the process of institutional integration itself. 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.

Another feature of real convergence, not specifically considered in this paper, is convergence in labor market performance. First of all, we should observe that 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 labor productivity and employment rate (ER)⁴.

The theoretical debate on OCA has also been focused on the labor market pre-conditions (mobility and wage flexibility) for realizing an effective monetary union. Then, a decade of evidences on the EMU can be useful for assessing if the endogeneity of OCA's criteria proposition could be extended also to the labor market flexibility. So, the extension of (beta) real converge analysis to ER and UR is functional in: (i) highlighting the contribution of labor market performance to a wider real convergence⁵ and (ii) assessing the process of convergence towards the European Employment Strategy (EES) objectives as defined in Lisbon (2000) and Stockholm (2001) Councils⁶.

1.3. Links between real, nominal and institutional convergence. If, according to OCA theories, *real convergence* is functional to *nominal convergence* (i.e. the establishment of a successful monetary union), why in the institutional process leading to the creation of EMU has the link *been reversed*? 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

¹ Luckily enough, it is the latter type of trade that seems to develop most after introduction of the euro (Böwer and Guillemineau, 2006).

² A stronger co-movement of business cycles within the European Monetary System (EMS) has been detected by Artis and Zhang (1999).

³ In particular, trade relations of NMS developed significantly even before the official EU accession (Bussière et al., 2005). Concerning output correlations, Hungary, Poland and Slovenia seemed to be the most correlated with the euro area; the lowest correlations, close to zero, were found for the Baltic states (Babetskii, 2005; Darvas and Szapáry, 2005; Fidrmuc and Korhonen, 2006). It should be noted that these results refer to the period prior to the recent financial and economic crisis.

$$^4 \frac{GDP}{P} = \frac{GDP}{E} \times \frac{E}{P} = \frac{GDP}{E} \times ER \times \frac{P_{15-64}}{P} \times \frac{1}{100}$$

⁵ Boldrin and Canova (2001) stress how the gap between the various convergence/divergence theories (predicting labor productivity dynamics) and empirical tests (which broadly adopt per capita incomes) is simply bridged by assuming full employment, neglecting the roles played by labor market performance dynamics.

⁶ The EES, launched in 1997, defined the following quantitative objective to be reached by 2010 (Lisbon and Stockholm Councils): (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%.

concerning inflation and interest rates, the spur of investment and international trade, all benefits finally leading to stronger economic growth. Because these benefits may be more important for formerly “deviating” economies (characterized 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, those countries have been punished for their previous “vices” (undisciplined public finances, inflation-prone behavior, 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.): these benefits are important for a sustained growth *in the long run*.

We must also say, at this point, that some economists do not consider *all* Maastricht’s criteria as necessary or even sensible prerequisites for the euro’s adoption. For example, Buitier (2004) underplays the role of inflation and interest convergence, and of exchange rate management; just fiscal sustainability is a decisive requirement. 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*. In particular, the NMS, which at the beginning of the ‘90s had some kind of soft pegs, moved in the last decade to either flexible exchange rate regimes with inflation targeting (the big countries) or to currency boards or hard pegs (the small ones). 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 adoption¹.

Many theoretical and empirical studies have also examined the joint concepts of growth, (real) convergence and *institutional change*. In the case of EMU, we can establish a link between nominal convergence (the satisfaction of Maastricht’s criteria), institutional convergence (admission to the Eurosys-

tem) 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, but recent empirical evidence shows that, soon 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)².

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 liberalizations or increased competitiveness in specific markets. Alesina et al. (2008), after reviewing the theoretical arguments that may link the adoption of the euro and “structural reforms”, 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 labor market reforms.

Institutional change has been more important in NMS, i.e. in “transition countries”. The complexities and peculiarities of the transformations occurred in Central and Eastern European Countries (CEEC) 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 labor 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 change³.

¹ Michelis and Koukouritakis (2007), investigating common trends of the *nominal convergence* criteria as well as two specific *real variables*: real exchange rates and real per capita GDP, argue that the NMS were partially ready to join the eurozone, although they needed further adjustments in their fiscal policies. See also Rinaldi-Larribe (2008).

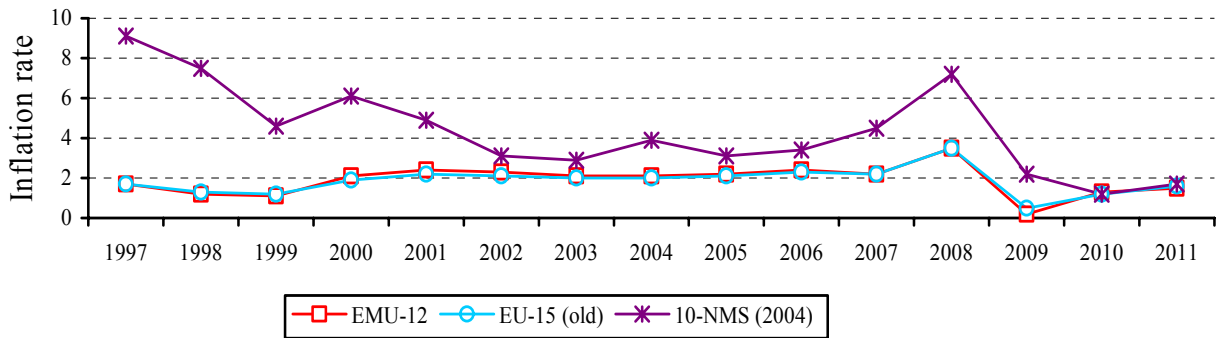
² A positive trade effect around 10-20%, which, however, has levelled off in the subsequent (2003-06) years, is confirmed for a long (eight-year) period by the latest investigation of Frankel (2008). The impact is much lower compared to the original Rose’s estimates and more similar in magnitude to the results of Micco et al. (2005).

³ Marelli and Signorelli (2010a) 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 (2010b), since in a sample of EU27 countries the same proxy contributes (together with human capital and some other control variables) to explaining differences in productivity levels across countries.

2. Nominal and real convergence: a first investigation through the sigma-convergence approach

Before considering the results of the econometric investigations on beta-convergence, we briefly summarize some evidences obtained on nominal and real sigma-convergences for EU-27 countries. To investigate *nominal* convergence, we have initially considered the four Maastricht parameters.

Figure 1 exhibits the evolution of the *inflation rate* for the 1997-2009 period (with the addition of EU Commission forecasts for 2009-2011). While the old (EU-15) and eurozone (EMU-12) countries had the lowest inflation rates around the start of EMU (1998-99), thereafter they have been close or little above the 2% target. Also, the NMS showed an initial convergence (till 2002-03), then they had a partial increase in inflation, especially some of them and particularly up to 2008 (the recent recession has brought to a stronger convergence of inflation downwards).



Notes: 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.
Source: Our elaboration on Eurostat database; EU Commission forecasts (October 2009) for 2009-2011.

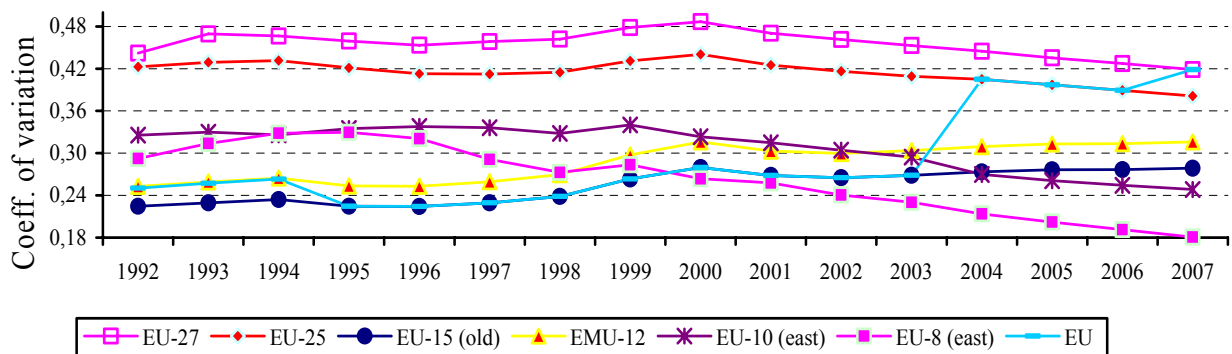
Fig. 1. Inflation rate (HICP)

Also considering individual countries and taking the coefficient of variation as a measure of dispersion, a remarkable *sigma convergence* in national inflation rates occurred in EU-27 countries (and less evidently for EU-15 and EMU-12 aggregates). Data and figures are available upon request.

ing) instability over time appears in *deficit/GDP ratios* disparities, without clear tendencies for all aggregates; (ii) *sigma divergence* in *debt/GDP ratios* emerged in recent years for all the main EU aggregates.

With reference to the other Maastricht's parameters, the following evidences on sigma-convergence can be briefly highlighted (complete results are available upon request): (i) significant reductions in the disparities in long-term *interest rates* emerged for EMU aggregate, especially in the 1990s; (ii) high (but decreasing)

Considering now the results on sigma-convergence of *real variables*, a weak sigma divergence in national per capita GDP can be detected – see Figure 2 – for EMU-12 and EU-15 aggregates (especially in the period of 1996-2000 and in more recent years), while a significant sigma convergence can be found in the NMS since 1994 (EU-8-east but only after 1999 for EU-10-east)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).

Fig. 2. Disparities (sigma) in GDP per capita

¹ Results on "lowess-beta-convergence" (available upon request) show that a clear convergence in inflation rates emerges for EU-27 countries; moreover, EMU members experimented a strong lowess beta-convergence in all the four parameters.

For the EU as a whole, the increase in 2004 and 2007 is of course related to the enlargements to new countries (with a much lower GDP per capita).

In addition to per capita GDP, the other real variables that have been investigated for sigma convergence are: productivity, unemployment rate and employment rate, and a specialization index¹. We have found for the old members low but persisting disparities in productivity, in contrast to a clear convergence for the NMS (especially since 1999). As to the labor market indices, a significant sigma convergence in unemployment rate (but only after 1999) and a remarkable sigma convergence in employment rate (since early '90s) are shown by the old members, while in the NMS persisting unemployment disparities during the '90s have been followed by 2-3 years of divergence, and a clear convergence in more recent years (up to 2007). Finally, the low but persisting disparities in industrial specialization of old members compare with the increase in the disparities in specialization index of NMS.

The dynamics in disparities of real variables for EU-25 and EU-27 aggregates reflect the above various trends².

3. Nominal and real convergence: some econometric investigations

Our econometric investigations refer especially to different aspects of *real convergence* and we shall check how it is affected by *nominal* and *institutional* convergence through an indirect method. In fact, the most original feature of our econometric estimates is the inclusion in the regressions of an "integration index", specifically computed, which tries to quantitatively summarize the progressive steps of *institutional* integration, which includes the *nominal* convergence implied by Maastricht's criteria and, ultimately, euro adoption.

We shall start with an investigation of *beta 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 second key element, as suggested by conditional convergence approaches (and also by OCA theories to take into account the degree

of symmetry of shocks). *Trade integration* is another variable suggested by the same theories: the net benefits of a monetary union are higher when the individual countries exhibit narrower trade links with the rest of the union. Finally, the analysis of *output correlations* evaluates real convergence from a business cycles point of view.

3.1. Data and sources. The empirical investigations refer to the *EU-27 countries*. The period refers to 1990-2007 or 2000-2007 (according to data availability). Data concerning *value added* (at constant prices) and *employment* are taken from Eurostat and Cambridge Econometrics. Eurostat (on-line) statistics have been used also for the *Gross domestic product* (at current prices) and for *Trade* (at current prices) of the individual countries *with the EU*, both imports and exports³. Employment data have also been collected at a sectoral level, particularly to compute the KSI index. As a proxy for *human capital* we have used Eurostat's "Total population (aged 25-64) having completed at least upper secondary education".

Finally, we computed an "*institutional integration index*". This is an index (I) whose numerical values are between 0 and 1; it has been computed as follows: I = 0 for non-EU members; I = 0.25 for non-EU members formally recognized as "candidate" countries; I = 0.5 for EU members; I = 0.75 for EU members belonging the ERM (or ERM-II) agreements; I = 1 for eurozone members⁴.

3.2. Beta convergence of productivity and labor market performance indicators. *The first aspect of real convergence* in the long run refers to the economic performance of economic systems, in terms of productivity (the latter variable is to be preferred according to many studies in the empirical literature on convergence). The regression can be specified as follows (in a *cross section* of countries it stands for an 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, t is the final year and n is the number of years from 0 to t . If Z is not included in the equation and β 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 β means that there is *conditional convergence*.

¹ We have used the "Krugman specialization index", defined as: $KSI_j = \sum_i |s_{i,j} - s_{i,0}|$, 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. 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).

² As for the (lowess) beta convergence/divergence, with reference to the whole available period (usually 1990 or 1992 as initial year), the EU-27 aggregate showed a clear convergence in all the considered variables, but the (lowess) beta convergence in both per capita GDP and productivity was stronger in the NMS, while beta convergence in the employment rate was stronger for the EMU and EU-15 aggregates (complete results are available upon request).

³ The price index of Exports (2000 = 100) has been used to deflate the nominal value of Exports to get a proxy for *real exports* of individual countries toward the EU.

⁴ In the regressions we have used either the index computed in this way or an "adjusted" index, where some linear interpolations have been considered. The results by using the second index are not different in terms of signs and significance, and very similar as regards the coefficients' values (complete results are available upon request).

Table 1 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 [1a] and [1d]): in fact, the β coefficient is negative and highly significant in the absolute convergence case. This is in accordance with previous empirical results concerning convergence in Europe, especially at the country level¹.

Turning now to a β -conditional approach, a key control variable is human capital, in accordance with endogenous growth models and EU's goals (Lisbon strategy). By adding this control variable, we obtain [1b] and [1e] for the two sub-periods, where education 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, we obtain [1c] and [1f]: we can see that the effect of institutional integration is positive, but statistically significant only for the full period (not for the recent 1998-2006 years).

Table 1. 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	27
Explanatory variables:						
Initial productivity*	-0.028***	-0.025***	-0.028***	-0.027***	-0.024***	-0.028***
Education*		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.

A different approach can be followed by using the annual data: it is the “*extended beta convergence approach*”², which tries to exploit the full time-series information of the panel and implies that each country may converge to its own steady-state. The equation to be estimated is the following:

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

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 2. Convergence in productivity is confirmed when we control for education and institutional integration.

¹ At the regional level the pattern is less clear; thus, *convergence across countries* may coexist with *divergence across regions* within the same countries. See Marelli (2007).

² It has been used in the past by Canova-Marcet (1995), Tondl (1999) and Marelli (2004).

Table 2. 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*	0.003	-0.030**	-0.047***	-0.076***
Education*		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.

As for convergence in labor market performance, the equations to be estimated for the employment rate (ER) and the unemployment rate (UR) are the following:

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

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

General and highly significant beta convergence dynamics emerge for both indicators, various aggregates and periods (Tables 3 and 4).

Table 3. 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%.

Table 4. 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.

3.3. Convergence in economic structures. We can apply the above *extended beta convergence* procedure to assess convergence in economic structures as well, by considering the Krugman specialization index (KSI). The equation to be estimated (pool with fixed effects) is the following:

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

The results are shown in Table 5. Convergence in sector structures is well established for the entire EU, for old members (EU-15) 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.

Table 5. Extended beta convergence: specialization (1990-2007)

	[a]	[b]	[c]	[d]	[e]
Aggregate	EU27	EU15	CEEC10	EMU12	EMU12 recent ^o
n. obs.	27*17	15*17	10*17	12*17	12*17
Explanatory variables:					
Initial specialization*	-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 ^o(1999-2007). Significance levels: 1%***, 5%***, 10%*; constant and fixed effects not reported.

3.4. Trade integration and its determinants. We have seen in the previous sections that *trade deepening* is expected to increase with the process of institutional integration within the EU. However, also candidate countries normally increase trade relationships with the EU even before formal admission; furthermore, trade links are enhanced by stable exchange-rates, thus, also ERM membership should be relevant; and, lastly, full EMU membership (i.e. euro adoption) should lead to the strongest increase in trade relations.

A simple way to investigate the effect of institutional and nominal convergence on trade is to regress trade flows with the EU on the integration index (I), with the addition of some control variables, e.g. the most relevant economic variables explaining trade flows, such as GDP in the individual countries and aggregate EU's GDP¹. The equation to be estimated is the following:

$$T_{iUt} = \alpha + \beta Y_{it-1} + \gamma Y_{Ut-1} + \delta I_{it-1} + \varepsilon ,$$

where T_{iUt} are total trade flows (imports plus exports) between individual countries (i) and EU-27 (U); all variables in this first specification are at current prices. The estimation is a pool with fixed

¹ This resembles "gravity models", although we do not consider here bilateral trade flows between country i and country j , but rather trade flows between country i and the aggregate EU-27. Distance is not considered in our case, but if we estimate a panel with fixed effects (FE), we can assume that distance is indirectly captured by such effects.

effects; in order to tackle the possible endogeneity problems, we have preferred to specify the explanatory variables with a 1-year lag. The results are in Table 6.

In the case of the full sample (EU-27), not only the coefficients of Y_{it} and Y_{Ut} are positive and significant as expected, but also the integration index is positive and significant (eq. [6a]). This means that the process of institutional integration and nominal convergence (EU membership, ERM joining, euro adoption, etc.) had indeed positive effects on trade integration within the EU².

Table 6. Trade integration (1999-2007)

	[a]	[b]	[c]	[d]	[e]	[f]	[g]
Depend. var.	Trade values (current prices)				Export volumes		Trade/GDP ratio
Aggregate	EU27	EU27	EU15	CEEC10	EU27	EU27	EU27
n. obs.	27*8	27*8	15*8	10*8	27*8	27*8	27*8
Explanatory variables:							
Country's GDP ^o	0.78***		0.02	0.71***	0.38**		-2.72***
EU27's GDP ^o	0.46***		1.22***	1.40***	1.71***		
Integr. index ^o	0.52***	1.49***	-1.00	0.21**	0.54***	1.04***	0.26***
Adj. R2	0.997	0.993	0.996	0.993	0.998	0.997	0.980

Note: + in logs and lagged values. ^ocountry's GDP share in eq. [g]. Significance levels: 1%***, 5%***, 10%*; constant and fixed effects not reported.

Since the previous result might be distorted because of the consideration of Trade and GDP at current prices, we have tried a different specification by considering real Exports (just exports and not total trade: E_{iUt} in the previous equation in the place of T_{iUt}), deflated according to the method already specified (see section 3.1); in this case, of course, also GDP data are at constant prices. Well, the estimated coefficients of eq. [6e] (and similarly of eq. [6f]) confirm the significance of all variables, especially of the integration index.

3.5. Output correlations. A final aspect of real convergence refers to the business cycle performance of the different countries. A simple method is to compute correlation coefficients between *value added* of individual countries and EU-27's output (at constant prices). In some empirical studies, the reference country or area is sometimes Germany or, more often, EMU; we prefer to consider EU-27 to identify an "average" cycle for all EU. From a business cycle perspective, it is more useful to compute correlation coefficients on *output differences* over time.

² A further check is that even leaving the integration index as the sole explanatory variable (in addition to fixed effects), it remains positive and significant (eq. [6b]). The integration proxy is positive and significant also for the group of CEEC-10, while it seems negative in the case of EU15 countries (equations [6d] and [6c], respectively).

Table 7 shows a definite picture: the first ten countries, according to the magnitude of correlations, comprehend not only “old” European countries (with Germany leading the group), but 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 euro¹.

Table 7. Output correlations on real value added changes (1993-2007)

	Correlation coefficients		Correlation coefficients
Germany	0.966017***	Ireland	0.656603***
Belgium	0.910347***	Malta	0.592743**
France	0.871988***	Cyprus	0.502705*
Sweden	0.870159***	Latvia	0.493134*
Spain	0.838866***	Denmark	0.482378*
Italy	0.830866***	Lithuania	0.386387
Austria	0.788153***	United Kingdom	0.365782
Portugal	0.763854***	Czech Republic	0.236564
Finland	0.758146***	Poland	-0.08836
Greece	0.731194***	Slovakia	-0.09452
Bulgaria	0.716843***	Estonia	-0.15134
Netherlands	0.711544***	Romania	-0.28936
Hungary	0.693873***	Luxembourg	-0.29896
Slovenia	0.679699***		

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

We can, perhaps, conclude by saying that the EMU has actually been launched including a group of rather “integrated” countries, paying full respect to OCA’s 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 are relevant to understand economic performances and evolutions in the EU over the considered period.

4. The impact of the recent global crisis and policy implications

An important question now arises relative to the current and future trends concerning nominal, real and (possibly) institutional convergence. Have the previous results been modified by the recent financial and economic crisis? Or will they be modified by its long-run impact? Although our empirical analysis focused – as we have just seen – on the fifteen years (or so) prior to the 2008 crisis, some words on this issue seem appropriate.

¹ In fact, UK business cycle is traditionally considered rather asymmetric (compared to “continental” countries). The real exception in the table is Luxembourg, but its tiny size is probably the cause.

The last crisis began as financial crisis during 2007; its deepest impact on financial markets (with Lehman Brothers default) was in September 2008. As to the initial *financial effects* (in Europe but similar effects occurred in other areas, the US in the first place), we can recall that banking systems suffered, stock indices plunged, exchange rates underwent huge devaluations (at least in countries adopting flexible regimes), and interest rates soared.

The *real effects* followed soon: a large-scale recession, with falling consumption and investment (partly due to the drop in confidence and expectations), decrease in industrial production, bankruptcy or reduced activity for many firms, contraction of international trade, falling employment and rising unemployment. However, the deepest fall in production was reached in the first half of 2009 (at least one year after the financial crisis) and led to increasing unemployment rates in 2009 (but in many countries they are still rising in 2010). In fact, the real effects (on product, income, etc.) of financial crises are always lagged and the labor market effects are even more lagged, since employment levels have been at first maintained thanks to “labor hoarding” phenomena (at least in some countries where the initial fall was mainly in productivity).

Table A1 in the appendix shows that the *unemployment rate*² in the EU rose from 7% in 2007 to more than 10% in 2010; the largest increases occurred in 2009 and 2010 (but in the eurozone it is forecast to increase till 2011). The same table shows an increase in the dispersion³: the *divergence in unemployment rates* is just an example of the current halt in the process of real convergence. Notice that not only cyclical unemployment has risen, but a permanent increase in structural unemployment is also likely, because even potential output will be significantly reduced as a result of the crisis, so the negative impact on unemployment is likely to persist over time because of *hysteresis* effects.

In the face of this awful scenario, economic policies adopted by most countries have been immediate and robust⁴ including: (i) easy monetary policies (also the ECB set its reference rate at historically low

² Similar trends appeared in the US and in other regions of the world. The impact was deeper on the weakest sections of labor markets: young people (who are the first segment generally hurt because of the less stable jobs), women, old workers (who are often unable to find alternative jobs), with a widespread increase in vulnerable employment as well. See ILO (2010).

³ The min.-max. range was 3.2/11.1 per cent (Netherlands vs. Slovakia) in 2007 and is forecast to increase to 5.6/20.5 per cent (Denmark vs. Spain) in 2011; we can also notice that the coefficient of variation of unemployment rates has increased after the crisis for all aggregates (see Table A3).

⁴ This massive and immediate policy response by all countries is probably the most significant dissimilarity between the last crisis and the Great Depression.

level of 1% since the Spring of 2009); (ii) rescue plans for the banks most deeply affected (the most relevant ones have been adopted in the US and in the UK); (iii) huge fiscal stimuli to sustain (through government expenditures) aggregate demand and production as well as the income of the unemployed (*passive* labor policies); (iv) plans to reform the international financial system (although the effective measures so far undertaken have been scarce and inadequate).

In view of the persistence of real effects in the future, stabilization policies to support aggregate demand should be accompanied by a continuous effort to adopt reforms and structural policies (including improvements in passive and active labor policies). *Structural policies* will especially be needed in countries that were suffering from scant growth (even before the crisis) or unbalanced development¹.

Many countries are now planning to adopt some *exit strategies*, but the timing of such strategies will be crucial, in order to avoid to interrupt a still uncertain recovery or to add new sources of macroeconomic instability. As to monetary policies, a reduction of the enormous increase in money supply will be necessary to contrast the future risk of inflation (some initial signals in this direction have been launched by the Federal Reserve in February 2010). Concerning fiscal policies, there is a need to start reducing the huge public deficits and debts, now risen at historical levels almost everywhere. Table A2 in the appendix shows that for the EU-27 the average *deficit* (as % of GDP) has risen from 0.8% in 2007 to 7.5% (forecast) in 2010; the *debt* is rising from 58.7% in 2007 to 83.7% in 2011. Also for these variables there has been a growing dispersion².

¹ Italy is the best example of a country with very low growth rates (less than 1% on average in the last decade) and heavily hurt by the recession (GDP fell by more than 6% in 2008-09), so it will take several years to return to former income levels. An unbalanced growth was peculiar to countries (like Ireland, the UK, Spain) where growth was sustained by specific components of aggregate demand (like consumption) or economic activities (building sector, financial investments, etc.). As for the transition countries, the policy mix looks like a break relative to the policies followed in the transitional period of the '90s: in contrast to the hyper-liberist and conservative policies of that period (see Nuti, 2009), the IMF itself has now suggested easy monetary and fiscal policies (although with some cautions concerning the exchange rate devaluations and the fiscal stance) as well as gradual changes (contrary to the previous shock therapy).

² The min.-max. range for the *public budget* (% on GDP) was +5.2/-5 per cent (Finland vs. Hungary) in 2007 and is forecast to increase to -1.2/-14.7 per cent (Bulgaria vs. Ireland) in 2010; in the latter year also Greece, Latvia, Spain, and the UK will exceed the 10% ceiling for the deficit/GDP ratio. As to the *debt/GDP ratio*, the min.-max. range was 3.8/103.5 per cent (Estonia vs. Italy) in 2007, expected to increase to 13.2/135.4 per cent (Estonia vs. Greece) in 2011. The standard deviation has increased both for the deficits and for the debts (Tables A4 and A5); the coefficient of variation of the debt (in the case of the deficit it is not shown because meaningless) just shows a halt in the previous process of reduction. However, instability in financial markets is more related to extreme values of the debt/GDP ratio (or to its increase in a short span of time), rather than to the overall dispersion measure.

The deterioration of public finances in many countries has led to widening risk premia and increased dispersion of interest rates, especially on public bonds of medium and long maturities. A preliminary conclusion concerning *nominal convergence* is that, while inflation had a similar behavior in many countries (falling to very low levels in 2009 and recuperating slowly in 2010-11: see previous Figure 1), the crisis has caused a *divergence in public deficits and debts* (despite a general increase) and in *interest rates*³.

The unstable financial situation of some eurozone⁴ members (like Greece, Spain and Portugal) is particularly worrying. As a matter of fact, EMU seems unprepared to cope with the risk of default of its members. The no-bail out clause, stated in the Maastricht Treat and again in the Lisbon Treat, is not fully credible and in a way not even fully sensible: a default of Greece would lead to a debt crisis in Portugal, Spain, Ireland, and perhaps Italy, causing a collapse of EMU itself. Some form of (indirect)⁵ aid is needed to support the most vulnerable countries, although limiting the incentives to opportunistic behavior by such countries (moral hazard problem), even through a partial surrender of sovereignty: it is probably necessary to go beyond the formal conditions of the Growth and Stability Pact.

An ideal solution would be to set up a "EU Government" – this could be the new *institutional change* in European institutions to be fixed for the next years⁶ – as imagined, for instance, in the past by J. Delors and recently reiterated by many scholars (like J. Stiglitz, J.P. Fitoussi and R. Solow). The present arrangement of a centralized monetary policy and "national" fiscal policies is not the best solution for an effective working of the monetary union (a partial centralization of the budget⁷ would also help in accommodating the asymmetric shocks, as happens in the US).

³ This nominal divergence has made more uncertain the timing of future extensions of the eurozone to new members; some countries already joined the ERM-II mechanisms and were almost ready to adopt the euro (before the outburst of the crisis).

⁴ Outside the eurozone, the risk of default has become worryingly apparent in many CEEC and Eastern countries (Latvia, Hungary and, out of the EU, Ukraine are in the worst position).

⁵ For instance, it has been suggested to provide a "European warranty" for the bonds issued by the weakest member states. Since in the EU there is scepticism about the opportunity of an aid by the IMF for eurozone members, a recent proposal is to create a European Monetary Fund (Gros and Mayer, 2010).

⁶ This scenario is still imaginary, because of the opposition of many countries (also leading EU members) to accept further steps in integration that could end up in a political union.

⁷ The EU budget is still very low and close to 1% of EU GDP and a significant increase in the near future is unlikely. An alternative solution (recently suggested, e.g. by S. Holland and A. Quadrio Curzio) would be to increase the "EU expenditure" (also for aiding the weakest members) with issues of "eurobonds" (sometimes called "union bonds"). For example, an additional expenditure of 5% EU GDP – for "growth, employment and stability" – could be realized with a sustainable issue of "eurobonds" (e.g., at 10 years and with a fixed interest rate of about 2-4% with an additional annual cost of just 0.1-0.2% of EU GDP for the European budget, due to the annual interest payments).

If the recent global shock has put forward, on a world scale, the need for a new “world governance” and a more effective coordination of economic policies¹, at the EU level it is necessary to complete the construction of the monetary union with a further integration in the field of macroeconomic policies – to guarantee *stability and nominal convergence* in the long run – accompanied by appropriate *structural policies*, to strengthen economic growth and contrast more effectively the real effects of big shocks (like the recent one).

Conclusions

In the review section of this paper, we have seen how complex the relations between *nominal and real convergence* are, and how many issues they involve. 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”, that captures the major steps of the process of institutional and nominal integration (up to the achievement of full EMU membership).

A satisfactory degree of *nominal convergence* was achieved in the EU, at least until the 2008 financial crisis. The *inflation rate* remained quite stable (around 2%) in “old” members, with some more difficulties in NMS. Long-term *interest rates* in the euro area declined, with a strong reduction in the immediate period before EMU’s birth. *Deficit/GDP* ratios improved in the EMU countries and showed a cyclical behavior: decreasing in the second part of the 1990s, worsening in the first three years of the new century, followed by a new reduction in the subsequent years (up to 2007); higher levels are exhibited by the NMS (although some improvements occurred in 2003-2007), which have in general lower *Debt/GDP* ratios. As to the *exchange rate* condition, the three Baltic states (in addition to Denmark) joined the ERM-II agreements (as did Slovenia, Slovakia, Cyprus and Malta before adopting the euro).

Concerning *sigma-convergence of real variables* the pattern is less clear. Old members had good convergence in labor market indicators, but poor convergence (or even divergence) in productivity and per-capita income; on the contrary, the NMS showed significant sigma-convergence in both per

capita GDP and productivity, divergence in industrial specialization and persisting disparities in employment and unemployment rates.

Regression analysis provides robust results for *beta-convergence* across the EU-27 countries for *productivity*: this refers both to absolute¹ and conditional (e.g., controlling for education) convergence; convergence in productivity is confirmed considering an “extended beta-convergence” approach. The inclusion in the real convergence analysis of an “integration index”, originally proposed and applied in this paper, highlights the positive effects – on real convergence – of institutional and nominal convergence.

The same approach has been applied to convergence in industrial specialization (which is important for the probability of occurrence of asymmetric shocks), which seems verified in the EU-27 aggregate (less clear is the result in the case of EMU countries). As to the trade flows, which have been estimated in panel regressions with fixed effects, they turn out to be positively linked not only to the level of activity (EU-27’s GDP and country’s GDP) but – again – to the integration index. Finally, the analysis of output correlations shows that the first ten countries (in a rank of countries according to the size of correlations) comprehend exclusively “old” European countries, with Germany leading the group and nine of them are EMU countries; 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, as shown by output correlations, trade links, convergence in productivity and labor 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). However, in old members, and particularly in EMU countries, the pattern of convergence in economic structures is uncertain and also convergence in productivity and per-capita income is not so clear.

Concerning the New Members, they generally had more difficulties in respecting nominal conditions, but have shown in the last decade a widespread catching-up – in terms of productivity and per-capita income – toward the average EU levels; they are also well integrated, in terms of trade links, with Western Europe. The major problems they experienced (even before the recent crisis) refer to the persisting disparities in labor market indicators and to the still different specialization and consequently low output correlations.

¹ Although the attempts to reform the international financial system have not yet produced effective results – as mentioned above – the coordination of economic policies has helped in some way the recovery (through concerted fiscal stimuli) and has avoided a vast restoration of protectionist practices (that were so detrimental in protracting the Great Depression in the ‘30s).

For these countries in particular, but also for Western EU countries, the recent financial and economic crisis has posed new challenges, for both nominal – especially in terms of public deficits, debts and interest rates – and real convergence, with a deep impact on output and labor market performance, as we have discussed in the previous section. The recent crisis and global recession can be considered as the beginning of a new, rather uncertain, phase of development and integration. As to the old members, al-

though the existing EMU has provided a “shield” for many countries (in fact the impact of the crisis has been greater in countries not belonging to the euro-zone), there is a need to complete the construction of the monetary union with a further integration of macroeconomic policies – hopefully ending with the setting up of a “EU Government” – and the adoption, at the EU and national levels, of adequate structural policies to reinforce economic growth and real convergence.

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Appendix

Table A1. Unemployment rates (2005-2011*)

	2005	2006	2007	2008	2009	2010	2011
Austria	5.2	4.7	4.4	3.8	5.0	6.0	5.7
Belgium	8.4	8.2	7.5	7.0	7.9	9.9	10.3
Denmark	4.8	3.9	3.8	3.3	6.0	5.8	5.6
Finland	8.4	7.7	6.9	6.4	8.2	10.2	9.9
France	9.2	9.2	8.3	7.8	9.4	10.2	10.0
Germany	10.7	9.8	8.4	7.3	7.5	9.2	9.3
Greece	9.8	8.9	8.3	7.7	9.0	10.2	11.0
Ireland	4.3	4.4	4.6	6.0	11.8	14.0	13.2
Italy	7.7	6.8	6.1	6.7	7.8	8.7	8.7
Luxembourg	4.5	4.7	4.7	4.9	5.7	7.3	7.7
Netherlands	4.7	3.9	3.2	2.8	3.5	5.4	6.0
Portugal	7.6	7.7	8.0	7.7	9.6	9.0	8.9
Spain	9.2	8.5	8.3	11.3	18.1	20.0	20.5
Sweden	7.4	7	6.1	6.2	8.3	10.2	10.1
United Kingdom	4.8	5.4	5.3	5.6	7.8	8.7	8.0
Cyprus	5.3	4.6	4.0	3.6	5.6	6.6	6.7
Malta	7.2	7.1	6.4	5.9	7.1	7.4	7.3
Slovenia	6.5	6.0	4.9	4.4	6.7	8.3	8.5
Slovakia	16.3	13.4	11.1	9.5	12.3	12.8	12.6
Bulgaria	10.1	9.0	6.9	5.6	7.0	8.0	7.2
Czech Republic	7.9	7.2	5.3	4.4	6.9	7.9	7.4
Estonia	7.9	5.9	4.7	5.5	13.6	15.2	14.2
Latvia	8.9	6.8	6.0	7.5	16.9	19.9	18.7
Lithuania	8.3	5.6	4.3	5.8	14.5	17.6	18.2
Hungary	7.2	7.5	7.4	7.8	10.5	11.3	10.5
Poland	17.8	13.9	9.6	7.1	8.4	9.9	10.0
Romania	7.2	7.3	6.4	5.8	9.0	8.7	8.5
EU	8.9	8.2	7.1	7.0	9.1	10.3	10.2
Euro area	9.0	8.3	7.5	7.5	9.5	10.7	10.9

Source: Eurostat online database; * EU Commission forecasts (October 2009) for 2009-2011.

Table A2. Public deficit and Debt (% GDP) (2005-2011*)

		2005	2006	2007	2008	2009	2010	2011
Austria	Deficit	-1.6	-1.6	-0.5	-0.4	-4.3	-5.5	-5.3
	Debt	63.7	62.0	59.4	62.6	69.1	73.9	77.0
Belgium	Deficit	-2.7	0.3	-0.2	-1.2	-5.9	-5.8	-5.8
	Debt	92.2	87.9	84.2	89.8	97.2	101.2	104.0
Denmark	Deficit	5.2	5.2	4.5	3.4	-2.0	-4.8	-3.4
	Debt	37.1	31.3	26.8	33.5	33.7	35.3	35.2
Finland	Deficit	2.8	4.0	5.2	4.5	-2.8	-4.5	-4.3
	Debt	41.4	39.2	35.2	34.1	41.3	47.4	52.7
France	Deficit	-2.9	-2.3	-2.7	-3.4	-8.3	-8.2	-7.7
	Debt	66.4	63.7	63.8	67.4	76.1	82.5	87.6
Germany	Deficit	-3.3	-1.5	-0.2	-0.0	-3.4	-5.0	-4.6
	Debt	67.8	67.6	65.0	65.9	73.1	76.7	79.7
Greece	Deficit	-5.2	-2.9	-3.7	-7.7	-12.7	-12.2	-12.8
	Debt	100.0	97.1	95.6	99.2	112.6	124.9	135.4
Ireland	Deficit	1.7	3.0	0.3	-7.2	-12.5	-14.7	-14.7
	Debt	27.6	25.0	25.1	44.1	65.8	82.9	96.2
Italy	Deficit	-4.3	-3.3	-1.5	-2.7	-5.3	-5.3	-5.1
	Debt	105.8	106.5	103.5	105.8	114.6	116.7	117.8
Luxembourg	Deficit	0.0	1.3	3.7	2.5	-2.2	-4.2	-4.2
	Debt	6.1	6.6	6.6	13.5	15.0	16.4	17.7
Netherlands	Deficit	-0.3	0.5	0.2	0.7	-4.7	-6.1	-5.6
	Debt	51.8	47.4	45.5	58.2	59.8	65.6	69.7
Portugal	Deficit	-6.1	-3.9	-2.6	-2.7	-8.0	-8.0	-8.7
	Debt	63.6	64.7	63.6	66.3	77.4	84.6	91.1
Spain	Deficit	1.0	2.0	1.9	-4.1	-11.2	-10.1	-9.3
	Debt	43.0	39.6	36.1	39.7	54.3	66.3	74.0
Sweden	Deficit	2.3	2.5	3.8	2.5	-2.1	-3.3	-2.7
	Debt	51.0	45.9	40.5	38.0	42.1	43.6	44.1
United Kingdom	Deficit	-3.4	-2.7	-2.7	-5.0	-12.1	-12.9	-11.1
	Debt	42.3	43.4	44.2	52.0	68.6	80.3	88.2
Cyprus	Deficit	-2.4	-1.2	3.4	0.9	-3.5	-5.7	-5.9
	Debt	69.1	64.6	58.3	48.4	53.2	58.6	63.4
Malta	Deficit	-2.9	-2.6	-2.2	-4.7	-4.5	-4.4	-4.3
	Debt	70.2	63.6	62.0	63.8	68.5	70.9	72.5
Slovenia	Deficit	-1.4	-1.3	0.0	-1.8	-6.3	-7.0	-6.9
	Debt	27.0	26.7	23.3	22.5	35.1	42.8	48.2
Slovakia	Deficit	-2.8	-3.5	-1.9	-2.3	-6.3	-6.0	-5.5
	Debt	34.2	30.5	29.3	27.7	34.6	39.2	42.7
Bulgaria	Deficit	1.9	3.0	0.1	1.8	-0.8	-1.2	-0.4
	Debt	29.2	22.7	18.2	14.1	15.1	16.2	15.7
Czech Republic	Deficit	-3.6	-2.6	-0.7	-2.1	-6.6	-5.5	-5.7
	Debt	29.7	29.4	29.0	30.0	36.5	40.6	44.0
Estonia	Deficit	1.6	2.3	2.6	-2.7	-3.0	-3.2	-3.0
	Debt	4.6	4.5	3.8	4.6	7.4	10.9	13.2
Latvia	Deficit	-0.4	-0.5	-0.3	-4.1	-9.0	-12.3	-12.2
	Debt	12.4	10.7	9.0	19.5	33.2	48.6	60.4
Lithuania	Deficit	-0.5	-0.4	-1.0	-3.2	-9.8	-9.2	-9.7
	Debt	18.4	18.0	16.9	15.6	29.9	40.7	49.3
Hungary	Deficit	-7.9	-9.3	-5.0	-3.8	-4.1	-4.2	-3.9
	Debt	61.8	65.6	65.9	72.9	79.1	79.8	79.1
Poland	Deficit	-4.1	-3.6	-1.9	-3.6	-6.4	-7.5	-7.6
	Debt	47.1	47.7	45.0	47.2	51.7	57.0	61.3
Romania	Deficit	-1.2	-2.2	-2.5	-5.5	-7.8	-6.8	-5.9
	Debt	15.8	12.4	12.6	13.6	21.8	27.4	31.3

Table A2 (cont). Public deficit and Debt (% GDP) (2005-2011*)

		2005	2006	2007	2008	2009	2010	2011
EU	Deficit	-2.4	-1.4	-0.8	-2.3	-6.9	-7.5	-6.9
	Debt	62.7	61.3	58.7	61.5	73.0	79.3	83.7
Euro area	Deficit	-2.5	-1.3	-0.6	-2.0	-6.4	-6.9	-6.5
	Debt	70.1	68.3	66.0	69.3	78.2	84.0	88.2

Note: If positive values, surplus instead of deficit.

Source: Eurostat online database; * EU Commission forecasts (October 2009) for 2009-2011.

Table A3. Unemployment rates (2005-2011*): standard deviation, average and coefficient of variation

		2005	2006	2007	2008	2009	2010	2011
Standard deviation	EU-27	3.17	2.49	1.94	1.90	3.51	3.94	3.88
	EU-15 (old)	2.20	2.05	1.83	2.12	3.37	3.60	3.65
	EU-10 (east)	3.96	3.01	2.21	1.61	3.59	4.31	4.24
	EMU-12	2.27	2.18	1.96	2.28	3.63	3.88	3.91
Average	EU-27	8.05	7.23	6.33	6.20	9.04	10.31	10.17
	EU-15 (old)	7.11	6.72	6.26	6.30	8.37	9.65	9.66
	EU-10 (east)	9.81	8.26	6.66	6.34	10.58	11.96	11.58
	EMU-12	7.27	6.80	6.35	6.36	8.42	9.68	9.75
Coefficient of variation	EU-27	0.39	0.35	0.31	0.31	0.39	0.38	0.38
	EU-15 (old)	0.31	0.31	0.29	0.34	0.40	0.37	0.38
	EU-10 (east)	0.40	0.36	0.33	0.25	0.34	0.36	0.37
	EMU-12	0.31	0.32	0.31	0.36	0.43	0.40	0.40

Source: Our elaborations on Eurostat online database; * EU Commission forecasts (October 2009) for 2009-2011.

Table A4. Public deficit (% GDP) (2005-2011*): standard deviation** and average

		2005	2006	2007	2008	2009	2010	2011
Standard deviation	EU-27	2.98	3.08	2.63	3.14	3.42	3.26	3.35
	EU-15 (old)	3.26	2.88	2.86	3.75	4.01	3.54	3.59
	EU-10 (east)	2.91	3.45	1.99	1.93	2.73	3.12	3.34
	EMU-12	3.31	2.92	2.79	3.75	3.81	3.26	3.48
Average	EU-27	-1.50	-0.79	-0.14	-1.92	-6.13	-6.80	-6.53
	EU-15 (old)	-1.12	0.04	0.37	-1.39	-6.50	-7.37	-7.02
	EU-10 (east)	-1.84	-1.81	-1.06	-2.73	-6.01	-6.29	-6.08
	EMU-12	-1.21	0.06	0.34	-1.41	-6.41	-7.26	-7.04

Source: Our elaborations on Eurostat online database; * EU Commission forecasts (October 2009) for 2009-2011. (** The coefficient of variation is meaningless when original data exhibit both positive and negative values).

Table A5. Public debt (% GDP) (2005-2011*): standard deviation, average and coefficient of variation

		2005	2006	2007	2008	2009	2010	2011
Standard deviation	EU-27	27.13	27.08	26.73	27.11	28.31	29.20	30.48
	EU-15 (old)	27.16	27.32	27.07	25.84	27.77	29.32	31.17
	EU-10 (east)	16.94	18.32	18.50	19.94	19.96	19.80	20.43
	EMU-12	28.91	29.14	28.86	27.18	29.08	30.37	32.02
Average	EU-27	47.38	45.34	43.27	46.30	54.33	60.41	64.87
	EU-15 (old)	57.32	55.19	53.01	58.01	66.71	73.22	78.03
	EU-10 (east)	28.02	26.82	25.3	26.77	34.44	40.32	44.52
	EMU-12	58.96	56.82	54.65	60.01	68.46	74.95	79.85
Coefficient of variation	EU-27	0.57	0.60	0.62	0.59	0.52	0.48	0.47
	EU-15 (old)	0.47	0.50	0.51	0.45	0.42	0.40	0.40
	EU-10 (east)	0.60	0.68	0.73	0.74	0.58	0.49	0.46
	EMU-12	0.49	0.51	0.53	0.45	0.42	0.41	0.40

Source: Our elaborations on Eurostat online database; * EU Commission forecasts (October 2009) for 2009-2011.