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Real convergence in the euro area: a long-term perspective

Contents

Abstract

In the euro area, there is mixed evidence that the GDP per capita of lower-income economies has been catching up with that of higher-income economies since the start of monetary union. The significant real convergence performance of some of the most recent members contrasts with that of the economies of southern Europe, which have not met expectations. However, attributing all the blame for this outcome to the introduction of the single currency simply misses the point. By taking a "long view" and reviewing the evidence since the 1960s, this paper shows that certain member countries began to face a "non-convergence trap" long before the euro years. We also provide stylised facts on: (i) the central role of total factor productivity in driving real convergence in the euro area over time, alongside other factors; and (ii) the crucial interaction of real convergence with "Maastricht convergence" and institutional quality, the other two key components of sustainable economic convergence. We conclude that it is critical that the euro area countries facing convergence challenges enhance the resilience of their economic structures by improving the relevant institutions and governance.

Keywords: sustainable economic convergence, real convergence, nominal convergence, GDP per capita, Maastricht convergence criteria, institutional quality, labour productivity, total factor productivity, Five Presidents' Report, Reflection Paper on the Deepening of EMU

JEL codes: E01, F15, J11, O11, O43, O47, O52, O57

Introduction and non-technical summary

This paper addresses the issue of *real convergence* in the euro area, focusing on its benefits, drivers, performance, time horizon and policy implications. Real convergence may be defined as a long-term process that brings about a lasting increase in real GDP per capita in lower-income countries towards the levels shown by higher-income countries. When driven by this catching-up of lower-income economies (as opposed to a "catching-down" of higher-income economies), real convergence benefits, first and foremost, the citizens of the countries in which the catching-up occurs. This paper examines convergence from three perspectives: (i) a conceptual perspective (Section 1), (ii) its performance during the euro years (Section 2), and (iii) a long-term perspective (Section 3).

Starting from a conceptual perspective, especially for the mature economies of the euro area – where growth is no longer an inherent spinoff of the reallocation of production factors from agriculture (structural transformation) – sound policymaking plays a key role in the attainment of real convergence, primarily via adequate measures and reforms at national level. Real convergence, therefore, is related to the broader notion of *sustainable economic convergence*, which also has other dimensions. In terms of sustainability, for a given euro area Member State to achieve economic convergence it needs to improve its *institutional quality*, i.e. that of those institutions and governance standards that facilitate growth and enhance the economic structure of a country, making it more resilient to shocks. This does not, however, imply convergence towards a single institutional model for all countries; rather, it points to a need to find solutions that are tailored to country-specific situations (e.g. differing political or cultural preferences of citizens, pre-existing institutional settings, etc.). Sustainable convergence also crucially requires conformity with the economic criteria for monetary union membership (e.g. price stability and fiscal soundness) which were identified in the Treaty and have remained equally relevant *since* adoption of the euro. This dimension of convergence is referred to in this paper as *Maastricht convergence* or, more broadly, nominal convergence.

Given these basic notions and definitions, the paper discusses real convergence itself, as well as its (possible) interaction with other dimensions in the pursuit of sustainable economic convergence. In the medium-to-long term, real convergence may indeed decrease the exposure of euro area economies to asymmetric shocks and inhibit the transmission of symmetric shocks, thus supporting the overall sustainability of convergence. Maastricht convergence may, in turn, facilitate real convergence by providing stable macroeconomic conditions and by anchoring expectations. In the same vein, an improvement in the economic institutions and structures of a country is likely to contribute to growth and living standards.

Another important conceptual issue is whether persistent differences in GDP per capita should be seen, *per se*, as affecting monetary policy in a currency union such as the euro area. The experience of the United States suggests that the reply to this

question is "no". Income dispersion in the United States is still broadly comparable to that in the euro area, yet this has not materially affected the ability of the Federal Reserve to conduct monetary policy at federal level, nor has it prevented the attainment of price stability. To this end, a much more important precondition is attaining low cyclical dispersion among the members of the monetary union, i.e. symmetry in their business and financial cycles. This issue, however, falls outside the scope of this paper, which focuses instead on *structural dispersion* in the monetary union.

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… the broader notion of sustainable economic convergence is important for the smooth functioning of EMU …

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From a convergence perspective, the main difference between a monetary union such as the euro area and more traditional monetary unions such as that of federal states is that the latter, while not necessarily more successful in delivering real convergence, can more easily cope with possible failures in the attainment of sustainable economic convergence. This is, first of all, because optimum currency area mechanisms – for instance cross-state labour mobility and other risk-sharing tools, whether private or public in nature – remain, despite the tangible progress made in recent years, less developed in the euro area than, for example, in the United States. As a result, the US monetary union is better equipped to smooth out income differences between its states in the presence of shocks. Moreover, the low and uncertain state of advancement of political union in Europe implies that destabilising dynamics could be more likely to materialise during a crisis, in contrast to the situation in a federal state. This means that sustainable convergence is required to prevent the emergence of such dynamics. Last, but not least, sustainable convergence also supports the success of single monetary policy, which tends to become overburdened and complex if unsustainable convergence and an ensuing phase of cross-country divergence materialise at a certain point, as was the case during the euro area crisis. On the basis of these arguments and in the light of the experience of the past twenty years, an enhanced awareness has gained traction among euro area policymakers that sustainable economic convergence is a relevant condition for the smooth functioning of Economic and Monetary Union (EMU).

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… and it remains a primary responsibility of Member States. The relevant European institutions should support efforts made at national level, introducing rules, regulations and surveillance procedures.

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The attainment of sustainable economic convergence in the euro area is, on the basis of the social contract on which EMU is based, a primary responsibility of individual Member States, whereas European institutions such as the Eurogroup, the Commission and the European Parliament are tasked with facilitating efforts made at national level, introducing rules, regulations and surveillance procedures that also help to avoid negative spillovers across Member States. This framework has evolved significantly since the euro area crisis. Up to that point, the fulfilment of sustainable convergence was a key precondition for euro adoption (Article 140 of the Treaty on the Functioning of the European Union), but after that it was mostly pursued – with mixed results – through its fiscal component under the Stability and Growth Pact. Little attention was paid by national authorities to other imbalances and vulnerabilities. Since 2010-11, the EU has not only strengthened its fiscal rules, but has also set up a new yearly cycle of economic policy coordination – the European Semester – which extends to the whole macroeconomic and structural dimension of policymaking and provides Member States with country-specific recommendations focusing on what can realistically be achieved over a horizon of 12-18 months.

Looking forward, an important debate is going on among the European and national authorities on the opportunity to further strengthen such framework.

Turning to the perspective of actual convergence performance, some euro area countries have not met expectations in terms of delivery of sustainable convergence since the launch of the single currency in 1999. Starting with the dimension of real convergence, in the period 1999-2016 income convergence towards the EU average occurred and was significant in some of the late euro adopters (the Baltics and Slovakia), but not in the south of Europe. As for CEE countries, it seems that the transition to a market economy and the integration into global value chains, alongside the incorporation of the *acquis communautaire*, have played a much more important role than the introduction of the euro *per se*. With regard to the south of Europe, in certain countries in this region there had been strong GDP growth in the pre-crisis years. To a significant extent these dynamics were, however, a side-effect of a credit-driven domestic demand boom associated with – depending on the country – the accumulation of large external imbalances, fiscal profligacy, capital misallocation, and an insufficient diffusion of technology coupled with an overestimation of growth potential. The unsustainability of these dynamics explains, in conjunction with the global Lehman shock, the subsequent painful adjustment and real divergence. As a result, while, most recently, the dispersion in GDP growth rates has reached historical lows in the euro area, if 2016 is compared with 1999 it is clear that cross-country income differences persist. Several low-income euro area members have, in fact, only just maintained (Slovenia and Spain) or even increased (Greece, Cyprus and Portugal) their income gaps in respect of the EU average, though this negative trend has in most cases been reversing over the past three years. Moreover, Italy – still a higher-income country in the mid-1990s – has recorded the worst relative performance since then, to the extent that the country now belongs to the lower-income group.

With regard to Maastricht convergence after euro adoption, some countries have underperformed. In addition to well-documented insufficient compliance with fiscal criteria, the emergence in such countries, prior to the crisis, of persistent inflation differentials exceeding those justified by economic fundamentals has not only produced losses in competitiveness, but is also the root – via too-low real interest rates – of other key vulnerabilities that would have been exposed by the euro area crisis (e.g. credit bubbles and a lack of incentives to implement reforms). The disappointing Maastricht convergence performance in this period and its dire consequences in the following years provide proof of the need for sustainable convergence to support the smooth functioning of EMU. This also raises important questions as to why nominal convergence has been suboptimal, and confirms that there is no automatism in the convergence process, which should, instead, be seen as a *continuum* before and after adoption of the single currency. An additional challenge that has emerged in the post-crisis environment is that the internal devaluation required in stressed countries needs to be combined with an internal revaluation in countries with undervalued real exchange rates in order for the adjustment process to run smoothly. This is because the sheer scale of misalignments may require large changes in relative prices. If this market-driven process were, however, to be achieved by just internal devaluation in the stressed

countries, the ensuing compression of demand in the stressed countries would be even greater and, therefore, would add to real divergence in the monetary union.

Finally, with regard to institutional quality, the evidence suggests that, despite the progress made in recent years towards creating more resilient economic structures, especially in countries that had undergone an EU/IMF programme, there is still great scope for additional progress – not only because of the "institutional divergence" that occurred in the pre-crisis years, but also as a result of the forces that have pushed in the direction of divergence even in the post-crisis environment.

… but it would be a mistake to ascribe their suboptimal performance to the introduction of the euro. The drivers of sustainable economic convergence are indeed more long-term and structural in nature.

The above-mentioned deficiencies in convergence performance since 1999 have led some observers to fully ascribe their origin to the introduction of the single currency. Focusing the analysis on just the past two decades, however, does not provide a sufficient understanding of the drivers of real convergence, which, to a large extent, are more long-term and structural in nature. The boom-bust and misallocation of resources experienced in some euro area economies, along with convergence challenges, was certainly exacerbated by these countries' inability to take advantage of the sharp drop in real interest rates associated with the launch of the euro; this can only really be understood, however, in the light of long-standing structural weaknesses. Growth in total factor productivity (TFP) – which, as this paper shows, is the key driver of convergence in a mature economy – had been on a declining path in the southern European economies relative to higher-income countries long before the introduction of the euro. The emergence of a strong financial cycle in the early 2000s simply allowed the consequences of this underlying weak productivity growth to be concealed for a number of years. In addition, countries such as Italy have posted poor long-term growth performances even without the legacy of a pronounced boom-bust. Conversely, countries such as Ireland, where relative income per capita has, overall, increased in the euro years, despite the deep crisis of 2008-13, confirm the vital importance of having a credible growth model that can be relied upon. Finally, the analyses that identify the euro as "the culprit" ignore the fact that several well-known global shocks occurred during the period of the launch of the single currency. Certain economies' poor convergence performance could also easily have been due to their inability to adjust to these shocks, which are unrelated to the euro.

3) Long-term approach to sustainable economic convergence in the euro area: the need to take a long view …

These considerations imply that assessing sustainable convergence in the euro area requires a longer-term perspective. This is the third perspective taken by this paper, as well as its main storyline: in order to look forwards with regard to the outlook for euro area convergence we also need to look backwards, i.e. to understand and address some of the deep-seated problems confronting certain economies. In other words, a long view is required. It is, therefore, useful to analyse developments in real convergence and its interaction with the other dimensions of sustainable convergence over a longer period, which we take as being the sixty years following the signing of the Treaty of Rome in 1957.

… is confirmed by the available evidence, which points to the importance of country-specific factors driving real convergence in the long term.

In respect of real convergence, we first constructed indicators for the twelve countries which had adopted the euro by 2002 (the EA12, taken as a whole). For the EA12 over the past 60 years, phases characterised by strong reductions in the dispersion of income levels (1958-73 and 1986-92) have alternated with stasis

periods – usually triggered by a crisis – in which no clear trend could be detected in either direction (1974-85 and 1993-2007). Focusing only on the years of the monetary union is not enough, it would appear, to provide us with a sufficient understanding of convergence developments in the euro area. The launch of the single currency in 1999 did not trigger any process of divergence *per se*; this was, instead, set off by the onset of the global financial crisis in 2008 – the real turning point. Overall, since 1960 there has been clear evidence of income convergence among the EA12 countries, although this appears to have been weakened by the Great Recession that began in 2007-08. The finding is observed when both "sigma" and "beta" convergence indicators are used – these focus, respectively, on the standard deviation in GDP per capita and the catching-up of lower-income countries. This is confirmed when we shift the focus to country-specific dynamics. Our review of convergence developments since the 1960s in Greece, Ireland, Italy, Portugal and Spain – the five EA12 countries on which this paper focuses – suggests that their long-term convergence processes have idiosyncratic features dating back to the decades preceding the adoption of the euro. Greece, for instance, was a successful "catching-up" economy in the 1960s, with GDP per capita close to the EU average at the beginning of the 1970s. This process halted for the remainder of the 1970s and then reversed until the mid-1990s for a variety of reasons that are reviewed in this paper. The Greek crisis that started in 2010 took GDP per capita back to a level which had already been in place two decades earlier, thereby showing the extent to which the country's economic weaknesses are long-standing and deeply rooted.

Labour productivity and, in particular, total factor productivity are the most important components of real convergence in the long run. Other significant components have been, depending on the period and country, labour market participation, the employment rate, demographics, and the accumulation of capital and labour.

A long-term analysis also points to the central role of labour productivity and, in particular, its TFP component in driving convergence over time in the five countries considered. The periods of faster GDP per capita growth were mostly associated with strong productivity gains vis-à-vis the EU average, although in certain countries the importance, even until the 1980s, of significant growth underpinned by labour and capital accumulation should not be overlooked. The decline in TFP growth appears, in turn, to be the main reason for the subsequent setback in the convergence process (i.e. falling into the "non-convergence trap" as discussed in Section 3.2), with the notable exception of Ireland. In Italy, for example, TFP relative to the EU peers' average had already started to decline in the early 1980s, for a number of reasons that we have identified by drawing on the existing literature. Depending on the country and the period, changes in the rate of employment and/or participation in the labour market have also been important factors supporting or hampering convergence. Finally, demographics have also played some role in driving convergence developments in these countries, the most prominent example being that of Ireland in the 1990s. Demographics are expected to become an even more important determinant of growth in the future.

The long-run relationship between real GDP convergence and price convergence has important policy implications for "catching-up" economies within the monetary union …

Turning to the long-run relationship between real convergence and Maastricht convergence, this can be measured as the link between GDP per capita levels and price levels. This relationship is usually positive due to the Balassa-Samuelson effect which, in a monetary union, explains cross-country inflation differentials, which may be viewed as "natural" since they originate from relative productivity growth differentials. In this paper we provide evidence for this positive relationship in Europe and conclude that the greater the scope for convergence in the monetary union, the

greater the scope for natural inflation differentials among its members during the catching-up phase. This implies relatively lower real interest rates in the catching-up economies, which would not be a problem in itself unless, at some point, these favourable financing conditions started fuelling unsustainable dynamics such as those experienced in the pre-crisis period. The challenge for policymakers in euro area catching-up economies will therefore be to enact, where appropriate, countercyclical fiscal and macroprudential measures to prevent the re-emergence of boom-bust cycles. The possible emergence of unsustainable inflation differentials in these economies would probably also flow from rigidities in labour and product markets that would need to be reduced through structural reforms.

This leads to the last issue discussed in this paper, which is the long-run relationship between real convergence and institutional quality, and which we gauge using a number of indicators of institutional performance at national level. Well-functioning institutions are a necessary precondition for convergence to occur, especially in mature economies. The overall level of institutional quality and its changes over time do indeed strongly correlate with growth in GDP per capita within the euro area, and the same kind of relationship holds for narrower measures such as the flexibility and resilience of product and labour markets. It is striking that, among the EA12 countries, Greece, Portugal, Spain and Italy are also the countries that show a significantly lower index of institutional quality, which is clearly associated with the poorer resilience of their economic structures and, hence, their weak convergence performance. Finally, there is evidence suggesting that a powerful catalyser of real convergence in the past was, for several countries, the run-up to EU membership via incorporation of the *acquis communautaire* (with Greece and Ireland being the two outliers).

Section 4 of this paper concludes with a few indications for economic policy that are supported by the analysis summarised above. While broad in nature, such indications should, in our view, be borne in mind by policymakers, first and foremost at national level. In particular, for the euro area, for countries confronted by the non-convergence trap, it is critical that they enhance the resilience of their economic structures through improved institutions and governance.

It should, finally, be borne in mind that one important convergence-related issue falls outside the scope of this paper. Whilst we provide a rationale for national policymakers to pursue sustainable convergence within EMU under the existing EU arrangements, we do not discuss how additional developments in the European governance framework could further facilitate national reform efforts. To this end, various avenues were outlined in the Five Presidents' Report of July 2015 and were further developed in the Commission's Reflection Paper on the Deepening of EMU of May 2017.

1 A conceptual perspective: definitions, motivation and literature

What are the various dimensions of sustainable economic convergence and how do we define them? Why should we pay attention, in particular, to "real" economic convergence in the euro area and its interaction with "Maastricht" convergence and institutional quality? What are the main strands of literature covering real convergence? These questions are addressed in this section, which starts with some definitions (Section 1.1), then discusses the motivation behind this paper (Section 1.2), and concludes with a brief review of the relevant literature covering real convergence (Section 1.3).

1.1 What do we mean by "convergence"?

The concept of convergence has various dimensions. This paper mainly focuses on the notion of real convergence and its sustainability over time. Sustainable convergence may be defined as the process whereby the real GDP per capita levels of lower-income economies catch up, on a durable basis, with those of higher-income economies. This definition has three advantages from the perspective of political economy: (1) it is simple and can, therefore, be easily understood by all citizens; (2) it refers to the welcome process of catching up with the richest economies[1]; (3) by referring to a "durable basis", it conveys the fundamental notion

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[1] It should be noted that the process of catching up with the richest economies does not necessarily imply greater income equality within the converging economies. Since it is measured by *average* GDP per capita, real convergence may occur in the presence of both relatively lower and relatively higher Gini coefficients (for econometric evidence on the euro area, see IMF 2017b).

An important and separate question, however, is whether real convergence could occur on a durable basis in the absence of "*economic inclusion*" (sometimes also referred to as "*equality of opportunity*") within an economy. The latter may be defined as "the opening up of economic opportunities to previously under-served social groups" (definition used by the EBRD) or, with IMF (2017b), as "inequality that is due to circumstances outside a person's control, including parental education, race and country of origin". More generally, economic inclusion may be defined as the process of broadening the productive asset base of an economy by, for example, investing in workers' skills and by creating an environment where all firms have a fair chance of expanding (definition used in OECD 2016).

As the OECD (2016) argues, broadening the productive base of an economy tends to generate strong and sustainable future productivity gains, thereby enhancing the catching-up potential of an economy. Conversely, the increasing extraction of rents by incumbent firms and workers traps valuable resources in unproductive activities. It may also contribute to low intergenerational mobility and a slowdown in the pace of diffusion from firms at the productivity frontier to the rest of the economy. As a result, non-inclusive economic structures (e.g. those limiting competition, innovation and high-quality education, discouraging firms' entry and exit, and leading to skills mismatches) may be at the root of the failure to attain real convergence – econometric evidence for the euro area is provided in IMF (2017b). This is not to deny that the process of catching up could co-exist for some time with the process of an economy becoming less inclusive. However, hindering workers and firms from participating fully and developing their potential would probably harm growth prospects in the long run (Lagarde 2014). Whilst we recognise the importance of studying the relationship between real convergence and economic inclusion, a systematic examination of this link falls outside the scope of this paper. Nonetheless, the paper provides a number of concrete examples for specific euro area countries which show the importance of this link. For recent analyses see IMF (2017b), EBRD (2017), OECD (2016) and Lagarde (2014). For a broader introduction see Acemoglu and Robinson (2012).

of the sustainability of convergence over time. For real convergence to be sustainable, the expansion of aggregate demand must be consistent with long-term potential output growth. GDP growth that results, for instance, from a financial boom such as that associated with the pre-crisis global demand shock and the decline in interest rate spreads that occurred following the launch of the euro may prove, as discussed in Section 2.3, to be unsustainable if not matched by higher potential growth (ECB 2015).

In the literature on economic growth, real convergence is captured by the two concepts of beta convergence (β-convergence) and sigma convergence (σ-convergence)[2]. The first type of convergence occurs when lower-income economies grow faster than higher-income economies, i.e. they experience a process of catching up. The second concept relates to a reduction in the dispersion of income levels across economies, which is a by-product of β-convergence but would also materialise if GDP per capita in the higher-income economies were to contract faster than in lower-income economies during an economic slump. For real convergence to be successful, therefore, β-convergence is required.

Whilst there are many other notions of convergence, as briefly reviewed in Box 1, this paper focuses on real convergence and its interaction with the two other key dimensions of sustainable economic convergence, the first of which is Maastricht convergence. Maastricht convergence usually refers to the main standard criteria that EU Member States are required to meet if they wish to adopt the euro. Although these criteria are also often referred to as economic convergence criteria in order to contrast them with the legal criteria for euro adoption – both set out in Article 140 of the Treaty on the Functioning of the European Union (TFEU) – they are nominal in nature, i.e. they are not adjusted for inflation, so their increase may partly or fully reflect the effect of inflation. As such, their fulfilment is a primary precondition for participation in the monetary union. This is, of course, by definition the case in respect of the price stability criterion. The other Maastricht criteria refer to: the sustainability of a government's financial position resulting from fiscal balances and debt ratios; the stability of the exchange rate vis-à-vis the euro; and nominal long-term interest rate levels[3]. For a detailed and updated analysis of the guiding principles used by the ECB and the European Commission in the application of the Maastricht criteria see ECB Convergence Report (2016). The principles are consistent with those set out in previous reports in order to ensure continuity and that Member States are treated equally.

The other dimension is institutional quality, which clearly interacts with and underpins real convergence. The Five Presidents' Report of 2015 refers to institutional quality as the "process towards more resilient economic structures"[4]. Institutional quality therefore implies the progression, sometimes also called "structural convergence", towards the high-level institutional and regulatory

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[2]   See Barro and Sala-i-Martin (1991 and 1992).

[3]   The Treaty also considers other factors relevant to economic integration and convergence, e.g. the integration of markets, the position and the trend for the balance-of-payments current account, and the trend for unit labour costs and other price indices.

[4]   Juncker, J.-C., Tusk, D., Dijsselbloem, J., Draghi, M. and Schulz, M. (2015), p. 9.

standards that make an economy more resilient to economic shocks. In this process, country specificities should be taken into account, i.e. the fact that one institutional size does not necessarily fit all economies under this dimension of convergence. In other words, what matters is not the adoption of a single institutional model by all Member States, but rather the model's outcomes: the fact that product and labour markets become more flexible, the business environment is sound and allows productive firms to thrive, the government and the public administration are effective, corruption is under control, the legal system and the rule of law are functioning well, etc. In a mature economy where growth is no longer primarily driven by structural transformation – i.e. by the reallocation of production factors from agriculture to manufacturing and then to services – institutional quality is probably the key precondition for real convergence to occur. For instance, prolonged external borrowing by catching-up economies would not be consistent with sustainable growth patterns in the absence of institutional quality, because weak institutions and rigid economic structures would result in the large-scale misallocation of resources. In the EU context, moreover, appropriate institutions and sound policies need to be in place and progress must be made not only at national level, but also at EU/euro area level (see, for example, Buti and Turrini 2015 and Dorrucci, Ioannou, Mongelli and Terzi 2015). This is an issue which, however, falls outside the scope of this paper.

Box 1
Other definitions and concepts of convergence

Besides the definitions of convergence actively used in this paper, we consider it useful to bear in mind four other definitions which have been used in the literature[5] and which are also relevant to our analysis.

First, the TFEU has identified *legal convergence* as another precondition for joining the monetary union. This requires national legislation to be compatible with the treaties and the Statute of the European System of Central Banks (ESCB) in areas such as, for instance, the independence of national central banks (NCBs), and compatibility with the prohibition of the monetary financing of governments. While recognising the vital importance of this dimension, this paper considers it to be just one component of a broader idea of institutional quality.

Second, "neoclassical growth theory establishes a presumption that countries with access to identical technologies should converge to a common income level. Countries that are poorer and have higher marginal productivity of capital should, therefore, grow faster in the transition to the long-run steady state" (Rodrik 2011). We call this kind of convergence *unconditional* (or *absolute*) convergence. Empirical evidence, however, does not provide conclusive evidence for unconditional convergence for countries as a whole[6]. In the words of Rodrik, "whatever convergence one can find is *conditional*: it depends on policies, institutions, and other country-specific circumstances" such as the savings rate, demographics, or foreign aid. Conditional convergence implies that economies will

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[5] For a comprehensive taxonomy of all definitions of economic convergence see Islam (2003).

[6] For a study finding contrary evidence supporting unconditional convergence see Korotayev et al. (2011).

tend towards different income levels even in the long run, which is the assumption on which this paper is based.

Third, another important concept is that of *club convergence* (Baumol and Wollf 1988 and Ben-David 1997, inter alia), which is seen when economies belonging to a group of countries with similar features (e.g. north-western vs. southern vs. central eastern European countries) show similar growth trajectories. Club convergence is, therefore, a possible form of conditional convergence. This paper contains some examples in line with this kind of definition, which points to the idea of a "multi-speed" Europe.

Fourth, another measure of convergence – also connected to the ideas of conditional and club convergence – is *gamma convergence* (γ-convergence), i.e. the ranking concordance over time of per capita incomes within a group of countries (Siegel, 1956 and Boyle and McCarthy, 1997). In other words, γ-convergence highlights whether, and to what extent, the highest-income and lowest-income countries remain the same within a given country grouping over time. Together with σ-convergence, γ-convergence helps to capture the complex dynamics of time-varying cross-country income distributions. This paper provides several examples of countries (e.g. Greece vs. Ireland from the 1960s until today) which have shown a dramatic change in their GDP per capita ranking in terms of EU income distribution.

1.2 Why do we need sustainable economic convergence in the euro area?

This paper points to the need for euro area Member States to actively pursue sustainable economic convergence – in all three of the aforementioned dimensions – as one of the keys to ensuring the smooth functioning of EMU. This is for four fundamental reasons, in addition to the clear benefits offered to the individual countries concerned. The first three reasons relate to the fact that EMU has some "special features" that mean the pursuit of convergence is particularly important when compared, for instance, with federal states such as those of the United States. The fourth reason is that facilitating β-convergence in the euro area would also help to reverse the trend of the divergence of the euro area from other advanced economies.

First, while significant progress has been made in recent years, optimum currency area[7] mechanisms need to be further developed in the euro area in order to help to smooth cross-country differences in income levels. Although income dispersion in the US monetary union is still broadly comparable with that of the euro area (see IMF 2017a), the latter is less able to cope with any failure to attain sustainable convergence. This is, ultimately, because the euro area performs relatively worse than the United States in the fulfilment of optimum currency area

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[7] An optimum currency area (OCA) is a geographical region where sharing a single currency would maximise economic efficiency. OCA theory describes the optimum criteria for the merging of currencies through the creation of a new single currency. The seminal contribution of Mundell (1961) was followed by a wide body of literature, the review of which falls outside the scope of this paper.

(OCA) criteria, as concluded by a wide body of literature[8]. For a start, *labour mobility* is still low. Despite strong migration flows from central and eastern Europe, only about 3% of the total EU population are Europe-born citizens who live and work in a Member State they are not from. In 2011, 2.7% of the US population had been living a year earlier in another of the 50 states, whereas only 0.2% of Europeans had migrated since the year before. The OECD (2014) has found that migration was not responsive to unemployment or wage differentials within the euro area between 2006 and 2011, although the euro area crisis did force emigration from stressed countries. Turning to *risk sharing via public channels*, in the euro area, in contrast to the United States, there are no major fiscal transfer mechanisms to smooth the impact of asymmetric shocks[9]. In the United States, for instance, a $1 decrease in per capita income in a state is associated with an approximately 20-40 cent net transfer to its residents. As explained in Malkin and Wilson (2013), this is effected through differences in federal tax payments across US states, rather than through transfer payments from federal programmes and services.

Conversely, in the EU the impact of the Structural and Cohesion Funds – the financial instruments of regional policy – is more limited, and these funds do not deal with idiosyncratic national shocks (see, for example, ECB 2015), and therefore contribute very little to risk sharing[10]. An additional consideration is that in the United States fiscal transfers are associated with stricter fiscal discipline (i.e. a balanced budget rule) for its states than has actually been the case in the implementation of fiscal rules within the euro area, at least so far. As noted in Milano and Reichlin (2017), this makes procyclical fiscal policies easier to occur in the euro area countries. Finally, as the crisis in the euro area has confirmed, *private sector financial risk sharing* across its member states could disappear – and sudden stops in private capital could therefore materialise – precisely when most needed. In addition, the recent crisis has shown that shocks hitting the economy of a euro area country could be amplified by quick transmission through the international financial system, causing credit markets to dry up. The lack of consumption smoothing provided by private saving via the credit channel leads to an increased inability to smooth output shocks. In other words, credit growth has tended to be very procyclical in many euro area economies, and private sector credit has all but disappeared in the periods in which it has been most needed to temporarily offset a sharp fall in disposable income. Furcieri and Zdienizcka (2013) find that almost 70% of GDP fluctuations are not smoothed in euro area countries, whereas the proportion of unsmoothed fluctuations is only about 25% in the United States. Milano and Reichlin (2017) complete the discussion by computing a comprehensive index of

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[8]   Frankel and Rose (1997) argue that certain OCA features – international trade patterns and international business cycle correlations – tend to be endogenous to participation in a monetary union, i.e. they tend to occur ex post even though they do not occur ex ante. In a subsequent paper, however, Glick and Rose (2015) recognised that EMU typically has a smaller trade effect than other currency unions – this is mildly stimulating at best.

[9]   Farhi and Werning (2012) have argued that in a monetary union there is a basic need for government intervention to complement market-driven risk sharing. This is ultimately because, even with complete markets, market-based insurance tends to be suboptimal in monetary unions, where private agents tend to ignore the macroeconomic stabilisation effects of portfolio choices.

[10]   The euro area, moreover, still lacks a common deposit insurance mechanism, while its Single Resolution Fund is yet to be completed.

total risk sharing, defined as the percentage of country-specific shocks that are smoothed via both public and private channels. Milano and Reichlin conclude that in the period 1999-2014 total risk sharing was 57% in the United States, but only 29% in the euro area. Since the start of the euro area crisis, however, the establishment of new European intergovernmental organisations providing loans against conditionality[11] has played a very important part in smoothing shocks to stressed euro area economies. As a result, total risk sharing in the euro area increased from 23% in the period 1999-2006 to 31% in the period 2007-14.

Second, the low level of advancement of political union in Europe implies that destabilising dynamics may be more likely to materialise during a crisis, which is not the case in a federal state. In the euro area, Member States are sovereign. It has therefore been noted that if, at a certain point in time, divergences across countries were considered by both citizens and market participants to threaten a country's position in the monetary union, there would be a risk that destabilising dynamics could arise. As Gros (2015) argues, in the United States the territory of Puerto Rico could, one day, undergo a crisis as deep as that of Greece, but the probability that it might secede from the union is much lower. As a result, there is no reason to fear that dollar-denominated deposits in this territory might at some point be converted into another currency. In the euro area, however, the institutional setup is inherently more fragile and, therefore, requires sustainable convergence for this risk to be contained.

Third, unsustainable convergence and the ensuing phase of divergence tend to complicate monetary policy in a monetary union such as the euro area. As witnessed during the euro area crisis, unsustainable convergence in certain member states eventually results in financial instability and causes sovereign debt to run up against market limits. This can severely disrupt the transmission of monetary policy, as discussed in ECB (2012). Moreover, experience shows that during a sovereign debt crisis fiscal policy tends to be procyclical since it becomes impossible to fund deficit spending. As a result, monetary policy has to compensate for the retrenchment of fiscal support to aggregate demand (Orphanides 2013). Another important consideration is that the attainment of lasting real convergence is fully consistent with sustainable, "catching-up-driven" inflation differentials across euro area countries. Such "natural" inflation differentials are part of the normal physiology of economic development, as discussed in Section 3.3 in greater detail, and do not, as such, hamper competitiveness. However, they can also contribute to lower real interest rates in the catching-up economies, which may contribute to the emergence of bubbles, especially in periods of ample global liquidity, as investigated in Section 2.3. This is why appropriate countercyclical macroprudential and fiscal policies are essential to lower the chances of boom-bust cycles developing in catching-up economies. If in place, such policies can greatly reduce the burden on monetary policy, which – since it is a uniform policy tool – would not be the most

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[11] The Treaty establishing the European Stability Mechanism (ESM) entered into force on 27 September 2012. The ESM replaced two earlier temporary EU funding programmes: the European Financial Stability Facility (EFSF) and the European Financial Stabilisation Mechanism (EFSM).

effective instrument for countering the emergence of bubbles limited to specific sectors/economies of the euro area.

Finally, focusing on intra-area convergence also means addressing the recent tendency of GDP per capita of the euro area as a whole to diverge from that of peer advanced economies. As shown in Chart 1, from the early 2000s until the onset of the euro area crisis, euro area GDP per capita moved in unison with that of the United States and Japan. Since 2011, however, this is no longer the case, with the euro area underperforming the other two economies. However, the individual performances of euro area countries are quite differentiated, with Germany performing even better than the United States and countries such as Greece at the opposite end of the spectrum. The catching-up of the latter countries would, therefore, contribute to the catching-up of the whole euro area.

Chart 1
Real GDP per capita in selected economies

(index: 2007 = 100)
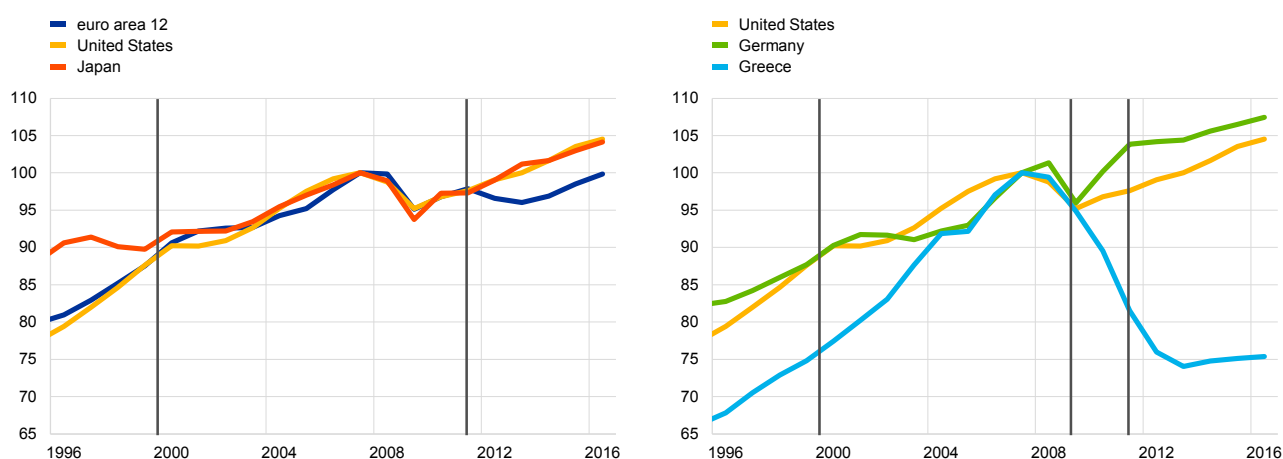
Sources: European Commission and ECB.
Note: The euro area 12 includes West Germany data before 1991.

At the same time, this paper argues that, when analysing convergence, it is not enough to focus only on the years after the introduction of the euro, which may even cause us to "miss the point". As shown in Chart 2 below, the underperformance of the 12 euro area countries which had adopted the euro by 2002 (the EA12) vis-à-vis mature economies such as the United States, Canada and Australia did not just start after 2010, but had in fact already begun in the 1990s. This suggests that a longer-term approach to convergence is required which is, as we shall see, the main storyline of this paper: in order to be able to look forwards with regard to the outlook for euro area convergence we also need to look backwards, i.e. to understand the deep-seated problems we face. In other words, we need to take a long view. This is the approach adopted in Section 3, following the focus on the euro years in Section 2.

Chart 2
GDP per capita of the EA12 vis-à-vis selected major developed economies

(GDP at constant prices per capita in PPS levels)
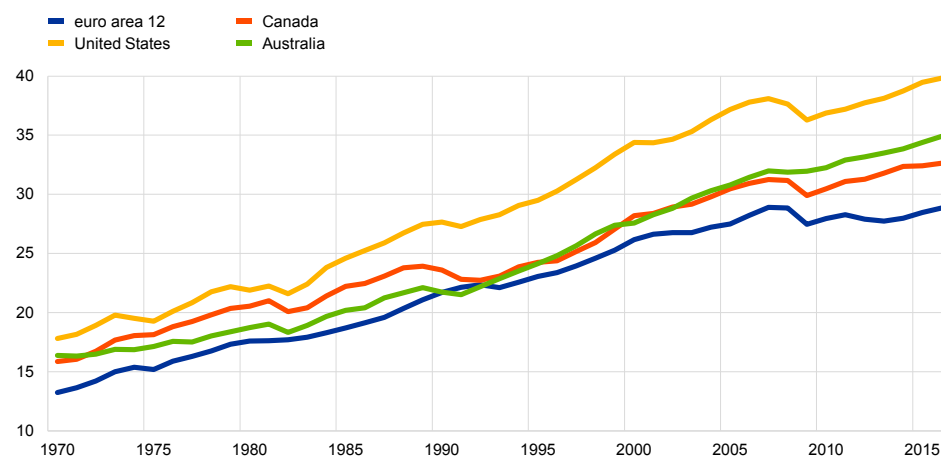
- euro area 12
- United States
- Canada
- Australia

Sources: European Commission and ECB.
Note: The euro area 12 includes West Germany data before 1991.

1.3 Economic literature on real convergence: a brief review

There is an ample body of theoretical and empirical literature on real convergence. The conceptual models, which serve as a basis for empirical studies, may be clustered into three main groups, depending on how they consider total factor productivity (TFP)[12], technology, innovation, and institutions in the convergence process over time.

The first, seminal group of studies follows the Solow exogenous growth paradigm (Solow 1956). Incomes per capita are explained in terms of varying cross-country paths of factor accumulation, which arise due to differences in saving rates and where technological progress exogenously determines the effectiveness of the production process. The Solow model ascribes differences in growth rates between countries to differences in stocks of physical capital, which positions these countries at different points on their balanced growth path. Assuming that preferences and other institutional features are identical across countries, the Solow model predicts a high expected return on investment in capital-scarce countries, which encourages capital to flow "downhill", i.e. from rich to poor countries. The increased investment causes the capital-scarce countries to move upwards on the balanced growth path, thereby converging towards the same steady state level of income (unconditional convergence), and inducing the catching-up phenomenon (i.e. β-convergence).

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[12] Total factor productivity is a very important (though controversial in terms of both measurement and theory) component of economic growth. According to its more general definition, it is the portion of output that is not explained by the amount of inputs used in production. As such, TFP is calculated as a residual and its level is determined by how efficiently and intensely the inputs are utilised in production. In his review of the literature on TFP, Hulten (2000) concludes that "*despite its flaws, the residual has provided a simple and internally consistent intellectual framework for organizing data on economic growth, and has provided the theory to guide a considerable body of economic measurement*".

The empirical evidence for β-convergence based on the exogenous growth framework is, however, inconclusive. For instance, Barro and Sala-i-Martin (1992) find evidence in support of catching-up for a sample of European countries, although the speed of this is significantly lower than the theory predicts. In addition, the theory fails to identify the sources of convergence outside these narrow conditions (the heavy reliance on identical preferences and institutions inherent in the model), which poses challenges not only for empirical analysis, but also from a policymaking point of view. Since the behaviour of individuals already leads to the best possible outcomes, and as growth is determined exogenously, there is no place for the role of economic policy (e.g. a policy introducing incentives to save or invest).

Some of these pitfalls are addressed by the second cluster of theoretical models, which endogenise technological change either by introducing increased returns to production factors or by generating innovation in its own right. For example, Uzawa (1963) and Lucas (1988) include investment in human capital, while in Romer's model a country may be more prosperous if it allocates more resources to innovation (Romer 1986). Borsi and Metiu (2013) use a neoclassical growth model augmented by endogenous technological progress, and find no evidence of overall real GDP per capita convergence for the EU27 in the period 1970-2010, although they identify "convergence clubs" (see Box 1 for a definition). In any case, the endogenous growth models permit policymakers to implement growth-enhancing strategies to target TFP, education, innovation and technological progress, thereby boosting economic growth and facilitating convergence.

The third group of models, to which this paper mainly refers, explains cross-country differences in per capita growth as differences between institutions. The introduction of institutional variables dates back to North (1990), who suggest that property rights are crucial in productive investment activities and in defining economic outcomes. North and Thomas (1973) define institutions as a society's rules of the game which shape social and economic incentives. In this way, societies with economic institutions designed to encourage innovation, factor accumulation and efficient resource allocation will prosper more than their counterparts. Starting from this idea, early empirical works have shown a link between long-term growth and institutions (e.g. Easterly and Levine 1997), showing how political instability is detrimental to growth for a sample of African countries; or have focused on output per worker in a more global sample (e.g. Hall and Jones 1999). This link has been further underpinned by the recent proliferation of institutional indicators which shed light on the importance of specific dimensions of governance to growth. For example, Mauro (1995) looks at corruption, red tape, the efficiency of the judicial system, and political stability; Knack and Keefer (1995) examine contract enforceability and the risk of expropriation; Barro (1996) finds non-linear relationships between growth and democracy and political freedom; while Aixala and Fabro (2008) use the Worldwide Governance Indicators to establish which dimensions are most important, and whether this importance is also affected by a country's initial level of income. Han, Khan and Zhuang (2014) also use the Worldwide Governance Indicators to show that countries which are endowed with good initial governance grow, on average, up to 2-2.5% faster than their

counterparts. Given the bourgeoning empirical evidence, there is a growing consensus that good governance is a non-negligible ingredient that supports long-term growth.

Drawing on this literature, the following sections focus on sustainable economic convergence in the euro area from a long-term perspective. Since the creation of the euro in 1999, sufficient time has passed to review and analyse the state of economic convergence in the EMU (Section 2). Moreover, convergence and its drivers need to be examined taking a longer-run perspective to fully understand the forces at play that underpin the current state of affairs (Section 3). On the basis of this analysis some policy indications may, in turn, be derived (Section 4).

2 Economic convergence in the euro years: 1999-2016

How has economic convergence evolved since the introduction of the euro? Has any real convergence occurred? Is it sustainable? While EU convergence procedures have focused on Maastricht convergence criteria as the key precondition for euro adoption, how have such criteria evolved during euro area membership? What indications can we draw regarding the resilience of economic structures in this period? Finally, is it sufficient to focus on the euro years to understand convergence dynamics? After a brief overview of how our understanding of economic convergence and the underlying rules and institutional processes have evolved since the launch of the euro (Section 2.1), this section explores the process of real convergence and, then, the divergence that has characterised several euro area countries (Section 2.2). Some explanations are provided in relation to the exacerbation of the financial cycle and the ensuing misallocation of resources, and the boom-bust cycle (Section 2.3). Section 2.4 then reviews the evolution of Maastricht convergence criteria in each euro area Member State since euro adoption. Next, we briefly outline the main developments relating to institutional quality (Section 2.5). We conclude by examining why certain explanations focusing on the euro period, although important, ignore the crucial longer-term dimension of the convergence process (Section 2.6). This acts as a bridge to the subsequent Section 3.

2.1 The EU institutional framework: from the Maastricht Treaty to the Five Presidents' Report

With regard to assessing convergence, two general lessons have been learned in Europe in recent years: (i) the sustainability of convergence can only be assessed taking a long-term perspective and using a holistic approach; (ii) there is no automatism in the convergence process. The interpretation and relative importance of the term "convergence" has evolved in Europe over time. Although, even today, the only legally binding definitions are those used in Article 140 of the TFEU, some important lessons on convergence have also been drawn in the various Convergence Reports of the ECB and the EU Commission. The Five Presidents' Report of 2015, moreover, provided some important indications for the future. In particular, two lessons have been learned in this period. First, the sustainability of convergence can only be assessed over a long-term horizon, within which all the dimensions of convergence reviewed in Section 1.1 – be these real, nominal or legal/institutional in nature – become relevant, interact, and should be pursued[13]. Second, there is no automatism (e.g. no OCA endogeneity as discussed

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[13] The importance of taking a multi-dimensional approach to economic convergence has already been identified in the Delors Report (Delors et al. 1989).

in footnote 8) in the convergence process, which should be seen instead as a product of relentless policy efforts not only before, but also after adoption of the euro – i.e. as a continuum.

In respect of the first lesson, the TFEU is unambiguous: before adopting the euro, a country should achieve a "high degree of sustainable convergence" with the euro area (Article 140). However, the experience with the euro area crisis has demonstrated that this has not always been the case. There is now widespread agreement that "the temporary fulfilment of the numerical convergence criteria is, by itself, not a guarantee to smooth membership in the euro area" (ECB 2012, 2013, 2014 and 2016). Accordingly, an assessment of sustainable convergence should be conducted following a coherent and holistic approach. In the TFEU, however, this assessment is based primarily on two specific dimensions: nominal and legal convergence. More recently, the Five Presidents' Report has emphasised the importance of real convergence and institutional quality. A key lesson learned in recent years is that, although convergence cannot be sustainable over time without a solid performance in all these dimensions, prior to the euro area crisis insufficient attention had been paid to the real and institutional dimensions.

To be sustainable, real convergence and Maastricht convergence should be underpinned by sound policies. Both dimensions depend on many factors that ultimately hinge on the sustainability of the relevant structural, fiscal, monetary and financial policies in place before and after adoption of the euro (Draghi 2012). The experience of the crisis has also highlighted the risk that large and persistent imbalances jeopardise not only the economic convergence of individual countries, but also the smooth functioning of the euro area as a whole. The dire implications of prolonged losses of competitiveness, excessive indebtedness or housing bubbles are now well acknowledged in the EU. Recognising this fact, the EU has moved towards stronger surveillance and coordination of its members' domestic policies. Two examples are, inter alia, the macroeconomic imbalance procedure (MIP) and the intergovernmental Treaty on the Stability, Coordination and Governance in the Economic and Monetary Union, known as the "fiscal compact"[14].

The importance of institutional quality to the sustainability of economic convergence is now also undisputed. Removing existing institutional rigidities and impediments to the efficient use and allocation of production factors helps to enhance the potential output of a country. This, in turn, improves a country's debt-servicing ability and makes it easier to make economic adjustments. Giannone et al. (2011) have indeed shown that quality of governance had a positive effect on economic resilience during the 2008-09 recession. Arbia et al. (2010) and, more recently, Masuch, Moshammer and Pierluigi (2016), have also found that institutional quality is an important explanatory variable for, respectively, cross-country growth

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14   The MIP aims to prevent a build-up of new macroeconomic imbalances and to enforce the correction of major existing imbalances, including through the excessive imbalance procedure (EIP). In its most recent Convergence Reports, the ECB has noted that "*EU Member States with a derogation that are subject to an Excessive Imbalance Procedure can hardly be considered as having achieved a high degree of sustainable convergence as stipulated by Article 140(1) of the Treaty*". The fiscal compact was signed by all EU Members States except the UK and the Czech Republic in March 2012, with the aim of strengthening the sustainability and credibility of fiscal policies.

differences across the EU and long-term growth in European countries. However, there are differing views with regard to the respective role of national policymakers and euro area/EU authorities in creating the preconditions for a process leading towards more resilient economic structures.[15] This issue will be discussed in greater detail in Section 3.4.

With regard to the second lesson, experience has shown that no automatic forces deliver convergence in the absence of appropriate national reforms. The experience of convergence in Europe in recent years has shown that this process does not end when a country adopts the euro, and that although participation in the single monetary policy requires the fulfilment of convergence criteria and acts as a disciplinary tool, it may not be sufficient to deliver subsequent convergence. This experience will be discussed in the following sections.

2.2   How did real convergence evolve?

To analyse real convergence developments in the euro years we focus, as discussed in Section 1.1, on relative GDP per capita. In particular, we compare GDP per capita expressed in Purchasing Power Standards (PPS) across countries. Box 2 gives details of alternative statistical measures and explains why we opt for PPS. Both here and throughout Section 2 we refer not only to the first wave of euro area members (the EA12), but we also include, as a point of reference, more recent members as well as all non-euro area EU Member States. To this end, we take into account the different accession dates of those countries to both the EU and the euro area.

Since 1999 some degree of real convergence has taken place in the most recent EU Member States. As shown in Chart 3, first figure, both non-euro area EU countries (green triangles) and countries that adopted the euro after 2002 (blue circles) usually performed better than the EA12 countries (red squares) over the period 1999-2016. In particular, Lithuania, Estonia, Latvia, Romania and Slovakia

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[15]   Cœuré (2014) was among the first to propose a synthesis of the "national responsibility" and the "European cooperation" approach in this field. He called for a "convergence process 2.0" based on: *(i)* a notion of institutional quality, subsequently developed in the Five Presidents' Report, and *(ii)* an interplay between national initiatives and joint European action. In the words of Cœuré, "*The answer to the remaining challenges could take the form of a "convergence process 2.0", which should have an agreed timeline and milestones. But convergence can only be sustainable if it is associated with (…) a race towards best practice institutions and policies rather than towards mere nominal outcomes. In this context, structural reforms, if properly designed, lead to greater prosperity in each country and, at the same time, ensure greater resilience of EMU as a whole, thereby contributing to economic and social stability. Growth and stability are therefore mutually reinforcing. The convergence process should consist of two legs: on the one hand, it should underpin the convergence of economic policies and structures at the national level. On the other hand, it should facilitate joint action. At the national level, convergence implies that euro area governments need to step up structural reforms, in particular those which have the greatest efficiency gains given the relative distance to best practices. And policy-makers should pay due attention to ensure that the burden of the adjustment effort is shared fairly. The convergence in national structures could be complemented by joint action at the European level to increase investment and by the transfer of certain budgetary responsibilities to the European level with a view to strengthening risk-sharing within the currency union. But joint action can only occur once trust has been restored across countries and within countries, and the convergence process has advanced successfully. (…)*"

have achieved the largest degree of convergence among EU countries so far, followed by other countries in the CEE (central and eastern Europe) region[16].

Chart 3

GDP per capita relative to the EU28, initial level in 1999 versus cumulative change (1999-2016, 1999-2007 and 2007-16)

(GDP at current prices per capita in PPS; EU28 = 100; 1) top-left chart: x-axis: level beginning period 1999; y-axis: cumulative change in the level (1999-2016); 2) top-right chart: x-axis: level beginning period 1999; y-axis: cumulative change in the level (1999-2007); 3) bottom-left chart: x-axis: level beginning period 2007; y-axis: cumulative change in the level (2007-2016))
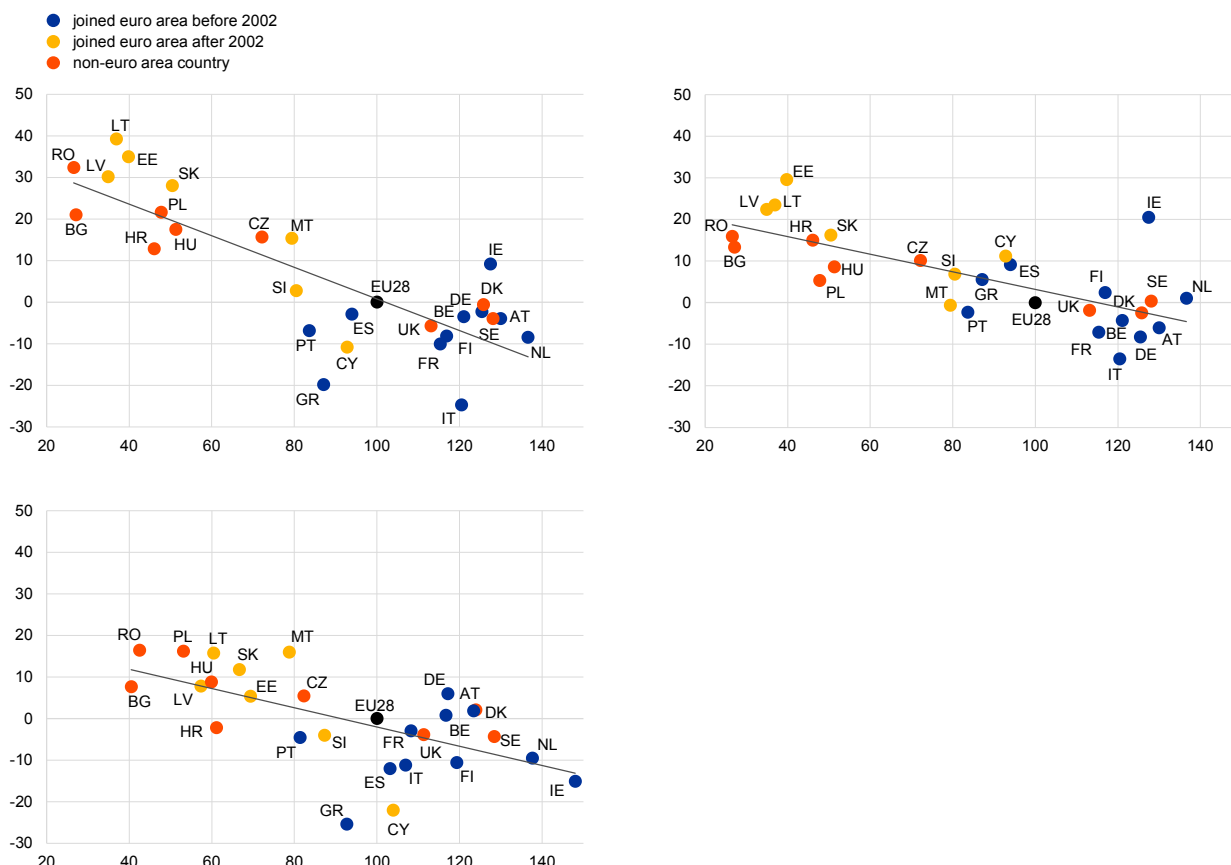
Sources: European Commission and ECB.
Notes: Luxembourg is excluded because GDP per capita computations are distorted by a high number of cross-border workers. Data for Ireland are adjusted to control for the exceptional GDP revision made for the year 2015, which did not reflect an actual increase in economic activity.

It is striking, however, that little convergence has occurred among the early euro adopters, despite their differences in GDP per capita. In contrast to some initial expectations that the establishment of the euro would act as a catalyser of faster real convergence, little convergence, if any, has taken place for the whole period 1999-2016[17]. No clear relationship between relative GDP per capita levels in

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16   The increase in the economic integration of CEE countries over the sample period could explain part of their convergence performance. Some evidence for the positive effect of EU membership on relatively low-income countries, largely thanks to a greater degree of economic integration, can be found in Crespo Cuaresma, J., Ritzberger-Grünwald D. and Silgoner M.A., "Growth convergence and EU membership", *Applied Economics*, Vol. 40, No 5, 2008, pp. 643-656. An additional factor lies, more simply, in the specific catching-up nature of these economies, i.e. their greater scope for accumulation of capital, shifts of labour out of the agricultural sector, and productivity gains.

17   Some additional empirical evidence confirming that the monetary union did not produce the expected lasting increase in GDP per capita is shown in Fernandez and Garcia Perea (2015).

1999 and their subsequent relative growth between 1999 and 2016 can be identified for the EA12. In fact, looking at the period as a whole, there is a lack of convergence among the early adopters of the euro, given that in 18 years a number of lower-income countries have either not reduced (e.g. Spain) or have even increased (e.g. Greece) their income gaps in comparison with the average. Moreover, Italy – initially a higher-income country – recorded the worst relative performance, i.e. a substantial divergence from the high-income group, to the extent that the country now belongs to the lower-income group. Although the Lehman global shock partly explains the divergences observed in the above countries, some more deep-rooted and country-specific explanations have also been in play. Ireland, for example, despite the major crisis of the period 2008-13, has shown some relative improvement over the whole period, and has remained among the higher-income countries (Chart 3).

The overall picture for the whole period 1999-2016 masks, however, different developments over time. Focusing on pre-crisis and post-crisis sub-periods, there was some temporary convergence before 2007 among the EA12 countries. As can be seen in Chart 3, second figure, before the global financial crisis there was faster growth in Greece and Spain than in the rest of the euro area, although this was not the case in Portugal. This catching-up process rapidly reversed over the period 2008-16, when these economies either initially underwent a severe recession or remained broadly stagnant (Chart 3, third figure). Some reduced catching-up speed is also evident in this period among the more recent euro area/EU members, with a significant reversal occurring in Cyprus, Slovenia and Croatia.

The persistent underperformance of growth for some euro area countries has clearly limited the overall performance of the whole area, which has recorded a modest increase in GDP per capita since 1999. This is illustrated by Chart 4 (see Chart 2 for a comparison between the euro area and peer economies in the rest of the world).

Chart 4

GDP per capita in the EA12, Greece, Italy, Portugal and Spain

(GDP at constant prices per capita in PPS levels)
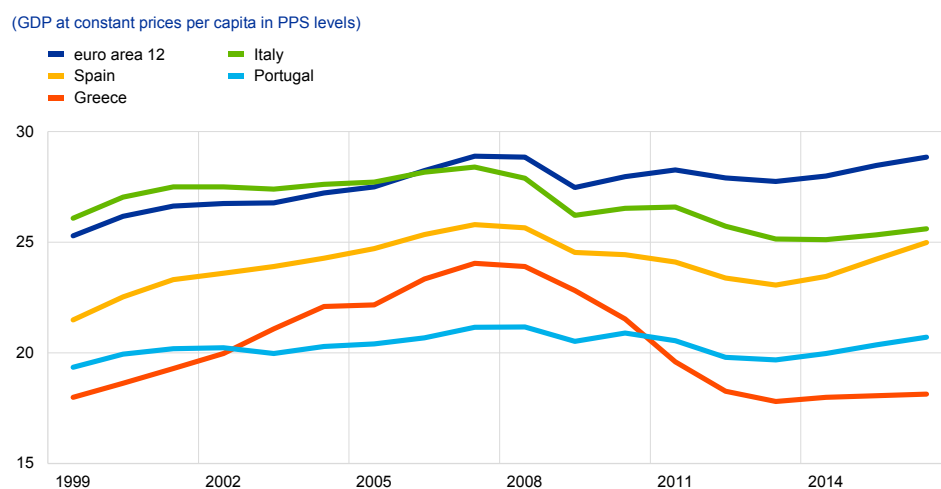
Source: European Commission.

Box 2
Measuring real convergence

This box first reviews methodological issues surrounding the measurement of real convergence in the euro area and then draws conclusions as to what data (and data sources) are optimal for capturing the process of cross-country real convergence or the lack thereof.

GDP per capita based on purchasing power parities (PPPs) has a long-standing tradition and allows valuable comparisons to be made between standards of living across countries over time. In particular, the conversion of national accounts using PPP exchange rates helps to improve international comparisons, which might be impaired if market exchange rates were used. Let us consider two countries which produce identical physical quantities of goods in two different years. Fluctuating market exchange rates could imply that one country has a higher GDP than the other in one year, but a lower GDP in the other year, resulting in a failure to capture the reality of their relative levels of production. Such a false inference can be avoided through the use of PPPs which are used to convert national accounts to a common currency, typically an international dollar (or Geary–Khamis dollar) or an artificial common currency unit such as the Purchasing Power Standard (PPS). The latter is commonly used by the European statistical office, Eurostat, since its base currency is the euro. The PPS is independent of the exchange rate, which is instead important for making historical comparisons between countries using different currencies.

In this paper, we refer principally to PPS euros based on the EA12 or EU15[18] aggregate, calculated as a weighted average of the purchasing powers of the national currencies of these EU Member States. PPS euros have the same purchasing power across the aggregate they are based on; in this way, they reflect its average price level. In addition, we provide two complementary approaches to decomposing GDP growth based on alternative data sources, i.e. the Penn World Tables (PWT) and the Conference Board's Total Economy Database (TED). Both sources apply different PPPs from Eurostat, which are based on the international dollar as a common currency. They serve to crosscheck and supplement our analysis based on the primary European Commission (EC) AMECO-based decompositions. The main features of the methodologies used by each source are summarised in Table A.

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[18]   EU15 refers to the countries that had become EU members by 1995.

Table A

Sources and methods for measuring real convergence

Source	National Accounts	Common Currency	PPPs
EC Ameco	Latest ESA 2010 GDP figures	PPS artificial currency unit based on the euro	Since 1995 calculated every year in the framework of the rolling base Eurostat-OECD program. Before 1995, retrapolated using GDP deflators. PPPs are obtained by EKS method.
The Conference Board Total Economy Database (TED)	GDP valued at market prices whenever possible; historical national accounts before1991 are obtained from Maddison Historical Statistics (Maddison, 2010)	International dollar	PPPs obtained by Geary-Khamis method is expressed in 1990 U.S. dollars. PPPs obtained by EKS method is expressed in 2014 US dollars. Relies on single PPP measurement.
Penn World Tables 8.0 (PWT)	Dissemination of multiple GDP series for various purposes to capture the concepts of expenditure and production side of the economy.	International dollar	Aiming to use "as many PPPs as possible" to increase cross-country comparability. PPPs are obtained by Geary-Khamis method.

Notes: The Geary-Khamis method is an aggregation method in which the category "international prices" (reflecting relative category values) and country PPPs (reflecting relative country price levels) are estimated simultaneously from a system of linear equations. It has the property of base-country invariance, matrix consistency and transitivity. For more details, see Chapter V and Annex II in UN (1992). The EKS method is a multilateral method developed by Eltoto, Kovacs and Szulc, that computes the nth root of the product of all possible Fisher indexes between n countries. It has been used at detailed heading level to obtain heading parities, and also at GDP level. EKS has the properties of base-country invariance and transitivity. For more details, see Chapter V and Annex II in UN (1992).

PPPs are designed to convert expenditures in different countries into a common currency and at a common price level to ensure comparability. On that basis they are suitable primarily for cross-country comparisons *at a given point in time*. More specifically, to maximise cross-country comparability at a point of time, national accounts should be expressed at current prices and used with current PPPs (for instance, GDP per capita at current prices deflated by the current PPP of each year ensures the comparability of relative volumes across countries for each individual year). Such GDP per capita is sometimes referred to as "real" (although nominal series are used, here "real" means GDP that is evaluated at constant prices across countries over a given period). Since such PPP-based indicators are based on common, current prices, they would be meaningless if used as growth rates in an inter-temporal context (Eurostat 2016).

Focusing on the *inter-temporal dimension* of GDP per capita in a single country (e.g. the historical evolution of per capita GDP growth over time and its drivers), we deploy a PPS-adjusted time series of GDP per capita in fixed prices, deflated by the PPP of the base year. In this context, "real" means GDP evaluated at constant prices over time, which produces real volumes expressed at the same price level for all countries, as well as real growth rates. However, since the assumption of the PPP for the base year is not realistic (as price structures and price relations across countries change over time, especially in long time series), the use of these series is much more suitable for the latter purpose, thus zooming in on the inter-temporal trend of growth rates, which is why we selected it to examine the long-term view of real convergence and its drivers.

In conclusion, a "perfect" multi-purpose indicator of GDP per capita, which captures both spatial and temporal aspects at the same time, simply does not exist. Measures and data sources must, therefore, be chosen and interpreted with care when examining real convergence.

2.3 Looking for explanations: the role played by the financial cycle and capital misallocation in the euro years

Macroeconomic explanations

In the early years following the introduction of the single monetary policy, until around 2007, several countries in the euro area (especially Spain and Greece) or countries about to adopt the euro (e.g. Slovenia and Cyprus) experienced some "temporary convergence". These lower-income countries did indeed grow relatively faster for several years after euro adoption. However, growth in that period proved to be unsustainable and led to a large accumulation of external and domestic imbalances coupled with increasing resource misallocation, particularly in those countries which subsequently came to be labelled as "stressed economies". At the time of the global crisis in 2008-09, and later during the euro area crisis, which peaked between 2010 and 2012, a painful economic adjustment took place in these countries, accompanied by a deep recession that triggered divergence from the average euro area income level. The unsustainable boom prior to 2007 and the high cost of the subsequent adjustment process in some countries were, to a significant extent, caused by inappropriate national policies and the failure to implement structural and institutional reforms during the boom years.

At the beginning of EMU many observers expected that deeper monetary and financial integration would trigger faster real convergence. In the early years of the euro, as predicted by neoclassical theory, gross private capital inflows were indeed sizeable in the euro area countries with per capita income levels significantly below the euro area average, including Greece, Portugal and, to a lesser extent, Spain. In the case of Italy, capital inflows were much lower, as was the case in most other higher-income economies (Chart 5). Conversely, in Ireland capital inflows turned out to be much larger, as a percentage of GDP, than in any other euro area economy in this period, even though the country was no longer viewed as a catching-up economy.

Chart 5

Gross private capital flows to Greece, Spain, Portugal and Italy

(as a percentage of GDP)

- FDI
- portfolio equity
- portfolio debt
- other investment
- total
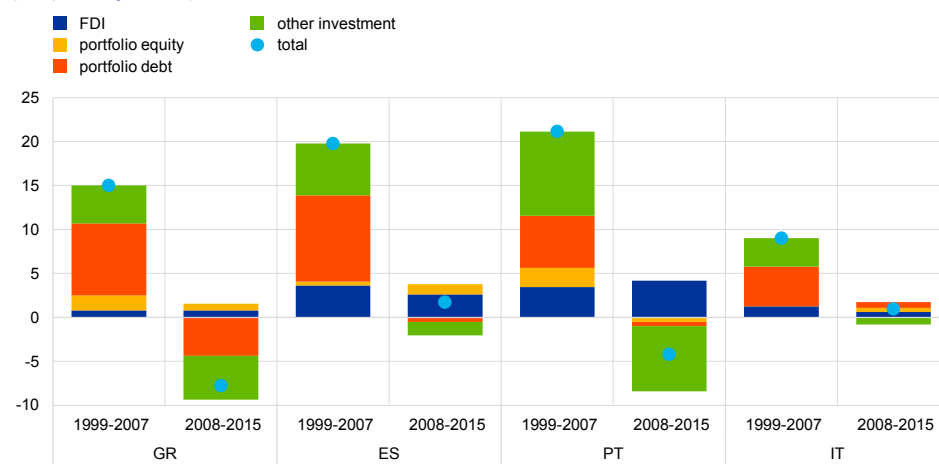
Source: ECB.
Notes: Other investment excludes flows to the government and national central bank. Ireland is not included in the chart as its gross private capital inflows were much bigger as a percentage of GDP.

However, the large capital inflows in the pre-crisis period did not set in motion a process of sustainable convergence. During the pre-crisis period capital inflows to the lower-income euro area countries consisted mainly of investment in debt instruments and banking flows channelled to the economy via the domestic banking system which, for reasons we will discuss, failed to trigger a catching-up of productivity. These capital flows mainly originated in the financial sector of core euro area countries and, therefore, represented a strong increase in financial integration in the euro area. However, this was not conducive to supporting effective private risk-sharing once the crisis had started, mainly due to the fact that this capital integration was largely based on portfolio investment (cross-border interbank loans and investment in government debt) rather than on foreign direct investment (FDI). As shown in Chart 5, the amount of FDI, which is more conducive to supporting productivity growth, was less significant. When the global financial crisis started, external private financing started to dry up, and subsequently suffered a sharp contraction during the sovereign debt crisis. Capital inflows have recovered somewhat in recent years, although they are at more moderate levels in comparison with the pre-crisis period[19].

In the years leading up to the crisis, the large capital flows channelled to the economy by the domestic banking sector contributed to a credit-driven domestic demand boom. The boom reflected erroneous expectations regarding future income prospects and masked the weak growth potential of a number of countries. Compared with the average of the pre-euro years (1995-1998), real and nominal interest rates dropped very sharply, especially in the EA-South countries, and also in Ireland (Chart 6). This substantial drop in real interest rates in these economies was a result of two factors: (i) a substantial convergence of nominal

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[19]   For a more detailed analysis see McQuade, P. and Schmitz, M. (2017).

interest rates before and after the introduction of the euro; and (ii) an acceleration in inflation in these countries above the euro area average during the early years of EMU (for more details, see Section 2.4 and ECB, 2005). The sharp drop in real interest rates contributed to a credit-driven boom in a number of countries which temporarily ensured higher growth in the lower-income EA-South countries.

Excessive private sector credit growth in some countries led, in turn, to rising debt levels in the corporate and/or household sector. Spain, Ireland and, to a lesser extent, Greece and Portugal, recorded a substantial increase in private sector indebtedness (Chart 7). The risks related to this sharp credit growth and increasing indebtedness were not appropriately addressed by national authorities. In particular, macroprudential tools limiting excessive borrowing were either not used or were too weak to dampen credit growth sufficiently in these economies.

Chart 6

Real three-month money market rates

(percentages)

■ 1995-98
■ 1999-2007
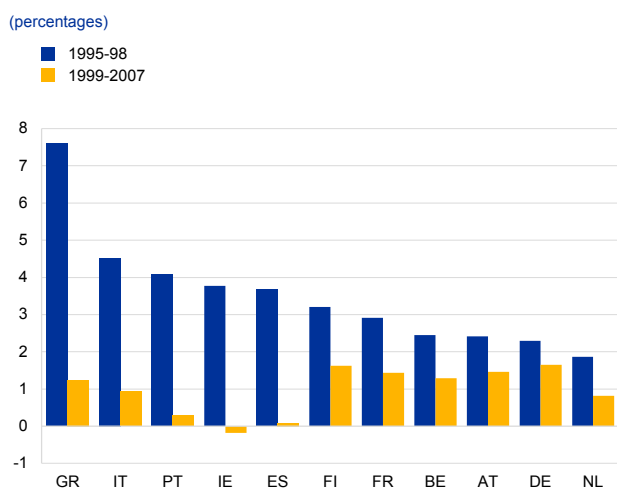
Sources: European Commission and ECB staff calculations.
Note: Nominal three-month money market rates are HICP-adjusted.

Chart 7

Private sector debt
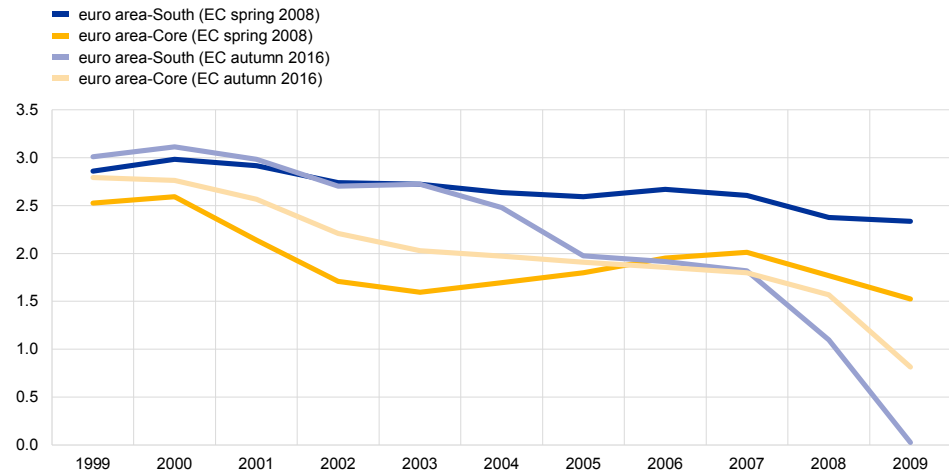
(percentages of GDP)

■ 2001
■ 2007
■ 2015
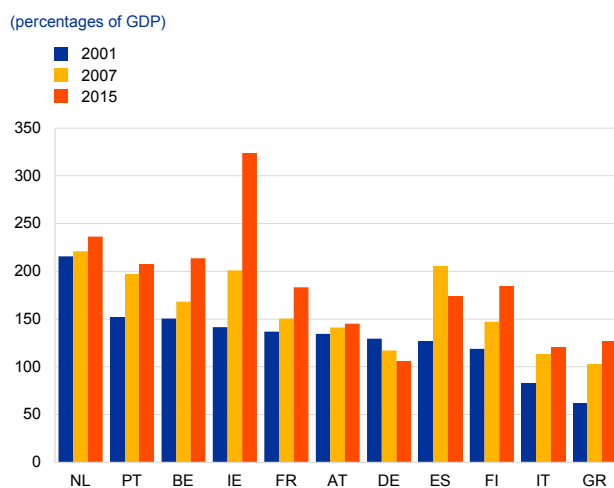
Sources: European Commission and ECB staff calculations.
Notes: Private sector debt is the sum of the unconsolidated debt of households and non-financial corporations. Due to data availability issues, 2015 data for Portugal refer to 2014.

The credit-driven domestic demand boom that continued for many years led to an overestimation of growth potential in certain countries (see Borio et al. 2017). This overestimation was particularly marked in Greece and Spain. As a result, fiscal policy was too procyclical during the boom years, as budgets were based on the assumption that the high revenues generated by unsustainable domestic demand would continue in the years to come. During those years potential growth estimates of the EA-South countries persistently exceeded that of the EA-Core countries, producing an illusion of sustainable convergence (Chart 8). With the onset of a severe crisis, fiscal revenues dropped sharply, given the context of insufficient fiscal buffers, resulting in a rapid increase of public debt. Also, estimates of potential growth were revised downwards sharply, particularly in the EA-South countries, which revealed that fiscal spending had been procyclical during the boom years in many stressed economies.

Chart 8

Average potential growth in selected euro area country groups

(percentages)

- euro area-South (EC spring 2008)
- euro area-Core (EC spring 2008)
- euro area-South (EC autumn 2016)
- euro area-Core (EC autumn 2016)

Sources: European Commission Spring 2008 and Autumn 2016 forecasts.
Notes: Potential growth estimates computed in 2008 compared with estimates in 2016. Unweighted averages. EA-South comprises Greece, Spain, Italy and Portugal; EA-Core includes Austria, Belgium, Finland, France, Germany and the Netherlands.

Excessive growth of credit and domestic demand was also associated with the accumulation of very large external imbalances in the pre-crisis years. The current account deficit increased significantly during the pre-crisis years in Greece, Spain and Portugal. By contrast, in Italy, a relatively higher-income country, the current account deficit remained moderate (Chart 9). The crisis brought about a rapid external deficit correction in these countries, as imports, which are driven by domestic demand, dropped significantly.

Chart 9

Current account balances

(percentages of GDP)

- euro area 12
- Spain
- Greece
- Italy
- Portugal
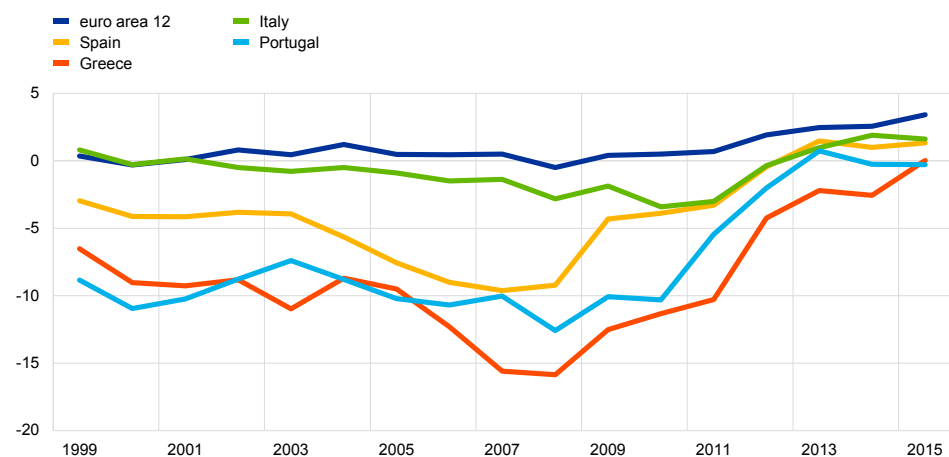
Source: European Commission.
Note: Euro area 12 refers to the aggregate of all EA12 balances and not to the euro area current account.

A key aspect of the boom-bust cycle described above is that the large gross capital flows to imbalanced economies was not sufficient to finance

productivity-enhancing investments. Large cumulative current account deficits in catching-up economies are not necessarily problematic if the accumulation of large net foreign liabilities is conducive to future current account surpluses. If large current account deficits are financed by productivity-enhancing investments that will lead to higher export revenues in the future, a temporary increase in current account deficits may turn out to be sustainable. However, the convergence pattern of these euro area countries did not meet this condition in the pre-crisis period. In fact, during the boom years TFP growth was very subdued in most imbalanced economies – in some cases even negative – a process which, as we shall see in Section 3.2, had in some cases already begun in the previous decade(s).

One reason for the weak TFP growth performance in the pre-crisis period was that the allocation of capital and labour was heavily skewed towards sectors with relatively low productivity, but temporarily high rents. After the introduction of the euro, in certain countries capital was increasingly channelled towards sectors with a low marginal product of capital (i.e. weak productivity), but high rents. These sectors typically included the services sectors that were comparatively sheltered from external competition (see the discussion by Praet 2014). Typical examples are provided by the distribution and network industries and, in Spain and Ireland, the dwelling sector, where gross fixed capital formation grew abnormally and peaked in 2006 before collapsing (Chart 10). In Portugal, where growth was subdued even before the crisis, the services sectors, with lower average productivity, were also major drivers of the increase in value added.

Chart 10
Gross fixed capital formation in the EA12, Spain and Ireland

(percentages of GDP)
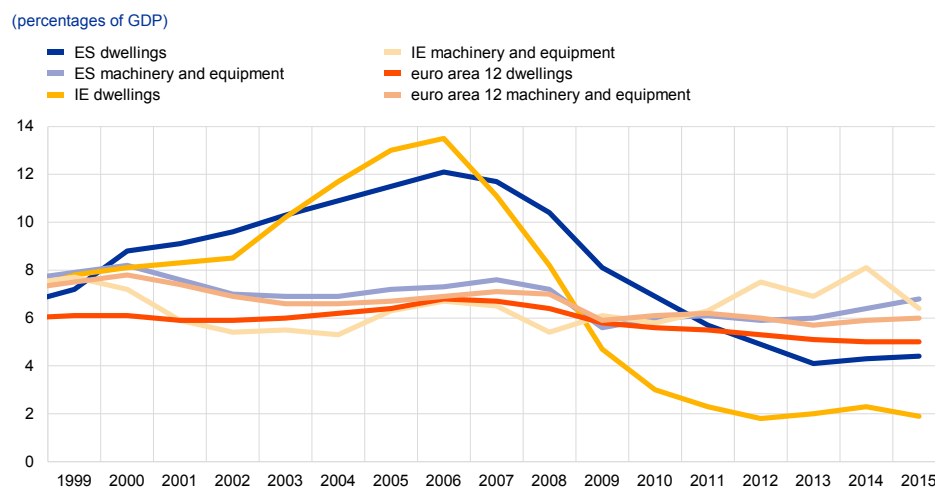
Source: Eurostat.

The evidence suggests, however, that the misallocation of capital reflected not only a misallocation towards lower productivity sectors during the financial boom, but also a broader set of longer-term structural weaknesses that hampered both efficiency gains within firms and allocative efficiency within sectors. This indicates that the macroeconomic picture should be complemented by a more micro-oriented analysis of convergence. In Italy, for

instance, the sectoral value-added composition was broadly similar to that of other large euro area countries, yet productivity was much less dynamic than elsewhere. As illustrated in Chart 11 for Italy and Spain, the weakness of TFP growth was broad-based across all main economic sectors in these two countries (although construction and services stand out in Spain). Even the manufacturing sector – a traditionally high productivity-growth sector – recorded negative average TFP growth in 2007, at a time when economies were peaking. This was well below the performance of other euro area countries. These developments raise questions that we will partially address in the remainder of this section, which focuses mainly on Italy and Spain.

Chart 11
Cumulative TFP growth in main economic sectors in the period 1999-2007

(percentages, cumulative)
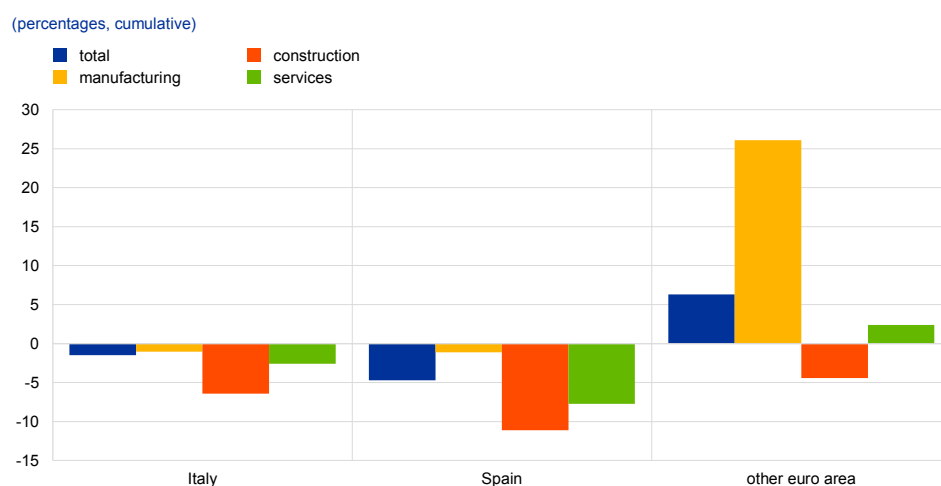
Source: European Commission.
Notes: No data are available for Greece and Portugal. "Other EA" refers to Belgium, Germany, France, the Netherlands, Austria and Finland. The 2007 value for Belgium is extrapolated from 2006. Aggregates are unweighted. "Total" also includes other sectors, such as agriculture and mining, electricity, transport, and financial intermediation.
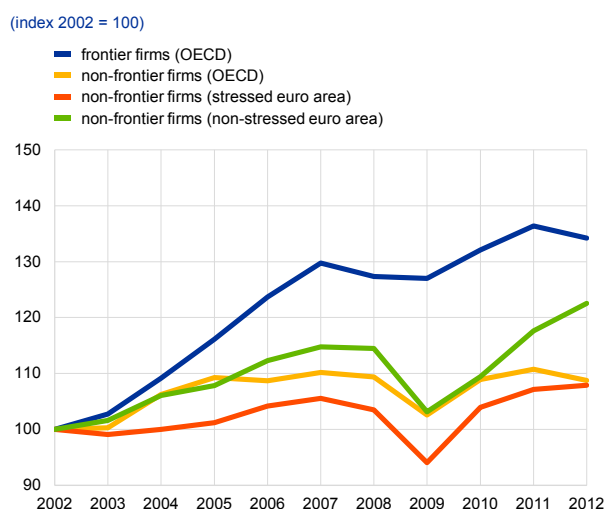
Microeconomic explanations

The previous discussion raises two fundamental questions: what factors impaired intra-sectoral productivity growth in the economies facing the greatest convergence challenges? Did these factors persist even after the onset of the crisis? The crisis should have set in motion some productivity gains via Schumpeterian creative destruction and/or the implementation of structural reforms. Although in no way exhaustive, a few hints are provided in the final part of this section to seek to address these challenging questions.

First, the evidence shows that the diffusion of new technologies to Italian and Spanish firms underperformed not only the OECD "frontier firms", but also all other available groups of non-frontier firms, including those of higher-income euro area economies. Looking first at the manufacturing sector (Chart 12), it may be seen that the gap between the labour productivity of the 100 most productive OECD firms within an industry ("frontier firms", blue line) and the weighted average labour productivity of non-frontier firms in Italy and Spain (green line) increased in

the period 2002-09, before subsequently stabilising. This may be viewed as an indication that, inter alia, technological innovations had not been sufficiently diffused and commercially applied to have any noticeable impact on productivity in these two countries – possibly because this would have required complementary investment in human capital and intangibles, as well as changes to organisational structures and business models, which did not occur[20]. Most strikingly, a gap materialises even when comparing Italian and Spanish non-frontier firms with those within five "core" euro area countries (Austria, Belgium, Finland, France and Germany – purple line), whereas a gap materialises but then closes at the end of the period vis-à-vis the OECD non-frontier firms (red line). Comparing the manufacturing sector and the services sector, moreover, shows the materialisation of a productivity gap vis-à-vis the OECD frontier firms persisting until 2012 and being even more pronounced (Chart 13).
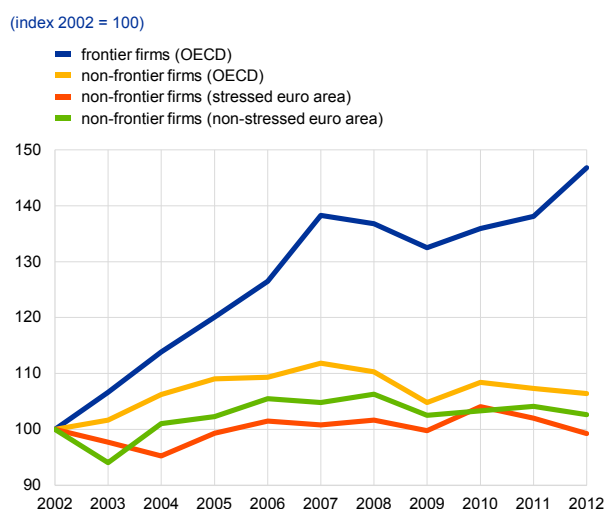
Chart 12

Labour productivity growth of OECD global frontier firms and non-frontier firms in selected country groups in the *manufacturing* sector (2002-12)

(index 2002 = 100)

- frontier firms (OECD)
- non-frontier firms (OECD)
- non-frontier firms (stressed euro area)
- non-frontier firms (non-stressed euro area)

Sources: OECD (2014) and ECB staff calculations based on CompNet data (4th vintage), using firms with 20 employees or more.
Notes: OECD global frontier firms are defined as the 100 most productive firms within an industry in the manufacturing sector (defined at the 2-digit level according to NACE rev.2) for a year. OECD non-frontier firms refer to the (weighted) average productivity growth of non-frontier firms in each of the 2-digit manufacturing industries, considering these three country groups: (i) all OECD countries; (ii) "core" EA countries (AT, BE, FI, FR and DE); and (iii) EA countries with convergence challenges (IT and ES).

Chart 13

Labour productivity growth of OECD global frontier firms and non-frontier firms in selected country groups in the *services* sector (2002-12)

(index 2002 = 100)

- frontier firms (OECD)
- non-frontier firms (OECD)
- non-frontier firms (stressed euro area)
- non-frontier firms (non-stressed euro area)

Sources: OECD (2014) and ECB staff calculations based on CompNet data (4th vintage), using firms with 20 employees or more.
Notes: OECD global frontier firms are defined as the 100 most productive firms within an industry in the services sector (defined at the 2-digit level according to NACE rev.2) for a year. OECD non-frontier firms refer to the (weighted) average productivity growth of non-frontier firms in each of the 2-digit service industries, considering these three country groups: (i) all OECD countries; (ii) "core" EA countries (AT, BE, FI, FR and DE); and (iii) EA countries with convergence challenges (IT and ES).

Second, turning to allocative efficiency, a number of empirical papers suggest that resource misallocation within sectors may have played a key role in leading productivity growth, which was occasionally even more significant than inter-sectoral misallocation. This occurred not only in the pre-crisis period, but also in the post-crisis period[21]. Gopinath et al. (2015) analysed data

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[20] For a broader discussion of the slowdown in technology diffusion in the euro area, see ECB (2017b).

[21] According to an alternative hypothesis, the post-crisis weakness of TFP could be the result of a measurement error, i.e. it might reflect the lack of any correction for the sharp fall in capital and labour utilisation during the crisis years.

for Spanish manufacturing firms between 1999 and 2012, and found a significant increase of dispersion in the return on capital across firms over time, which is seen by the literature as a key indicator of capital misallocation. Based on a model including heterogeneity of firms, financial frictions and capital adjustment costs, the paper also demonstrates how the decline in real interest rates could have contributed to the decrease in TFP, as capital flows were channelled towards lower productivity firms operating in relatively undeveloped financial markets. The paper also shows that similar trends for capital misallocation and productivity losses may be observed in Portugal and Italy, although not in Germany, France or Norway. Gamberoni, Giordano and López-Garcia (2016), for their part, provide a comprehensive analysis of capital and labour misallocation *within* the main industrial and services sectors of six euro area countries (Belgium, Finland, France, Germany and, of the economies facing convergence challenges, Italy and Spain). A key finding is that in all countries, except for Germany after 2006, within-sector capital allocation worsened in the period 2002-12, while labour allocation did not change significantly. The paper also finds that capital misallocation has grown more in the services sectors (especially the information, communication, professional and administrative sectors), as might be expected. To the extent that these sectors were "upstream" in the value chain, this may also have negatively affected overall TFP trends. In line with these findings, ECB (2017a) shows capital misallocation trending upward, particularly in Italy, although it halts and then reverses slightly in France after 2010 (Chart 14). Finally, another recent work on Spain (Santana et al. 2015) links allocation deficiencies to long-standing structural weaknesses. Examining multiple sectors, the study finds that productivity dispersion within sectors – associated with capital misallocation – has been especially large in sectors characterised by more state intervention (e.g. via licencing and regulation). Interestingly, the authors also demonstrate that smaller and newer firms suffered more from market distortions than larger firms.

Chart 14

Developments in capital misallocation in Belgium, Spain, France and Italy in the period 2002-13

(weighted average of sector dispersion in the marginal revenue product of capital by country; index 2002 = 100)
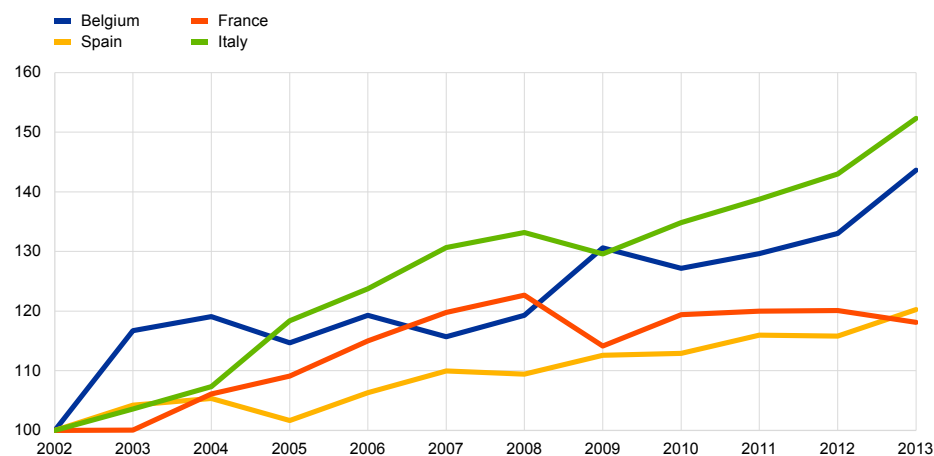
Source: ECB (2017a), based on CompNet data (5th vintage) using firms with 20 employees or more.

Third, the boom-bust cycle hampered productivity during the expansion phase as well as during the contracting phase, which was characterised by a financial crisis and protracted deleveraging. Uncertainty over demand conditions, financial frictions, and also strong risk aversion prevented more productive firms from expanding during the bust phase, thereby impairing resource allocation and TFP dynamics (Bloom et al. 2014, Riley et al. 2015). On the whole, these factors prevailed over the positive TFP impact of Schumpeterian creative destruction and structural reforms, as found by Gamberoni et al. (2016). This was also because bank and regulatory forbearance, as well as inadequate insolvency regimes, were locking capital into low productivity firms that would otherwise have gone out of business. Moreover, collateral's loss of value during this period, coupled with deleveraging requirements, limited the options for otherwise healthy firms to obtain external financing for productivity-enhancing projects. It seems reasonable to assume that these effects were more significant in economies such as Greece, Italy, Portugal or Spain, which were also facing the greatest convergence challenges.

2.4 How did Maastricht convergence evolve?

Another complementary way to measure convergence is provided by the standard economic convergence criteria for euro adoption, known as the Maastricht criteria. In this subsection we explore how Maastricht convergence has evolved since the start of Stage 3 of EMU, i.e. 1999. We focus on developments seen *after* each euro area member had adopted the euro, using the other EU members as a benchmark. We look at convergence in terms of inflation differentials, long-term nominal interest rates and fiscal positions as identified in the TFEU. For both inflation and long-term rates, we use the *reference values* and periods identified in each of the thirteen ECB Convergence Reports produced since 1998. Although, having adopted the euro, Member States are no longer obliged to comply with these values at any point in time, they still provide an indicative yardstick that may be used in the assessment of convergence. With regard to fiscal positions we refer to the excessive deficit procedure (EDP) and compute the number of years a country has been found to run an excessive deficit. Box 3, at the end of this section, explains the relevant Treaty provisions and their application in greater detail.

Looking at price stability from a post-euro-adoption nominal convergence perspective, it is important to have a clear understanding from the outset of the two different concepts of (i) price stability as defined in Article 140 of the TFEU ("Maastricht convergence" price stability) and (ii) price stability from a monetary policy perspective, as defined by the ECB's Governing Council. In this regard, it should, first of all, be borne in mind that the single monetary policy does not – and should not – focus on cross-country inflation differentials, but rather maintains price stability over the medium-term for the euro area as a whole. By anchoring inflation expectations and increasing market transparency, monetary policy facilitates the necessary adjustment of relative prices across different countries or sectors in the presence of economic shocks. Moreover, by maintaining a medium-term orientation in the conduct of its monetary policy, the ECB facilitates the

necessary adjustment of relative prices across regions and sectors in the presence of asymmetric shocks (see, for example, González-Páramo 2005).

Nevertheless, even if the ECB formulates its policy at area level, it is important that it takes into account country-specific and sectoral information regarding the source and nature of economic shocks, which includes monitoring and understanding the underlying reasons for inflation differentials. Lasting cross-country inflation differentials that are the result of misaligned national policies and/or deep-seated structural inefficiencies may be damaging for national economies and may need to be addressed by national policies. In particular, suitable structural policies aimed at enhancing countries' flexibility and their ability to adapt to continually changing conditions in the monetary union are of the essence.

These considerations imply that all euro area members need to fully appreciate that the sustainability of cross-country inflation differentials after adoption of the euro requires each country to be consistent, depending on its economic conditions, with the ECB's objective of price stability over the medium term. This objective – a year-on-year increase in the Harmonised Index of Consumer Prices (HICP) for the euro area that must be below but close to 2% – provides a margin that is sufficient to address the implications of inflation differentials in the monetary union, and avoids euro area members having to deal with, structurally, either too-high or too-low inflation, or even deflation. At individual country level, therefore, consistency with the ECB price stability objective for the whole euro area means it is necessary to avoid unsustainable inflation differentials vis-à-vis the other Member States. This may also create a need for internal devaluation if a country has an overvalued real effective exchange rate (REER), or internal revaluation if a country has an undervalued REER. The concomitance of internal devaluation and internal revaluation in different euro area countries may be justified, especially in cases where the sheer size of REER misalignments requires big changes in relative prices. If these changes were to be achieved by internal devaluation *only*, the ensuing compression of demand in the unbalanced countries would be even greater and would, therefore, add to real divergence in the monetary union.

For these reasons, the "Maastricht convergence" price stability criterion, although different in nature, is a useful complement to the ECB's monetary policy definition of price stability. The two definitions are, at the same time, distinct and complementary in nature. On the one hand, the monetary policy definition of price stability focuses on the euro area as a whole over a medium-term horizon. On the other hand, the convergence definition of price stability focuses on the inflation differentials of euro area Member States over a short-term (one year) horizon, which may be fully justified economically, but should be coherent with sustainable participation in the single monetary policy. The Maastricht Treaty considers this to be the case only if such differentials remain, at the moment of euro adoption, within a set deviation margin from the "best" price stability performers. The question, therefore, arises as to how to identify both (i) the "best performers" and (ii) a meaningful deviation margin in the context of the monetary union. When implementing the Treaty, this question received a normative reply in terms of

assessing whether a country is ready to adopt the euro: the deviation margin was set at 1.5 percentage points above the three non-outlier countries with the lowest inflation in respect of short-term price developments (see Box 3 for the definition of "outlier" and other details). For illustrative purposes Chart 15 below, although it has no normative content, has been constructed mechanically on the basis of exactly the same methodology as that used when the Treaty was implemented[22].

Against this backdrop, from a price convergence perspective our cross-country comparison is based on the number of times (as a percentage) that the average rate of inflation, observed over a period of one year before each convergence examination, has remained within the Maastricht reference value[23]. Accordingly, in the charts shown in this section euro area countries are ordered in relation to the number of times they have remained within each reference value. In particular, in order to compare relative performance across countries a calculation has been made of the number of times (as a percentage) that inflation in each country has been below the reference value (green) or above (red) it across all reference periods.

Chart 15

The Maastricht price stability convergence criterion (1999-2016)
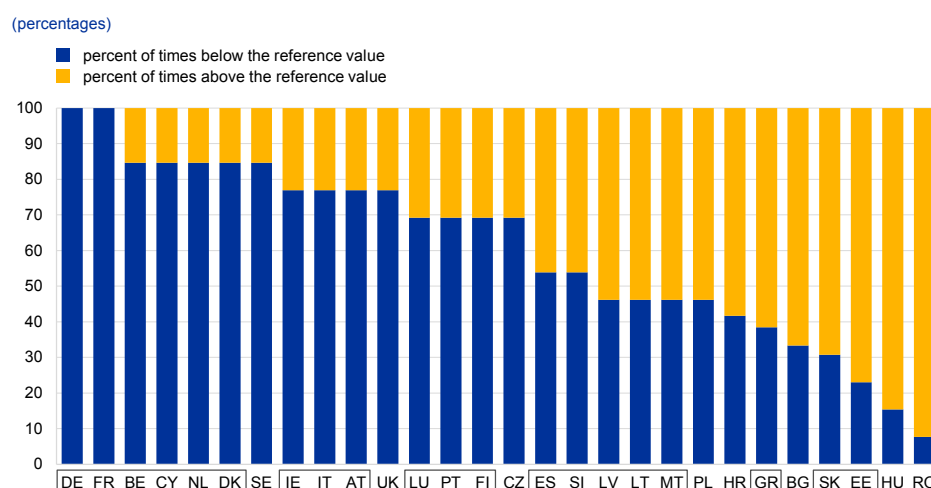
(percentages)

Sources: ECB Convergence Reports since 1998 and authors' own calculations.
Note: See actual outcomes in Annex 1.

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22 It should be emphasised that this approach, while providing useful indications as to the sustainability of cross-country inflation differentials after adoption of the euro, may not necessarily be consistent – at any point in time and for all countries – with ECB monetary policy objectives. The relevance of this caveat may be illustrated by a theoretical example. If we were in an outright deflationary environment (e.g. for the sake of argument, with a euro area deflation rate at -10%), it would make sense – given that price stability is a symmetric concept – to calculate price convergence by inverting the sign of the above-described rule (i.e. the best performers would, in this case, be the non-outlier countries with the lowest *deflation* rate and the deviation margin would have a *negative* sign). While this example is, of course, conjectural in nature, it suggests that a purely mechanical application of the Maastricht rule may not necessarily be correct under *all* circumstances in the monetary union.

23 The same approach is then followed for the other variables scrutinised in this section. Tables 1 to 3 in Annex 1 complement the picture by showing the actual developments of these variables with respect to the reference values and periods following the 1998 ECB Convergence Report.

As Chart 15 shows, price convergence performances vary across euro area countries over time when the Maastricht-based reference value is used as a benchmark. Of the EA12 countries, Greece and Spain appear to be those with the poorest track records, while of the recent euro area members, Estonia and Slovakia show the least satisfactory price stability performances over time. Finally, with regard to the so-called "pre-in" countries in the sample (which do not include Denmark and the UK), the worst relative inflation performances over time have been seen in Romania and Hungary.

Interestingly, however, incomplete price convergence after euro adoption was preceded by a remarkable process of alignment of inflation rates. Chart 16 focuses on the EA12 countries and shows the disciplining effect of the process leading to euro area accession, i.e. the years when price convergence was a compulsory requirement for adoption of the single currency. The standard deviation of inflation rates across the EA12 countries dropped from 5% in 1990, at the outset of Stage 1 of EMU, to around 1% in 1998, and remained low thereafter.

Chart 16
Dispersion in inflation rates among the EA12 countries (1990-2016)

(standard deviation of annual HICP inflation rates, as a percentage)
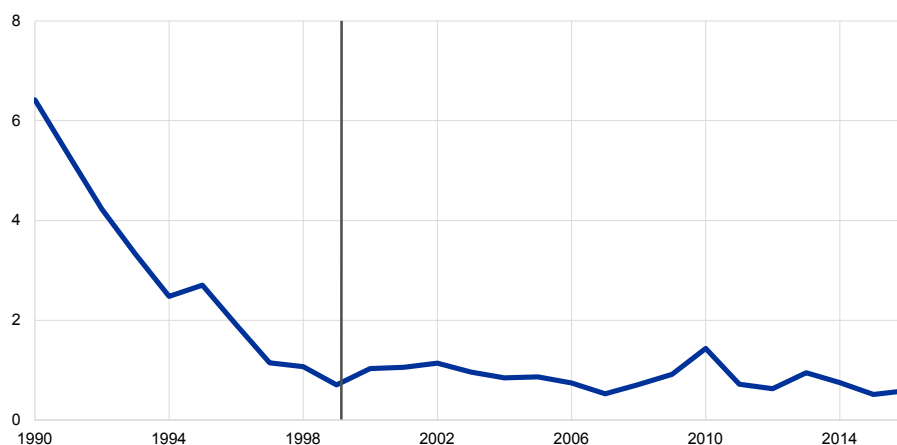
Source: Eurostat.
Notes: HICP available since 1993 for all EA12 countries except Luxembourg, which is included as of 1996. The vertical line denotes the start of EMU's Stage 3.

From an exchange rate perspective, these stylised facts suggest that (i) the size of REER misalignments within the euro area is comparatively low by international standards, also thanks to the pronounced price convergence in the run-up to euro adoption, but (ii) REER misalignments, while relatively small, were persistent in the years following euro adoption due to the insufficient additional progress made on price convergence. Recent econometric analysis confirms this conclusion and, at the same time, qualifies it further. Giordano, Fidora and Schmitz (2017) conducted an econometric analysis moving on from the stylised facts presented in Charts 15 and 16, and conclude that, although REER misalignments across euro area countries are of much smaller *size* than those in countries outside EMU (be these exchange rate peggers or floaters), the opposite is true when it comes to the persistence of such misalignments until
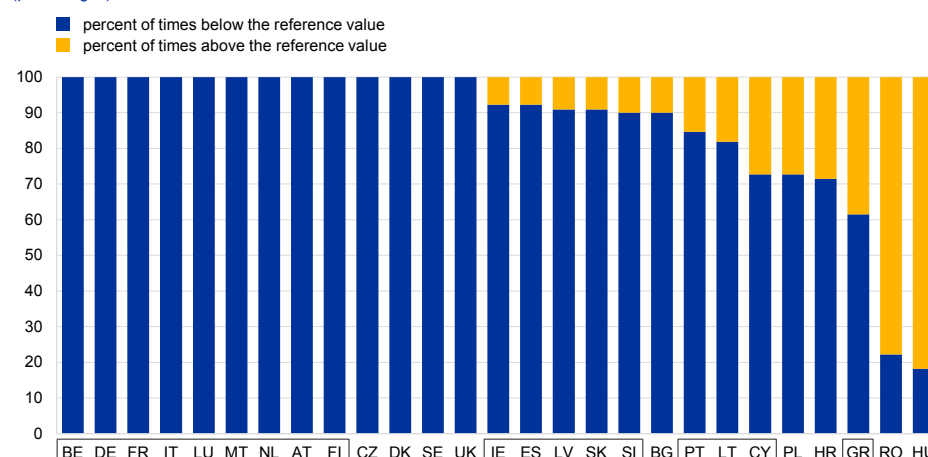
2009. Up until then, REER reactivity to past misalignments had been smaller for euro area countries than for other countries – a result which, as we saw in Section 2.3, was driven by euro area members with unsustainable inflation differentials. However, this has not been the case since the start of the crisis, due to successful internal devaluation in stressed euro area members.

Turning from price stability to the long-term interest rate Maastricht criterion, which is more forward-looking in nature, this appears to have been met by a large majority of countries over the whole sample of Convergence Reports (Chart 17). This probably reflects a relatively lower incidence of country-specific factors in driving long-term government bond yields. Also for this criterion, the worst historical performances have been seen in Hungary and Romania, and, of the euro area countries, in Greece, due to the emergence of debt sustainability concerns since 2010.

Chart 17

The long-term interest rate criterion (1999-2016)

(percentages)

■ percent of times below the reference value
■ percent of times above the reference value

Sources: ECB Convergence Reports since 1998 and authors' own calculations.
Note: See actual outcomes in Annex 1.

The excessive deficit procedure shows a low degree of compliance with fiscal criteria overall (see Box 3). As Chart 18 shows, only three euro area countries, Estonia, Luxembourg and Finland, have recorded nearly full fulfilment of the fiscal criteria. By contrast, EA12 countries such as Greece, Portugal and France have recorded excessive deficits over many years. This is also the case for a number of euro area countries that joined more recently such as Cyprus, Malta and Slovakia. The worst fiscal performance in terms of the EDP, however, has been delivered by four central and eastern non-euro area EU countries, i.e. the Czech Republic, Hungary, Poland and Croatia (only since 2013). As Table 3 in Annex 1 more clearly shows, the global crisis had a major impact on the fiscal discipline position of EU Member States, particularly in the years from 2009 to 2013. It should be borne in mind that the comparison across EU countries with regard to EDP application during the period 1999-2016 is not fully homogeneous since the sample varies according to the year a country joined the EU (e.g. Croatia only joined the EU in July 2013).

Chart 18

Fiscal criteria: the excessive deficit procedure (1999-2016)

(percentages)

■ percent of times not in the EDP
■ percent of times in the EDP
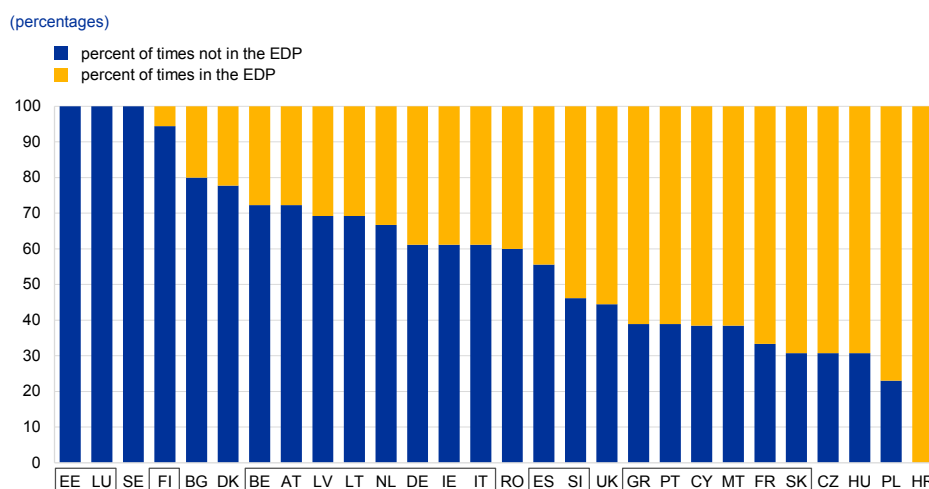
Sources: European Commission and authors' own calculations.
Notes: Applicable only after EU entry. The sample period is not, therefore, fully comparable across all EU countries. Euro area countries are highlighted. See more detailed notes in Annex 1.

Looking back, the Maastricht convergence performance of euro area members after they adopted the euro has been mixed overall, with no country meeting all the criteria set out in Box 3 for the whole period, and some countries (especially Greece) systematically underperforming for all variables. The track record of the standard convergence variables identified in the Treaty (all except the exchange rate criterion – obviously it makes no sense to consider this in a post-euro-adoption context) points, across a large sample of thirteen Convergence Reports since 1998, to underperformance by a number of euro area Member States – in some cases significantly worse than in some pre-in countries. This raises important questions as to why this has been the case and confirms that there is no automatism in the convergence process, which should instead be seen as a continuum before and after the adoption of the euro.

Box 3

Some Treaty provisions regarding the Maastricht convergence criteria

Price developments

Article 140(1), first indent, of the Treaty requires "the achievement of a high degree of price stability; this will be apparent from a rate of inflation which is close to that of, at most, the three best performing Member States in terms of price stability".

Article 1 of Protocol (No 13) on the convergence criteria stipulates that "The criterion on price stability referred to in the first indent of Article 140(1) of the Treaty on the Functioning of the European Union shall mean that a Member State has a price performance that is sustainable and an average rate of inflation, observed over a period of one year before the examination, that does not exceed by more than 1½ percentage points that of, at most, the three best performing Member States in terms of price stability. Inflation shall be measured by means of the consumer price index on a comparable basis taking into account differences in national definitions".

In the convergence reports that have been published by the ECB and the European Commission over time, the notion of "at most, the three best performing Member States in terms of price stability", which is used for the definition of the reference value, has been applied by taking the unweighted arithmetic average of the rates of inflation for the three EU countries which have the lowest inflation and which are not outliers. As noted in the ECB 2016 Convergence Report, "the concept of "outlier" has been referred to in previous ECB Convergence Reports (…). In line with those reports, a Member State is considered to be an outlier if two conditions are fulfilled: first, its 12-month average inflation rate is significantly below the comparable rates in other Member States; and second, its price developments have been strongly affected by exceptional factors. The identification of outliers does not follow any mechanical approach. The approach used was introduced to deal appropriately with potential significant distortions in the inflation developments of individual countries" (ECB 2016).

Long-term interest rate developments

Article 140(1), fourth indent, of the Treaty requires "the durability of convergence achieved by the Member State with a derogation and of its participation in the exchange-rate mechanism being reflected in the long-term interest-rate levels".

Article 4 of Protocol (No 13) on the convergence criteria stipulates that "The criterion on the convergence of interest rates referred to in the fourth indent of Article 140(1) of the said Treaty shall mean that, observed over a period of one year before the examination, a Member State has had an average nominal long-term interest rate that does not exceed by more than two percentage points that of, at most, the three best performing Member States in terms of price stability. Interest rates shall be measured on the basis of long-term government bonds or comparable securities, taking into account differences in national definitions".

Fiscal developments

Article 140(1), second indent, of the Treaty requires: "the sustainability of the government financial position; this will be apparent from having achieved a government budgetary position without a deficit that is excessive as determined in accordance with Article 126(6)".

Article 2 of Protocol (No 13) on the convergence criteria stipulates that "The criterion on the government budgetary position referred to in the second indent of Article 140(1) of the said Treaty shall mean that at the time of the examination the Member State is not the subject of a Council decision under Article 126(6) of the said Treaty that an excessive deficit exists".

Article 126 sets out the excessive deficit procedure (EDP). According to Article 126(2) and (3), the European Commission prepares a report if a Member State does not fulfil the requirements for fiscal discipline, in particular if:

the ratio of the planned or actual government deficit to GDP exceeds a reference value (defined in the Protocol on the EDP as 3% of GDP), unless either the ratio has declined substantially and continuously and reached a level that comes close to the reference value; or, alternatively, the excess over the reference value is only exceptional and temporary and the ratio remains close to the reference value;

the ratio of government debt to GDP exceeds a reference value (defined in the Protocol on the EDP as 60% of GDP), unless the ratio is sufficiently diminishing and approaching the reference value at a satisfactory pace.

2.5   How did institutional quality evolve?

To what extent did institutional quality improve in the euro area after 1999?[24] **Answering this question is not straightforward, with several factors making it difficult to draw a conclusion.** First, as discussed in Section 1.1, the definition of institutional quality adopted in the Five Presidents' Report – the "process towards more resilient economic structures" – focuses on its economic effects, rather than on institutional quality *per se*. This assumes that no institutional model may be presumed to be preferable ex ante. The available indicators, however, try to measure the various dimensions of economic governance directly, possibly implying some measurement bias. Second, when the available indicators are used regarding the quality of institutions, they are often based on perception-based surveys and, as such, may present some distortions. Third, the institutional focus has only gained analytical prominence in recent years and, therefore, this branch of literature still has ample scope for development. Fourth, cross-country approaches to an issue as complex as institutional quality are insufficient, and clearly need to be complemented by country-specific assessments. Fifth, the optimal time horizon required for a proper analysis of institutional quality developments reaches far beyond the less-than-two decades of EMU's existence. All these caveats should be borne in mind when reading this subsection.

Certainly, most of the stressed euro area countries facing greater convergence challenges adopted a wider and deeper spectrum of structural reforms after the onset of the crisis. This is captured by Chart 19, which reproduces the OECD reform responsiveness indicator for 17 EU countries in the period 2011-14. The chart shows that the EA12 countries which underwent an EU/IMF programme were, comparatively speaking, those that were implementing more structural reforms in the period, together with Estonia (OECD 2015 and 2016). These were among the euro area countries with the highest unemployment rates at the beginning of the period. In the same vein, ECB (2015) illustrates that reform efforts since 2010 have concentrated mainly on the countries under stress[25] (Cyprus, Greece, Italy, Ireland, Portugal, Slovenia and Spain), which, to a great extent, were also among those with the largest catching-up needs.

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[24]   See ECB (2016) for a more in-depth analysis of the role of institutional quality in EMU.

[25]   This evidence is in line with the economic literature, which has found that national policymakers are more inclined to implement reforms in times of recessions (see for example, Tomassi and Velasco (1996) and Drazen and Easterly (2001)).

Chart 19

OECD reform responsiveness indicator (2011-14)

(x-axis: unemployment rate in 2010 (percentages); y-axis: OECD reform responsiveness indicator 2011-14)

- ● joined euro area before 2002
- ● joined euro area after 2002
- ● non-euro area EU countries
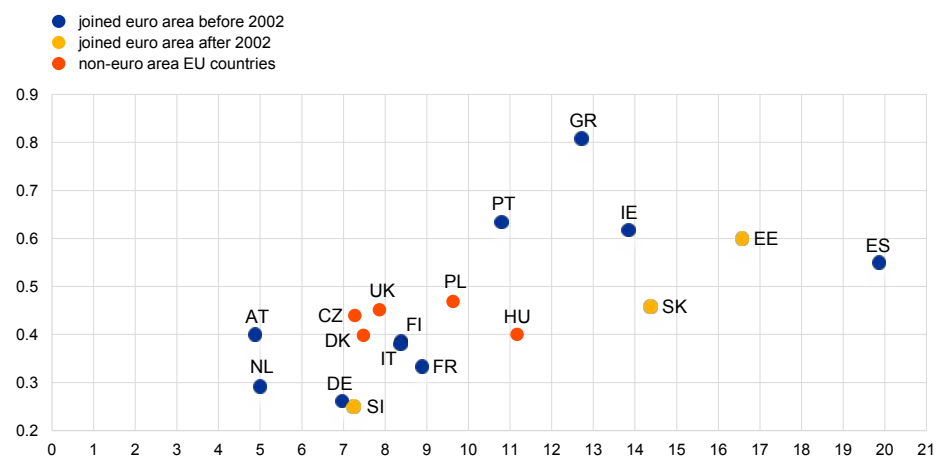
Source: OECD Going for Growth 2016.
Note: The OECD reform responsiveness indicator is a qualitative measure based on a scoring system in which recommendations set in the Going for Growth Report of the OECD take a value of one if significant action has been taken and zero if it has not. Bulgaria, Cyprus, Croatia, Malta and Lithuania are not included because they do not belong to the OECD. Latvia only became a fully-fledged member of the OECD on 1 July 2016, i.e. after the publication of the OECD report in February 2016.

Three considerations, however, mitigate the conclusion that institutional quality has improved strongly in the euro years.

First, an opposing tendency towards institutional divergence had materialised before the crisis, with the pre-crisis bubble discussed in the previous section reducing pressure for reforms in the unbalanced euro area economies. As argued in Fernandez-Villaverde, Garicano and Santos (2013), this happened for two main reasons: the build-up of the bubble (i) lessened the constraints under which agents were acting; and (ii) made it more difficult to glean proper information about who was performing well or badly in each economy, thus causing the reforms to appear less urgent.

Second, despite the progress made since 2010, the scope for institutional progress in the stressed economies is, on an objective basis, still considerable. The ECB (2015) provides evidence pointing to the conclusion that, "even though some euro area countries have made significant progress, indicators show that there is still ample room for further reforms". Similarly, the OECD (2015 and 2016) has identified considerable room for seeking to catch up with the OECD average in several stressed euro area economies, for instance in Greece and Cyprus in respect of product market regulations, or in Italy and Spain with regard to active labour market policies, e.g. in relation to the skill levels of their workers in terms of literacy and numeracy.

Third, evidence suggests that, even after 2010, divergence has increased with regard to certain dimensions of institutional quality. Papaiannou (2016) shows that, in spheres as important as the rule of law and the control of corruption, the quality of institutions has, if anything, diverged in several stressed euro area

countries from that in core countries since the launch of the euro[26]. Even in the post-crisis environment, Papaiannou argues, there were forces pushing towards institutional divergence in certain spheres. For instance, the courts operated with greater delays and their ability to deal with bankruptcy and insolvencies deteriorated as a result of the worsening economic conditions. As can be seen in Charts 20 and 21, the available World Bank[27] indicators for, respectively, regulatory quality/rule of law and control of corruption confirm this finding. In both cases, the euro area countries for which this indicator has worsened or not significantly improved since 1998 typically include the stressed economies. In fact, it is striking that for the period 1998-2015 there was practically no improvement in Portugal and even some deterioration in Greece, Spain and Italy. Conversely, some of the new euro area members, particularly the Baltic states, have recorded notable improvements, albeit starting from a relatively low indicator.

Chart 20

Worldwide Governance Indicators of Regulatory Quality and Rule of Law

(initial indicator versus cumulative change; horizontal axis: indicator in 1998; vertical axis: difference in the indicator 1998-2015)

- joined euro area before 2002
- joined euro area after 2002
- non-euro area EU countries
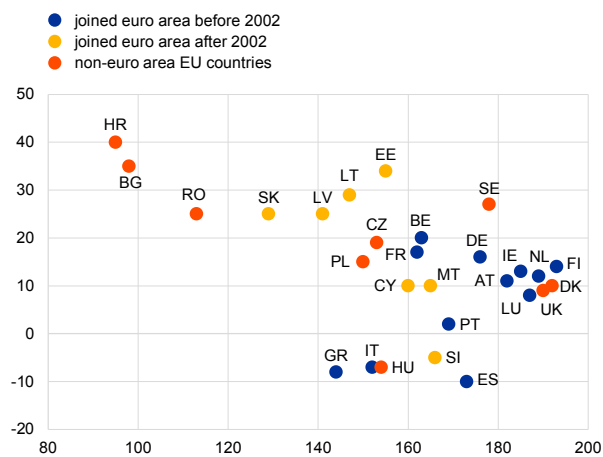
Source: World Bank.
Notes: The chart shows the unweighted average of the Regulatory Quality and Rule of Law governance indicators. The higher the indicator, the better the relative performance. The comparison may be distorted by breaks in the sample.

Chart 21

Worldwide Governance Indicators of Control of Corruption

(initial indicator versus cumulative change; horizontal axis: indicator in 1998; vertical axis: difference in the indicator 1998-2015)

- joined euro area before 2002
- joined euro area after 2002
- non-euro area EU countries
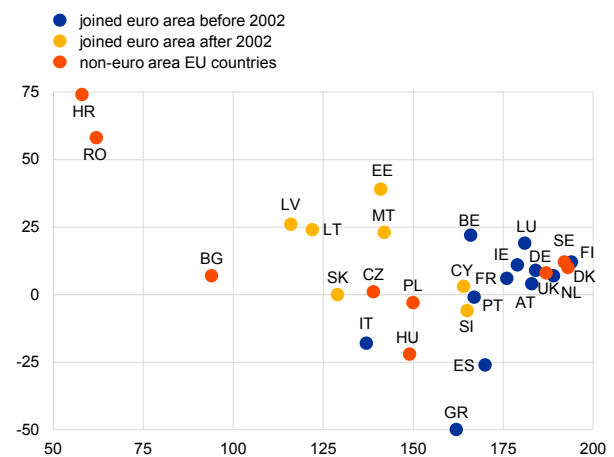
Source: World Bank.
Notes: The chart shows the Control of Corruption indicator. The higher the indicator, the better the relative performance. The comparison may be distorted by breaks in the sample.
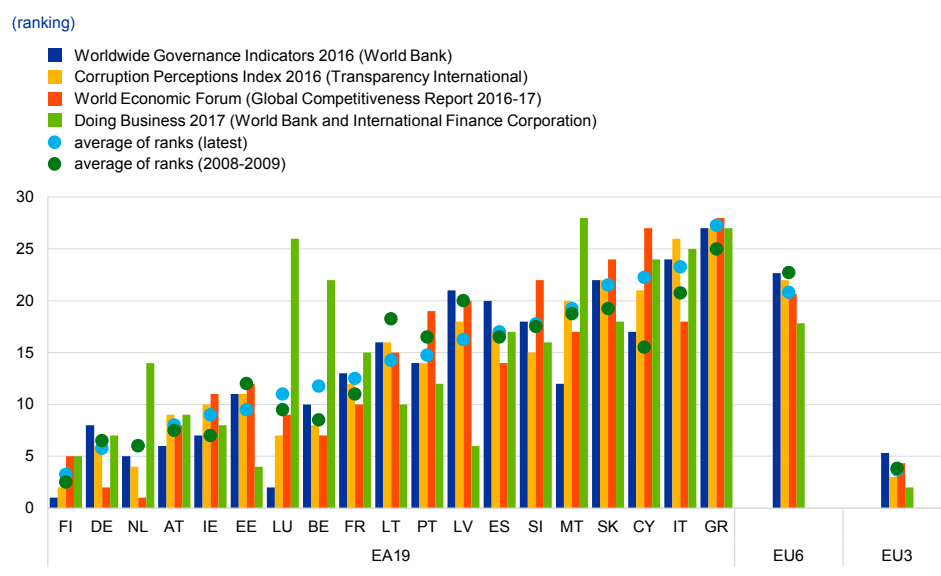
An important final consideration relates to the fact since the crisis there has been a generally increasing perception that additional institutional progress is required. This need, of course, was already present at the start of monetary union. Its perception, however, has undoubtedly been amplified by the severity of the crisis in recent years, which might have distorted the measurement of institutional quality. This factor may aid our understanding, together with the three

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[26] More specific indicators such as legal quality, court efficiency, red tape in product markets, and ease of registering property also point in the same direction (Papaiannou 2016).

[27] The Worldwide Governance Indicators (WGI) project reports aggregate and individual governance indicators for over 200 economies over the period 1996-2015 for six dimensions of governance. These aggregate indicators combine the views of a large number of enterprises, citizens and expert survey respondents in industrial and developing countries. They are based on over 30 individual data sources produced by a variety of survey institutes, think tanks, non-governmental organisations, international organisations, and private sector firms.

other considerations discussed above, of the disappointing pointers drawn from Chart 22. In this "catch-all" chart we have reproduced a wide range of institutional indicators[28] available from 2008-09 until 2016, and calculated the relative positions of the 28 EU Member States for these indicators. The chart shows that even though some countries attempted to enact reforms after the crisis, a number of stressed economies' overall institutional quality positions in the EU remained unchanged (Spain), worsened marginally (Greece, Italy), or even deteriorated significantly (Cyprus). In the same vein, Chart 23 focuses on the Worldwide Governance Indicator for countries which underwent an EU/IMF programme and shows, quite surprisingly, an overall worsening in this indicator since the start of the programme in the case of three countries (Greece, Ireland and Spain), with a clear improvement shown only for Latvia. Looking at GDP per capita, however, Chart 24 shows that, with the single exception of Greece, all these countries recorded a rebound in their income per capita at some point after the start of the programme.

Chart 22

Institutional progress/regression: ranking of euro area/EU Member States

(ranking)

■ Worldwide Governance Indicators 2016 (World Bank)
■ Corruption Perceptions Index 2016 (Transparency International)
■ World Economic Forum (Global Competitiveness Report 2016-17)
■ Doing Business 2017 (World Bank and International Finance Corporation)
● average of ranks (latest)
● average of ranks (2008-2009)

Sources: World Bank (Worldwide Governance Indicators 2016), Transparency International (Corruption Perceptions Index 2016), Global Competitiveness Report 2016-17 (World Economic Forum), and World Bank and International Finance Corporation (Doing Business 2017).
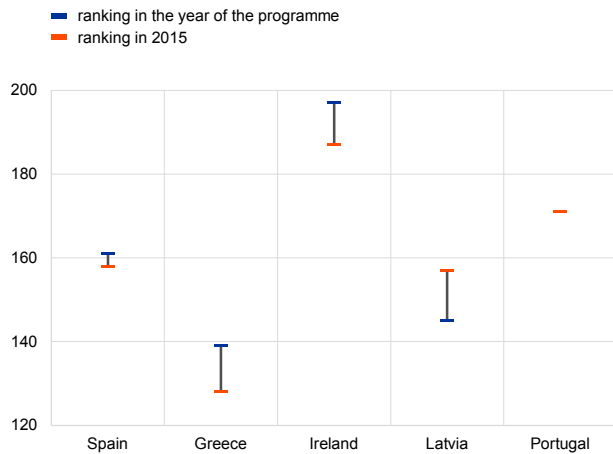Notes: Countries are ranked from one (best performer in the EU) to 28 (worst performer in the EU) and ordered according to their average position in the rankings. The comparison with previous years could be affected by changes in the surveys. EU6 represents the unweighted average of Bulgaria, the Czech Republic, Croatia, Hungary, Poland and Romania, while EU3 represents the unweighted average of Denmark, Sweden and the United Kingdom.

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28 The indicators used in Chart 22 are produced by various international organisations in the following reports: the Worldwide Governance Indicators (World Bank Institute), the Global Competitiveness Index (World Economic Forum), the Corruption Perception Index (Transparency International) and the Ease of Doing Business Report (International Finance Corporation and World Bank). These indicators provide mostly survey-based qualitative information and, in some cases, they reflect perceptions rather than observed facts. Nevertheless, taken as a whole, they summarise a broad set of highly relevant information regarding the quality of the institutional environment.

Chart 23

Change in the Worldwide Governance Indicator in
some programme countries
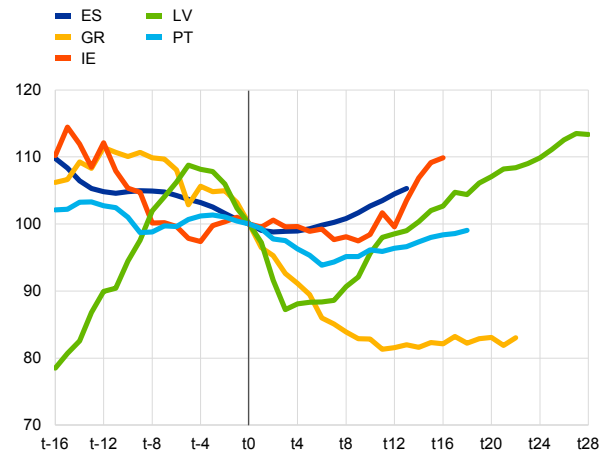
(2015-year of the programme)

— ranking in the year of the programme
— ranking in 2015

Chart 24

Comparison of real GDP per capita levels in some
programme countries

(index, t0=beginning of the programme)

— ES — LV
— GR — PT
— IE

In conclusion, there is scope for further improvement in institutional quality.
The jury is still out on the extent to which the process leading to more resilient and
better-functioning institutional structures has taken shape in the euro area since the
start of monetary union. The most robust deduction that may be drawn from the
stylised facts presented in this section is, probably, that there is still significant scope
for additional progress in institutional quality in some euro area countries. This
conclusion as to scope will be complemented, in Section 3.4, by an analysis of the
need for institutional improvements as a key precondition before sustainable
economic convergence can be achieved in the euro area.

2.6   Why focusing only on the euro years is missing the point

**As seen previously, the financial cycle had a profound impact on convergence
patterns after the launch of the euro and the launch of the single monetary
policy in 1999.** The strong increase in debt levels in some countries during the
upswing phase of that cycle contributed to stronger growth in low-income countries,
while the deleveraging process and the deep macroeconomic adjustment contributed
to strong divergence after 2008.

**However, it is not sufficient to focus only on the euro period in order to
understand the drivers of convergence, which are, to a great extent,
longer-term and more structural in nature.** *First*, as we have seen, the strong
financial cycle contributed to a large-scale misallocation of resources not just in
isolation, but in combination with long-standing structural weaknesses in the
stressed countries facing convergence challenges, for which details will be provided

in Section 3. *Second*, TFP growth – the main driver of growth in the long run – had been significantly underperforming the EU15 average in several euro area countries before the introduction of the euro, for instance in Italy since the early 1980s (and then, more markedly, in the mid-1990s), or in Spain since the 1990s (see Chart 25). The emergence of a strong financial cycle in countries such as Spain in the 2000s simply concealed the consequences of this weak productivity growth for a few years. As for Italy, it posted a very weak long-term growth performance even without the legacy of a credit-driven boom-bust cycle. In Italy, the level of income per capita had already started to decline towards the level of lower-income euro area countries in the mid-1990s, reflecting its disappointing TFP growth performance. *Third*, the case of Ireland – where there had been a very strong financial cycle and a classic boom-bust cycle in the 2000s – proves the importance of having a sound underlying long-term growth model. Following a V-shaped adjustment process, Ireland has posted a very powerful recovery since 2014. Even by 2015, Irish GDP per capita had exceeded its pre-crisis level (and this even before the GDP data revision of July 2016, which reflected a level shift in GDP due to factors related to the activities of multinational companies). The cases of Spain, Italy and Ireland, as well as those of Greece and Portugal, will be reviewed in Section 3.2 in greater analytical detail. *Fourth*, it would be equally erroneous to argue that the single currency added to the productivity slowdown in countries with positive inflation differentials through the negative impact of REER appreciation on foreign demand[29]. *Fifth*, the analyses identifying the euro as "the culprit" ignore the fact that several global shocks occurred around the same time the single currency was launched, ranging from the emergence of China in the world economy and its participation in the WTO to the rise of global value chains, and from intense technological innovation and robotisation in several spheres to the "uberisation" of services. The poor convergence performance of the EA12 may well have been due to the inability of certain countries to adjust to these shocks, which are unrelated to the euro.

It is, therefore, essential to analyse past developments over a longer time horizon, paying greater attention to structural factors. This will be discussed in Section 3.

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[29] In respect of the assumption that there is a link between aggregate demand and productivity, Monacelli (2017) identifies several facts which contradict this possible argument. For instance: (i) the unsustainable inflation differentials materialised only in the pre-crisis years, whereas the productivity slowdown also continued thereafter; (ii) the very same countries also incurred a positive demand shock in the early 2000s due to the emergence of very low real interest rates, so it is difficult to argue that as the overall demand shock was so strong it affected productivity significantly; and (iii) contrary to predictions, the productivity slowdown occurred more in the non-tradable service sectors than in the tradable manufacturing sectors.

Chart 25

Total factor productivity in selected EU countries, 1980-2016

(Index 1980 = 100)

- EU15
- Germany
- Spain
- Italy
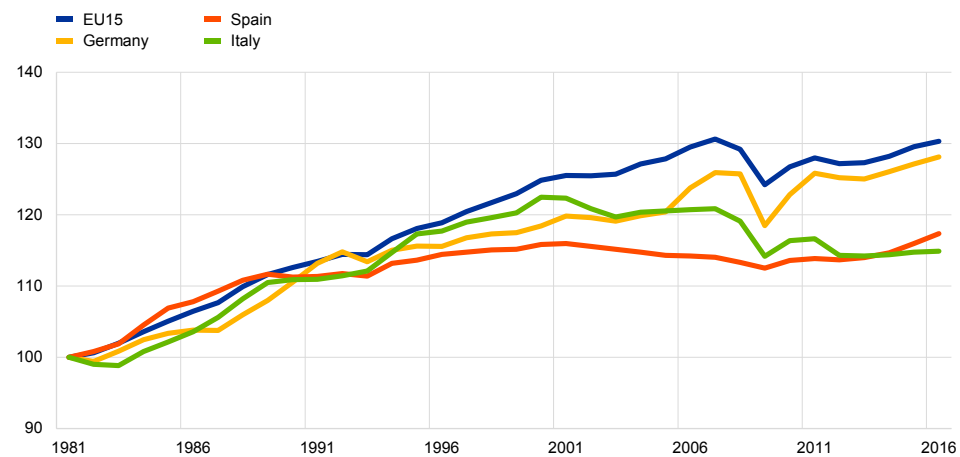
Source: European Commission.
Notes: Data on Germany relate to West Germany until 1990. The EU15: countries that had joined the EU by 1995.

3   The need to take a long view on convergence in the euro area

What drives real convergence in the long run? How country-specific rather than common in type are the determinants of convergence? What lessons may be drawn from the experience of European countries from the 1960s to today? What is the long-run relationship between real and price convergence? What roles do factors such as productivity, demographics, labour market structure, and institutional quality play? First we provide a broad overview of the European experience of real convergence since the 1960s (Section 3.1). Then we look deeper by focusing on three aspects: (i) the components of GDP per capita which are at the root of real convergence (Section 3.2), and how real convergence interacts, in the long run, with (ii) price convergence (Section 3.3) and (iii) institutional quality (Section 3.4).

3.1   Real convergence since the Treaty of Rome: an overview

For the sixty years that have followed the signing of the Treaty of Rome in 1957, the process of real convergence in Europe has been characterised by phases of economic convergence and divergence. In reviewing these phases, we look first at indicators for countries taken as a whole, before identifying individual countries or subgroups of countries.

Focusing first on sigma convergence[30] and looking at two broad country groupings for which long-term time series are available – the euro area countries which had adopted the euro by 2002 and the Member States which had joined the EU by 1995 (the EA12 and the EU15) – five periods can be identified. As Chart 26 shows, the *first period* features strong convergence and runs from the establishment of the European Economic Community (EEC) in 1958 to the first oil crisis in 1973-74. This phase was characterised both by strong economic growth in Western Europe and by the gradual setting-up by the six EEC founding members of a free trade area and a customs union[31], which were completed in 1968, and then extended to Denmark, Ireland and the United Kingdom in 1973. During the *second period* (1974-1985), the standard deviation of GDP per capita from the EA12 and EU15 averages did not show any clear trend, i.e. real convergence stalled in each of these two groups. In the *third period* (1986-1992) the process resumed and turned out to be as dynamic as it had been in the 1960s. This short phase coincided with the signing, in 1986, of the Single European Act, aiming to establish the EU

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[30]   As explained in Section 1.1, σ-convergence refers to the reduction in the dispersion of income levels across countries, regardless of whether this is combined with catching-up by lower-income economies.

[31]   A free trade area is an area in which tariffs and quotas are abolished for imports from area members, while a customs union is a free trade area setting common tariffs and quotas (if any) for trade with non-members.

Single Market[32], which was launched on 1 January 1993. Developments in the *fourth period* (1992-2007) are more nuanced, and on the whole no clear sense of direction is detectable. These years were characterised, from a European institutional perspective, by two major developments: (i) the entry into force of the Maastricht Treaty on 1 November 1993, which involved, inter alia, the institutionalisation of nominal and legal convergence and the creation of the EU; and (ii) the launch of the euro and the single monetary policy in 1999. This suggests that, apart from specific trends in individual countries, none of these two major events, by itself, unambiguously triggered – as is sometimes argued – a phase of divergence in the EA12/EU15 taken as a whole. The real turning point was, instead, the onset of the global crisis in 2008, which marked the start of an unprecedented phase of pronounced GDP per capita divergence[33] – the *fifth period* that is still under way at the time of finalisation of this paper (although the robust and broad-based recovery recorded most recently in the euro area may herald the start of a sixth, more favourable phase). As a result, the degree of sigma convergence in the EA12 (and, to a lesser extent, the EU15) is currently comparable with that of the mid-1980s, and shows a clear reversal of the progress made since then. Nonetheless, the pronounced divergence that was particularly noticeable in the period 2010-12 seems to have ceased, with some tentative signs of reversal visible since 2014.

Chart 26

Sigma real convergence in the EA12 and the EU15: a long-term perspective

(standard deviation in GDP per capita)
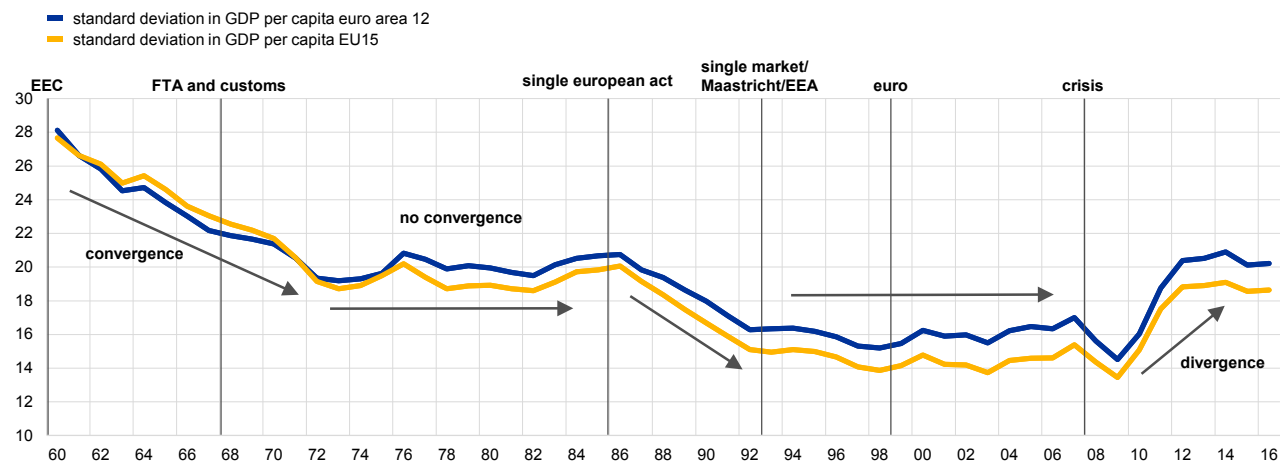
Source: European Commission.
Notes: Sigma convergence refers to the degree of dispersion of GDP per capita levels across economies. GDP per capita in PPS. EA12 denotes the countries that had adopted the euro by 2002, EU15 the countries that had become EU members by 1995. Luxembourg is excluded from the country sample. Data for Ireland are adjusted in order to control for the exceptional GDP revision in 2015, which did not reflect an actual increase in economic activity. Data for Germany are approximated by data for West Germany over the period 1960-1991. EEC: European Economic Community; FTA: Free Trade Area; EEA: European Economic Area.

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[32]   The EU Single Market (also known as the common or internal market) is a customs union in which non-tariff barriers to trade and restrictions on the movement of labour and capital are abolished.

[33]   Since the chart shows sigma convergence, at the very beginning of the fifth period there was a temporary spike in convergence due to the global shock that hit all countries, thus producing an unwelcome "catching-down".

Turning to beta convergence[34], it is broadly confirmed that some convergence took place until the onset of the global crisis in 2008. As may be seen in Chart 27, there is some evidence of convergence among the EA12 countries for the whole of the period 1960-2016. However, when the period after the global crisis is excluded, i.e. the period since 2008, the pattern of convergence among EA12 countries becomes clearer. This confirms the findings previously discussed for this long period with regard to sigma convergence. Beta convergence can be assessed more formally through the application of a simple bi-variate cross-country linear regression, where the average annual change in per capita income is regressed on the initial per capita income level. The coefficients obtained, as explained in detail in Box 4, confirm the results shown in Charts 26 and 27.

Chart 27
GDP per capita relative to the EA12, initial level versus cumulative change (1960-2007, 2007-2016 and 1960-2016)

(GDP at current prices per capita in PPS; EA12 = 100; x-axis: initial level; y-axis: cumulative change in the level)
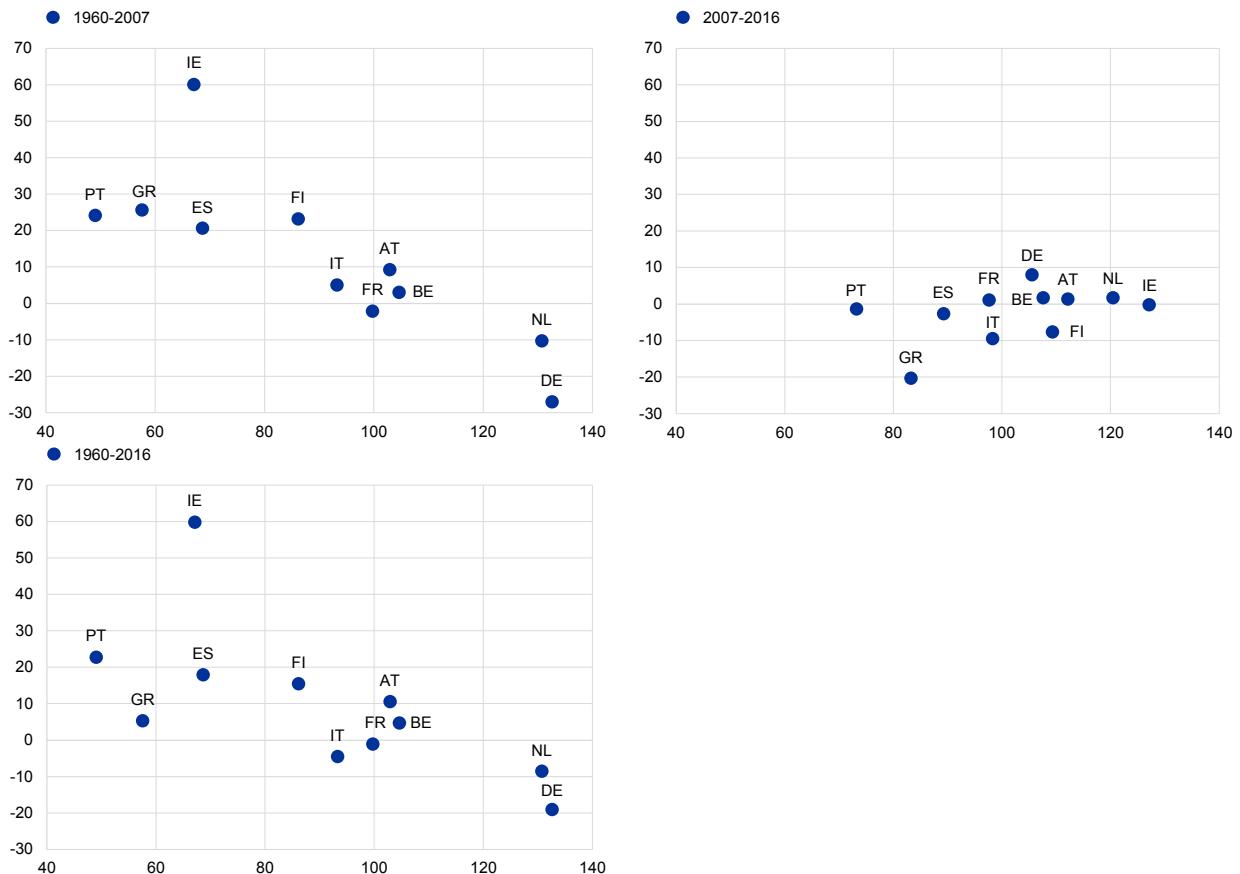
Sources: European Commission and the ECB.
Notes: Luxembourg is excluded because GDP per capita computations are distorted by the high numbers of cross-border workers. Data for Ireland are adjusted to control for the exceptional GDP revision in 2015, which did not reflect an actual increase in economic activity. Data for Germany are approximated by data for West Germany over the period 1960-1991.

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[34] As explained in Section 1.1, β-convergence occurs when lower-income economies grow faster than higher-income economies.

Focusing on just the monetary union does not seem, therefore, to provide a sufficient understanding of real convergence trends in the euro area. This is confirmed when we shift the focus to country-specific real convergence trends. Looking in detail at the five euro area countries discussed in Section 2 (Greece, Ireland, Italy, Portugal and Spain), it can be seen that their long-run process of real convergence has idiosyncratic features which date back to the years, or even the decades, preceding the adoption of the euro. This conclusion is supported by Chart 28 below, where Greece and Ireland are at opposite ends of the convergence spectrum.

Chart 28

Historical developments in GDP per capita in some euro area countries

(GDP per capita in PPS; EU15 = 100)
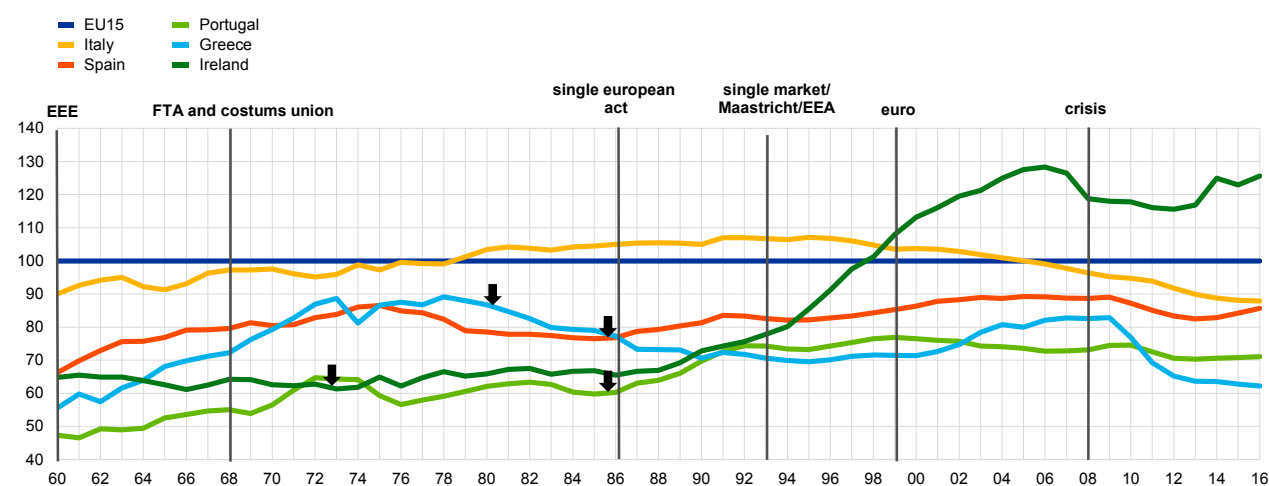
Source: European Commission.
Notes: Arrows denote dates of EU entry. For Italy, no entry date is indicated as this country is a founding member. In the case of Ireland, data are adjusted to control for the exceptional GDP revision in 2015, which did not reflect any actual increase in economic activity.

The experience of Greece suggests that macroeconomic stabilisation may not be sufficient to deliver real convergence on a sustainable basis, unless it is supported by an adequate level of institutional quality. Greece was a successful catching-up economy in the 1960s, but the trend had already reverted by the second half of the 1970s. As discussed in Graham and Nicolaïdis (1997), GDP per capita at the beginning of the 1970s was close to the EU15 average, and comparable with that of Italy. Average real GDP growth in the country, led by the shipping industry, was as much as 7.7% between 1960 and 1973, in comparison with 4.7% for the EU15. This process halted for the rest of the 1970s and then subsequently reversed. In the 1980s and during the first half of the 1990s a surging fiscal deficit, driven by indiscriminate hiring in the public sector, led to the crowding out of private investment. Inflation and the current account deficit increased dramatically; competitiveness was impaired. In light of these negative domestic developments, Vamvakidis (2003) takes the view that the opening up of uncompetitive domestic industry may have been too sudden. As a result, GDP per capita dropped from around 90% to 70% of the EU15 average. The process of divergence bottomed out in the second half of the 1990s, reflecting sounder macroeconomic policies (including a significant fiscal stabilisation) in view of the country adopting the euro.

Unfortunately, this temporary stabilisation of macro policies was not combined with an overhaul of economic institutions, such as easing the extremely rigid and distortive labour and product market regulations. This aids our understanding, at least partly, of why convergence in the early 2000s – driven by sectors such as shipping, tourism and the financial industry – proved unsustainable. The opportunities offered by much more favourable financing conditions due to participation in the monetary union were wasted, as discussed in Section 2.3. The ensuing "fiscal bubble" and consumer-led growth proved unsustainable. It should be stressed, however, that the crisis that began in 2010 led relative GDP per capita dynamics back to a trend which had already been in place two decades earlier[35]. This confirms how long-standing and deeply rooted the country's economic weaknesses are.

Ireland provides an opposite case study to that of Greece. Ireland's remarkable, albeit fairly late, catching-up (which started towards the end of 1980s) demonstrates that the convergence of a country that enjoys relatively satisfactory institutional quality can be held back for a long time in the absence of sound macroeconomic policies. When the country joined the EU in 1973 its GDP per capita was only about 60% of the EU15 average. It remained quite flat in relative terms until 1987, when it started to surge at a remarkable pace due to factors such as the abandoning of economic nationalism in favour of economic and financial openness, a very favourable regime for inward-oriented foreign direct investment (FDI), sounder macroeconomic policies, investment in education and infrastructure, as well as demographics (e.g. Dorgan 2006). In the case of Ireland, in contrast to Greece, a number of institutional essentials were already in place well before the end of 1980s, when a period of extremely rapid convergence began. The degree of economic governance was already relatively high in the 1970s: for example, universal, free secondary education, which is an important factor supporting long-term growth, had already been introduced by 1967. Growth, however, could not have taken off without the stabilisation of macro (in particular fiscal) policies that was only achieved at the end of the1980s. By the late 1990s, GDP per capita was increasingly outpacing the EU15 average, a process which lasted until the onset of the crisis in 2007-2008. Interestingly, Ireland's GDP per capita's growth trend has returned to levels last seen in the 1990s. The boom-bust period between 2004 and 2013 did not alter that trend, although it showed how sensitive the economy is to external conditions and procyclicality. Any understanding of Ireland's convergence requires, therefore, taking a longer-term perspective. Emphasis should be placed not only on the positive changes made to the Irish growth model since the late 1980s but also on how to address the related downside risks.

Finally, also trends in Italy, Portugal and Spain – although not as "extreme" as those in Greece and Ireland – make a clear case in favour of taking a long-term approach to convergence. In the post-WW2 period *Italy* underwent a process of gradual but significant catching-up, with its GDP per capita slightly exceeding the

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[35]   Fernández-Villaverde et al. (2013) argue that there are signs are that this negative process is now once again slowly coming to an end, and is about to reverse.

EU15 average from the 1980s before peaking in the mid-1990s. Since then (i.e. since before it adopted the euro), however, a divergence phase has taken hold, and does not yet appear to have clearly reversed. Attributing such a development to adopting the euro, rather than to economic fundamentals and policies over the previous decades seems, once again, short-sighted, as we will discuss in more detail in the next section. Portugal and Spain, for their part, experienced a process of "gentle catching-up" after joining the EU in 1986, which came to a halt in the second half of the 1990s in Portugal and the second half of the 2000s in Spain. This process was reversed during the euro area crisis (which affected the two countries particularly severely), but has been under way again in Spain since 2014.

Chart 29

Historical developments in GDP per capita relative to the EU15 average: CEE euro area and non-euro area countries

GDP per capita in PPS

(EU15 = 100)
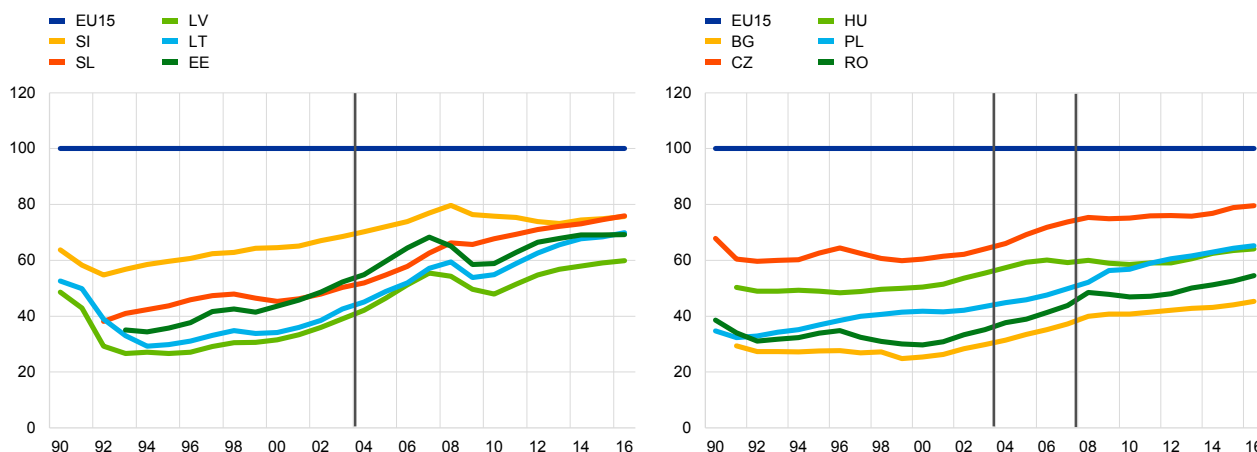
Source: European Commission.
Notes: The vertical dotted line denotes the year countries joined the EU (i.e. 2004 for SI, SK, LV, LT, EE, CZ, HU and PL, and 2007 for BG and RO). Croatia is not shown in the chart as it only became an EU member very recently, in July 2013.

A brief inspection of real GDP dynamics in the new EU Member States leads to the same conclusion, i.e. that euro adoption vs. euro non-adoption was not the main driver of real convergence. This is shown in Chart 29, which highlights real convergence since the 1990s (i.e. the decade from when evidence is available for these economies). Four countries which introduced the euro (Slovakia and the three Baltics), as well as one country which did not (Poland), have experienced the most significant catching-up performance – and this not only towards the average GDP per capita of the EU15, but also when compared with the two CEE countries with the highest income at the beginning of the 1990s (i.e. the Czech Republic and Slovenia). Real convergence materialised in the Baltics and Romania despite the boom-bust episode, whereas it was more linear in Slovakia and Poland. For all economies in the region, the transition toward a market economy and the integration into global value chains, alongside the incorporation of the *acquis communautaire*[36], seem to have

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[36] *Acquis communautaire* is the accumulated legislation, legal acts, and court decisions which constitute the body of European law.

played a much more important role than the introduction of the euro as such. This in part reflected the fact that the harmonisation of business conditions and economic institutions towards those of the more developed countries in Europe increased the attractiveness of the CEE region for foreign capital, which helped to accelerate its convergence. The remarkable convergence performance of the Baltics countries (Lithuania, Estonia and Latvia) over this period is explained in more detail in Box 5 at the end of this section.

Neither euro adoption nor the choice of a fixed vs. floating exchange rate regime seem to have played a central role in driving real convergence. Some stylised facts supporting this conclusion are presented in Chart 30, which divides new EU Member States into two groups: exchange rate targeters and inflation targeters. During the period considered, i.e. from 2004 to 2016, these two groups of countries displayed virtually the same performance in terms of GDP per capita growth, although GDP growth volatility was much higher in the exchange rate targeting group.

Chart 30
Is the exchange rate regime relevant to real convergence?

Exchange rate regime, GDP per capita growth and output volatility in selected new EU Member States

(percentages; average 2004-2016)

- exchange rate targeting
- inflation targeting
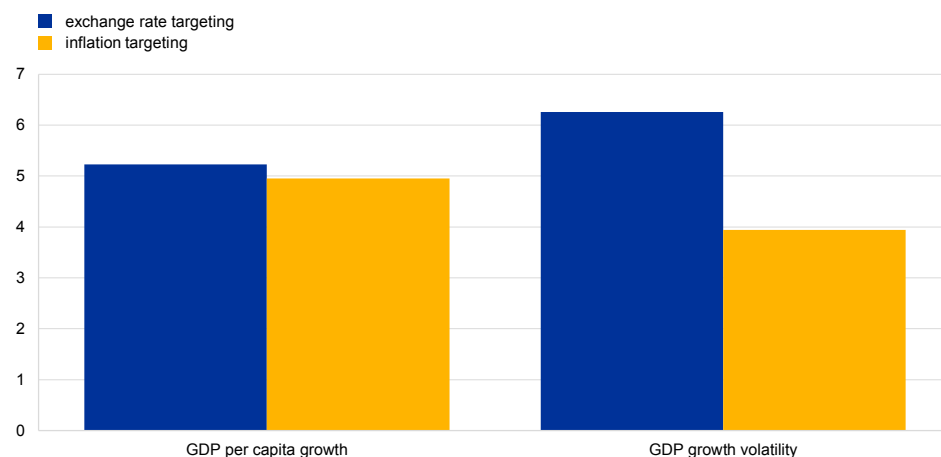
Sources: European Commission and ECB.
Notes: Exchange rate targeting countries: BG, LT, LV and HR (N.B. LV and LT adopted the euro in 2014 and 2015 respectively); Inflation targeting countries: PL, HU, RO and CZ. Averages in unweighted terms.

In several countries, a catalyser of real convergence seems to have been, rather than euro adoption or choice of exchange rate regime, the implementation of the *acquis communautaire* during the process of EU accession. As shown in Chart 31, real convergence accelerated in both Portugal and Spain after they joined the EU in 1986. This also occurred during and after the phase of *acquis communautaire* enactment in new EU Member States, whose transition process had begun in the 1990s (EU8 and EU2 in the chart). Ireland and Greece, however, were clear outliers, for the reasons discussed above.

Chart 31

Real convergence in selected countries before and after EU entry

EU entry = t

(GDP per capita in PPS, EU15 = 100)
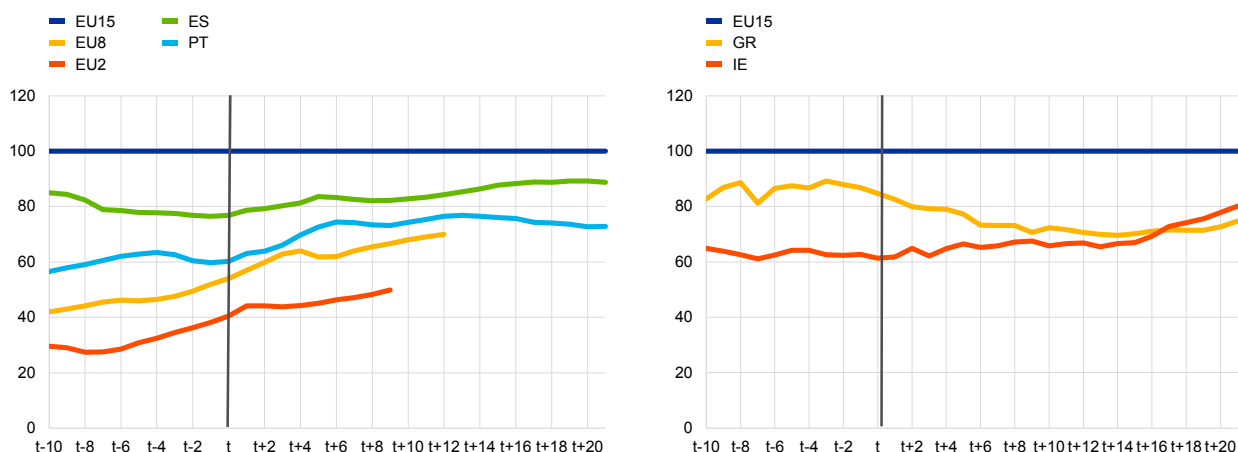
■ EU15 ■ ES
■ EU8   ■ PT
■ EU2

■ EU15
■ GR
■ IE

Box 4

A test of β-convergence

Beta convergence can be assessed through the application of a simple bi-variate cross-country linear regression, where the average annual change in per capita income is regressed on the initial per capita income level (in PPS) for each decade over the period 1960-2016. The period since 2000 can be split into pre-crisis and post-crisis periods (2001-2007 and 2008-2016). The sample covers all EA12 countries, excluding Luxemburg.

More formally:

$$\Delta y i, t + 1, t + T = \alpha + \beta y i, t + \varepsilon i, t;$$

where Δyi,t+1,t+T refers to the average annual growth of per capita income levels between t+1 and t+T (approximated as log-difference); while yi ,t , refers to the initial income level in purchasing power standards and in natural logarithm.

A negative β coefficient in this regression is consistent with the hypothesis of convergence, suggesting that a higher initial income level is associated with lower growth in per capita income in the subsequent period. Conversely, a positive coefficient suggests divergence, where countries with a higher initial income level tend to grow faster.

This simple test of convergence reveals that divergence (a positive β coefficient) is only observed in the period 2008-16, i.e. during and after the crisis, when the correction of severe macroeconomic imbalances took place, especially in the lower income EA12 countries (see Chart A). In each sub-period between 1961 and 2007 a negative β coefficient signals convergence. The negative slope coefficient is especially large in the 1960s, giving a clear signal of convergence, when the three countries with the lowest initial income level at that time, i.e. Greece, Portugal and Spain, posted the highest growth among the EA12. The β coefficient is, similarly, large and negative in the

1990s. In that decade however, this reflected, to a great extent, the extremely fast convergence of Ireland, although the average per capita income growth of Portugal and Spain was amongst the highest in the EA12 in that period.

Chart A

β coefficients of the cross-country linear regression of the EA12 countries' per capita income growth on initial income levels in different sub-periods between 1960 and 2016

The pattern of convergence and divergence suggested by the β coefficients over time is broadly in line with the pattern of sigma convergence shown in Chart 26.

Box 5

Convergence in the Baltic states

The Baltic states have been able to maintain an impressive rate of convergence towards average EU per capita income over the past 20 years. Despite the severity of the crisis that followed the financial cycle-driven boom (from around 2004 to 2007), the Baltic states managed to converge further after the major adjustment of imbalances in 2008-09. This box reviews the long-term performance of Estonia, Latvia and Lithuania.

The Baltic states are very small. They jointly represent only 0.4% of euro area GDP and 1.8% of the euro area population. The three countries joined the EU in 2004 with per capita income of, on average, 44% of that of the euro area. Since they joined the EU, the three countries have each pursued a strongly free-market and pro-business economic agenda, although they accumulated severe imbalances in the period leading up to the outbreak of the financial crisis in 2008. The economic adjustment which followed the 2008 financial crisis was sudden and extremely fast. Estonia had already adopted the single currency by 2011, meeting all the Maastricht criteria and benefiting from a very sound fiscal position in spite of the severe macroeconomic adjustment that was taking place. Latvia and Lithuania joined the euro in 2014 and 2015 respectively.

The three countries are different in many ways, although they share a number of key features: very high levels of trade and financial openness, as well as very high labour mobility; high economic flexibility with wage bargaining mainly at firm level; relatively good institutional framework conditions; and low levels of public debt (Table A). Most of these features are generally considered to support real convergence. At the same time, the high level of openness of these countries has also been a source of macroeconomic vulnerability and specific policy challenges. In particular, managing the business cycle against a backdrop of volatile capital flows has proved challenging.

Table A

Selected country features in 2015

	Trade openness (ratio of exports and imports to GDP)	Financial openness (percentage of foreign branches in the total assets of the banking system)	Coordination level in wage bargaining*	Framework conditions** (four main WGI indicators)	Public debt (percentage of GDP)
Baltic states	142%	78%	1.00	1.06	30%
Euro area	88%	13%	2.63	1.18	90%

Sources: European Commission, World Bank, Database on Institutional Characteristics of Trade Unions, Wage Setting, State Interventions and Social Pacts.
Notes: * Coordination level in wage bargaining includes five categories: 1) bargaining predominantly takes place at local or company level, 2) intermediate or alternating between sector and company bargaining, 3) bargaining predominantly takes place at sector or industry level, 4) intermediate or alternating between central and industry bargaining, 5) bargaining predominantly takes place at central or cross-industry level. ** "Framework conditions" refers to the sub-index of the Worldwide Governance Indicators (WGI) of the World Bank comprising the average of the following components: rule of law, regulatory quality, government effectiveness and control of corruption. The average for the Baltic states is unweighted.

From a long-term perspective, the convergence performance of the Baltic states has been remarkable. The Baltic states are among the few euro area countries (along with Slovakia) in which real GDP per capita in purchasing power standard (PPS) terms has shown substantial convergence towards the EU average over the past 20 years. While in 1995 their average income per capita (in PPS) stood at around only 28% of the EU15 average, it reached 66.5% in 2015 (see Chart A). It is also noteworthy that all three Baltic states experienced deep declines in real GDP in 2008 and 2009, although they enjoyed strong recoveries after that.

Chart A

GDP per capita relative to the EU15

(PPS, EU15 = 100)
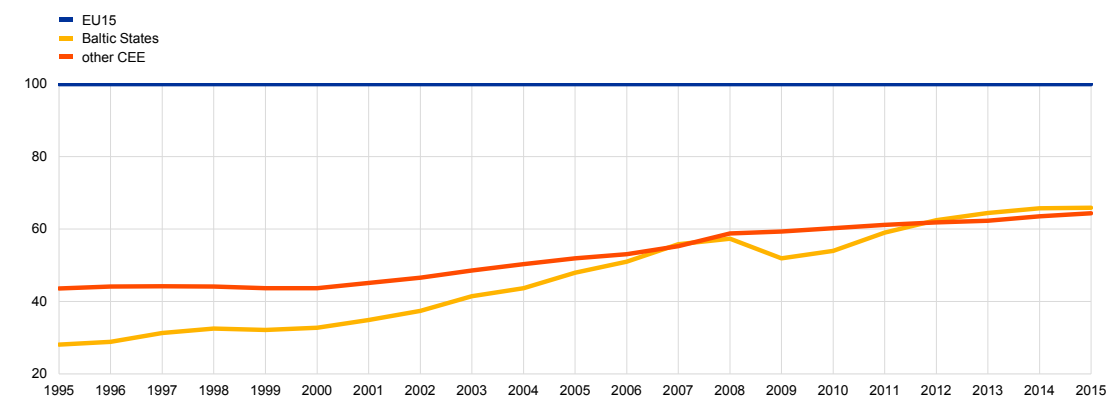
Source: European Commission.
Notes: "Other CEE" is an average of the per capita income levels of seven other central and eastern European countries that joined the EU in 2004 and 2007, i.e. Bulgaria, the Czech Republic, Hungary, Poland, Romania, Slovakia and Slovenia. The term EU15 refers to the 15 Member States of the European Union as at 31 December 2003, before the new Member States joined the EU, i.e. Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom.

One possible reason for the fairly strong convergence performance of the Baltic states is the significant improvement in institutional quality in these countries (Chart B). The Worldwide Governance Indicators of the World Bank, which is a composite indicator of institutional quality, suggests that institutional quality has improved markedly in the Baltic States – especially in Estonia – in recent decades; this improvement in institutional quality was particularly fast in the years prior to EU accession. The harmonisation of regulations with the EU prior to EU accession (the adoption of the *acquis communautaire*) was probably an important driving factor.

Chart B

Worldwide Governance Indicator (delivery index)

(synthetic index based on average ranking across four sub-indicators)
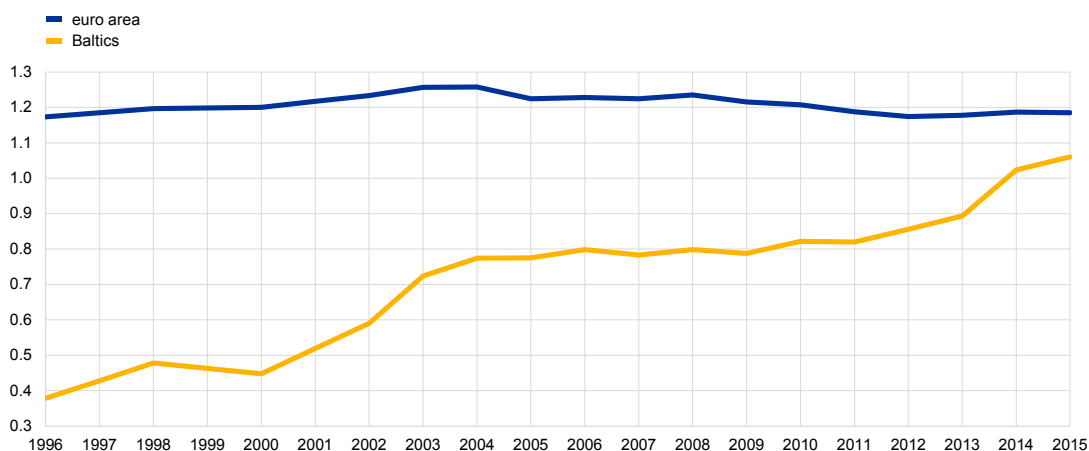
Source: World Bank.
Notes: The delivery index is an average of the sub-indicators regulatory quality, government effectiveness, control of corruption and rule of law. A higher index implies a better relative performance in institutional quality.

Another possible reason for the strong convergence performance is the re-integration of the Baltic countries into Europe. At the beginning of the transition process, these countries had very limited economic links with western Europe and were moderately open in economic terms. Integration with Europe via trade and FDI helped the Baltic countries by providing them with necessary capital, knowhow and foreign technology.

Although the crisis hit the Baltic states hard, the adjustment of imbalances took place very quickly. This helped the economy to recover rapidly, minimising the impact of the crisis on potential growth. The rapid adjustment of fiscal balances and private sector balance sheets indicated that the Baltic states could avoid the accumulation of a large debt overhang. In addition, the fast reduction in unemployment helped to decrease the risk of hysteresis, thus avoiding lasting consequences for potential growth.

Looking ahead, maintaining the fast pace of convergence may prove challenging. International experience suggests that countries that reach a middle-income level, such as the Baltic states, tend to find it difficult to converge further and to achieve a high-income level. A World Bank study (World Bank (2012)) suggests that out of 101 middle-income economies in 1960, only 13 had become high-income economies by 2008. In the middle-income stage of development, the scope for a productivity boost from the inter-sectoral transfer of labour from agriculture to more productive sectors, such as manufacturing, is typically limited and productivity growth should stem increasingly from innovation-based activities. According to the literature, there are a number of factors that could increase the chances of a pronounced slowdown in the pace of convergence. Ayar et al. (2013)

analysed determinants of growth slowdowns in a panel setup, using a large sample of 138 countries from 1995-2009, and found that, inter alia, the presence of strong institutions decreases the probability of growth slowdowns, and also leads to a low old age dependency ratio, a high investment share and diversified trade and output. Institutional quality is relatively high in the Baltic states compared with their GDP per capita levels, which decreases the chances of a growth slowdown. At the same time, the export structure of all three countries requires a further upgrade. Their export structures had already developed from low-skilled sectors during the 1990s to medium-skilled sectors by the 1990s (see Zaghini 2005). However, in Latvia and Lithuania in particular, skill-intensive and high-tech products have a much smaller export structure share than is the case in some central European countries (e.g. the Czech Republic, Slovakia and Hungary). In addition, the old age dependency ratio of all three countries is expected to deteriorate in the coming years, which may create a headwind to growth.

3.2 What drives real convergence in the long run? An overview

Two approaches are considered here to the analysis of the sources of GDP growth in the euro area in the long run. While other, more sophisticated decompositions are possible in principle, the time series on euro area countries available over a long period gives us two complementary approaches for the analysis of the components driving GDP per capita catching-up. The first of these focuses on a country's "human resources" while the second concentrates on the accumulation of production inputs and the efficiency with which these are used.

First, the importance of labour productivity, labour markets and demographics may be assessed using a standard GDP per capita accounting decomposition. In this approach, real GDP per capita may be broken down as follows[37]:

$$\frac{\text{Real GDP}}{\text{Population}} = \left(\frac{\text{Real GDP}}{\text{Employment}}\right) * \left(\frac{\text{Employment}}{\text{Labour Force}}\right) * \left(\frac{\text{Labour Force}}{\text{Working age pop}}\right) * \left(\frac{\text{Working age pop}}{\text{Population}}\right)$$

The first term consists of the contribution of labour productivity. The second and third terms focus on the role of labour markets, measured in terms of both employment rate and incidence of labour force (which includes both employed and unemployed workers) on working age population – the so-called participation rate. Finally, the fourth term identifies the contribution of demographics. A closer inspection reveals that there are many additional ways to break down GDP per capita, e.g. by highlighting the total number of hours worked in an economy. Whatever the decomposition chosen, however, this approach stresses the importance of how labour is utilised within a country.

A second, complementary approach highlights the importance of TFP growth to mature economies such as those of the euro area. This is because TFP

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[37] It should be noted that this decomposition, although it has other advantages, does not allow hours worked to be identified, nor the efficiency, quality and skills of the labour force.

captures increases in productivity which are no longer mainly driven by the accumulation of labour and capital (extensive growth), but by the efficiency and intensity with which such inputs are utilised in the production process. TFP increases may be the result, for instance, of the creation/absorption of new technologies, more efficient business processes, organisational improvements, or an improved allocation of labour and capital to the more productive firms (intensive growth). An insufficient switch from extensive to intensive growth may result in a country falling into the so-called "middle-income trap", which Aghion and Bircai (2017) have generalised into a "*non-convergence trap*" under a neo-Schumpeterian paradigm that may also apply to countries (e.g. euro area countries) with relatively high incomes. The non-convergence trap refers to a level of development which implies that if an economy does not progress from growth driven by accumulation of capital to growth led by innovation, then it stops converging towards the technology frontier. This happens ultimately because "*the growing firms, which played an important role in the growth process during the catching up stage, are precisely those which have vested interests in maintaining trade and entry barriers so as to preserve their incumbency position*" (Aghion and Bircai 2017). Similar considerations may of course also apply to workers' organisations.

TFP, as a component of labour productivity, links the first to the second approach here for the analysis of the drivers of GDP growth in the long term[38]. Although it is important to bear in mind that TFP measurement is surrounded by considerable uncertainty and a number of data issues[39], a standard, well-known approach for its calculation starts from the assumption that output is given by a Cobb-Douglas production function, i.e.

$$\text{GDP} = \text{TFP} * \text{K}^{\alpha} * \text{L}^{1-\alpha}$$

where K represents the capital stock, L the labour supply and α and (1-α) the shares of capital and labour in GDP respectively. It is usually assumed that α is equal to 0.35. Following this equation, GDP growth can be measured by means of these three components, i.e. TFP growth, capital and labour utilisation. Annex 2 at the end of this paper elaborates further on the different methodologies and databases that may be used by this approach. In addition, Table A in Annex 2 shows two additional, useful statistical breakdowns (although these cover shorter periods) that are possible using complementary data sources: the decomposition of the labour factor into

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[38] Labour productivity growth can indeed be decomposed into contributions of capital intensity (also called capital deepening), labour quality and TFP. *Capital intensity* may be measured as the amount of fixed or real capital in relation to labour. It is often calculated as capital services derived from the stock of physical assets and intellectual property assets, divided by hours worked. *Labour quality* measures the effect of shifts in the age, education and gender composition of the workforce on the efficiency of hours worked. For a review of the role of TFP in the euro area, see the special articles in the European Commission quarterly reports released in March 2013 and April 2014.

[39] Since TFP is calculated as a residual unexplained by the contribution of key production factors, its calculation depends on the measurement of both labour and capital which, especially in the case of the latter, is dependent on underlying assumptions and methodologies. The contribution of TFP growth can show large differences across different statistical sources, pointing to the high model uncertainty of such estimates.

labour quantity and labour quality, and the decomposition of the capital factor into ICT[40] vs. non-ICT capital.

Our overview spans from the 1960/70s until today, and centres on the five euro area countries which were the focus of the previous sections. With regard to the labour market decomposition of GDP per capita, we focus on the period from 1960 to 2016 and the EA12 countries which have significantly underperformed during the EMU years in terms of GDP per capita, i.e. Italy, Greece, Portugal and Spain. At the opposite end of the spectrum, the main factors explaining the special case of Ireland will be also addressed. In respect of the second decomposition, we focus on the same countries, although data availability only allows us to address the period from the 1970s onwards (from 1984, in the case of Greece). We also discuss a more sophisticated decomposition of value added into TFP, ICT vs. non-ICT capital, hours worked and labour composition, which has been available since the 1970s, but only for Italy and Spain.

Italy

Looking back, labour productivity has been the core component of two contrasting developments that have characterised GDP per capita growth in Italy: (i) its outperformance of the EU15 average in the 1960s and, to a lesser extent, the 1970s and 1980s; and (ii) the process of divergence that began in the 1990s. The latter process has also been somewhat exacerbated by demographics, which have reversed their contribution to GDP per capita growth since the 1990s. Moreover, a decline in the employment rate provided a negative contribution in the 1990s as well as in the more recent period 2008-16 (Chart 32). If we shift the focus from the dynamics to the *level* of Italy's GDP per capita, moreover, one cannot ignore the major drag on this, decade after decade, arising from the low share of the labour force of the working age population when compared with the EU15 average (Chart 35).

TFP has been the main driver of labour productivity in Italy. In particular, it is striking that its decline relative to peer EU15 economies had already started in the 1980s, when total labour productivity was still growing. Strong TFP performance was the main driver of Italian growth until the 1970s – a fact which explains the bulk of Italy's GDP overperformance compared with the EU15 average in this period (Chart 33). Capital accumulation, although also dynamic, was at that time broadly in line with the EU15 average (Chart 34). The pace of TFP growth started to decline afterwards, and was already underperforming the EU15 average by the 1980s. Although, in that period, the contribution of capital and labour still more than compensated for the growth gap vis-à-vis the EU15, all components turned negative in relative terms during the 1990s. Since the early years of the euro, the TFP decline has further explained Italy's deteriorating growth performance compared

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[40]   ICT stands for "Information and Communication Technologies".

with the EU15, with other factors having less impact, though remaining significant, after 2008 (Chart 34).

Chart 32

Decomposition of GDP per capita in Italy, in annual changes and vis-à-vis the EU15

(annual changes; GDP per capita at constant prices in national currency)

- ● GDP per capita
- labour productivity
- participation rate
- employment rate
- demographics

Sources: European Commission and ECB.
Notes: GDP per capita = (GDP/Employment)*(Employment/Labour Force)*(Labour Force/Working age pop)*(Working age pop/Population). The first term represents labour productivity; the second term is the employment rate; the third is the participation rate, and the fourth indicates the role of demographics. The diamonds in the chart show the change in the level of GDP per capita. In the Chart on the right-hand side, this is reported as the difference from the EU15 unweighted average. The period under consideration is 1961-2016. The bars show the contribution to the GDP per capita change of the four above-mentioned components. The natural logarithm is taken to render the four components additive.

Chart 33

The importance of TFP and capital intensity in driving long-term GDP growth in Italy

(annual changes; GDP at constant prices in national currency)

- labour contribution
- capital contribution
- TFP
- ● GDP growth
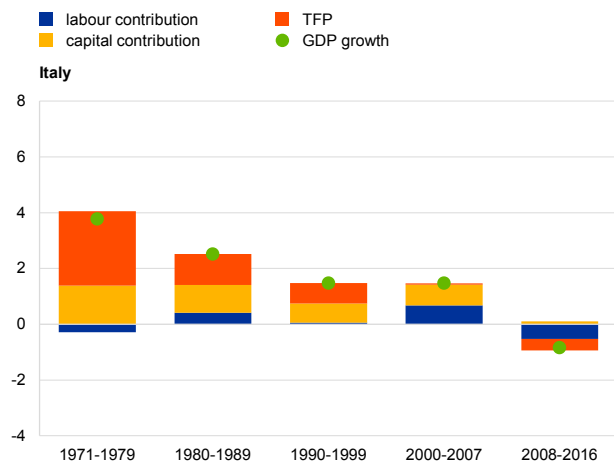
Sources: European Commission and the ECB.
Note: Factor contributions are calculated using the constants 0.63 for labour and 0.37 for capital, in line with EC AMECO methodology.

Chart 34

The role of TFP in driving Italy's increasing GDP growth gaps vis-à-vis the EU15 over time

(percentage points; GDP at constant prices in national currency)

- labour contribution
- capital contribution
- TFP
- ● GDP growth
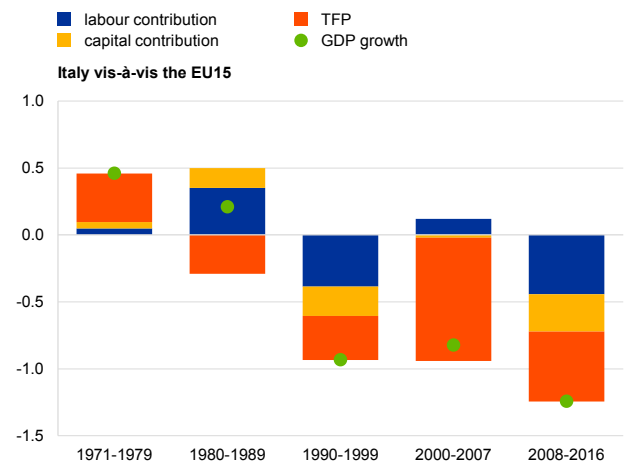
The economic literature suggests that the comparative decline in Italy's TFP growth since the 1980s reflects a number of structural weaknesses that have only partially been addressed over time. Starting with the most well-known explanations and making no claim to be exhaustive, three broad groups of

country-specific factors have been identified: (i) rigidities affecting the product market (e.g. red tape, a market structure dominated by non-expanding small firms with low-quality management and an insufficient absorption of technology, deficiencies in corporate governance, insufficient competition, especially for professional services, an inefficient judicial system, etc.); (ii) labour market rigidities (e.g. a structure of taxation that excessively burdens labour, protection of "inside workers" within firms, etc.); and (iii) weaknesses in the public administration (e.g. corruption, inefficient public procurement and tax administration, etc.). For a review of these factors, see, for example, Buti (2009), Hassan and Ottaviano (2013), and Mody and Riley (2014).

Chart 35

Italy's comparatively low labour force participation rate

(age 15-64 years old; labour force as a % of the working age population)

Legend: EU-15, IT, GR, IE, PT, ES

Source: Eurostat.

Chart 36

Decomposition of value added growth in Italy

(as a percentage)

Legend: hours worked, labour composition, total-factor productivity, ICT capital, non-ICT capital
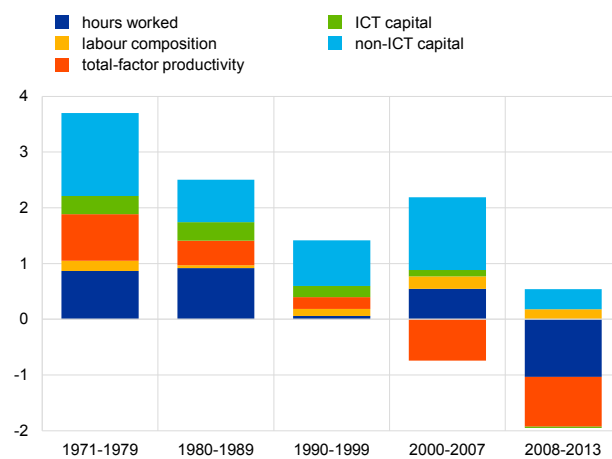
Source: EU-KLEMS database, latest data vintage at the time of finalisation of this paper.

In particular, one country-specific factor which has had a negative impact on Italy's TFP performance has been the promotion of labour quality ("human capital"), which has lagged behind most other euro area countries. This effect has, until recently, been further exacerbated by strong labour market duality. In addition to the aforementioned evidence of low participation in the labour market (Chart 35), the relatively low contribution of human capital to Italy's growth (compared with, for example, Spain) is illustrated in Chart B.1 in Annex 2 (the middle chart). As discussed in Pinelli, Szekely and Varga 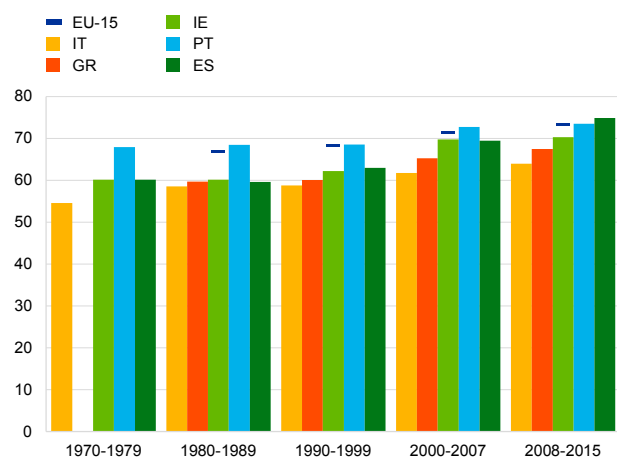(2015), the percentage of the population educated to tertiary level is currently the lowest, and the percentage of the population with just a basic education the fourth-highest, in the EU (European Commission 2014). According to Daveri and Parisi (2010), moreover, the labour market reform of 1997 introduced temporary employment contracts and other forms of employment which made it easier for firms to hire cheap, low-productivity labour rather than invest in productivity-enhancing technologies. This labour market duality has impacted TFP dynamics, and helps to explain the dismal productivity growth in the period following the 1997 reform. If this analysis is correct, the most recent labour market reform ("Jobs Act") may, instead, support TFP growth in the future, although it will take time for its effects to materialise.

Finally, another specific factor identified in the literature is the difficulty faced by many potentially productive Italian firms in setting up and, more to the point, expanding and absorbing technology. As Pinelli, Szekely and Varga (2015) emphasise, the costs of setting up a business are higher in Italy than in nearly all other OECD countries. Italy is also clearly lagging behind in terms of R&D and technological innovation and absorption, which has played a role in the country's specialisation in low-to-medium tech sectors characterised by slower TFP growth (see, for example, European Commission (2014)). The low contribution of ICT capital to Italy's growth is clearly apparent in both Chart 36 and Chart B.1 in Annex 2 (chart on the right). An econometric analysis conducted by Pellegrino and Zingales (2014) finds that Italy's productivity slowdown was mainly due to two factors: (i) the inability of small and medium-sized enterprises (SMEs) to respond to the challenges posed by growing international competiti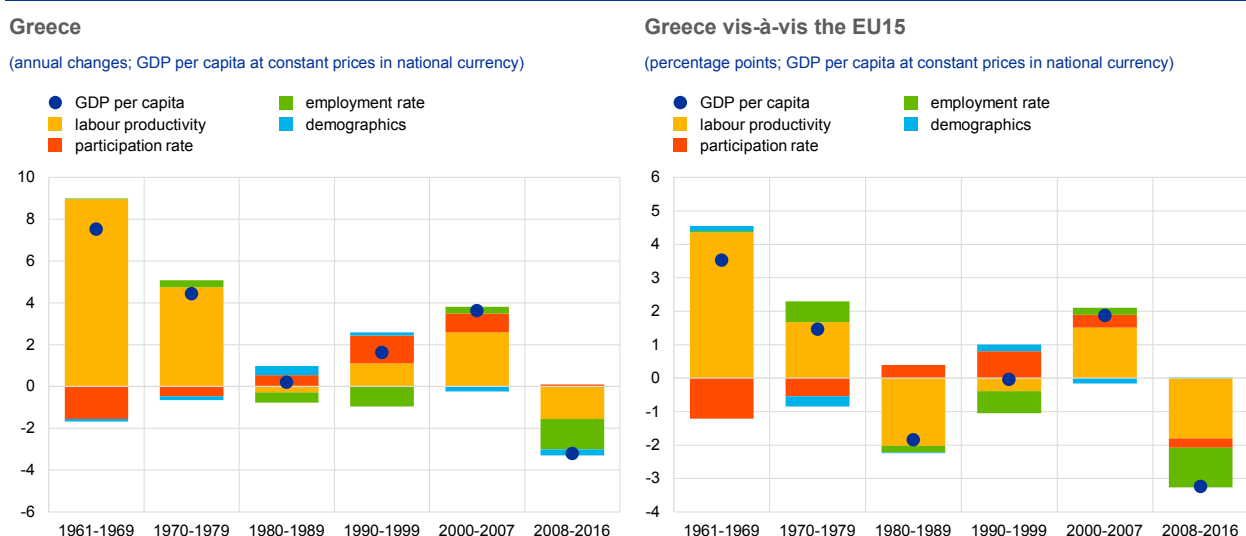on; and (ii) Italy's failure to take advantage of the ICT revolution (also due to the lack of a meritocracy in the selection and advancement of management). Some measures recently taken by the Italian government are a step in the right direction in addressing these problems, although additional efforts will be required.

Greece

Since the 1960s Greece has experienced two periods of strong real convergence followed by severe reversals, with these sharp movements usually being dominated by changes in labour productivity and, to a lesser extent, participation rates. The periods with declining or stalling GDP per capita growth relative to the EU15 – the 1980s, the 1990s and, especially, the post-2008 period – have also been marked by falling employment rates (Chart 37).

Chart 37

Decomposition of GDP per capita in Greece, in annual changes and vis-à-vis the EU15

Greece

(annual changes; GDP per capita at constant prices in national currency)

● GDP per capita   ■ employment rate
■ labour productivity   ■ demographics
■ participation rate

Greece vis-à-vis the EU15

(percentage points; GDP per capita at constant prices in national currency)

● GDP per capita   ■ employment rate
■ labour productivity   ■ demographics
■ participation rate

Sources: European Commission and ECB.
Notes: Notes: GDP per capita = (GDP/Employment)*(Employment/Labour Force)*(Labour Force/Working age pop)*(Working age pop/Population). The first term represents labour productivity; the second term is the employment rate; the third is the participation rate, and the fourth indicates the role of demographics. The diamonds in the chart show the change in the level of GDP per capita. In the Chart on the right-hand side, this is reported as the difference from the EU15 unweighted average. The period under consideration is 1961-2016. The bars show the contribution to the GDP per capita change of the four above-mentioned components. The natural logarithm is taken to render the four components additive.

Since 1984, when data on Greece's TFP became available, the country's divergence from the EU15 has been driven mainly by its weak TFP performance (net of measurement errors), reflecting, inter alia, long-standing structural weaknesses, low attractiveness for FDI, and an inefficient use of EU structural funds. The economic literature points to a number of possible reasons for the long-term divergence of TFP growth in Greece (Chart 39). Bossworth and Kollinitzas (2001) suggest that the marked drop in TFP growth in the 1980s and the first half of the 1990s is partly attributable to a strong deterioration in institutional quality, which added to the negative growth impact of fiscal and monetary policy errors in that period. In particular, an extremely restrictive and inflexible labour market regime was introduced in the late 1970s and early 1980s. This remained in place until the start of the EU/IMF economic programme in 2010, and included some of the toughest employment protection legislation in the EU, which provided extensive protection against the dismissal of long-tenure workers. In the 1980s this feature of the labour market was accompanied by a marked increase in the number of lifetime jobs in the public sector, and relative wages increased in this sector in comparison with the private sector. This led, in turn, to a rise in the reservation wage in the private sector, with negative consequences for Greece's international competitiveness. Another factor that constrained TFP growth was that Greece was an unattractive destination for FDI, which limited any potential technology transfers from foreign frontier firms. It is significant that, of the four extremely low-income-level economies in the EU15 that joined the EU (Greece, Portugal, Spain and Ireland), only Greece did not see a surge in FDI in the years following EU accession. This low attractiveness for FDI reflected the extreme rigidity of Greek product and labour markets, as well as weaknesses in infrastructure. Although Greece received substantial EU cohesion and structural funds that could have been better used to upgrade infrastructure, a significant part of these funds was used to subsidise inefficient public firms. Finally, probable measurement errors should also be taken into account, especially since the 2000s, thus calling for a very cautious interpretation of the pronounced rise and fall in TFP growth before and after the crisis. With regard to the first period, the upsurge in measured TFP may conceal resource misallocation, while for the second period, Leounakis and Sakellaris (2014) note that a large part of the recorded drop in TFP since 2008 has been "due to lack of correction for capital and labour utilization, which, undoubtedly, fell sharply during the period".

Chart 38

Greece: weak TFP and labour contribution until the 1990s, and a subsequent boom-bust, dominated by positive labour productivity growth

Greece

(annual changes; GDP at constant prices in national currency)
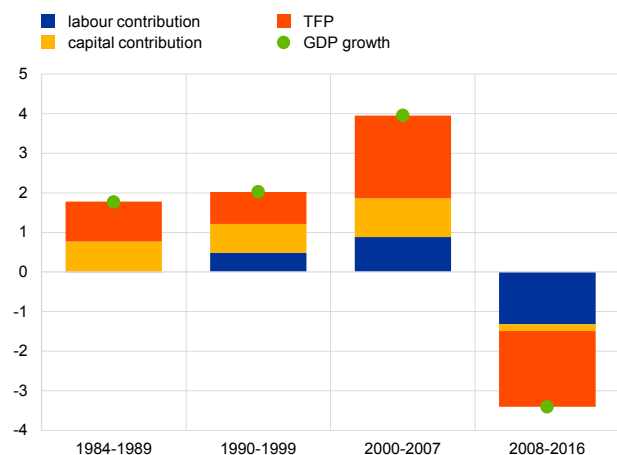
- labour contribution
- capital contribution
- TFP
- GDP growth

Chart 39

Greece: underperformance vis-à-vis the EU15 except for the period 2000-07, when the residual nature of TFP conceals unsustainable growth

Greece vis-à-vis the EU15

(percentage points; GDP at constant prices in national currency)

- labour contribution
- capital contribution
- TFP
- GDP growth

Sources: European Commission and ECB.
Note: Factor contributions are calculated using the constants 0.63 for labour and 0.37 for capital, in line with EC AMECO methodology.
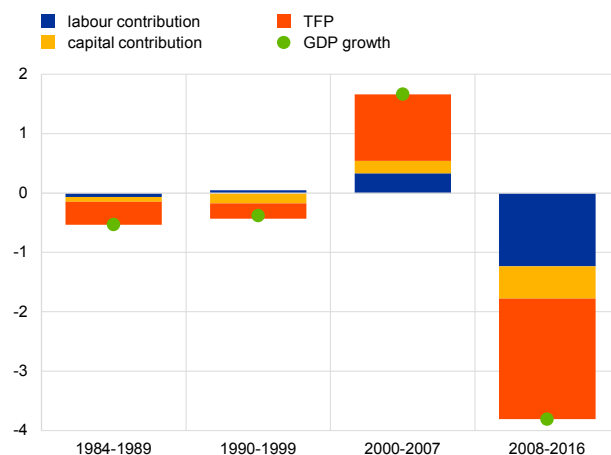
In addition to weak TFP growth performance, a drop in the rate of capital accumulation in the Greek economy also contributed to divergence in the 1980s and 1990s, as well as after 2008 (Chart 39). One of the key reasons for this was the sharp decline in the savings rate already seen in the 1980s, which mainly reflected an increase in public dis-saving in the form of a rapidly expanding fiscal deficit. As noted in Bossworth and Kollinitzas (2001), the fiscal balance changed from 0.5% of GDP in 1960-73 to -13.6% in 1985-95 (annual average). The sharp drop in the capital contribution since 2008 is a consequence of a variety of factors, including the marked deterioration of corporate funding conditions during the crisis, a fall in investor confidence due to fiscal sustainability concerns, and heightened political uncertainty. In addition to these issues, the lower prospects for domestic demand growth during the crisis years had a negative effect on investment during the period of painful economic adjustment. Since Greece is a fairly closed economy, with an export sector of limited size, external demand offset the drop in domestic demand much less than it did in countries such as Ireland or the Baltic states.

Portugal

Portugal experienced gradual, albeit modest, real convergence during the period 1961-99, which was dominated by positive labour productivity growth. This process halted and then reversed slightly during the EMU years, mostly because of declining employment and participation rates. Real convergence was slowed by declining employment rates relative to the EU15 in the 1970s and 1980s, and by falling participation rates in the 1990s and after the crisis (see Chart 40).

Chart 40

Decomposition of GDP per capita in Portugal, in annual changes and vis-à-vis the EU15

Portugal

(annual changes; GDP per capita at constant prices in national currency)

- GDP per capita
- labour productivity
- participation rate
- employment rate
- demographics

Portugal vis-à-vis the EU15

(percentage points; GDP per capita at constant prices in national currency)

- GDP per capita
- labour productivity
- participation rate
- employment rate
- demographics

Sources: European Commission and ECB.
Notes: GDP per capita = (GDP/Employment)*(Employment/Labour Force)*(Labour Force/Working age pop)*(Working age pop/Population). The first term represents labour productivity; the second term is the employment rate; the third is the participation rate, and the fourth indicates the role of demographics. The diamonds in the chart show the change in the level of GDP per capita. In the Chart on the right-hand side, this is reported as the difference from the EU15 unweighted average. The period under consideration is 1961-2016. The bars show the contribution to the GDP per capita change of the four above-mentioned components. The natural logarithm is taken to render the four components additive.

Portugal's catching-up was, until the 1990s, mainly driven by extensive rather than intensive growth. In respect of the period after 1999, the main contributors to the reversal of convergence were the gap in TFP growth during the early years of the euro, and in labour growth after the onset of the crisis. The accumulation of physical capital (both public and private) played a major role in Portugal's growth advantage compared with the EU15 between 1971 and 1999. By contrast, TFP growth played a comparatively minor or even negative role. Between 2000 and 2007, during the early years of the euro, Portugal's growth performance was already below that of the EU15, driven largely by weak TFP growth. Although TFP growth recovered slightly after the start of the crisis, it has only partly compensated for the drag from investment and, even more, labour utilisation (see Charts 41 and 42, and Chart B.1 in Annex 2 for further details).

The weak relative TFP performance of Portugal can be attributed to a range of structural factors. One of these is a significant lag in the accumulation of human capital versus Portugal's peers. As noted in IMF (2013), the relatively low level of educational attainment compared with other EU countries may have hampered ICT adoption. Moreover, a weaker business climate than that of Portugal's trade partners – including a high cost of doing business, an inefficient judicial system, and extensive red tape – further discouraged investment in the non-protected, innovative sectors of the economy.

Chart 41

The role of TFP, capital and labour intensity in driving Portugal's GDP growth since the 1970s
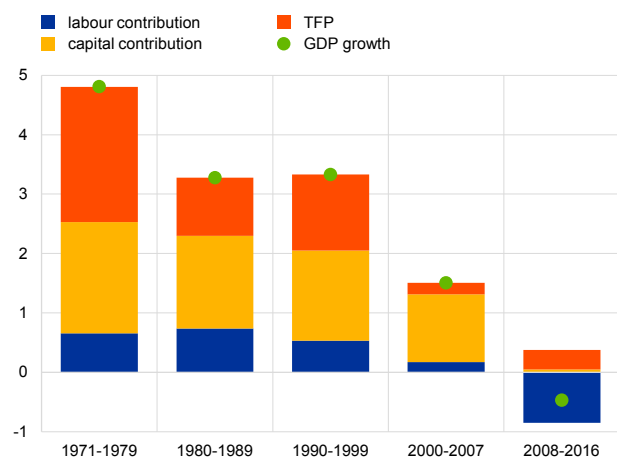
Chart 42

Portugal's catching-up was driven by extensive growth until the 1990s. TFP and then labour have since been the main contributors to the subsequent reversal of convergence

Portugal

(annual changes; GDP at constant prices in national currency)

- ■ labour contribution
- ■ capital contribution
- ■ TFP
- ● GDP growth

Portugal vis-à-vis the EU15

(percentage points; GDP at constant prices in national currency)

- ■ labour contribution
- ■ capital contribution
- ■ TFP
- ● GDP growth

Sources: European Commission and ECB.
Note: Factor contributions are calculated using the constants 0.63 for labour and 0.37 for capital, in line with EC AMECO methodology.
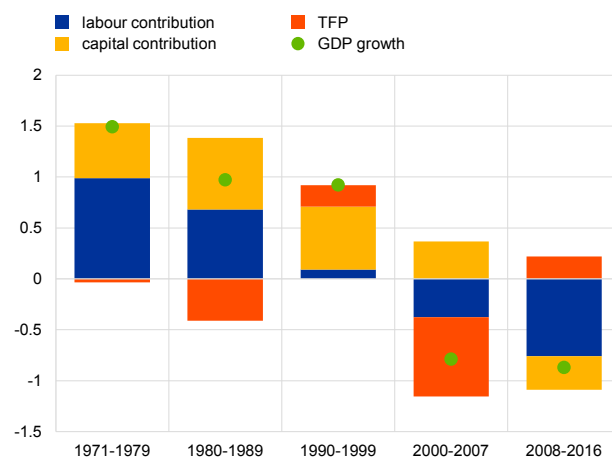
Spain

It was only in the 1960s that Spanish GDP per capita growth clearly outperformed the EU15 average – this was mainly driven by labour productivity. Some modest convergence was also seen in the 1990s and the early EMU years, but this was mostly due to factors such as increasing participation rates in relative terms, partly offset by a poor labour productivity performance. Declining employment exerted a drag on growth in the 1970s in particular, and has done since 2008 (Chart 43), combined with hours worked since 2008 (Chart 47). A drag has also been exerted over time on the level of Spain's GDP per capita by an employment rate that is lower than the EU15 average (Chart 46).

Chart 43

Decomposition of GDP per capita in Spain, in annual changes and vis-à-vis the EU15

Spain

(annual changes; GDP per capita at constant prices in national currency)

- GDP per capita
- labour productivity
- participation rate
- employment rate
- demographics

Spain vis-à-vis the EU15

(percentage points; GDP per capita at constant prices in national currency)

- GDP per capita
- labour productivity
- participation rate
- employment rate
- demographics

Sources: European Commission and ECB.
Notes: GDP per capita = (GDP/Employment)*(Employment/Labour Force)*(Labour Force/Working age pop)*(Working age pop/Population). The first term represents labour productivity; the second term is the employment rate; the third is the participation rate, and the fourth indicates the role of demographics. The diamonds in the chart show the change in the level of GDP per capita. In the Chart on the right-hand side, this is reported as the difference from the EU15 unweighted average. The period under consideration is 1961-2016. The bars show the contribution to the GDP per capita change of the four above-mentioned components. The natural logarithm is taken to render the four components additive.

While TFP growth made an important contribution to Spain's convergence in the 1980s, it exerted a drag on growth in the 1990s and 2000s, until the onset of the crisis. Although it had been the main factor behind Spain's catching-up in the run-up to EU membership (1986) and immediately thereafter, TFP growth started to level off in the 1990s and turned negative between 2000 and 2007 (Charts 45 and 47). During these periods TFP had a negative impact on Spain's convergence, with only capital and labour explaining the positive growth differential compared with the EU15. In the post-crisis years, Spain's divergence was mainly the result of a fall in labour utilisation, which – as was the case in Portugal – was partly offset by the modest recovery of TFP (see Charts 44,45 and 46, and Chart B.1 in Annex 2 for further details).

Chart 44

Although it had been the main factor behind Spain's catching-up, TFP growth had already started to level off in the 1990s

Spain

(annual changes; GDP at constant prices in national currency)
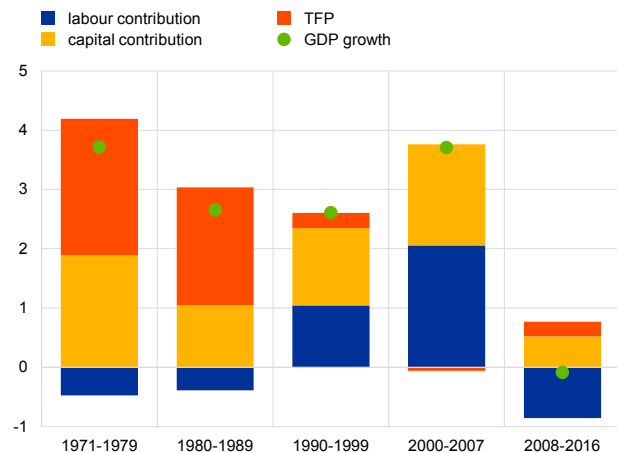
- labour contribution
- capital contribution
- TFP
- GDP growth

Chart 45

The different contributions of TFP, capital and labour in driving the differences in Spanish GDP growth vis-à-vis the EU15

Spain vis-à-vis the EU15

(percentage points; GDP at constant prices in national currency)

- labour contribution
- capital contribution
- TFP
- GDP growth

Sources: European Commission and ECB.
Note: Factor contributions are calculated using the constants 0.63 for labour and 0.37 for capital, in line with EC AMECO methodology.
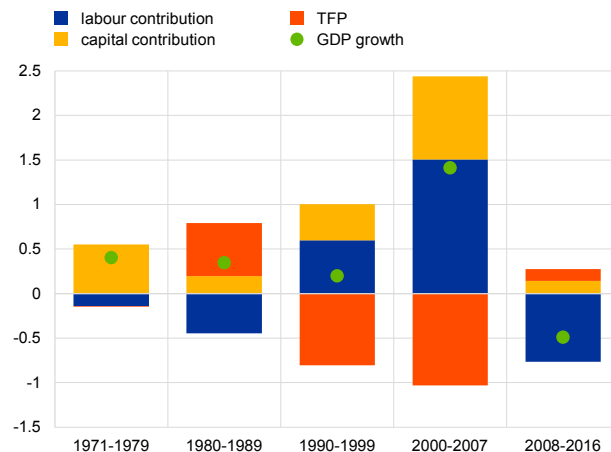
Spain's relatively weak TFP performance may be explained by a number of general factors, as well as some specific factors rooted in the Spanish growth model. In general, the low rates of productivity may be attributed to the reasons that we have already identified for the other countries, including less skilled human capital, low investment in R&D, an unfavourable business environment, and generally high administrative burdens on firms. In the case of Spain, however, there have also been more country-specific factors. First, as Estrada et al. (2009) underline, the bias in growth in Spain towards relatively unskilled labour-intensive activities (construction and services) brought about an unfavourable composition effect on productivity. Second, labour availability, which may have been conducive to firms using less advanced technologies, as well as strict labour market regulations that restricted flexible working arrangements within firms, have also played a role. Using firm-level data, Garcia-Santana et al. (2016) show that the deterioration in allocative efficiency across firms was at the root of low TFP growth in Spain prior to the crisis. As discussed in Section 2.3, the economy increasingly misallocated capital and labour to less productive industries. Third, labour market duality may also explain the low level of TFP growth. Dolado, Ortigueira and Stucchi (2016) show how changes in the gap between firing costs for permanent and temporary workers affect firms' TFP in a dual labour market. Firms' conversion rates from temporary to permanent contracts go down as this gap increases. Temporary workers respond to lower conversion rates by making less effort, while firms react by providing less paid-for training. Both these channels lead to a decline in TFP. Turning to the more recent rebound in productivity since the crisis, Hospido and Moreno-Galbis (2015) find that this mostly reflects a composition effect, with larger firms displaying a better TFP performance during the crisis.

Chart 46

Spain's low employment rate

(age 15-64 years; labour force as a % of working-age population)

- EU-15
- GR
- IT
- ES
- IE
- PT
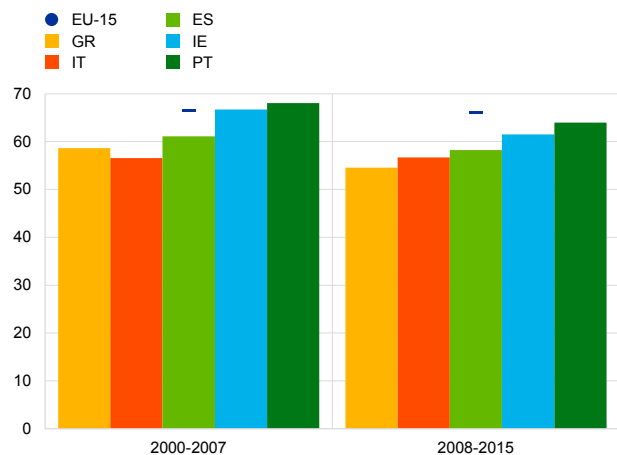
Chart 47

Decomposition of value-added growth in Spain

(as a percentage)
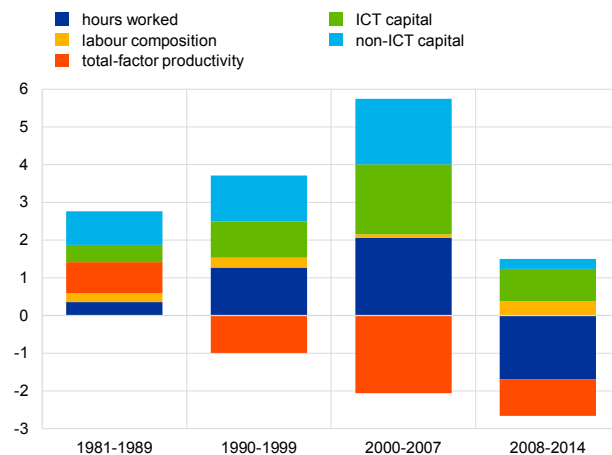
- hours worked
- labour composition
- total-factor productivity
- ICT capital
- non-ICT capital

Ireland

In contrast to the countries reviewed so far, Ireland has recorded an outstanding relative growth performance since the mid-1980s. This was especially the case in the 1990s, when convergence was fuelled not only by labour productivity growth, but also by demographics and increasing employment and participation rates. On average for the period 2008-16, labour productivity growth made the only positive contribution, although it more than offset the negative contribution from the other factors (Chart 48).

Chart 48

Decomposition of GDP per capita in Ireland, in annual changes and vis-à-vis the EU15

Ireland

(annual changes; GDP per capita at constant prices in national currency)

- GDP per capita
- labour productivity
- participation rate
- employment rate
- demographics

Ireland vis-à-vis the EU15

(percentage points; GDP per capita at constant prices in national currency)

- GDP per capita
- labour productivity
- participation rate
- employment rate
- demographics

Sources: European Commission and ECB.
Notes: GDP per capita = (GDP/Employment)*(Employment/Labour Force)*(Labour Force/Working age pop)*(Working age pop/Population). The first term represents labour productivity; the second term is the employment rate; the third is the participation rate, and the fourth indicates the role of demographics. The diamonds in the chart show the change in the level of GDP per capita. In the Chart on the right-hand side, this is reported as the difference from the EU15 unweighted average. The period under consideration is 1961-2016. The bars show the contribution to the GDP per capita change of the four above-mentioned components. The natural logarithm is taken to render the four components additive.

For Ireland, TFP growth appears to have been even more prominent in the process of catching-up than it was in other countries, except for the years preceding the crisis, when capital accumulation was driving Ireland's growth advantage. The "great catching-up" of the 1990s was led by TFP, together with a marked turnaround of the labour contribution from a negative role in the 1980s to a positive role in the 1990s. During the pre-crisis years the role of TFP was increasingly replaced by capital accumulation, while in the post-crisis period TFP is once again the main driver of Ireland's growth advantage (see Charts 49 and 50, and Chart B.1 in Annex 2 for further details).

Chart 49

In Ireland, TFP growth appears to have played an even more prominent role than in other countries …

Ireland

(annual changes; GDP at constant prices in national currency)
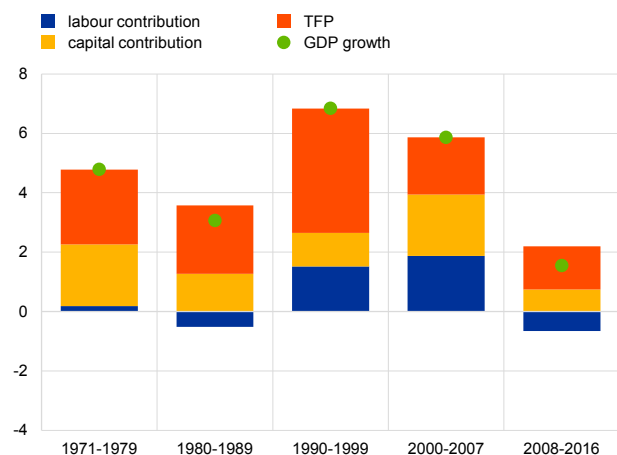
- labour contribution
- capital contribution
- TFP
- GDP growth

Chart 50

… driving convergence, especially in the 1990s. In the years before the crisis, however, capital contribution was the main factor behind Ireland's growth advantage

Ireland vis-à-vis the EU15

(percentage points; GDP at constant prices in national currency)

- labour contribution
- capital contribution
- TFP
- GDP growth

Sources: European Commission and ECB.
Note: Factor contributions are calculated using the constants 0.63 for labour and 0.37 for capital, in line with EC AMECO methodology.
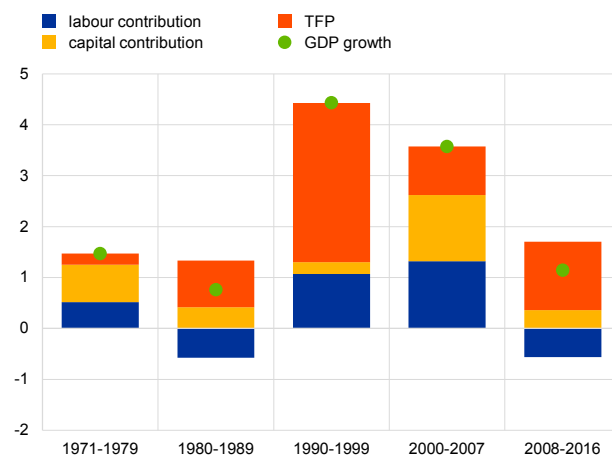
Although the contribution from TFP growth appears to be dominant in the "great catching-up" period compared with all other sub-periods, the headline data may overstate its role. There are clearly identifiable reasons why TFP growth was particularly strong in Ireland, including (i) Ireland's early investment in human capital (e.g. the introduction of free, compulsory secondary education as early as 1967), (ii) relatively high institutional quality (already in the 1970s), and (iii) an ability to attract a substantial amount of FDI since the end of the 1980s, which served as a catalyser of convergence, providing know-how and capital for development. It has also been noted, however, that the headline Charts greatly overstate the role of productivity growth and understate the role of the increase in labour utilisation. As explained by Honohan and Walsh (2002), the extremely high productivity increase seen during Ireland's great catching-up period may be attributed to a handful of industries (in particular software production, organic and basic chemicals, computers, and electronic components) employing a small percentage of the total labour force. These industries are totally dominated by multinational enterprises (MNEs) and are characterised by research-intensive, patented products, with most of the underlying research being carried out in the United States. According to Honohan and Walsh (2002), many of the MNEs involved were well placed to take advantage of low corporate tax rates in Ireland by channelling a large share of their profits to Ireland through the use of transfer pricing. As a result, "in many cases, the huge profits recorded by the Irish affiliates have very little to do with manufacturing activities conducted in Ireland". This implies that productivity (and also GDP) growth in Ireland has been overstated by headline statistics. The TFP growth performance should therefore be taken with a pinch of salt. According to the authors, Ireland's productivity growth was robust, but not extraordinary, during the great catching-up

period, and labour utilisation played a more important role than standard decompositions suggest.

Overall, the long-term perspective provided in this Section provides evidence of the crucial role of labour productivity and, in particular, TFP in fostering real convergence. The periods of faster GDP per capita growth in the five countries considered here were mostly associated with strong labour productivity gains. The decline in the TFP component appears to be the main reason behind the subsequent drop in labour productivity growth[41]. In some cases, higher participation rates have also been a relevant factor supporting growth in periods such as the early EMU years in Greece and Spain. By contrast, declining employment rates have been a negative contributing factor in several periods in Greece, Portugal and Spain. Finally, demographics have, overall, played a relatively limited role in these countries during the nearly sixty years under consideration, with the clear exception of Ireland in the 1990s. Demographics, however, may be expected to play an increasingly negative role in most of these countries in the future.

3.3   The long-run link between real convergence and price convergence

The long-run relationship between real and nominal convergence is an important question. This subsection focuses on this relationship in the euro area/EU countries under review, measured as the link between GDP per capita levels and price levels, and its policy implications.

The empirical literature tends to confirm that this relationship is positive and is partially driven by the normal "physiology" of economic development. The most common explanation is that the catching-up of productivity in the so-called "tradable sector" drives convergence in GDP per capita levels and also – via the prices of non-tradables – convergence in price levels. This is the well-known Balassa Samuelson (BS) effect (Balassa, 1964 and Samuelson, 1964). According to the original BS theory, the convergence in price levels between, for example, Latvia and the rest of the euro area will be faster: (i) the larger the relative productivity growth differential in the tradable to non-tradable sector of Latvia compared with the rest of the euro area; and (ii) the larger the share of non-tradables in consumption in Latvia compared with the rest of the euro area. In addition to this equilibrium convergence, however, the presence of nominal and/or real rigidities in the catching-up country may affect sectoral productivity developments, which may, in turn, further drive up inflation differentials (see Box 6 for a more detailed explanation).

The BS effect has been widely discussed in relation to inflation differentials between countries at different levels of economic development. In a monetary

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[41]   While the overall decline of TFP growth appears to be a robust finding, its magnitude tends to differ across different institutions, pointing to a high model uncertainty of such estimates. Therefore, as a robustness check, we show the decomposition of different data sources in Annex 2. This check confirms the overall narrative in this subsection, i.e. the key importance of TFP growth in explaining the convergence performance of most of the countries analysed over time.

union, it explains the inflation differential between two countries that arises directly from their productivity growth differentials. The tradable (mainly manufacturing) sector is more capital intensive and has a higher degree of competition, while the non-tradable goods sector consists mainly of services, is more labour-intensive and is less exposed to competition. When productivity growth rises in the tradable sector, wages tend to increase without this leading to higher prices, which are, to a significant extent, decided internationally. Due to labour mobility, wages in the non-tradable goods sector will rise as well. As productivity growth in the non-tradable goods sector is normally lower (and more similar across countries) than in the tradable goods sector, wage increases that are higher than productivity growth will tend to cause higher price increases in the non-tradable goods sector.

Higher labour productivity growth in the tradable goods sector and higher inflation in the non-tradable sector are, in the long run, confirmed by historical data from 1960 onwards in all euro area countries, although the differences vary across countries. The larger the difference in productivity growth between the tradable and non-tradable goods sectors, the higher inflation will tend to be overall. Inflation differentials between countries could therefore develop, and may be viewed as "natural" (i.e. "steady-state", "equilibrium") inflation differentials. As wage increases in the tradable goods sector reflect productivity gains, there is no pressure on tradable goods prices and, therefore, no effect on competitiveness between countries.

There are several caveats to the original Balassa-Samuelson model, however. These relate to the underlying assumptions and difficulties in isolating BS effects from other historical influences on inflation, such as differences in monetary and exchange rate policies across countries and different periods, indirect taxes, regulated prices, and structural changes to inflation due to a shift towards higher quality/value products. Moreover, obtaining precise and reliable estimates of these effects is hampered by measurement errors. Most importantly, while it was broadly valid in the past, in a world characterised by the advent of global value chains the distinction between tradable and non-tradable sectors has become largely obsolete, as each sector tends to present some "degree of tradability"[42].The BS effect, however, is sensitive to the classification of tradable and non-tradable sectors, and services are often used as a proxy for the latter, although they have become increasingly tradable. In the same vein, data on average labour productivity is usually used instead of TFP, which may conceal the contribution of the other components of labour productivity.

The above caveats to estimating the BS effect help explain the large range of estimates of this effect in the economic literature. Depending on the estimation

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[42] In the light of the most recent, "micro-founded" literature, the traditional definition of low-productive non-tradable versus highly productive tradable sectors (e.g. real estate versus manufacturing) needs to be rearticulated at the level of individual firms within each sector. This is for three reasons: (i) due to the operation of global value chains, every single sector presents some "degree of tradability"; (ii) only the most productive firms in each sector are able to bear trade costs and sell abroad; and (iii) within-sector productivity differences across firms are larger than the average productivity difference between sectors. We are not aware, however, of any study redefining the BS effect at micro level and, therefore, in this section we will maintain the traditional sector-based distinction.

methodology, the calculation of the BS effect has led to quite different results in different studies. Estimates for the euro area countries vary from zero to two percentage points per annum, whereas for the non-euro area EU countries, the range widens from zero to three percentage points per annum (see, for example, Mihaljek and Klau 2008, and Égert 2010). In some more recent studies, the BS estimates for the new Member States are estimated to be in line with those for the old EU Member States (Égert, 2010).

At the same time, stylised facts unambiguously point to a positive relationship between GDP per capita and price levels. As illustrated in Chart 51 for the eleven CEE EU Member States (five of which are in the euro area), the higher GDP per capita, the higher the level of prices at a given point in time[43]. The chart also shows that, when comparing 2004 with 2015 data, the economies most exposed to BS effects are those with the lowest GDP per capita, such as Bulgaria and Romania, whereas the effect is more limited in countries such as the Czech Republic and Slovenia.

Considering the underlying assumptions for BS effects, the most exposed economies are also those with the highest share of services in their price structure (Chart 52). Moreover, as illustrated in Chart 53, GDP per capita is also positively correlated with a higher weight of services in the Harmonised Index of Consumer Prices (HICP) across countries.

Alongside GDP, the pace of price level convergence stalled in many euro area countries in the post-crisis period, which is also likely to have reduced the impact of BS effects on inflation. Chart 54 also shows that real effective exchange rates and price levels were negatively correlated across countries, especially in the pre-crisis period.

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[43] The same kind of relationship is found for a broader set of euro area/EU countries.

Chart 51

GDP per capita and price levels relative to the EU28:
EU Member States in central and eastern Europe

(as a percentage of the EU28 average; EU28 = 100; x-axis: relative price level; y-axis:
relative GDP per capita)
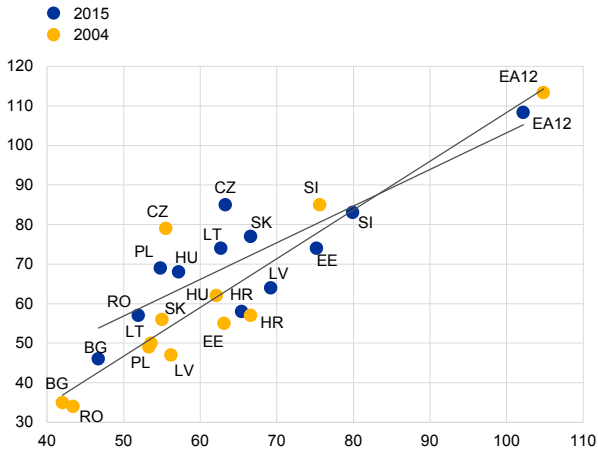
Source: Eurostat.
Note: Data based on the earliest and latest observation for both variables,
corresponding to 2004 and 2015.

Chart 52

Weight of services in HICP

(parts per 1000; HICP overall index = 1000)
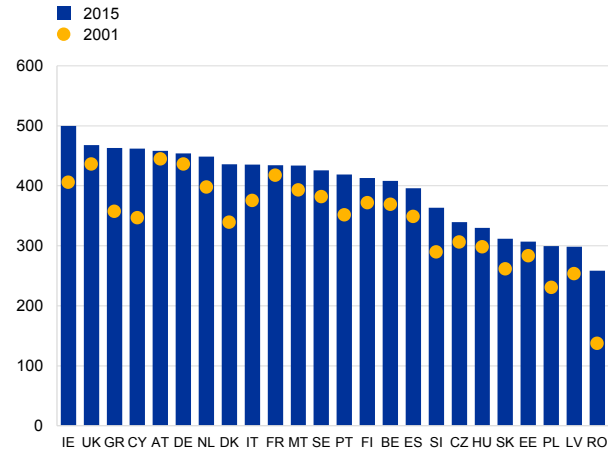
Source: ECB.
Note: Values ranked by 2015.

Chart 53

Relative GDP per capita and weight of services in HICP

(x-axis: weight of services in HICP, overall HICP = 1000; y-axis: relative GDP per capita,
EU28 = 100)
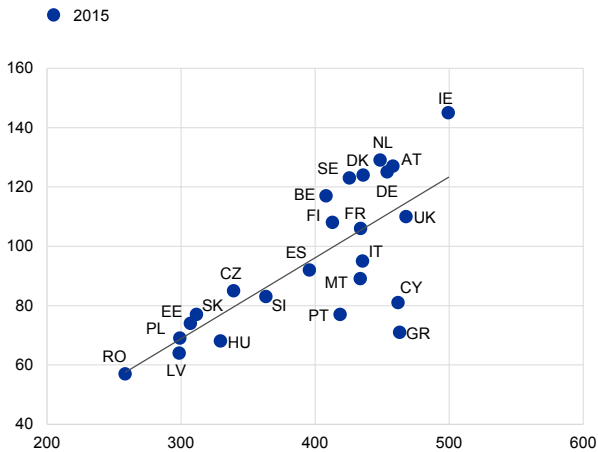
Source: ECB.
Note: Data refer to 2015.

Chart 54

Average relative effective exchange rate change and
relative price level

(x-axis: relative price levels 2015; y-axis: REER average annual changes, CPI-deflated)
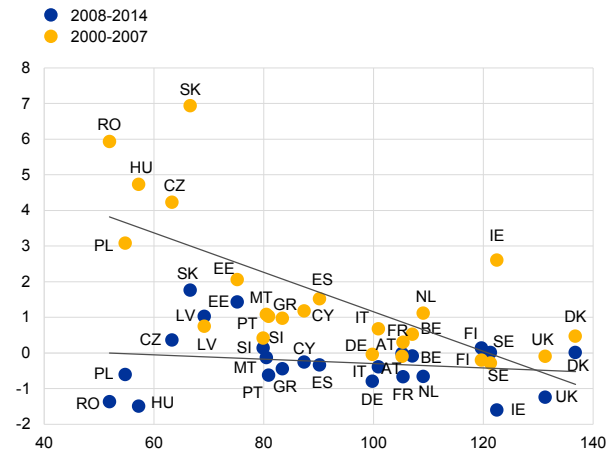
Sources: ECB, ECB calculations and Eurostat.
Notes: REER denotes Real Effective Exchange Rates, computed as average annual
changes (CPI-deflated) calculated using data for period 2000-2007 and 2008-2014. Data
for relative price levels correspond to 2015.

**In conclusion, the Balassa-Samuelson effect has a number of relevant
implications for the current policy debate on convergence.** *First*, the greater the
scope for real convergence within the monetary union, the greater the scope for
natural inflation differentials between its Member States. This implies relatively lower
real interest rates in the catching-up economies, which would not be a problem
unless, at some point, this starts to fuel unsustainable credit growth, house price

dynamics, etc. This is, however, exactly what happened in the pre-crisis period in many countries (as described in Section 2.3), which also suggests that Balassa-Samuelson effects could explain a proportion of inflation differentials in that period. Looking forward, the core lesson for policymakers in euro area catching-up economies is that appropriate countercyclical fiscal and macroprudential measures should be taken over time. *Second*, the emergence of unsustainable inflation differentials and their persistence in catching-up economies probably hinges on nominal and real rigidities that affect sectoral productivity developments. Reducing these market rigidities through structural reforms would improve conditions for output growth and employment and would facilitate the absorption of shocks, thereby reducing the persistence of their impact on inflation. For example, if reforms were enacted for sheltered sectors, this would reduce their relative prices and increase their relative demand. As a result, total inflation would trend downward. *Third*, some stressed euro area countries also have significantly lower price and GDP per capita levels. These economies have experienced significant setbacks in the process of real convergence in recent years, and some have even been confronted by deflationary pressures. Once growth resumes, however, these countries might once again face positive inflation differentials vis-à-vis the euro area due to the re-emergence of the BS effect, thus raising the policy challenges identified above.

Box 6
Theoretical framework of the Balassa-Samuelson effect

The Balassa-Samuelson (BS) effect can be captured by a variety of models. The effect is typically derived within a static model, but can also be incorporated into the dynamic framework of the new open economy macroeconomic models. This box provides a more formal summary of the BS effect proposition, which is based on these key assumptions:

- a two-sector economy in which both tradable and non-tradable goods are produced;

- prices of traded goods (PT, PT*) are the same in two countries, i.e. PT is set exogenously. In other words, it is assumed that "absolute PPP" holds in the tradable sector;

- prices in the non-tradable sector are set equal to marginal cost;

- wages in the tradable sector are linked to productivity growth, i.e. WT=PT + LPRODT;

- wages in the traded and non-traded sectors equalise (due to mobility within the domestic labour market), i.e. WT=WNT;

Thus, the larger the discrepancy in productivity differences in the traded goods sector, the larger the difference in wages and prices of non-tradables between countries.

Finally, non-tradables are included in price indices but do not affect the exchange rate (because they are not traded). As a result, the PPP will not hold for aggregate price level differences between a high productivity country and a low productivity country.

From a policy perspective, it is important to know what the source of inflation is. The BS effect is a source of benign endogenous inflation as it occurs as an indirect result of productivity increases that imply an increase in external competitiveness.

The above can be formulised in a simplified accounting framework as follows:

$$\Delta p - \Delta p* = \Delta e + (1-\alpha)(\Delta prodT - \Delta prodNT) - (1-\alpha*)(\Delta prodT* -\Delta prodNT*)$$

Where:

Δp, $\Delta p*$ denotes inflation rates in home and foreign (*) country

Δe is the nominal exchange rate expressed in units of the domestic currency per unit of the foreign currency.

α, α* denotes the share of tradables in consumption in home and foreign (*) country

$\Delta prodT$- $\Delta prodNT$, $\Delta prodT*$ - $\Delta prodNT*$ denotes the change in relative productivity of the tradable and non-tradable sector in home and foreign (*) country. Accordingly, if Δe is held constant, the real effective exchange rate appreciates, when $\Delta prodNT$-$\Delta prodT$ > $\Delta prodNT*$ - $\Delta prodT*$. In addition to the standard BS effect, which refers to the relative developments vis-à-vis another country (i.e. the "international" effect), one may consider the so-called "domestic" BS effect (e.g. Mihaljek et al. 2008). Both versions of the BS effect are hypotheses regarding the structural origins of inflation – in the international version, the tendency for inflation in the catching-up economies to be higher than in the economies they are converging to; and in the domestic version, the tendency for the domestic prices of non-tradables to rise faster than those of tradables.

This may be expressed as

$$\Delta p = (1-\alpha)(\Delta prodT - \Delta prodNT).$$

In conclusion, the scope for the BS effect in a country is greater: (i) the larger the relative (tradable vs non-tradable sector) productivity growth is, compared with the foreign country; and (ii) the higher the share of non-tradables is in the HICP basket, also compared with the foreign country.

3.4 The importance of institutional quality

The quality of institutions appears to be an important determinant of long-term growth. Following a new institutional economics approach, Masuch, Moshammer and Pierluigi (2016) examine the impact of institutional quality and public debt on growth. They measure long-term growth as per capita income growth over a 15-year period, with the main measure of institutional quality represented in the equations as an initial condition variable. The paper's findings suggest that cross-country institutional differences largely explain the relative long-term GDP performance of European countries when the initial level of GDP per capita and government debt are also taken into account. The empirical findings on the importance of institutions appear robust in terms of various measures of output growth and institutional quality, different sample sizes, different country groupings and the inclusion of additional control variables. The results generally support the call for structural reforms in general and, in particular, for reforms enhancing the efficiency of public administration and regulation, the rule of law and the fight against rent-seeking and

corruption. Moreover, the results seem to imply that convergence in per capita income levels requires a certain degree of convergence in institutional quality.

The quality of domestic institutions and governance does indeed appear to be correlated with per capita income growth. For instance, there is a strong correlation between per capita income levels and overall institutional quality, as captured by the Worldwide Governance Indicator (WGI) database of the World Bank (see Chart 55), which was mentioned in Section 2.5. The WGI is a holistic measure of economic institutions and measures six dimensions of governance: government effectiveness, regulatory quality, rule of law, control of corruption, voice and accountability, and political stability coupled with absence of violence/terrorism. It is striking that, among the EA12 countries, Greece, Portugal, Spain and Italy are also those countries with a significantly lower institutional quality index, which is clearly associated with their weaker convergence performance. By contrast, Ireland – another former stressed euro area member – has exhibited a combination of institutional quality and convergence above that of most euro area countries. Chart 54 also suggests that there is scope for further institutional catching-up, combined with real convergence, in central and eastern Europe.

Chart 55
GDP per capita relative to the EU28 in 2015 and Worldwide Governance Indicator ranking in 2008

(index: EU28 = 100; ranking; x-axis: GDP per capita relative to EU28 (2015); y-axis: Worldwide Governance Indicator rank (2008))

- ● joined euro area before 2002
- ● joined euro area after 2002
- ● non-euro area country
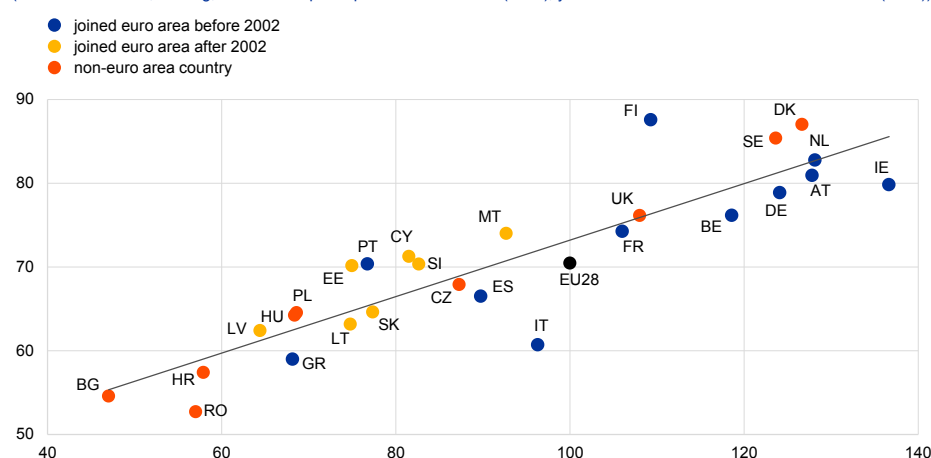
Sources: Eurostat and World Bank.
Notes: The Worldwide Governance Indicator is the composite ranking of average positions in six broad institutional dimensions. Luxembourg is excluded because GDP per capita computations are distorted by, for example, the high number of cross-border workers. Data for Ireland are adjusted to control for the exceptional GDP revision made for the year 2015, which did not reflect an actual increase in economic activity

Apart from the level of institutional quality, changes are also relevant to growth patterns. Chart 56 shows the growth performance of individual euro area countries between 1999 and 2015, calculated as the difference between their actual growth and the growth expected on the basis of their initial income levels. The latter is, in turn, calculated using a univariate regression that explains the growth performance of euro area countries between 1999 and 2015, taking their initial income levels in 1999. According to this measure, the growth performance of Ireland and the CEE euro area countries greatly exceeded growth expectations based on initial income

levels. By contrast, the performance of core euro area countries was broadly in line with predictions, whereas the EA-South countries mainly delivered a performance that was well below growth expectations based on initial income levels. As Chart 57 shows, the differences in growth performance for different subgroups of euro area countries are associated with *changes* in their institutional quality – the WGI values serve as a proxy for this. The difference is most striking between the new EA countries that joined the euro area after 2002 and the EA-South countries. The new EA countries started (and most of them still remain) at a comparatively low level on the WGI index, although in the years running up to their accession to the EU in 2004 they experienced a strong improvement in institutional quality, partly due to the adoption of the *acquis communautaire.* By contrast, the EA-South countries mostly experienced an overall deterioration in institutional quality in the pre-crisis period. As discussed in Section 2.5, this might also have been due to the lack of any government incentives encouraging structural reforms in an environment of falling real interest rates and easing fiscal constraints.

Chart 56

Changes in GDP per capita in 1999-2015 compared with expected changes based on initial income levels

(percentage points)
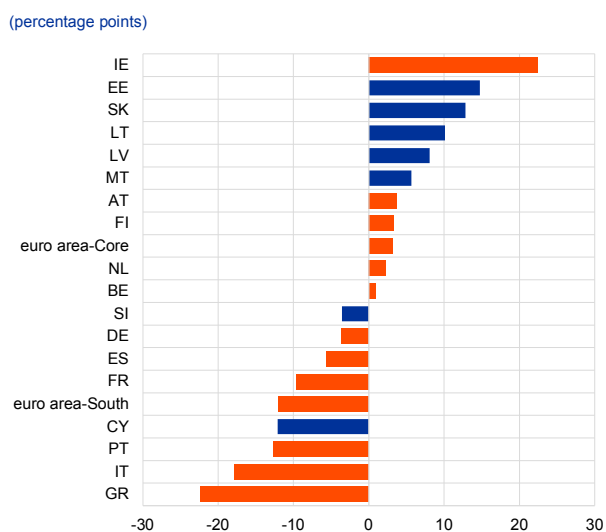
Sources: Eurostat and ECB staff calculations.
Notes: GDP per capita at constant prices in national currencies. Expected levels are obtained by applying the coefficients estimated from a linear regression between GDP per capita growth and its level across EA countries to the initial level of GDP per capita for each country. Data for Ireland are adjusted to control for the exceptional GDP revision in 2015, which did not reflect an actual increase in economic activity. EA-Core includes BE, DE, FR, NL, AT and FI; EA-South includes ES, GR, IT and PT. Countries in red are countries that joined the EA before 2002 and those in blue are countries that joined after 2002.

Chart 57

Average value of the delivery index of the World Bank's Worldwide Governance Indicator
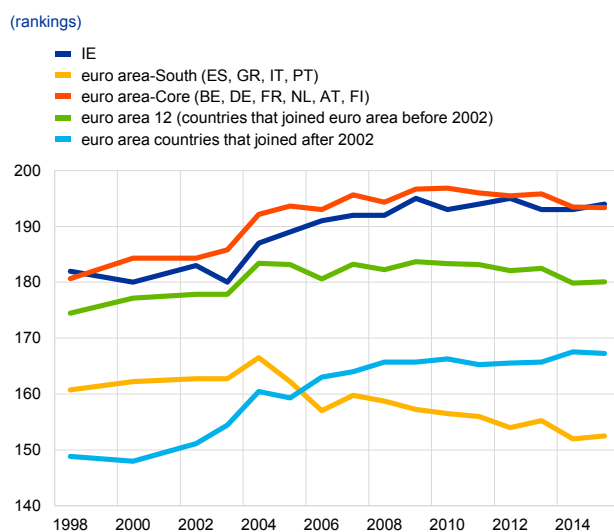
(rankings)

Source: World Bank.
Notes: The Worldwide Governance Indicator delivery index represents the average of the rankings of four components of the WGI: Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption. The ranking is based on the WGI whole sample. The higher the indicator, the better the relative performance.

Finally, the evidence also suggests that the flexibility and resilience of product and labour markets is an important factor in real convergence. EA12 countries with structural rigidities were hit particularly hard during the recent crisis, which contributed to a sharp reversal of convergence during this period. Greece and Portugal in particular had extremely rigid product and labour markets before the crisis, as Chart 58 shows. In the product markets, several sectors, ranging from network industries to professions, were sheltered from competition, which slowed the adjustment of profit mark-ups during the crisis. In the labour market, rigidities

included a high degree of employment protection and wage bargaining systems that did not support wage adjustment. The rigidities that hampered the adjustment of wages and prices also significantly lengthened the process of reallocation of labour and capital to the most productive firms and sectors. This, as explained in Section 2.3, had also contributed to the extensive misallocation of capital in the pre-crisis boom period in some countries, which then increased the cost of adjustment in terms of unemployment and income loss.

Chart 58

GDP per capita relative to the EU28 in 2015 and product and labour market indicators in 2008

(index: EU28 = 100; ranking; x-axis: GDP per capita relative to EU28 (2015); y-axis: average PMR and EPL (2008))

- ● joined euro area before 2002
- ● non-euro area country
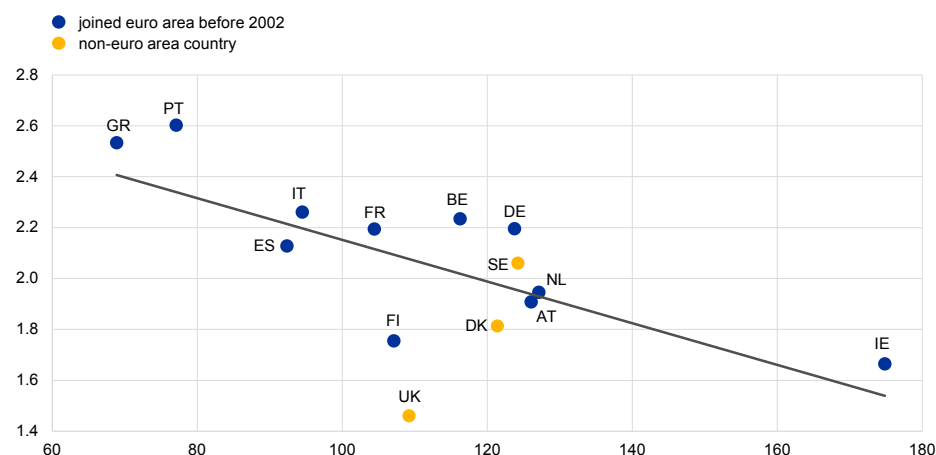
Sources: European Commission and OECD.
Notes: The OECD product market regulation (PMR) indicators cover formal regulations for state-controlled business enterprises, legal and administrative barriers to entrepreneurship, and barriers to international trade and investment. The higher the value, the more rigid the regulations. The OECD employment protection legislation (EPL) indicators are synthetic indicators of the strength of protection against individual and collective dismissals for workers with a regular contract. The summary indicators are obtained by factor analysis, in which each component is weighted according to the overall variance of the data. PMR and EPL data were unavailable for 2008 for Bulgaria, Croatia, Cyprus, Latvia, Lithuania, Malta and Romania. Luxembourg is excluded.

4 Conclusions: a few indications for economic policy

A few broad policy-relevant indications may be drawn from the economic analysis in this paper:

- *Sustainable economic convergence is an important condition for ensuring the smooth functioning of EMU.*

- *There is no automatism in the convergence process, which should instead be seen as a product of relentless policy efforts both before and after the adoption of the euro, i.e. as a continuum.*

- *The attainment of sustainable economic convergence in the euro area is a primary responsibility of individual Member States under the social contract on which EMU is founded.*

- *The task of European institutions such as the Eurogroup, the Commission and the European Parliament is to facilitate the efforts made at national level through rules, regulations and surveillance procedures that also help to avoid negative spillovers across Member States.*

- *The time horizon against which the success of sustainable economic convergence should be assessed is the long run. As the euro area crisis has shown, there are no shortcuts, i.e. a "long view" is required in policy-making within the euro area.*

- *The long-term view on convergence should look not only forward, but also back. Several country-specific weaknesses and challenges date back to the years, or even the decades, preceding the adoption of the euro.*

- *The long-term perspective also leads to the prioritisation of policy measures that acknowledge the central role of productivity in fostering real convergence. The periods of faster GDP per capita growth in the lower-income euro area countries were mostly associated with strong labour productivity gains vis-à-vis the higher-income countries. These were, to a great extent, driven by the total factor productivity component.*

- *The temporary fulfilment of the numerical convergence criteria set in the Maastricht Treaty is not, in itself, a guarantee of smooth membership in the euro area. A holistic approach integrating all dimensions of sustainable economic convergence – be these real, nominal or institutional in nature – is, therefore, required.*

- *With regard to cross-country inflation differentials after euro adoption, policymakers in all euro area Member States should appreciate that such*

differentials are a natural by-product of real convergence. They should be kept in check by appropriate national fiscal, structural and macroprudential policies.

- *In mature economies such as those in the euro area, which are no longer characterised by extensive growth driven by structural transformation, avoiding the non-convergence trap requires relying on intensive growth propelled by sound institutions, governance and policies. To be sustainable, real convergence should therefore be underpinned by improvements in institutional quality. Empirical evidence suggests, in fact, that these two dimensions of sustainable economic convergence are strongly correlated.*

Finally, as regards areas for further research and key policy questions not addressed in this paper, the most important of these is whether – and how – additional progress in the European governance framework could further facilitate and incentivise national reform efforts in the pursuit of sustainable economic convergence. The Five Presidents' Report of July 2015 and the Commission's Reflection Paper on the Deepening of EMU of May 2017 sketched out avenues, milestones and timelines through which an enhanced European governance framework could effectively interact with national reform efforts in the development of more resilient economic structures. For this potential process to materialise, however, substantial progress is required, not only from a political and accountability angle, but also in terms of concrete proposals based on sound analysis.

Annex 1
Patterns in Maastricht convergence after euro adoption (detailed tables)

Table A.1

The price stability criterion

(percentages)

Convergence Report	1998	2000	2002	2004	May 2006	December 2006	2007	2008	2010	2012	2013	2014	2016
Reference period	February 1997 to January 1998	April 1999 to March 2000	May 2001 to April 2002	September 2003 to August 2004	April 2005 to March 2006	November 2005 to October 2006	April 2006 to March 2007	April 2007 to March 2008	April 2009 to March 2010	April 2011 to March 2012	May 2012 to April 2013	May 2013 to April 2014	May 2015 to April 2016
Reference value	2.7	2.4	3.3	2.4	2.6	2.8	3.0	3.2	1.0	3.1	2.7	1.7	0.7
Belgium	1.4	1.3	2.4	1.7	2.6	2.4	2.1	2.3	-0.1	3.3	2.0	1.1	1.2
Germany	1.4	1.0	1.9	1.5	2.0	1.9	1.7	2.6	0.3	2.6	1.9	1.4	0.1
Estonia	9.4	2.9	5.1	2.1	4.1	4.3	4.6	8.3	-0.7	4.9	4.0	2.3	0.2
Ireland	1.2	3.1	4.4	2.6	2.3	2.6	2.8	3.0	-2.3	1.4	1.7	0.3	0.0
Greece	5.2	2.0	3.9	3.0	3.4	3.4	3.3	3.3	1.7	2.4	0.4	-1.2	-0.5
Spain	1.8	2.5	2.9	2.9	3.6	3.7	3.2	3.3	0.0	2.7	2.6	0.8	-0.6
France	1.2	0.9	2.0	2.4	1.9	1.9	1.7	2.1	0.3	2.4	1.7	0.9	0.1
Italy	1.8	1.9	2.4	2.5	2.2	2.3	2.2	2.3	0.7	3.2	2.7	0.8	0.1
Cyprus	3.3	2.0	2.1	2.1	2.0	2.3	2.0	2.9	0.6	3.5	2.4	-0.4	-1.8
Latvia	7.6	2.4	3.2	4.9	7.0	6.7	6.7	12.3	0.1	4.1	1.3	0.1	0.0
Lithuania	9.6	1.0	2.2	-0.2	2.7	3.5	4.0	7.4	2.0	4.2	2.7	0.6	-0.1
Luxembourg	1.4	1.8	2.1	2.8	3.9	3.2	2.5	3.2	0.7	3.6	2.6	1.3	0.1
Malta	3.9	2.5	3.1	2.6	2.6	3.1	2.2	1.5	1.2	2.4	2.9	0.8	1.2
Netherlands	1.8	1.9	4.9	1.6	1.5	1.7	1.6	1.7	0.6	2.7	2.9	1.7	0.4
Austria	1.2	0.9	2.2	1.6	1.9	1.7	1.8	2.6	0.5	3.5	2.5	1.8	0.9
Portugal	1.8	1.9	4.0	2.6	2.4	3.1	2.9	2.6	-0.8	3.5	1.8	0.3	0.6
Slovenia	8.3	6.8	8.3	4.1	2.3	2.5	2.6	4.7	0.9	2.1	2.7	1.3	-0.8
Slovakia	6.1	12.7	6.3	8.5	3.2	4.3	3.7	2.2	0.3	4.2	3.1	0.7	-0.4
Finland	1.3	1.8	2.6	0.4	1.0	1.2	1.3	2.1	1.4	3.2	3.0	1.9	-0.1
Bulgaria	n.a	4.7	7.2	5.9	7.3	7.7	6.5	9.4	1.7	2.7	2.4	-0.8	-1.0
Czech Republic	8.4	2.1	4.2	1.8	1.8	2.2	1.9	4.4	0.3	2.7	2.8	0.9	0.4
Denmark	1.9	2.4	2.3	1.0	2.0	1.9	1.8	2.0	1.1	2.7	1.8	0.4	0.2
Hungary	18.3	10.1	7.7	6.5	3.2	3.5	5.6	7.5	4.8	4.3	4.6	1.0	0.4
Croatia	n.a	3.6	3.5	2.3	3.5	3.6	2.7	3.6	1.6	2.1	4.0	1.0	-0.4
Poland	14.6	8.2	4.3	2.5	1.5	1.2	1.5	3.2	3.9	4.0	2.7	0.6	-0.5
Romania	157.4	50.2	30.1	13.5	9.0	7.3	5.4	5.9	5.0	4.6	4.1	2.1	-1.3
Sweden	1.9	0.8	2.9	1.3	0.9	1.5	1.6	2.0	2.1	1.3	0.8	0.3	0.9
United Kingdom	1.8	1.1	1.4	1.4	2.1	2.2	2.6	2.2	2.3	4.3	2.6	2.3	0.2
Euro area	1.5	1.4	2.4	2.1	2.2	2.2	2.1	2.5	0.3	2.8	2.2	1.0	0.1

Source: ECB convergence reports.
Note: When a country is above the reference value the Chart is marked in orange.

Table A.2

The long-term interest rate criterion

(percentages)

Convergence Report / Reference year	1998 February 1997 to January 1998	2000 April 1999 to March 2000	2002 May 2001 to April 2002	2004 September 2003 to August 2004	May 2006 April 2005 to March 2006	December 2006 November 2005 to October 2006	2007 April 2006 to March 2007	2008 April 2007 to March 2008	2010 April 2009 to March 2010	2012 April 2011 to March 2012	2013 May 2012 to April 2013	2014 May 2013 to April 2014	2016 May 2015 to April 2016
Reference value	7.8	7.2	7.0	6.4	5.9	6.2	6.4	6.5	6.0	5.8	5.5	6.2	4.0
Reference value + 0.5 pp	8.3	7.7	7.5	6.9	6.4	6.7	6.9	7	6.5	6.3	6	6.7	4.5
Belgium	5.7	5.2	5.2	4.3	3.4	3.8	3.9	4.4	3.8	4.1	2.5	2.4	0.9
Germany	5.6	4.9	4.9	4.2	3.3	3.7	3.9	4.2	3.2	2.3	1.4	1.6	0.5
Estonia	6.2	5.1	5.1	4.2	3.3	3.7	3.9	4.4	5.0	9.1	5.1	3.5	1.2
Ireland	9.8	6.4	5.3	4.4	3.6	4.0	4.2	4.5	5.3	19.0	18.3	8.7	9.4
Greece	6.3	5.1	5.1	4.2	3.4	3.7	3.9	4.3	3.9	5.4	5.7	4.1	1.8
Spain	5.5	5.0	5.0	4.2	3.4	3.7	3.9	4.3	3.6	3.2	2.2	2.2	0.9
France	6.7	5.1	5.2	4.4	3.6	4.0	4.2	4.5	4.2	5.7	5.1	4.0	1.7
Italy	n.a	n.a	7.2	5.2	4.6	4.1	4.2	4.5	4.6	6.4	7.0	6.2	3.9
Cyprus	n.a	n.a	7.0	5.0	3.8	3.9	4.5	5.4	12.7	5.8	3.8	3.3	1.0
Latvia	n.a	n.a	7.2	4.7	3.7	4.0	4.2	4.6	12.1	5.2	4.4	3.6	1.5
Lithuania	5.6	5.1	4.9	3.0	2.5	3.1	3.6	4.6	4.1	2.6	1.6	1.9	0.4
Luxembourg	n.a	n.a	6.2	4.7	4.5	4.3	4.3	4.8	4.5	4.4	3.9	3.2	1.4
Malta	5.5	5.0	5.0	4.2	3.3	3.7	3.9	4.3	3.6	2.7	1.8	2.0	0.7
Netherlands	5.6	5.1	5.1	4.3	3.4	3.7	3.9	4.3	3.8	3.2	2.0	2.0	0.8
Austria	6.2	5.2	5.2	4.3	3.4	3.8	4.1	4.5	4.2	11.7	8.3	5.8	2.7
Portugal	n.a	n.a	n.a	5.2	3.8	3.8	4.0	4.5	4.2	5.4	5.6	5.5	1.8
Slovenia	n.a	n.a	7.8	5.1	3.5	4.3	4.5	4.5	4.5	4.6	4.1	2.8	0.8
Slovakia	5.9	5.1	5.1	4.2	3.3	3.7	3.9	4.3	3.6	2.7	1.7	1.9	0.8
Finland	n.a	n.a	n.a	5.6	3.7	4.1	4.3	4.7	6.9	5.3	3.9	3.5	2.5
Bulgaria	n.a	n.a	6.0	4.8	3.5	3.8	3.9	4.5	4.7	3.5	2.3	2.2	0.6
Czech Republic	6.2	5.3	5.1	4.4	3.3	3.8	3.9	4.3	3.6	2.4	1.3	1.8	0.8
Denmark	n.a	n.a	7.4	8.1	6.6	7.1	7.1	6.9	8.4	8.0	7.0	5.8	3.4
Hungary	n.a	n.a	n.a	n.a	n.a	n.a	4.6	5.2	7.5	6.7	5.2	4.8	3.7
Croatia	n.a	n.a	10.0	6.9	5.0	5.2	5.3	5.7	6.1	5.8	4.4	4.2	2.9
Poland	n.a	n.a	n.a	n.a	7.0	7.2	7.3	7.1	9.4	7.3	6.4	5.3	3.6
Romania	6.5	5.4	5.3	4.7	3.3	3.7	3.8	4.2	3.3	2.2	1.6	2.2	0.8
Sweden	7.0	5.3	5.1	5.0	4.3	4.3	4.6	4.9	3.6	2.5	1.6	2.2	1.8
United Kingdom	5.9	5.0	5.1	4.3	3.4	3.8	4.0	4.3	3.8	4.4	3.5	2.9	1.2
Euro area	7.8	7.2	7.0	6.4	5.9	6.2	6.4	6.5	6.0	5.8	5.5	6.2	4.0

Source: ECB convergence reports.
Note: When a country is above the reference value the Chart is marked in orange.

Table A.3

The fiscal criteria: excessive deficit procedure

(percentages)

Reference period	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Belgium	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	N	N	N
Germany	N	N	N	N	Y	Y	Y	Y	N	N	Y	Y	Y	N	N	N	N	N
Estonia	-	-	-	-	-	N	N	N	N	N	N	N	N	N	N	N	N	N
Ireland	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	N
Greece	N	N	N	N	N	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y
Spain	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y
France	N	N	N	N	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y
Italy	N	N	N	N	N	N	Y	Y	Y	N	Y	Y	Y	Y	N	N	N	N
Cyprus	-	-	-	-	-	Y	Y	N	N	N	N	Y	Y	Y	Y	Y	Y	N
Latvia	-	-	-	-	-	N	N	N	N	N	Y	Y	Y	Y	N	N	N	N
Lithuania	-	-	-	-	-	N	N	N	N	N	Y	Y	Y	Y	N	N	N	N
Luxembourg	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Malta	-	-	-	-	-	Y	Y	Y	N	N	Y	Y	Y	N	Y	Y	N	N
Netherlands	N	N	N	N	N	Y	N	N	N	N	Y	Y	Y	Y	N	N	N	N
Austria	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	N	N	N
Portugal	N	N	N	N	N	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y
Slovenia	-	-	-	-	-	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	N
Slovakia	-	-	-	-	-	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N	N	N
Finland	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	N	N	N	N
Bulgaria	-	-	-	-	-	-	-	-	N	N	N	Y	Y	N	N	N	N	N
Czech Republic	-	-	-	-	-	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N	N	N
Denmark	N	N	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	N	N	N
Croatia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y	Y	Y
Hungary	-	-	-	-	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N
Poland	-	-	-	-	-	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	N
Romania	-	-	-	-	-	-	-	-	N	N	Y	Y	Y	Y	N	N	N	N
Sweden	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
United Kingdom	N	N	N	N	N	N	N	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y

Source: European Commission.
Notes: Applicable since EU entry. Therefore, the sample period is not fully comparable across all EU countries. A country is in an EDP from the time a "Commission recommendation for a Council decision on the existence of an excessive deficit" is launched. Thus, if the EC concludes that an excessive deficit is present in November/December (potentially after its autumn forecast), it is assumed that the country is in the EDP in the same year, though the Council decision may be adopted the following year. In particular, in the case of France, the Commission recommendation of November 2006 was adopted by the Council in January 2007, and in Croatia the Commission recommendation of December 2013 was followed by a Council decision in January 2014. The EC usually receives the final fiscal data during its Spring forecast. If the data point to a sustainable headline fiscal balance lower than 3% of GDP, a "recommendation for a Council decision abrogating the decision on the existence of an excessive deficit" should be launched. Thus, if, in a given year, the EC recommendation is followed by a Council decision, the country is considered to be out of the EDP in that same year.

Annex 2
Decomposing GDP growth: some complementary approaches

This annex reviews the production function approach to the decomposition of GDP growth, along with two other complementary approaches, in order to shed light on the statistical sources and methodologies used to identify the historical drivers of the processes of real convergence.

First, it should be recalled that the main statistical source used throughout this paper is the European Commission's (EC) *AMECO database*. This relies on the EC's Production Function Methodology for calculating potential growth rates and output gaps, and decomposes GDP growth into TFP, labour and capital contributions. The Cobb-Douglas production function approach deployed here focuses on the supply potential of an economy, and has the advantage of providing a more direct link to an important strand of economic theory. The factor inputs are measured in physical units, with hours worked serving as a measure for labour, and private plus government spending on structures and equipment serving as a measure for capital. Various simplifying assumptions underlie the specification of the production function, the best-known of these being constant returns to scale, perfect competition, and factor price elasticity equal to 1. These assumptions – although they are simplifying – seem broadly consistent with the empirical evidence at macro level. The same Cobb-Douglas specification is applied across all countries. The mean wage share for the EU15 over the period 1960-2003 is used as guidance for the estimate of the output elasticity of labour, giving a value of .63 for all Member States and .37 for the output elasticity of capital. TFP is not measured directly, but is obtained as a residual after accounting for the contributions of all other factors of production to growth.

The first complementary approach to the AMECO database uses the *Penn World Tables* (PWT) database to decompose GDP growth into TFP and factor contributions, while the labour factor contribution is further split into labour quantity and labour quality (the latter is also referred to as "human capital"). Another advantage – besides the more detailed breakdown of labour contribution – is time coverage, which starts in the 1950s, although the downside, however, is that the data series ends in 2011. In order to derive the various components we follow a similar Cobb-Douglas production function approach, using the PWT national accounts-based variables at 2005 constant national prices in million 2005 US dollars. In contrast to our baseline, we allow the estimate of the output elasticity of labour to vary over time and across countries (rather than use a constant of .63), taking advantage of the availability of such estimates in PWT. Although some direct estimates of TFP are also available, so we do not deviate significantly from the methodology used for our baseline, TFP is calculated here as a residual after accounting for labour quantity, human capital and the capital contribution.

The second complementary approach uses the *Conference Board Total Economy Database* (TED) to decompose GDP growth into TFP and factor contributions, where the value added is the more detailed information on capital services by asset class, i.e. ICT vs. non-ICT capital. ICT capital services are based on investment in software, hardware and telecommunications, while non-ICT capital includes non-residential construction, machinery and transport equipment. The clear disadvantage in this case is the time coverage for this type of growth accounting, which only offers an overview of about two decades.

Table A provides a summary of the three decompositions below.

Table B.1

Various GDP growth decompositions with an emphasis on TFP and capital intensity

Source	EC Ameco	Penn World Tables 8.0 (PWT)	The Conference Board (TED)
Independent variables	Labour contribution, Capital contribution, TFP	Labour contribution (Labour quantity), Human capital (Labour quality), Capital contribution, TFP	Labour contribution (Labour quality & quantity), Capital contribution ICT and non-ICT capital), TFP
Time coverage	1970-2016	1950-2011	1990-2014
Country coverage	EU15	EU15	EU15

Notes: The EU15 benchmark contains data for Germany that are approximated by series for West Germany over the period 1960 to 1991. The EU15 benchmark includes Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom.
Sources: EC AMECO, the Conference Board Total Economy Database, and the Penn World Tables.

Turning to the comparisons between these three data sources for the same subset of countries, (i.e. Italy, Greece, Portugal, Spain and Ireland), and for identical sub-periods available (1990-1999 and 2000-2007), it may be inferred that while data on GDP growth and the labour contribution are consistent across the three sources, this is not the case for TFP and the capital contribution[44]. This is particularly the case for Ireland, as illustrated in Chart B.1, where our baseline decomposition from EC AMECO is shown alongside the PWT and TED sources.
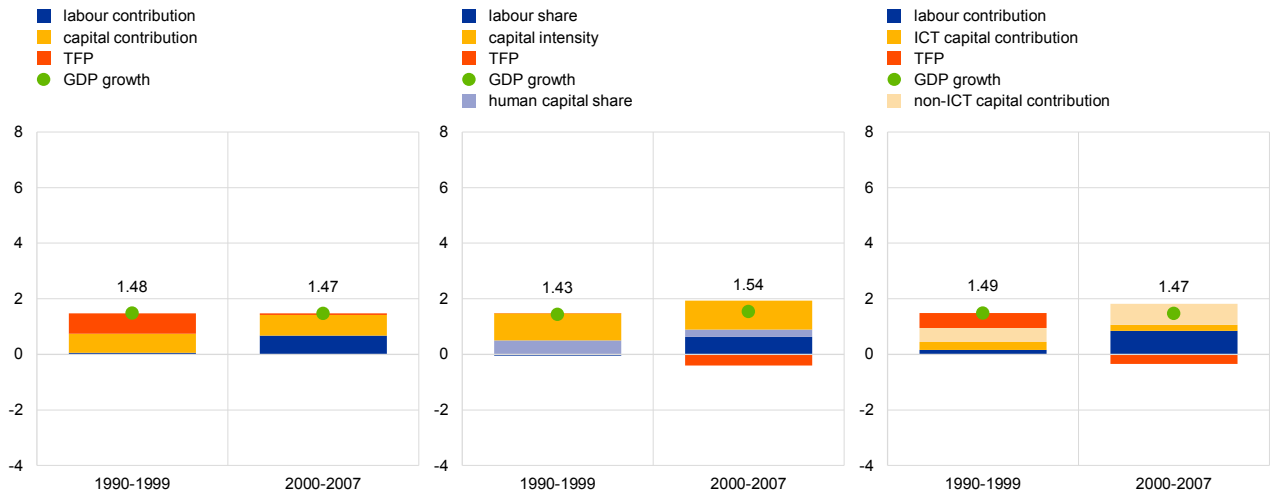
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[44] The discrepancies between the three sources with regard to these two variables may be attributed to: (i) differences in underlying raw data (e.g. different national accounts used, different PPPs used for these national accounts, etc.); and (ii) methodological differences in compiling the data series. The latter also include the use of different data definitions. For example, "capital contribution" in EC AMECO may not encompass assets that are identical to those covered by PWT or TED, which therefore also results in TFP deviations since TFP is obtained as a residual.

Chart B.1

Comparison of various growth decompositions by the European Commission (left), Penn World Tables (centre) and Conference Board (right)
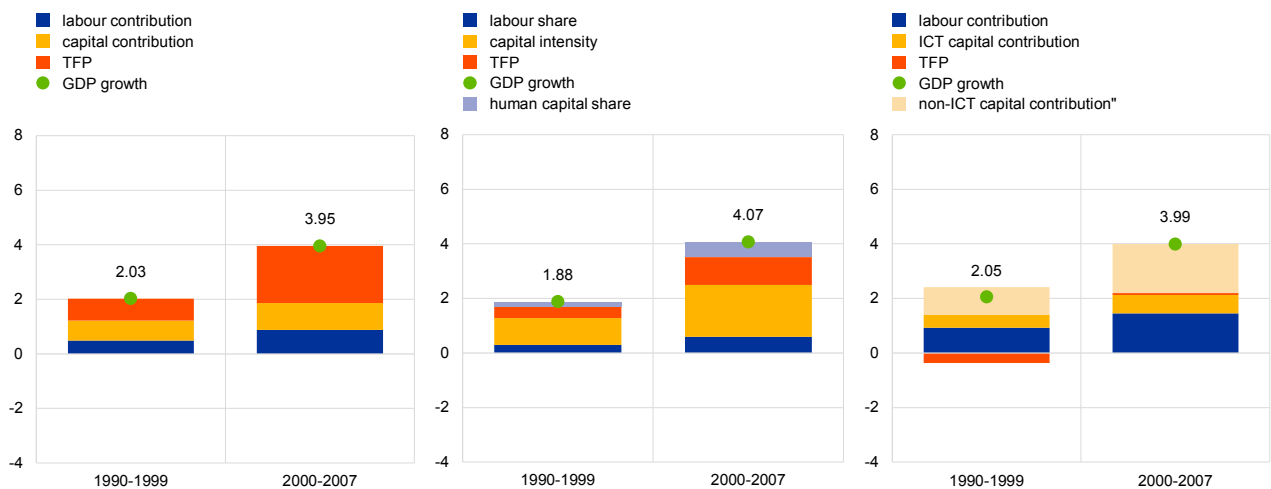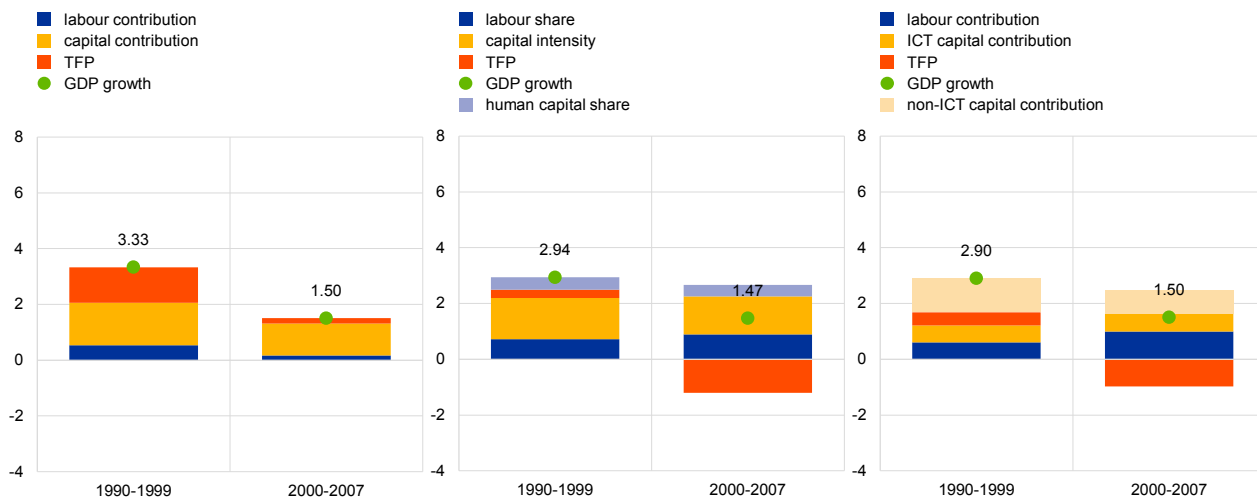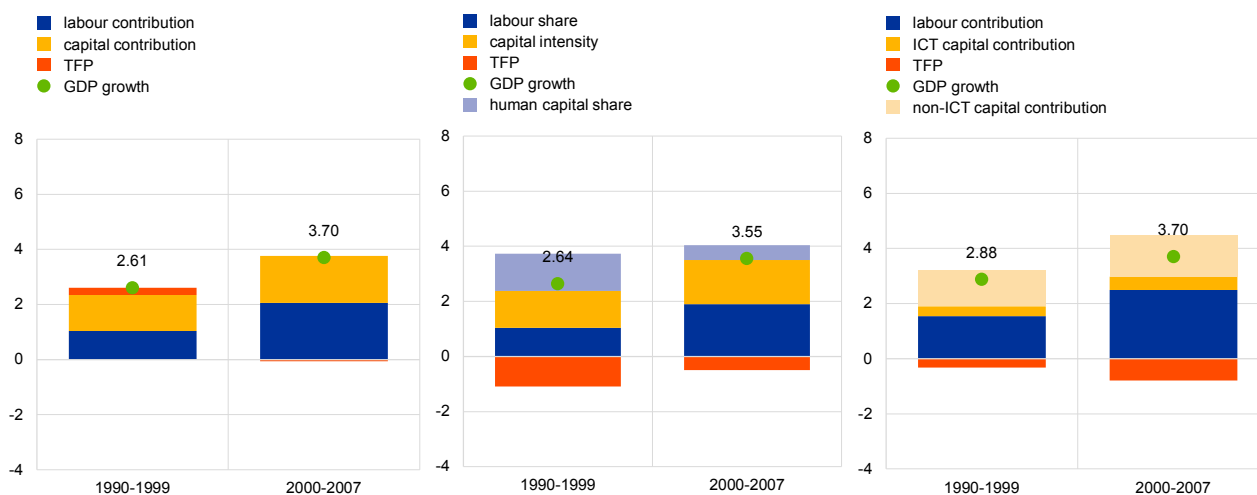
Italy

(average annual growth rates)

Legend (left):
- labour contribution
- capital contribution
- TFP
- GDP growth

Legend (centre):
- labour share
- capital intensity
- TFP
- GDP growth
- human capital share

Legend (right):
- labour contribution
- ICT capital contribution
- TFP
- GDP growth
- non-ICT capital contribution

Greece

(average annual growth rates)

Legend (left):
- labour contribution
- capital contribution
- TFP
- GDP growth

Legend (centre):
- labour share
- capital intensity
- TFP
- GDP growth
- human capital share

Legend (right):
- labour contribution
- ICT capital contribution
- TFP
- GDP growth
- non-ICT capital contribution"

Portugal

(average annual growth rates)

- labour contribution
- capital contribution
- TFP
- GDP growth

- labour share
- capital intensity
- TFP
- GDP growth
- human capital share

- labour contribution
- ICT capital contribution
- TFP
- GDP growth
- non-ICT capital contribution

1990-1999	2000-2007
3.33	1.50

1990-1999	2000-2007
2.94	1.47

1990-1999	2000-2007
2.90	1.50

Spain

(average annual growth rates)

- labour contribution
- capital contribution
- TFP
- GDP growth

- labour share
- capital intensity
- TFP
- GDP growth
- human capital share

- labour contribution
- ICT capital contribution
- TFP
- GDP growth
- non-ICT capital contribution

1990-1999	2000-2007
2.61	3.70

1990-1999	2000-2007
2.64	3.55

1990-1999	2000-2007
2.88	3.70

Ireland

(average annual growth rates)

- labour contribution
- capital contribution
- TFP
- GDP growth

- labour share
- capital intensity
- TFP
- GDP growth
- human capital share

- labour contribution
- ICT capital contribution
- TFP
- GDP growth
- non-ICT capital contribution

1990-1999	2000-2007
6.84	5.86

1990-1999	2000-2007
6.85	5.65

1990-1999	2000-2007
6.76	5.37
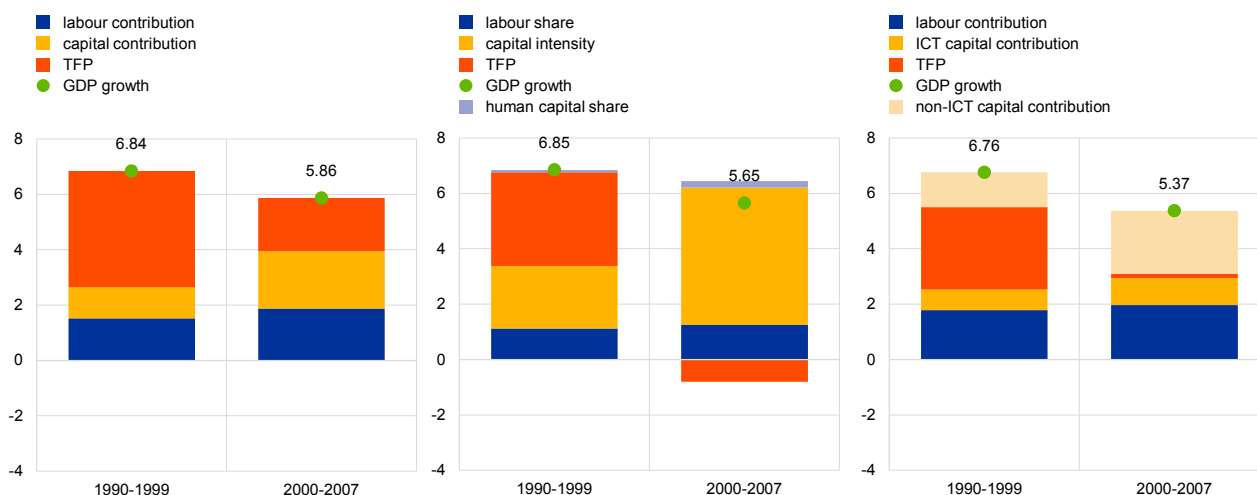
Sources: EC AMECO, Penn World Tables Version 8.0, The Conference Board Total Economy Database May 2015.

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Glossary

CEE	Central and eastern European economies that became EU members in 2004 (Estonia, Latvia, Lithuania, the Czech Republic, Slovakia, Poland, Hungary and Slovenia), 2007 (Romania and Bulgaria in 2007) and 2013 (Croatia)
CPI	Consumer Price Index
EBRD	European Bank for Reconstruction and Development
EC	European Commission
ECB	European Central Bank
EDP	Excessive deficit procedure
EIP	Excessive imbalance procedure
EMU	Economic and Monetary Union
ESCB	European System of Central Banks
EU	European Union
EA12	The twelve countries that adopted the euro in 1999 or 2002 (Belgium, Germany, Greece, Spain, France, Ireland, Italy, Luxembourg, the Netherlands, Austria, Portugal and Finland)
EU15	The 15 countries which had become Member States of the European Union by 1995 at the latest (Belgium, Denmark, Germany, Greece, Spain, France, Ireland, Italy, Luxembourg, the Netherlands, Austria, Portugal, Finland, Sweden and the United Kingdom)
EU28	The 28 Member States of the European Union before the exit of the UK (the EU15 plus the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, Slovenia, Malta and Cyprus (2004), Bulgaria, Romania (2007) and Croatia (2013))
EU8	The CEE countries that joined the EU in 2004 (the Czech Republic, Hungary, Slovakia, Poland, Slovenia, Lithuania, Latvia and Estonia)
EU-North	Refers to the EA12 countries, except Greece, Spain, Italy and Portugal
EU-South	Refers to Greece, Spain, Italy and Portugal within the EA12 aggregate
FDI	Foreign direct investment
ICT	Information and Communication Technologies
IMF	International Monetary Fund
MIP	Macroeconomic imbalance procedure
MNE(s)	Multinational enterprise(s)
NCB(s)	National central bank(s)
OECD	Organisation for Economic Co-operation and Development
PPP	Purchasing power parity
Pre-in country	EU Member State that is eligible for euro adoption, but does not yet fulfil the relevant criteria
TFEU	Treaty on the Functioning of the European Union
TFP	Total factor productivity

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