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Abstract

Economic and monetary union (EMU) implies the acceleration of an ongoing process of real convergence, whereby worker productivity, income and price levels tend to equalise across the euro area. Over the next 10–30 years, as real convergence takes place, trend inflation will be higher in poorer countries and lower in richer ones. When the accession countries in Central and Eastern Europe join the EMU, these structural differences in inflation rates among euro area countries will present the European Central Bank with new challenges in maintaining price stability. Three benchmark estimates for speed of real convergence are derived using data from Europe, the United States and Canada, respectively.

Key words: Real convergence, Euro area, trend inflation, EU accession

JEL codes: E58, O49

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Contents

1 Introduction

Economic and monetary union (EMU) has brought a common monetary policy to the eleven countries of the euro area, a policy which is formulated to address the needs of the euro area as a whole. The suitability of this policy to individual countries will inevitably vary, however, as member economies will from time to time experience differing rates of growth and inflation. At present, for example, Ireland is experiencing much higher growth and inflation rates than Germany. If the entire euro area were to resemble Ireland, monetary policy would be tighter than if the entire euro area looked like Germany.

Such "divergences" across euro area countries are made up of two components: (i) cyclical, resulting from economies being at different points on the business cycle, and (ii) structural, resulting from underlying differences in the economies. Real convergence in this paper relates to the latter, and specifically to a gradual elimination of differences in economic development across euro area countries. This is desirable and probably inevitable in the long run; total welfare will increase, and the European economy will emerge stronger and more vibrant than before. Nevertheless, the process may also entail a destabilising element for EMU macroeconomic policy, because the larger the developmental differences across the euro area economies, the greater will also be the structural divergences in trend inflation rates.

When economies integrate closely enough, developmental differences begin to diminish by means of a real convergence process, whereby poorer countries "catch up" to richer countries in terms of per capita incomes. Price levels converge as well. This is a long term process which affects trend inflation differentials. As price levels converge in the euro area, structural inflation in the poorer countries will be higher, since the two levels simply cannot equalise without one growing faster than the other. This causes a protracted dispersion in inflation rates across member countries, which is impossible to address via monetary policy tools as long as the monetary policy is shared. Gradual convergence in living standards thus results in a sustained divergence in inflation rates within the EMU.

The inflationary effect of real convergence has already been well-documented in the case of Spain and Portugal, which have the lowest per capita GDP levels in the euro area. At the time of this writing, total inflation (cyclical plus structural) in individual euro area countries ranges from 1.5 to 4.5 per cent. When the EMU enlarges to include 13 more countries, many of which are substantially poorer than the poorest of the current euro area countries, the dispersion in structural inflation rates is set to increase. In the event that cyclical inflation does not converge, a wider range of inflation across euro area countries seems likely.

At the same time, the primary and overriding objective of the euro area common monetary policy is to maintain price stability. This is defined as an annual increase in the harmonised index of consumer prices (HICP) of less than two per cent, on average, over the medium term, across the entire euro area. Since the average nominal inflation rate is limited to 2 per cent, any higher levels of inflation in euro area catching-up economies will have to be offset by lower levels elsewhere.

While this phenomenon can potentially become serious, there are three reasons why it will not take policymakers by surprise. First, EMU enlargement will not take place until at least two years after the EU has enlarged, and this is a process which seems likely to be protracted and incremental. Second, nominal convergence of inflation rates is a formal prerequisite for an economy seeking to join the EMU. Thus,

whether by tight national monetary policy or otherwise, inflation will be brought down and held down in accession countries before they join the euro area.

Finally, considerable catching up in living standards will have to take place before the weight of the accession countries' economies becomes substantial in the calculated euro area aggregates. At present, the combined size of the accession countries' economies is close to that of Spain; nevertheless, with a combined population of over 170 million people, if full convergence takes place, the accession countries will eventually converge to a weight of about one third of the euro area.

In any case, it is likely that EMU will include more countries in the decades to come, and like Spain and Portugal today, real convergence will lead accession countries to have both above-average inflation and a steadily increasing weight in euro area inflation aggregates. This paper assesses the size, speed and importance of this phenomenon.

The rest of the paper is structured as follows. Section 2 surveys recent literature on real convergence and takes stock of current income and price level differentials across euro area countries. Sections 3, 4 and 5 gather available evidence on the speed of real convergence from Europe, the United States and Canada, respectively, in order to provide some indication of what might be expected in the euro area over the next two to three decades. In all three areas, real convergence has taken place at a fairly rapid pace. In the United States and in Canada, however, migration appears to have had an important effect in the convergence process, something which has been much less of a factor in Europe. Section 6 constructs a scenario for real convergence and draws implications for future trend inflation developments in the euro area. Section 7 concludes.

2 Real convergence in the EMU today

Real convergence refers to the narrowing of productivity and price level differentials across countries. Broadly speaking, it occurs as a consequence of increased economic integration between poorer and richer countries. With increased trade and technology transfer, poorer societies "catch up" to richer partners over time by experiencing on average both higher price level and productivity increases[1].

Table 1 documents very recent differences in per capita GDP across euro area countries. The numbers represent per capita GDP figures as a percentage of euro area averages. The figures are easily comparable, since per capita GDP is denominated in euros in each country.

Fluctuations from 1998 to 2000 reveal which countries have been growing faster or more slowly than the average; numbers that grow larger each year indicate growth levels that are larger than the euro area average. Fluctuations result from both cyclical and structural factors, as well as one-time shocks. Over the long run, the net effects of random shocks and cyclical factors should cancel out, revealing the effects of structural differences.

[1] The literature sometimes makes a distinction between β-convergence, which refers to the tendency of poor countries to grow faster, and σ-convergence, which is the tendency of sample dispersion of incomes to diminish (see e.g. Taylor, 1999). The two concepts are closely related (e.g. β-convergence is a necessary but not sufficient condition for σ-convergence). For the purpose of this paper there is no compelling reason to distinguish between the two.

Table 1. **Index of euro area per capita GDP**

	1998	1999	2000
Luxembourg	183,8	184,0	185,5
Austria	118,2	118,9	119,6
Germany	117,7	116,5	116,4
Belgium	110,6	110,2	109,8
Finland	110,6	111,7	112,6
France	110,1	109,2	108,9
Netherlands	108,6	109,2	109,3
Ireland	99,5	107,3	115,9
Italy	89,9	89,8	89,7
Spain	63,6	64,6	65,4
Portugal	48,5	50,0	50,9

Note: Euro11=100 in each year
Data source: Eurostat, NewCronos

Two key observations can be drawn from Table 1. First, there are large differences in per capita GDP across the member states of the euro area. Second, growth in small, peripheral euro area states has been much more dynamic than in the large core countries.

The numbers in Table 1 are not purchasing power parity (PPP) corrected. Comparable PPP-corrected figures show much smaller differences across euro area countries, e.g. figures for Portugal are around 75 (and Greece around 67). PPP-corrections have the drawback that they artificially inflate poorer country worker productivity, however, and since productivity differences are of key interest in examining real convergence, a comparison using PPP-corrected figures is less meaningful.

Table 2. **EU country rankings of price levels**

	1985	1997
Finland	130	109
Sweden	127	120
Denmark	124	121
Germany	113	108
France	109	108
Austria	108	104
Netherlands	103	98
Ireland	103	96
Belgium	101	98
Luxembourg	98	108
UK	98	100
Italy	92	90
Greece	75	80
Spain	75	80
Portugal	52	65

Note: For 1985 EU12=100 while for 1997 EU15=100

There is some correlation between per capita income differences and price levels. Table 2 shows rankings of price levels (including taxes) across EU15 countries in

1985 and in 1997. The information is reproduced from EC (1999), p. 210. Again, there are notable differences across the euro area.

In both tables, the interesting outliers are the poorest countries. There are well-established theoretical reasons for believing that trend growth and inflation in e.g. Portugal, Spain and Greece will continue to outpace the rest of the euro area in the foreseeable future, by virtue of real convergence.

The mechanism for real convergence

A driving force behind real convergence is found in the Heckscher-Ohlin-Samuelson model for international trade, in which functioning markets and reasonably similar relative factor endowments will result in goods price equalisation and factor price equalisation, without even necessitating any movement of labour or capital across borders (Kim, 1997). Allowing for cross-border labour and/or capital flows speeds up productivity, wage and price convergence in an absolute sense (Razin and Yuen 1995). Thus, closer economic integration alone should be enough to eventually lead to approximate price and wage level convergence across countries, in traded and non-traded sectors alike. Increased trade in turn supports economic growth directly via specialisation according to the principle of comparative advantage, and indirectly via a diffusion of technology and best practices.

A second mechanism for convergence is found in new growth theory (see e.g. Barro and Sala-i-Martin 1995), whereby growth is determined by technological change. Since imitation or copying of technology is assumed to be less expensive than innovation, countries that are able to imitate leaders will grow faster until followers and leaders have converged technologically. Much empirical work on convergence has focused on this mechanism, and a brief overview of this literature is contained in Appendix A.

There is a link between per capita GDP growth rates and price level increases, which is commonly referred to as the Balassa-Samuelson effect. Balassa (1964) and Samuelson (1964) explained that lower price levels are observed in poorer countries because productivity in their tradables sector is lower. Prices of traded goods (primarily manufacturing) are set on the world markets, while prices of nontraded goods (primarily services) are set locally. While productivity in nontraded sectors is similar across wealthy and poor countries, a less productive tradables sector in poor countries will result in generally lower wages, lower non-traded goods prices, and thus also lower price levels. It follows that in any given country, the price level correlates positively with per capita GDP, and faster-growing countries should experience higher inflation rates.

It is also true that across countries, price levels will depend on other things besides per capita GDP. The price level of the US is not higher than in the EU, in spite of the income differential. This is generally explained by microeconomic factors such as efficiency and competitiveness of labour and product markets[2]. Exchange rate movements will also distort price level comparisons across time periods. A good

[2] For example, in Table 2 above, it is notable that the Nordic countries had very high price levels in the mid-1980s. Traditionally this is explained by cartellised markets and difficulties in market entry due to language and transportation barriers. The price level in high-income Luxembourg was similar to that of Belgium and France.

summary of reasons for deviation from the "law of one price" is contained in EC (1999).

In this paper, I will take advantage of the correlation between price levels and per capita GDP, by studying convergence of the latter and inferring at least some convergence of the former. In spite of the inaccuracies introduced, this indirect approach is necessary for two reasons. First, the data on price levels is much less reliable than GDP data. In Europe, national price level indices frequently reflect price levels observed only in national capitals, and include indirect taxes. Only a few countries include adjustments to make the indices representative for the whole country.

Second, EMU will limit the availability of some past mechanisms of convergence, namely widely different inflation rates followed by periodic currency exchange rate realignments. At the same time, monetary integration will lead to greater cohesion and provide further impetus to the catching-up effect in living standards (see ECB 1999, p. 42). To appreciate how real convergence may take place in the future, it is interesting to look at the United States and other monetary unions to see these have dealt with the issues of real convergence internally. Unfortunately, the US government does not publish statistics that allow for a price level comparison across regions. The best available is a set of relative price comparisons for selected consumer goods across different US cities, compiled by the American Chamber of Commerce Research Association (ACCRA). On balance, it therefore makes more sense to compare convergence using the national accounts statistics.

Real convergence will matter for EMU

The practical implication of real convergence is that poorer euro area countries, such as Portugal or Spain, can expect to have a faster trend growth than richer euro area countries until average labour productivity and price levels are no longer substantially different. Given competitive markets, this convergence process should continue until levels of GDP per capita are roughly the same throughout the euro area.

In the euro area today, even a very rapid real convergence of Portugal and Spain (and soon also Greece) to euro area averages is not likely to pose problems for the eurosystem to fulfil its inflation objective[3]. The poorest countries are simply not that poor relative to the average, and their weight in the euro area harmonised index of consumer prices (HICP) is and will remain small.

In the future, however, the euro area is expected to expand significantly. In the event that in the coming decades the euro area includes an additional 170 million people (the current population of Central and Eastern European accession countries + Turkey), the price stability objective may become more complicated to implement. For this reason, assessing the speed of real convergence is important for all parties concerned, not just Portugal, Spain and Greece. It is ironic that the process of convergence between integrated trading partners implies a period of divergence in

[3] The weights of Portugal and Spain in the euro area HICP statistic are currently 1.8 and 9.1 per cent, respectively. Thus, the ECB price stability objective can technically be fulfilled even with an explosive 10 per cent inflation in these two countries, as long as the inflation in the rest of the euro area is below 0.91 per cent.

structural inflation. Unless policy and institutional structures are made sufficiently flexible, this divergence may be disruptive for the very process that is accelerating the real convergence in the first place[4].

In the sections that follow, I examine historical evidence on real convergence in Europe and North America for the sole purpose of deriving implications for a common monetary policy in a diverse but converging euro area. For this reason, and in contrast with most academic research on convergence[5], I make no assumptions with regard to either future long-run aggregate growth rates or hypothetical steady-states of individual countries. Neither do I attempt to quantify the relative importance of different alternative mechanisms driving convergence, since available monetary policy variables do not include adjusting the speed of trade and capital market liberalisation, slowing the spread of technology, restricting worker migration, etc. Such endeavours are left to future research.

3 Case evidence: Portugal, Greece, Ireland and Spain after joining the EU

In recent decades, Western Europe has seen a considerable increase in economic integration. At the same time, poorer European countries have seen their average living standards rise dramatically toward the average for the region. These developments are shown graphically in Chart 1, which demonstrates how real convergence has taken place within the EU framework during the period 1970-1997. On the vertical axis is the per capita GDP of the current 15 members of the European Union, with the EU15-wide average normalised to 100. On the horizontal axis is the cumulative population of the countries. The countries are ordered by per capita GDP, from highest to lowest. All data in this section are from OECD sources.

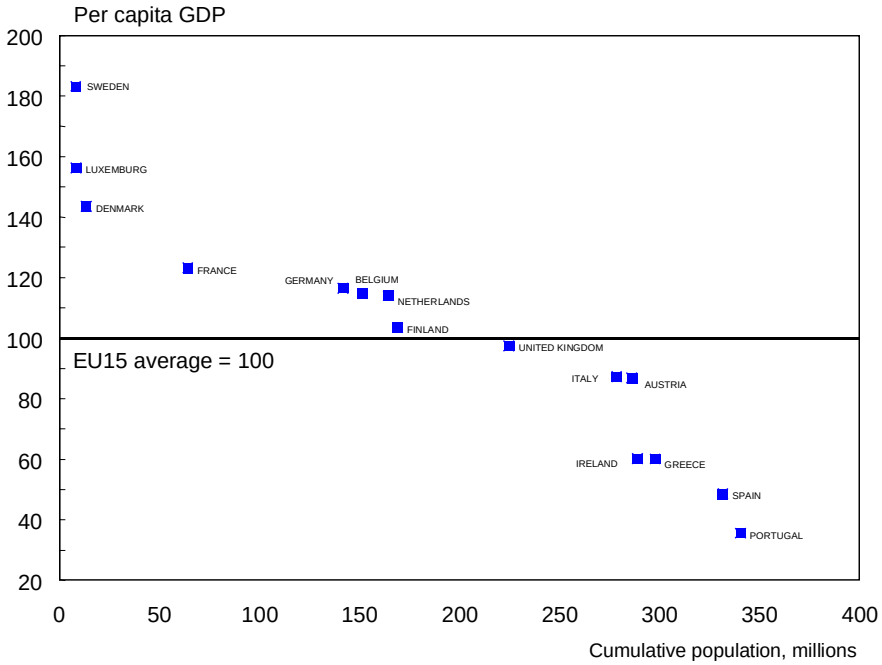
Comparing the two panels in Chart 1, since 1970 there has been a tendency for convergence towards the mean. By and large, the poorer countries have tended to catch up with the average, and the richer countries have reduced their lead, thus making for the flatter distribution in 1997, shown in Panel B. Here it is worth noting that the poorest EU countries (Greece, Spain and Portugal) all joined the EU in the 1980s. In the case of Spain and Portugal, a sustained and rapid catching-up process did not start until the time of their EU accession in 1986, and Greece has only been converging since 1988.

[4] In theory, this divergence in structural inflation can be compensated for by offsetting divergences in cyclical inflation. In practice, it would be reckless for policymakers to rely on this possibility.

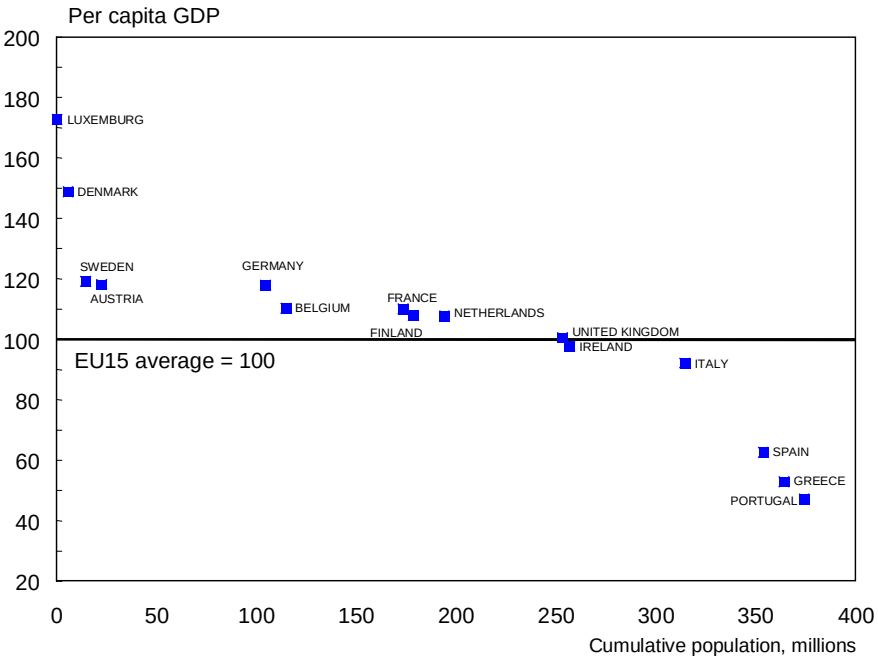
[5] The standard approach of convergence studies is to test the fit and estimate the parameters of existing growth models in assorted permutations. These models were designed to explain long-run growth, and thus always include assumptions of steady states and (endogenous or exogenous) technological innovation. Convergence only happens to be an incidental implication which is well borne out by the data.

Chart 1.

Panel A **EU-15 1970**

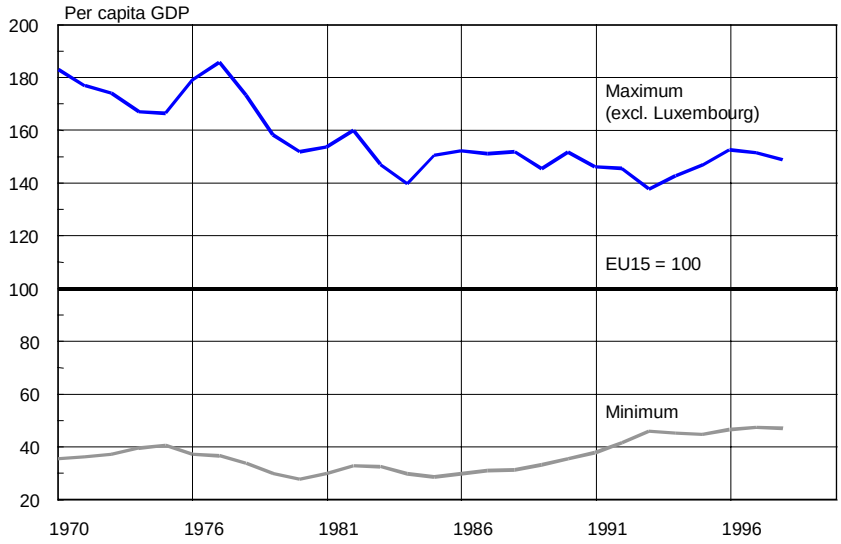


Panel B **EU-15 1997**



The trend real convergence phenomenon is equally evident when we observe the time series data of per capita GDP in the EU15, as shown in Chart 2. For simplicity of exposition, only the minimum and maximum of the time series are shown. A closer look at the data reveals a broad trend of convergence for practically all countries that in 1970 were outside of the GDP per capita range of 80-120 per cent of the EU15 level (the exception being Denmark).

Chart 2. **Real convergence**



Data source: OECD

This development is exactly what is predicted by basic trade theory (see e.g. Leamer and Levinsohn, 1994), given closer economic integration between European countries. Investment would be expected to flow from richer countries toward poorer countries, where improvements in technology would allow rapid increases in productivity. In the first instance, this results in higher industrial wages and faster economic growth in the poorer countries. Secondary effects include a faster rise in service sector wages and prices (the so-called Balassa-Samuelson effect, which is described in a European context in e.g. Alberola and Tyrväinen 1998, Tyrväinen 1998 and ECB 1999), and a broad-based increase in the price level toward what exists in the richer trading partners. A catching-up country will therefore experience faster trend inflation than wealthier countries.

For policymakers today, two questions immediately arise out of the empirical observations in Charts 1 and 2:

- How fast is this real convergence process, and the associated differential in trend inflation between wealthy and poorer euro area countries?
- Does the convergence process slow down as differentials decline, or is the speed relatively constant regardless of the size of per capita GDP differentials?

To help answer these questions, I gathered per capita GDP data from 18 European countries[6] indexed i = 1..18 over the time period j = 1970-97, and ran the following panel regression:

[6] The EU15 plus Norway, Switzerland and Iceland. Data source: OECD

$$DGAP_{ij} = \alpha_i + \beta GAP(-1)_i + \gamma GAP(-1)_i^2 + \delta GAPNEG(-1)_i + \varphi EU_i$$

where

$DGAP_i$ = the annual change in the gap between country i's per capita GDP level and the EU15 average per capita GDP level (GAP_t-GAP_{t-1})

$GAP(-1)_i$ = the absolute size of the gap between country i's per capita GDP level and the EU15 average per capita GDP level, lagged 1 period

$GAPNEG(-1)_i$ = a dummy variable that takes on a value of 1 if country i has a per capita GDP level below the EU15 average, lagged 1 period

EU_i = a dummy variable that takes on a value of 1 for years during which country i was a member of the EU

Parameters for the variables were estimated using the entire set of 486 observations, but country-specific effects (including different political environments, institutional setups, etc) are taken into account by having separate intercept terms for each country[7]. The seemingly unrelated regression (SUR) method was used, since country-specific error terms are likely to be correlated[8]. Making use of this information improves the efficiency of the parameter estimates. The regression results are shown in Table 3 below. The full regression results, including coefficients for fixed effects, is described and discussed in more detail in Appendix B.

Table 3.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GAP(-1)	-0.082	0.0137	-5.97	0.0000
GAP(-1)^2	-0.001	0.0001	-9.86	0.0000
EU(-1)	0.515	0.1579	3.26	0.0012
GAPNEG(-1)	2.636	0.3114	8.46	0.0000
Log likelihood	-1205.4			
R-squared	0.1211		DW-Stat	1.64

As expected, the regression was highly significant, with a large income gap being a very good explanatory variable for convergence toward the mean; all else equal, a 1 percentage point larger gap implies a 0.08 percentage point greater reduction in the gap in the following year. The evidence for a nonlinear relationship, whereby convergence is faster when differentials are larger, was also strong. The force for convergence in nominal per capita GDP levels thus appears to be very strong. This convergence can be divided into real output per capita growth differentials and changes in relative price levels, of which the latter are composed of both trend and

[7] De la Fuente (1997) notes the importance of including preference and policy parameters in the regression along with social, political, demographic and institutional variables. Unfortunately, a lack of data means that such variables are invariably left out in empirical estimations. The second-best approach is to catch them by including fixed effects in the way that I have. Care must then be exercised not to over-interpret the resulting intercept terms, which include a complicated mish-mash of unquantifiables. Moreover, in the European case, the political, social and institutional variables are likely to converge over time, though at a speed which is anyone's guess. In my regression I have therefore decided not to give an economic interpretation to the country-specific constants.

[8] To test robustness of the SUR results, the same regression was also run using GLS with cross section weights and calculating White heteroskedasticity-consistent standard errors and covariance. The coefficients remained of the same sign and order of magnitude, and were significant at the 1 per cent level.

cyclical inflation. Over the time period in question, the differences in real growth rates have been significant but much smaller than what is indicated by the regression. It follows that a large part of the convergence has involved real appreciation/ depreciation. In particular, the trend inflation differential could amount to several percentage points per year for the euro area countries with the lowest per capita GDP.

As far as the control variables were concerned, the fact of having become an EU member did seem to matter with regard to convergence. This supports the anecdotal evidence of Portugal and Spain starting a sustained convergence process toward the EU average only after becoming EU members. Intuitively, closer integration seems to have facilitated the convergence process. A plausible mechanism for this is the adoption of common EU institutions, which may have resulted in increasing competitiveness and/or larger investment inflows. Another factor may be EU support for infrastructure projects, etc.

Likewise, the regression results suggest a bias for poorer countries to converge upwards rather than richer countries to converge downwards. This is not surprising, as convergence is in part driven by a diffusion of good ideas and best practices, which obviously disproportionately benefits countries at the lower end of the income distribution.

On a year to year basis, the regression explains only about 12 per cent of annual fluctuations in DGAP. Presumably this is because in the short term, cyclical factors and economic shocks of various types tend to swamp the long-term trend effects of real convergence. Nevertheless, the strong significance of the regression indicates that over the longer term, there is indeed a strong trend component for convergence in the poorer EU member countries. This supports the validity of the graphical evidence of convergence that is provided in Charts 1 and 2.

The estimated speed of convergence is considerably higher than the 2 per cent per year standard estimates obtained in the literature using cross-sectional methods, but is on a par with other estimates obtained using panel data, such as those of Canova and Marcet (1995) or Funcke and Strulik (1999). As those authors have pointed out, using panel estimation techniques is a more efficient use of the available data than aggregating growth rates over the sample period and running a cross-section regression with only one observation per country. Moreover, the method allows for the introduction of fixed effects, as I have done, to capture systematic but unmeasurable differences across countries, the current and historical existence of which is really beyond any reasonable doubt.

Interpreting the speed of real convergence from this regression is not straightforward, however. Strictly speaking, the regression tells us that each country is rapidly converging towards its own particular hypothetical steady-state, which may differ across countries and change over time (see Quah 1993ab, Canova and Marcet 1995). It seems plausible, however, that country-specific long-run steady-states are themselves converging over time within the economic and monetary union, and that they are closer to each other today than they were three decades ago. European integration has contributed to harmonised institutional practices and greater competitiveness in retail markets, and this process is by no means complete[9]. From observing the data, I would expect the steady states of the Euro area countries' per capita GDP levels today to easily be within 20 percentage points of the euro area average, and closing.

[9] For further discussion of this, see Appendix B.

Drawing implications for the convergence in price levels involves adding another layer of uncertainty. While there is an established link between price levels and per capita GDP via the Balassa-Samuelson mechanism, the country-specific price levels are bound to be affected downwards in varying degrees by the improvements in labour and product markets that are being introduced in the wake of the common currency. Moreover, the leeway of adjustment in price levels has been constrained for several years already as EU countries have pursued Maastricht criteria-related disinflationary programmes. Under the common currency arrangement, these constraints will persist into the future, and may impose a cost on the future growth rates of catching-up countries.

4 Case evidence: United States real convergence between major regions

Studies of economic integration on international incomes are complemented by studies of domestic integration on regional incomes (see Razin and Yuen, 1995). After correcting for differences in political regimes and macroeconomic policies, the effects of economic integration is fundamentally similar whether we are examining nations or regions. Thus, we gain valuable insight into the future path of European economies by examining long-run trends in US regional developments, where a common currency prevails, along with common institutions, highly integrated labour and product markets, and a system of fiscal federalism.

Existing studies document strong evidence of economic convergence in the United States. Over long samples, holding constant the region and measures of sectoral composition, Barro and Sala-i-Martin (1992) find that the speed of convergence is roughly 2 per cent per year regardless of the time period or whether the converging variable is personal income or gross state product. The results were the same using data on both on personal income 1929-1988[10] and gross state product 1963-1986. Likewise, Kim (1997) and Caselli and Coleman (1999) find that convergence across US regions has continued throughout the 20th century[11].

These findings are replicated below. Chart 3 Panels A and B show snapshot pictures of the income distribution across eight major regions of the United States, in 1950 and in 1998, respectively. All data are from the Bureau of Economic Analysis, US Department of Commerce. Once again, during the time period there appears to have been a convergence towards the mean, with few changes in the ordering by income of the regions.

Two observations are immediately apparent from Chart 3. First, with practically all regions within ten per cent of the average in 1998, the differences across US

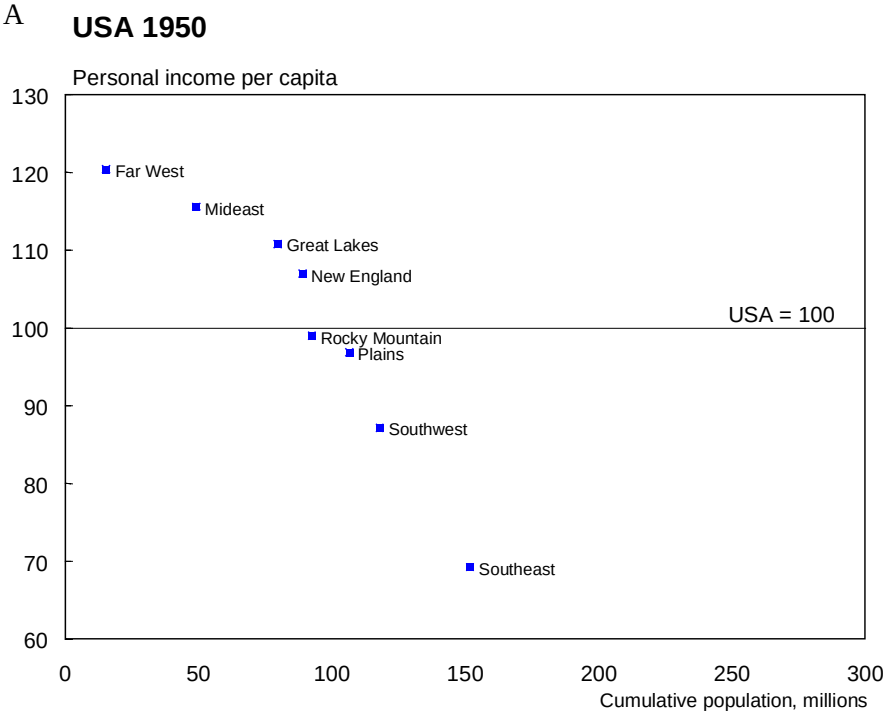
[10] Supplementary data is also used for various subsets of the region, in some cases going all the way back to 1840.

[11] Kim, Caselli and Coleman are actually more interested in determining the mechanism of convergence, which they find in trade theory as opposed to growth theory as in Barro's work. As a result, Kim is also able to explain the divergence that took place in US regional per capita income during the 19th century, while Caselli and Coleman explain the observed structural transformation out of agriculture and into manufacturing/services.

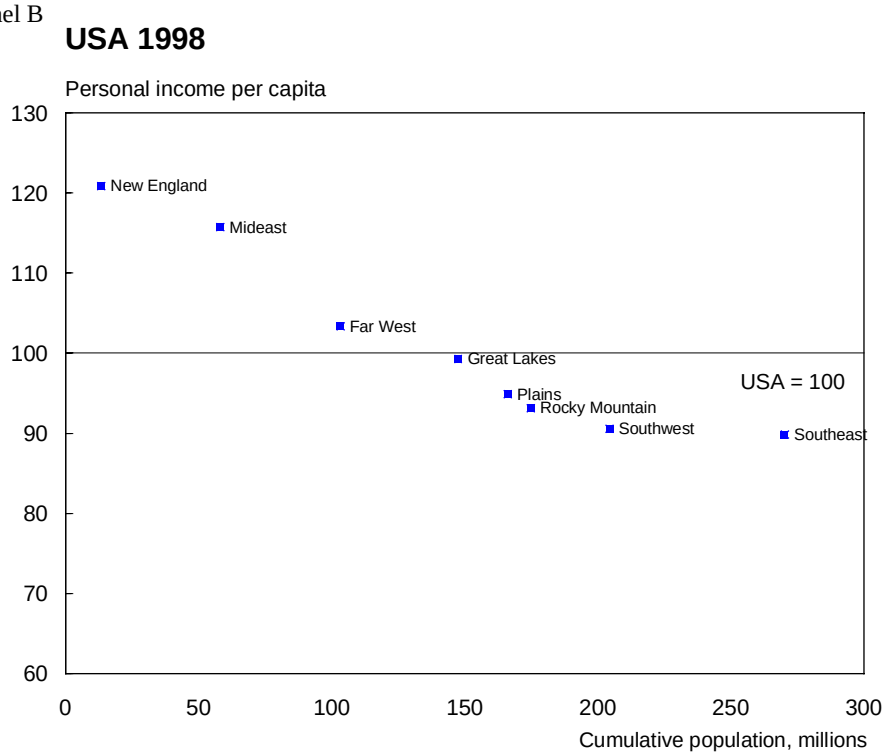
regions are not as large as are the differences across Europe. In observing the development record of the United States, it is encouraging that on average and across large units, large differences in per capita income tend to disappear, and the poorest regions in particular catch up toward the average.

Chart 3.

Panel A



Panel B



Second, it is equally apparent that in contrast to Europe, there are significant effects of migration at play. The United States has as a whole experienced substantial population growth, which has not been evenly distributed across the eight major regions. In part this reflects large positive net immigration during most if not all years. Presumably there has also been considerably more migration across regions in the United States as compared to migration across countries in Europe. It is therefore possible that income convergence is partly explained by changes in population, with relatively poorer persons relocating to relatively wealthier areas to live and work.

To formally test income convergence in the United States, I ran a second panel regression as follows:

$$DGAP_{ij} = \alpha_i + \beta GAP(-1)_i + \gamma LPOP(-1)_i + \delta GAPNEG(-1)_i$$

where

DGAPi	=	the annual change in the gap between region i's per capita income level and the US average per capita income level (GAPt-GAPt-1)
GAP(-1)i	=	the absolute size of the gap between region i's per capita income level and the US average per capita income level, lagged 1 period
GAPNEG(-1)i	=	a dummy variable that takes on a value of 1 if region i has a per capita income level below the US average, lagged 1 period
LPOPi(-1)	=	the log of population in region i, lagged one period.

Parameters for the variables were estimated using the entire set of 232 observations, but region-specific effects (including different industrial structures, demographics, etc) are taken into account by having separate intercept terms for each region. This time, the seemingly unrelated regression (SUR) method was not used, since there is serial correlation in the region-specific error terms[12]. The estimation is GLS with fixed effects and cross section weights. Results are reported in Table 4.

Table 4.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GAP(-1)	-0.037507	0.018078	-2.074722	0.0392
LPOP(-1)	-1.306681	0.464849	-2.810978	0.0054
GAPNEG(-1)	0.542828	0.333623	1.627072	0.1051
R-squared	0.188148	Mean dependent var		0.109577
Log likelihood	-234.0316	F-statistic		25.60849
Durbin-Watson stat	1.317379	Prob(F-statistic)		0.000000

Data source: US Commerce Department, Bureau of Economic Analysis

Once again, the regression was highly significant, with a large income gap being a very good explanatory variable for convergence toward the mean. This time, however, the parameter was not as large; all else equal, a 1 percentage point larger gap implies less than a 0.04 percentage point greater reduction in the gap in the following year. This

[12] The error terms' correlation over time is most likely a consequence of migration; relative population changes follow the same trend from year to year. Serial correlation in the error terms causes a problem for SUR estimation when a lagged dependent variable is included on the right hand side of the regression equation; in particular, parameter estimates are inconsistent (see e.g. Kmenta, 1986 pp. 647-648).

estimate is not incompatible with the 2 per cent convergence rate found by Barro and Sala-i-Martin (1992).

The evidence for a nonlinear relationship, whereby convergence is faster when differentials are larger, was not strong. When a squared gap term was included, neither the gap nor the squared gap terms were statistically significant explanatory variables. This indicates a problem of multicollinearity, most likely due to the fact that the gap sizes are in general not so large in the United States as they are in Europe.

Much of the convergence may in fact have been driven by migration effects, however. In the regression above, regional population growth was a highly significant explanatory variable for convergence, with a large and negative coefficient. This can be explained in three ways. First, as relatively poor people immigrate into the United States from abroad, they tend to settle in relatively wealthier regions such as New York and California, which brings these areas closer to the average. Second, internal migration occurs across the regions of the United States, as wage-earners pursue more attractive income opportunities in other parts of the country. If this group of native migrants consists mostly of persons earning below average (such as young persons, unemployed or underemployed), generally moving to faster-growing, wealthier areas, the net effect is to increase average income in the area where they leave and decrease average income where they take up residence. Third, a similar effect occurs as wealthy retirees from other parts of the United States take up residence in places such as Florida, a development that has boomed since the proliferation of air conditioning and the dramatic increase in the number of wealthy retirees. The available data does not allow for a differentiation between the three effects.

As far as the control variables were concerned, during the time period concerned the regression did not show a clear bias for poorer regions to converge upwards rather than richer regions to converge downwards (as observed in Europe). Again, this may be explained by the relative importance of migration as a convergence mechanism, as opposed to investment, technological change and proliferation of "best practices".

On a year to year basis, the regression explains close to 20 per cent of annual fluctuations in DGAP, which is considerably more than in the European case. Presumably this is because there are no short term exchange rate fluctuations to swamp the long-term trend effects of real convergence. As before, the strong significance of the regression indicates that over the longer term, there is a strong trend component for convergence in the poorer regions of the United States. This confirms the validity of the graphical evidence of convergence that is provided in Chart 3.

The US example poses two large drawbacks in drawing lessons for prospective real convergence in Europe. First, while the existence of real convergence seems practically incontestible, the mechanism for this convergence may in large part involve migration, and is therefore different from what has been the case in Europe and will probably continue to be the case for some time. While other mechanisms certainly played a role as well, we simply cannot use US data to determine what real convergence would have been in the absence of migration[13].

Second, the income differences across US regions are proportionally much smaller than the differences will be within the enlarged euro area of 2010. If we accept that equilibrium "full convergence" most likely will still imply differences in average per

[13] Razin and Yuen (1995) hypothesise that growth rate convergence is driven by capital mobility and income level convergence by labour mobility. Their evidence for this hypothesis is weak, however, and the hypothesis is also not supported by the observed real convergence in Europe.

capita income across regions of plus minus ten per cent or so, the US regions are by and large very close to full convergence today. Under these circumstances, it is unreliable to extrapolate small movements in the data to draw implications for speed of convergence when gaps are on the order of 50 percentage points or more.

5 Case evidence: Canadian real convergence between provinces

The Canadian experience also differs from EU experience by virtue of a common currency and significant net immigration from abroad, but is similar in terms of having multiple national languages and lower internal labour mobility than in the US. A priori, therefore, one might expect Canada to present an intermediate case between Europe and the United States.

Again, convergence is readily apparent (see Chart 4). In fact, it is quite striking how large the divergences were as recently as 1961, and how much the provinces have converged since then. Nonetheless, the dramatic (over 50 per cent) increase in population between 1961 and 1998 suggests that in Canada as well, migration probably played some role in the convergence. As in the United States, immigration to Canada has not been evenly distributed across all provinces.

To formally test the existence and mechanisms of real convergence across the Canadian provinces, a regression was run which was very similar to that for the United States above:

$$DGAP_{ij} = \alpha_i + \beta GAP(-1)_i + \gamma LPOP(-1)_i + \delta GAPNEG(-1)_i$$

where

DGAPi	=	the annual change in the gap between province i's income level and the average income level for Canada (GAPt-GAPt-1)
GAP(-1)i	=	the absolute size of the gap between province i's income level and the average income level for Canada, lagged 1 period
GAPNEG(-1)i	=	a dummy variable that takes on a value of 1 if province i has an income level below the Canadian average, lagged 1 period
LPOPi(-1)	=	the log of population in province i, lagged one period.

Statistics Canada compiles data by province on both per capita income and on output. The regression was run on both sets of data, and yielded very similar results in both cases[14]. Table 5 reports results using annual personal income data across Canadian provinces 1962–1998; that is, 37 observations each for 10 provinces with a balanced panel of data including 370 observations[15].

[14] The size and statistical significance of the tabulated regression coefficients were virtually the same. Differences were by and large relegated to the province-specific fixed effects, which were all close to -5 in the income regression and 0 in the output regression.

[15] The Canadian data contained two relatively minor discontinuities: a methodological change in provincial vs. aggregate Canadian data compilation (whereby provincial and Canadian data are only fully reconciled from 1992 onward) and the splitting in two of a Canadian territory mid-period (into Yukon and Northwest Territories, with a combined population of well under 100,000).

The method used is GLS with cross section weights, and White hetero-skedasticity-consistent standard errors and covariance.

Table 5. **Canadian personal income data**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GAP(-1)	-0.061	0.0125	-4.86	0.0000
LPOP(-1)	0.311	0.3049	1.02	0.3089
GAPNEG(-1)	-0.115	0.3943	-0.29	0.7713
R-squared	0.074	F-statistic		14.34302
Durbin-Watson stat	1.82			

Data source: Statistics Canada

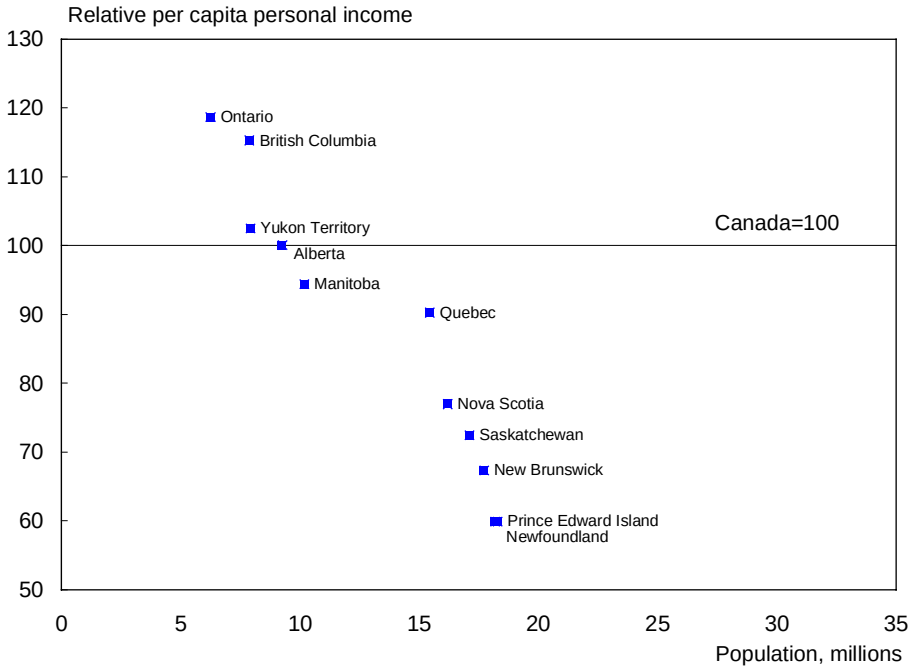
The coefficient on GAP again had the expected size and magnitude, and was statistically significant with over 99 per cent confidence. Real convergence thus appears to have been a fact in Canada as well, with convergence proceeding at a pace that is not significantly different from that in Europe.

As far as the mechanisms driving this convergence, however, the role of migration is less clear, since province-specific population growth was not a statistically significant explanatory variable in the regression. While the sheer scale of immigration into Canada makes it a variable that cannot be ignored, no reliable conclusions can be drawn about it without better descriptive statistics of the population flows in question.

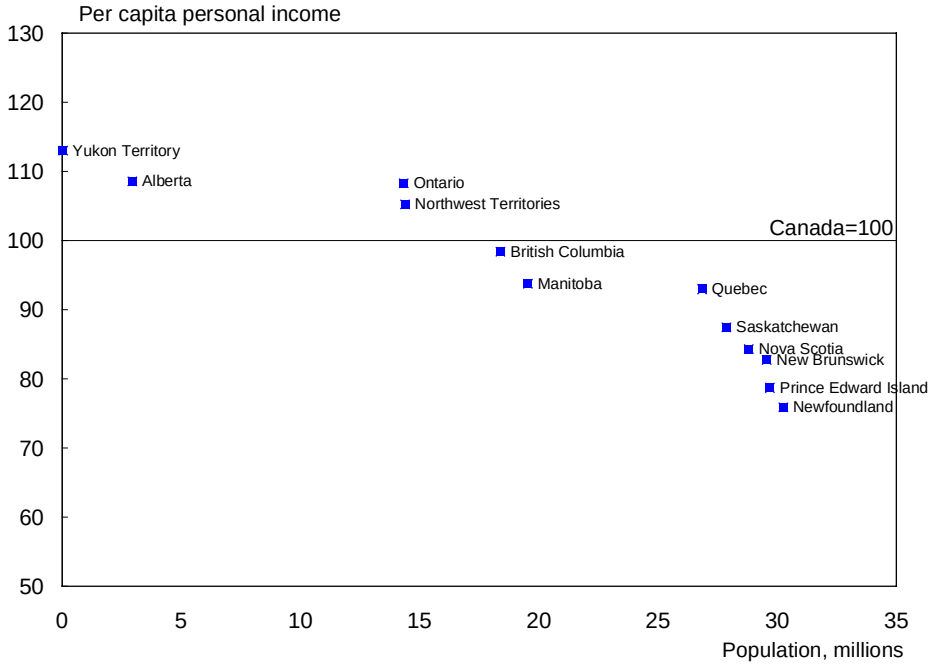
Once more, and in contrast with Europe, the lower end of the distribution did not seem to converge to the average any faster than the higher end of the distribution. As in the United States, a plausible interpretation of this is that convergence was not driven by a diffusion of investment, best practices and technology, but rather by migration and perhaps changes in sectoral compositions.

Chart 4.

Panel A **Canada 1961**



Panel B **Canada 1998**



6 Implications for euro area inflation

Trend inflation depends in part on the pace of aggregate price level convergence. Over time, lower aggregate price levels in poorer euro area countries are catching up to the higher levels found in richer countries, and this catch-up creates a component of inflation.

To assess the impact of this phenomenon on euro area inflation, I conducted a simple simulation involving a faster-growing Spain, Portugal and Greece. Assuming that these three countries (i) all experience annual real growth and inflation averaging 3 per cent each, (ii) while real growth in the rest of the euro area averages 2 per cent annually, then the faster-growing countries' real per capita GDP would still only be about 85 per cent of the euro area average by 2040. In the interim, however, price stability requires that average inflation in the rest of the euro area would have to be maintained at ever lower levels, as the weight of the faster-growing part of the euro area gradually increases. Maximum inflation in the Euro-9 would be almost 1.9 now and gradually fall to about 1.8. This does not seem to be an insurmountable obstacle, and the European Central Bank (ECB 1999) is probably right not to be concerned.

The enlargement process looks to be more problematic, however. Besides the poorer euro area countries, there are currently also 13 candidates for accession to the EU, most of them substantially poorer than the euro area average (see European Central Bank, 2000). Based on the historical evidence of real convergence presented in sections 3-5 above, the accession countries to the European Union should, in time, boast per capita income levels on a par with those of the current Euro area members. As price levels converge across countries, there will, on average, also be a positive inflation differential between the EU accession countries and the current euro area. This differential will persist until price levels have converged.

The size of this inflation differential depends on how fast real convergence actually takes place, and there are few serious estimates of this. A lower bound is given by Fischer, Sahay and Vegh, 1998, who project a 5-6 per cent long term trend growth rate of per capita GDP, on average, in the transition economies. The reason that this can be considered a lower bound is because the authors use a Barro-type growth regression without fixed effects, which statistically biases downward the convergence rate estimates (see Canova and Marcet, 1995). The authors also obtain similar results using an alternative (Levine-Renelt, 1992) growth regression specification, which suffers from the same bias. By contrast, the panel-type estimation benchmarks in sections 3-5 above suggest that growth may well be substantially higher. In the extreme, a case can be made for sustained double-digit growth rates, once well-functioning EU-type institutional structures of a market economy have successfully been put into place. Such growth rates have already been observed in e.g. Estonia, although they were interrupted by the outbreak of the Russian crisis and a subsequent capital withdrawal from emerging markets in general.

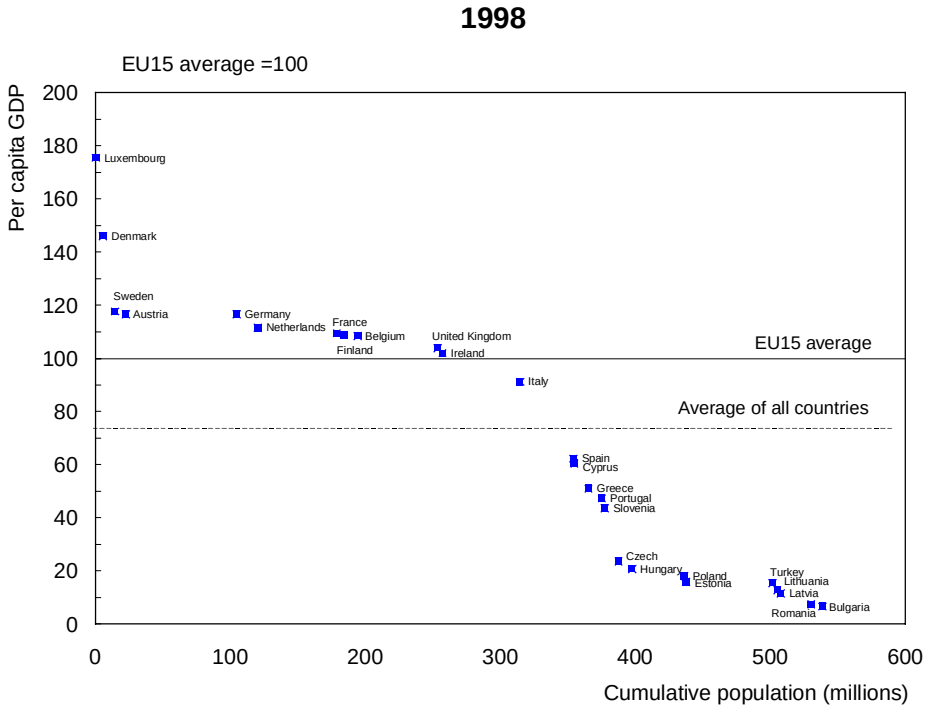
On a technical note, caution must be taken in interpreting current inflation and real convergence statistics in the accession countries. For inflation in non euro area countries, Eurostat currently uses consumer spending weights at PPP exchange rates. This procedure inflates the relative size and average labour productivity of the accession countries, and therefore underestimates the real extent of price level increases from year to year. Thus, a poor country which shows pre-accession inflation rates that conform to the Maastrict criteria may, upon accession, show a much higher

inflation rate merely because inflation calculations are now based on actual price increases rather than adjusted by purchasing power parity.

Looking forward to the years 2010 and 2020, one might ask how catching up would affect inflation developments in the euro area. Assuming that real convergence takes place along the patterns that have historically been observed, the impact on euro area inflation and subsequently monetary policy will depend on the rate and circumstances of the coming accession process -- who is actually counted into the average, and what weight they are given. The more rapid and large scale the accession process, the greater will be the impact on the common monetary policy.

Chart 5 presents in one graph the EU15 countries and the 13 accession countries, in descending order of per capita GDP. The dispersion in per capita incomes increases when all countries are taken into account, and indeed the average itself falls by over 25 per cent. Real convergence will take place both before and after the EMU accession of the individual countries at the lower end of the distribution, but euro area inflation statistics will not be affected until after accession has taken place and the countries are included in the averages.

Chart 5.



A net effect of real convergence on euro area aggregate inflation can therefore only be estimated after having arrived at a belief about both the accession timetable and the size of the inflation differential between richer and poorer euro area countries. In calculating average inflation for the euro area, individual country inflation is weighted by country GDP denominated in euros. Thus, the weights of accession country inflation developments will eventually also be determined by the size of their GDP in euros. In 1998, the combined GDP of all of the accession countries was quite small, amounting to less than 9 per cent of the euro area combined GDP, or smaller than Spain alone.

Seen from this perspective, one might conclude that the accession countries' catching up will only have a similarly small effect on euro area inflation. This

conclusion is mistaken: as real convergence progresses, the weight in the euro aggregates of the accession countries converges toward their share in euro area population, which is well over one third. To illustrate this, I conducted a second naive simulation that assumed (i) EMU accession of the 13 countries above within 15 years, (ii) average real growth of 2 per cent in wealthier countries, and (ii) average real growth and inflation of 5 per cent each in accession countries until 2010, with 2010-2015 inflation averaging 4 per cent, declining to 3 per cent thereafter. Between 2010 and 2015, the simulation showed wealthier euro area countries obliged to maintain average annual inflation levels below 1.25 per cent. After 20 years of convergence, per capita GDP in accession countries would still only be about 66 per cent of the euro area average. Spain, Portugal and Greece would have caught up by this time, however, and would therefore no longer exert an upward pull on inflation. Inflation in the nine wealthiest euro area countries could then return to close to 1.6 per cent, but would again have to fall as the weight of the accession countries increased further. The catching-up process nears completion by 2030, after which the related inflation differential is assumed to disappear. The simulation did not take into account any eventual changes to relative positions on the business cycle.

7 Conclusions

As the economic and monetary union (EMU) enlarges to include the 13 accession countries, there will be a greater dispersion of per capita income levels across the euro area. These differences will tend to diminish over a period of 20-30 years. During this process, however, trend inflation will be higher in the "catching-up" countries. Once the new countries join EMU, relatively wealthy member countries will have to have lower inflation in order for euro area price stability to be maintained on average. The situation will be similar to what has already been observed with regard to Ireland, Portugal, Spain and Greece, but on a larger scale, due to the greater differences in average living standards.

Regarding the predicted speed of convergence, the available estimates range from 2 per cent per year to over 10 per cent. This paper has developed three benchmark estimates for how fast real convergence may take place, using data from Europe, the United States and Canada, respectively. In all three places, real convergence has been the rule. Nevertheless, the mechanisms for convergence appear to have differed. Migration was probably a more important element in both the United States and Canada, whereas European convergence has relied more on trade and investment flows and a proliferation of best practices in institutional design. Perhaps consequently, the differences today remain much larger between the average per capita income levels of various euro area countries. While migration may yet become an important force for real convergence in the enlarged euro area as well, the best benchmark for what the future will contain for Europe may still be that derived from Europe itself over the past thirty years. As always, however, the limitations must be recognised of using Western Europe in the past to predict Central European and Balkan developments in the future, especially as EMU also imposes changes to the real convergence process as it has occurred in the past.

When studying the EU accession countries, it must be kept in mind that many of them are still in various stages of systemic and institutional transformation to market

economies. Until this process has progressed further, the macroeconomies remain fragile and sustained very rapid growth will be difficult to accommodate. This will slow the average pace of real convergence during the next several years. Real convergence may thus take hold with full force at about the time when the accession countries are expected to be joining the euro area, and become subject to the common monetary policy.

On the positive side, the very fact that accession countries are adopting EU institutions is almost certainly a facilitating factor to real convergence in living standards. Current popular conventional wisdom holds that without the presence of the EU, the central European transition economies would not have progressed nearly as far in the past decade, and would not be nearly as clear on the direction in which they were developing.

Two reasons were identified why real convergence in the enlarged euro area will not immediately cause problems for the common monetary policy. First, the economic weight of the accession countries relative to the rest of the euro area is still small enough that any inflation divergences will only have a negligible impact on the euro area as a whole. Eventually, however, the convergence of living standards will cause the economic weight of this group of countries to converge toward its share of population, which is around one third of an enlarged euro area.

The second reason is that EMU accession criteria will compel the countries in question to bring inflation rates into line before they can join the euro area. It is one thing to achieve nominal convergence, but quite a different one to sustain it in the face of large differences in living standards. Prior to joining EMU, it is possible to use tight monetary policy to achieve low inflation for a requisite two-year qualifying period. After that, the monetary policy tool is no longer available and real convergence may proceed once more. An economic policy strategy whereby real convergence would not be allowed to proceed would probably be difficult for a local constituency to accept.

Many poor countries have recently witnessed dramatic successes in lowering inflation to single-digit levels, but real convergence of living standards is making it very difficult for them to sustain inflation levels below 2 per cent over the medium term. Given an ongoing process of economic integration, as trade expands and improved technology/best practices proliferate, such low inflation levels may in some cases only be compatible with conditions of a cyclical recession, where real convergence has artificially been stopped. This seems to be the case at present in the Czech Republic and in all three of the Baltic states (See ECB Monthly Bulletin, February 2000, Table 2 p. 41).

For accession countries, then, it may be counterproductive to achieve nominal parity in inflation early on. Joining the EU does not preclude the existence of substantial inflation differentials. Inflation may be brought down to single digits, but should probably still remain somewhat over the euro area average in order for real convergence in living standards and price levels to take place. Just how high nominal inflation should be will depend on country-specific circumstances related to catching up at a sustainable pace.

After EU accession has taken place, the subsequent accession process to EMU requires a decision by EU Heads of State. Recommendations will then be considered from both the European Commission and the European Central Bank. One important component of such recommendations is bound to be the sustainable nature of an accession country having met the inflation criteria of the Maastricht Treaty. Due to real convergence considerations, this could become a critical sticking point. At the

same time, economic judgements on this point will necessarily be subjective. In the final analysis, political factors will also have to be considered.

Institutionally, it must be kept in mind that the European Central Bank has essentially no room for manoeuvre in order to reconcile the common monetary policy with differing inflation developments within the euro area. It is up to national policymakers to keep growth in their economies stable and balanced. The task of managing EMU enlargement in a sustainable and non-disruptive way must therefore lie in the preparatory work of economic policymakers in the countries themselves, as post-enlargement economic strategies are prepared.

To do this, a fuller assessment is needed with regard to the likely mechanisms for real convergence. If convergence takes place primarily through trade and investment flows, policies and institutions need to focus on increasing the amount of investment that can effectively be absorbed by the accession countries without precipitating macroeconomic overheating. If the convergence mechanism also involves substantial migration within and between European countries, a policy and institutional response is needed to manage these flows as well. Finally, the timing and conditions for EMU accession must take into account the economic realities that will be presented by the issue of real convergence.

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Appendix A: Convergence according to the New Growth Theory

The so-called "convergence property" of the neoclassical growth model, as developed by Solow (1956) and others, states that once corrections have been made for relevant differences across economies, then a lower starting level of real per capita GDP implies a higher predicted growth rate. A lot of empirical support exists for the conditional convergence property of various versions of the Solow model, and good discussions of this are contained in e.g. Murthy and Chien (1997), Barro and Sala-i-Martin (1992, 1995) and Bernard and Durlauf (1994). Indeed, empirical work on convergence has recently concentrated on this mechanism, while convergence results that derive from trade theory have by and large been incidental[16].

As Barro (1996) points out, the convergence property derives from diminishing returns to capital (including human capital); economies with less capital per worker thus have higher marginal product of capital than capital-rich countries. With free movement of capital, capital will flow toward countries where it is relatively scarce until marginal products of capital have been equalised. Even without free capital flows, an equal propensity to save and invest in each country will in time result in convergence, as capital-poor countries grow faster. Nevertheless, there are many reasons why cross-country variation can arise and persist, including differing government policy environments and market distortions.

In a cross-country study of 100 countries from 1960 to 1990, Barro (1996) finds strong support for the convergence property above. Nevertheless, the devil is clearly in the details of how best to correct for differences in variables that are hard to quantify, such as schooling, political stability or the quality of government policies and institutions. When forecasting relative growth rates, one is also making implicit statements about economies' relative current and future performances. To do this reliably enough for policymaking purposes, it becomes essential to have a detailed and sophisticated knowledge of the structure of the economies. Barro-type regression estimates should therefore not be taken as more than a starting point for further discussion. This point is driven home by Table 4 in Barro (1996), which tabulates winners and losers for prospective economic growth 1996-2000. Big winners include South Korea, Malaysia, Thailand and Hong Kong, countries that were severely hit by the Asian crisis shortly after the publication of the forecasts.

Canova and Marcet (1995) have questioned the adequacy of this mechanism in fully explaining convergence. Using panel data, the authors estimate a Bayesian model and introduce fixed effects to control for systematic differences across countries. The result is convergence estimates that are far too high to plausibly be explained using the neoclassical model. De la Fuente (1997 pp. 68-69) uses these results to open a discussion of the respective mechanisms of convergence. In particular, he cites evidence that contradicts what he calls the "prevailing view" that income convergence is mainly the result of decreasing returns to scale in reproducible factors. Instead, he suggests technological diffusion, factor flows and changes in the sectoral composition of output as important explanations. The results in this paper provide additional evidence which broadly favours de la Fuente's interpretation.

[16] A survey is contained in Leamer and Levinsohn (1994).

Appendix B: Robustness tests on European data regressions

1. Basic case, common intercept

Dependent Variable: DGAP_? Method: Pooled Least Squares
Sample: 1971 1997 Included observations: 27
Total panel (balanced) observations 486
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.373673	0.242763	1.539249	0.1244
GAP_?(-1)	-0.016978	0.008023	-2.116264	0.0348

R-squared	0.010861	Mean dependent var	0.165898
Adjusted R-squared	0.008817	S.D. dependent var	6.636847
S.E. of regression	6.607522	Sum squared resid	21131.13
Log likelihood	-1237.372	F-statistic	5.314502
Durbin-Watson stat	1.733046	Prob(F-statistic)	0.021571

Discussion: This regression corresponds to the most basic test of absolute convergence; without conditioning for any systematic differences in characteristics of individual countries, it is tested whether there exists a tendency for an economy to converge toward the mean per capita GDP. The coefficient for GAP(-1) is negative and significant, and of the same order as is generally found in Barro-type regressions in various permutations. The regression itself has a very low explanatory power, but is statistically significant.

Nonetheless, this regression ignores the fact that there are systematic differences between European countries (via different institutions, industrial structures, cultural habits, etc). Including measures of all these differences would significantly improve the fit of the regression. Unfortunately, the nature of these differences make them very hard to control for (witness the efforts and discussions of Barro, 1996 and Barro and Sala-i-Martin, 1995). Therefore, a second-best way of approaching this problem is to include fixed effects in the regression, as was done in the paper and tabulated in Table 3. This explicitly acknowledges a systematic pattern in the error term of the regression above, and thus improves the fit. Below is a more detailed discussion of this methodology.

2. Full regression from Table 3, including fixed effects' coefficients

Dependent Variable: DGAP_? Method: Pooled Least Squares
Sample: 1971 1997 Included observations: 27
Total panel (balanced) observations 486
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GAP_?(-1)	-0.082033	0.013745	-5.968295	0.0000
GAP_?(-1)^2	-0.001108	0.000112	-9.855137	0.0000
EU_?(-1)	0.515457	0.157934	3.263745	0.0012
GAPNEG_?(-1)	2.635854	0.311412	8.464208	0.0000
Variable	Coefficient	Std. Error		
Group I				
SWI--C	14.43890	2.092684		
NOR--C	9.460126	1.830267		
LUX--C	7.266000	1.911771		
ICE--C	6.337636	2.559822		
DK--C	5.919310	1.219909		
SWE--C	5.222878	1.821346		
Group II				
FIN--C	1.917663	1.756537		
AT--C	1.676109	0.649213		
GER--C	1.615525	0.828617		
FRA--C	1.155262	0.686210		
NE--C	1.114300	0.850886		
BEL--C	0.965146	0.839246		
Group III				
POR--C	-3.105769	1.032634		
IRL--C	-3.146190	0.835859		
UK--C	-3.162240	1.100689		
IT--C	-3.278406	0.804329		
SPA--C	-3.784663	0.855923		
GRE--C	-4.551849	0.881505		
Log likelihood	-1205.407			
R-squared	0.121100	Mean dependent var		0.165898
Adjusted R-squared	0.081322	S.D. dependent var		6.636847
S.E. of regression	6.361265	Sum squared resid		18776.08
Durbin-Watson stat	1.639317			

Discussion: This regression conditions convergence on the existence of systematic differences across countries. Nevertheless, these differences are never made explicit. To the extent that the coefficients on the fixed effects differ from each other, they may indicate convergence toward different long-run steady-state levels of per capita GDP.

When the countries are ordered according to the sizes of the fixed effects coefficients, they appear to break into three groupings (numbered I-III above). A statistical argument can be made that all counties in each grouping are converging toward the same level, but the levels differ across the groups -- these would be so-called "convergence clubs" within Europe, along the lines that have been discussed in Quah (1993ab).

On closer examination of the data, however, such a conclusion seems inappropriate. Ireland and the UK in the third grouping are not obviously much poorer today than Germany or France. Neither is it plausible that Finland is converging to a lower income level than Sweden or Denmark, even though technically speaking Finland has a fixed effect coefficient not statistically different from that of Portugal.

The logical conclusion is cautionary, warning against over-interpreting the fixed coefficients. It should also be recognised that the fixed effects include institutional factors, and there is a trend toward convergence in these as well as Europe becomes an ever closer group of nations. With time-invarying regression coefficients, there will be a bias toward overemphasising initial conditions. This is very important to keep in mind as well when using the past to infer the future of the poorer accession countries.

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