Ville Kaitila

CONVERGENCE, INCOME DISTRIBUTION, AND THE ECONOMIC CRISIS IN EUROPE

Convergence, income distribution, and the economic crisis in Europe

Ville Kaitila[1] **(ETLA)**

Abstract: We analyse the Sigma convergence (standard deviation divided by average) of purchasing power adjusted GDP per capita and GDP per hour worked in the European Union. We also link the development in income distribution as measured by Gini coefficients to convergence. With short pauses, there has been a long term trend of GDP per capita convergence in the European Union after 1960. The Great Recession was a shock to the development, and convergence within the EU-15 has suffered considerably. The largest relative declines have occurred in Cyprus, Greece, Italy, Portugal and Spain. On the other hand, the ex-transition countries have mostly continued their catching up. Historically, convergence in the EU has been faster when aggregate GDP growth has been faster. We also find that income disparities measured by Gini coefficients are negatively related to GDP per capita levels. Convergence was not correlated with changes in income distribution in 2000–2011 except for a group of six catching-up countries where we find a positive relation. We also find that there has occurred Sigma convergence in national Gini coefficients.

Key words: EU, GDP per capita, productivity, Sigma convergence, Gini coefficient

JEL codes: F15, F43, O15, O47

Tiivistelmä: Tässä tutkimuksessa analysoidaan sigma-konvergenssia (keskihajonta jaettuna keskiarvolla) Euroopan unionissa käyttämällä sekä henkeä että tehtyä työtuntia kohti laskettua ostovoimakorjattua brutto-kansantuotetta. Yhdistämme konvergenssikehityksen Gini-kertoimella laskettuun tuloerokehitykseen. Lyhyi-tä taukoja lukuun ottamatta EU-maiden henkeä kohti lasketut bruttokansantuotteet ovat vuoden 1960 jälkeen konvergoituneet. Suuri taantuma oli huomattava häiriö tälle kehitykselle, ja EU15-alueen konvergenssi on kärsinyt pahasti. Pahiten ovat kärsineet Espanja, Kreikka, Kypros, Italia ja Portugali. Sen sijaan entiset siir-tymätalousmaat ovat enimmäkseen edelleen kuroneet eroja umpeen. Pitkällä aikavälillä konvergenssi on ollut EU:ssa ripeämpää, kun bkt:n kasvu on ollut nopeampaa. Havaitsemme myös, että mitä korkeampi hen-keä kohti laskettu bkt maassa on, sitä pienempiä maan sisäiset tuloerot keskimäärin ovat. Konvergenssikehi-tys on ollut riippumaton Gini-kertoimien muutoksista vuosina 2000–2011. Poikkeuksena on kuuden kiinni-kurovan maan ryhmä, jossa nähdään positiivinen yhteys konvergenssin ja tuloerojen kasvun välillä. Tulosten mukaan sigma-konvergenssia on myös kansallisissa Gini-kertoimissa, jotka ovat lähentyneet toisiaan.

Avainsanat: EU, bkt henkeä kohti, tuottavuus, sigma-konvergenssi, Gini-kerroin

JEL-koodit: F15, F43, O15, O47

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1   Introduction

The economic, financial and fiscal crisis that started in Europe around 2008 has taken its toll on the convergence of GDP per capita levels in the European Union. One of the aspired aims of the EU and the single market process has been and remains a decrease in the wide income disparities between European countries. To what extent has the development now been disrupted?

We will review the long-term convergence process across the EU[2] using not just GDP per capita but also GDP per hour worked which is a better measurement of labour productivity. The difference between these two measures is the change in labour input relative to the population. The principal method we use to evaluate convergence is Sigma convergence which we get by dividing the standard deviation of nominal purchasing-power adjusted GDP per capita figures by their average. We will also see how relative GDP per capita developments are reflected in income disparities as measured by national Gini coefficients[3] across the region.

From a policy point of view, a reasonably similar level of economic development and cyclical behaviour are good for the smooth functioning of the EU economy. This is particularly important for the Euro Area. Similarity helps political cohesion, decreases the need for transfers, and makes the single monetary policy more suitable for all the Euro Area member countries. Convergence can be supported through market oriented reforms both at the level of the EU single market and the national level. This would improve the working of goods, service, labour and financial markets across the region.

Our results confirm that since 1960 there has been a long-term trend of convergence in nominal purchasing power adjusted GDP per capita in the European Union. In the EU-15 region, convergence levelled off in 2001. However, the Great Recession was a considerable shock to the development, and convergence within the EU-15 has now suffered considerably. On the other hand, most ex-transition countries have continued to convergence with the EU-15 countries, in some cases after a small pause. Historically, convergence in the EU has been faster when aggregate GDP growth has been faster.

National income disparities as measured with Gini coefficients are negatively related to GDP per capita levels in the member countries. This is the case for the EU-27 as a whole as well as for the subgroups of EU-15 countries and the ex-transition countries. According to our results, average GDP per capita convergence in the EU27 has not correlated with changes in income distribution across the member countries in 2000–2011. As an exception we find a positive relationship between the two measures for a subgroup of six catching-up countries, namely Cyprus, the Czech Republic, Hungary, Latvia, Lithuania and Poland. We also find that there has been Sigma convergence of national Gini coefficients in the EU after the late 1990s.

We will take a glance at literature in Section 2. This is followed by our analysis of Sigma convergence using GDP per capita in Section 3. Section 4 compares convergence of GDP per capita and convergence of GDP per hour worked. Section 5 links the GDP per capita convergence with the development in income distribution as measured by the Gini coefficient. In Section 6 we will review how aggregate GDP growth has affected convergence. Section 7 concludes.

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[2] Luxembourg is removed from the analysis, because its inclusion twists the calculations dramatically, as we also show.
[3] The Gini coefficients (of equivalised disposable incomes) are from the Eurostat database. There are breaks in the time series for the Gini coefficient.

2   Literature and general observations

There are two main approaches when measuring economic convergence, namely Beta and Sigma convergence. Beta convergence measures GDP per capita convergence as a function of the first period GDP per capita level. Convergence is found when there is a negative relation between the two. In addition to the GDP per capita level also other variables, such as levels of human capital, can be used as independent variables. Beta convergence gives an average rate at which convergence has proceeded. We will not use this method, however. Our preferred method is Sigma convergence which is a simple and unambiguous way of measuring convergence. Also, it is not tied to any particular growth model. Sigma convergence is calculated as the evolution in the coefficient of variation of GDP per capita, which we get by dividing the standard deviation of the GDP per capita figures by their average. We witness a convergence process if the coefficient of variation declines over time.

Recent work on GDP per capita convergence in the EU include Apergis, Panopoulou and Tsoumas (2010) who analysed purchasing power adjusted GDP per capita in the EU-15 area (without Luxembourg) in 1980–2004 using a panel convergence methodology developed by Phillips and Sul (2007). According to their results, the EU-15 is divided into two convergence clubs. The last year of the data places Germany in the weaker group with Greece, Italy, Portugal and Spain. Fritsche and Kuzin (2011) use the same methodology and find three different per capita income convergence clubs for the EU-15, with Italy and Germany not converging to any one of them.

Using the Solow growth model, Cavenaile and Dubois (2010) analyse income convergence in the EU-27. They argue that the new member countries and the EU-15 countries belong to different groups of convergence. Vojinović, Oplotnik and Próchniak (2010) use both Beta and Sigma convergence to review the development up to 2006.

Halmai and Vásáry (2012) analyse how convergence and potential growth rates were disrupted after the start of the Great Recession. They cluster the EU countries in four groups: 'developed', 'Mediterranean', 'catch-up' and 'vulnerable' countries. According to their estimates, a longer period of divergence may ensue in Europe.

Some of the EU countries seem to have fallen into a long-term relative decline that is not related to the phase of the business cycle. The obvious candidate in this respect is Italy where GDP per capita adjusted for purchasing power (PPS) relative to the EU-15 average rose steadily up until 1995, then exceeding the average by almost 5 per cent. Since then growth has continuously fallen behind the EU-15 average. In 2012, relative GDP per capita was the same as it was in 1961, or over 11 per cent below the average.

Convergence in GDP per capita does not take into account individual or regional income disparity within countries. Consequently, more convergence in GDP per capita levels may or may not be accompanied by changes in average income disparity. Especially in the new member countries the most dynamic regions, typically around the capital city, have grown both in terms of output and income levels much faster than more rural and peripheral regions. The same applies to the development in wages in different professions. In convergence literature these issues are left aside as matters for national income distribution policies. We will glance briefly at this issue in Section 5, however.

Furthermore, the convergence research is focused on convergence, good or bad. From this point of view, convergence with lower average GDP per capita growth is 'better' than divergence with faster GDP per capita growth, even with all countries growing faster than in the scenario with convergence. According to our results, however, convergence in the EU has historically been faster when aggregate GDP growth has been faster.

3   Sigma convergence in the EU

Next we will review how convergence has proceeded in the EU. We will analyse the development in three groups of EU countries: the EU-15, the EU-27 and the EU-33. The countries in the EU-33 group include those that were candidate countries at the end of 2012, i.e. Croatia, Iceland, Macedonia FYR, Montenegro, Serbia and Turkey. Also the development in the Euro Area (EA-17) will be reviewed. These groups of countries and the timeline of European integration are shown in Table 1.

Table 1   Timeline of European integration

Year	EEC/EU	EA	New/founding members
1957	EEC-6		Belgium, France, Germany, Italy, Luxembourg, Netherlands
1973	EEC-9		Denmark, Ireland, United Kingdom
1981	EEC-10		Greece
1986	EEC-12		Portugal, Spain
1995	EU-15		Austria, Finland, Sweden
2004	EU-25		Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, Slovenia.
2007	EU-27		Bulgaria, Romania
?	EU-33		Croatia, Iceland, Macedonia FYR, Montenegro, Serbia, Turkey
1999		EA-11	Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain
2001		EA-12	Greece
2007		EA-13	Slovenia
2008		EA-15	Cyprus, Malta
2009		EA-16	Slovakia
2011		EA-17	Estonia

Note: Croatia will join the EU on 1 July 2013. The table does not include other economic integration, such as EFTA and their free trade agreements with the EEC/EU, as well as the former Europe Agreements between the EU and the Central and Eastern European countries.
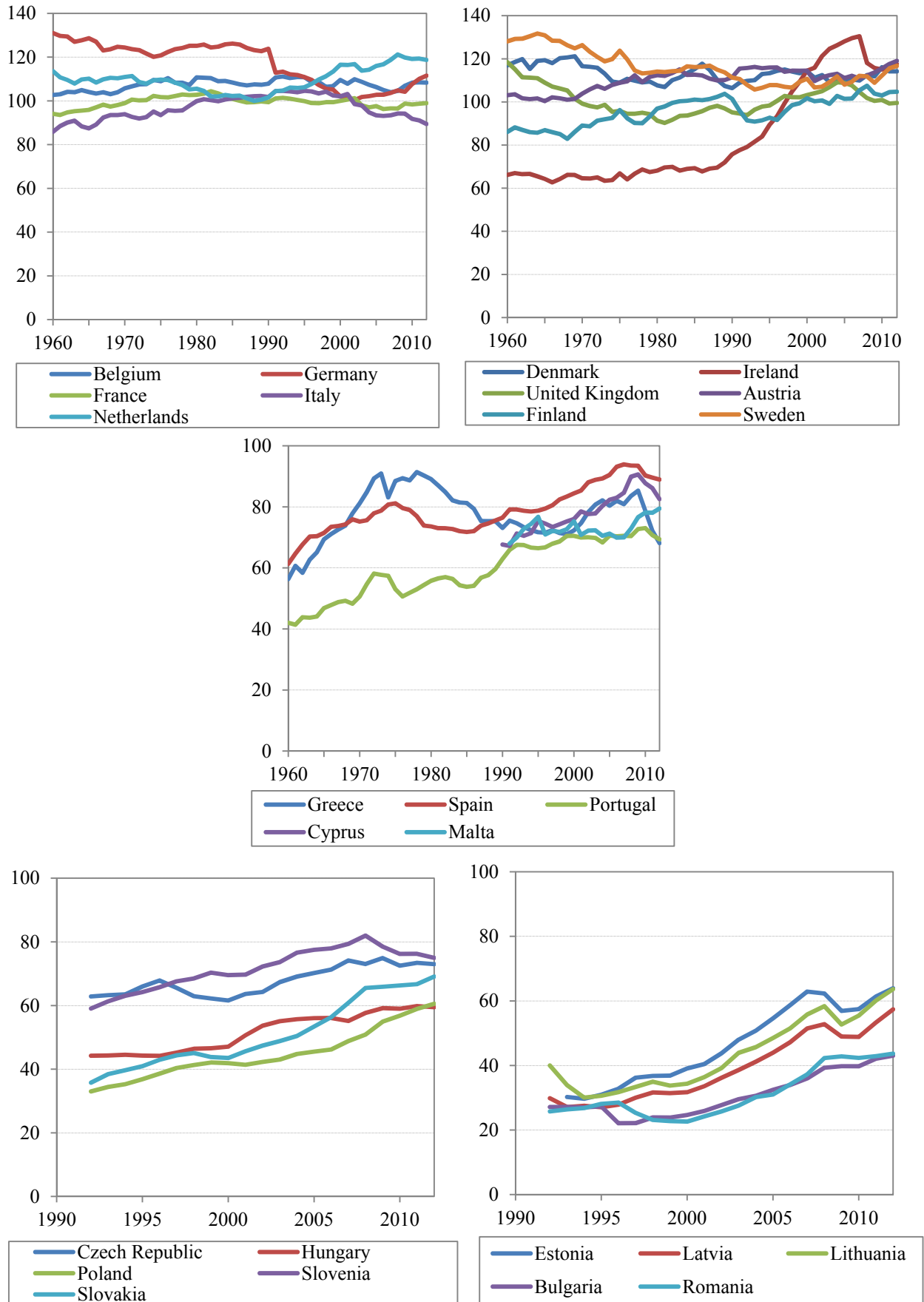
Whether economic integration affects growth or not is not explicitly analysed here. The topic has been discussed in the European context by, among others, Kaitila (2005), Crespo Cuaresma, Ritzberger-Grünwald and Silgoner (2008), Niebuhr and Schlitte (2009), and Vojinović, Oplotnik and Próchniak (2010). Dismantling trade and investment barriers, unifying regulation and standards, and improving institutions will have a positive impact on growth.

Our data cover the years 1960–2012 and we use Eurostat data for gross domestic product at current market prices per head of population adjusted for purchasing power.[4] Figure 1 shows how nominal GDP (PPS) per capita has developed relative to the EU-15 weighted average. The German reunification can be seen as a drop in the German curve. Germany's relative descent lasted until 2002 after which GDP per capita in Germany has been growing faster than in the EU-15 on average. France has lost a little in relative terms during the past 30 years, Italy has lost a lot after the mid-1990s, and the Netherlands has gained after the late-1980s.

Ireland's rapid growth can be seen in the second graph. Also Finland has gained in the long term. On the other hand, the UK has lost ten points after 2004. Portugal and Spain in the third graph have gained significantly in relative terms over the course of time. Greece lost 17 points in 2009–2012.

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[4] The year 1991 is the first with data for the unified Germany. Before this the German data only include West Germany. The data were downloaded 3 June 2013.

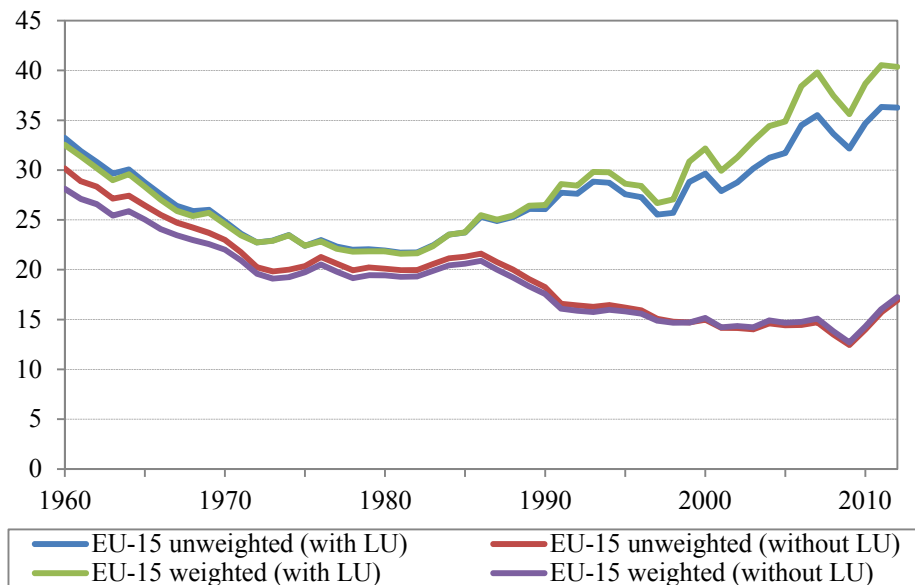**Figure 1**   **Nominal GDP (PPS) per capita, EU-15 = 100**

Souce: Eurostat.

The ex-transition countries' data are shown with 1992 or 1993 as the first year. There we witness considerable catching up over time. Slovenia has suffered the most during the Great Recession, while catching up has levelled off in the Czech Republic, Hungary and Romania. In the other countries, catching up has continued unabated or after a temporary respite in some cases.

Sigma convergence is calculated as the coefficient of variation of GDP per capita, i.e. by dividing the standard deviation of the GDP per capita figures by their average. A rise in the index implies divergence in GDP per capita levels and a decline implies their convergence. Let us first take a look at some methodological issues already referred to above. We need to exclude Luxembourg because its inclusion twists the results radically (see Figure 2). GDP per capita in PPS terms in Luxembourg is now 2.4 fold the EU-15 average.

Another issue is whether the denominator should be the simple, unweighted average or the readily available EU-15 or EU-27 weighted average. This makes a small difference, especially for the enlarged EU. We could of course also calculate a weighted standard deviation for the nominator. However, the spirit of convergence advocates the use of simple averages. This means that it is equally unwanted whether it is Malta or Italy that lags behind the EU average despite the 146-fold difference in their populations. We will use this principle throughout our analysis. Convergence can also be calculated for geographic regions smaller than the nation state, data allowing, but this is to some extent a separate research and policy question. Also, at some point, commuting will start to affect the results.

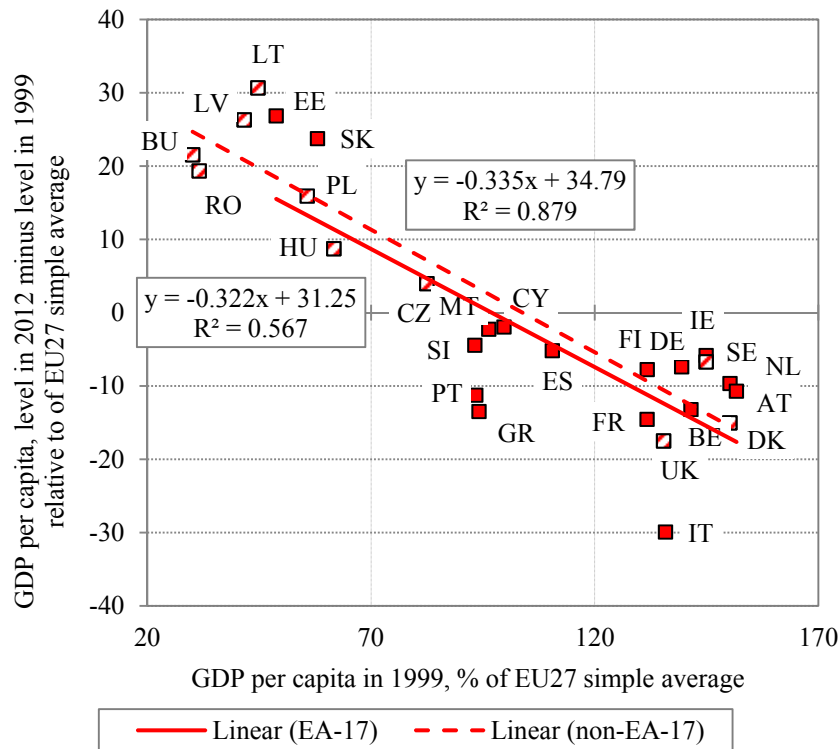**Figure 2   Sigma convergence of GDP (PPS) per capita in the EU-15**

Note: The EU-15 weighted average (but not the standard deviation) is with Luxembourg in both cases. However, due to the small size of the country's GDP, this does not affect the results. Sources: Eurostat, own calculations.

Figure 3 shows how GDP per capita in 1999 relative to the EU-27 countries' GDP per capita (simple average without Luxembourg, our preferred method from hereon) correlates with its relative development up until 2012.[5] The lower the first-period GDP per capita was in 1999, the faster the countries have been catching up with the average. The R^2 value is 0.77 for the whole EU-27 (not shown in the graph). For the EA-17 countries the R^2 value is 0.57 and for the non-EA countries 0.88.

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[5] This graph is close to Beta convergence analysis.
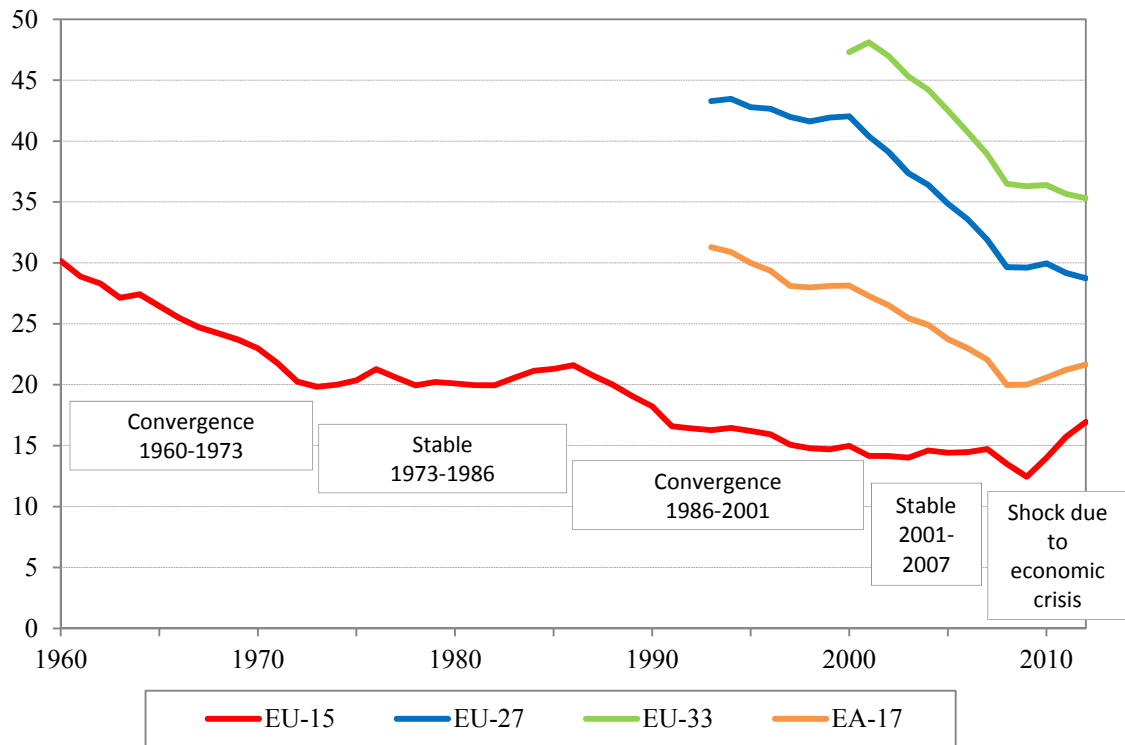
Figure 3   GDP per capita in 1999 (% of EU27 simple average) and its change in 1999–2012, %-points

Note: EA-17 countries are shown with solid dots, while the non-EA-17 countries have diagonal lines. Sources: Eurostat, own calculations.

Figure 4 shows how Sigma convergence has developed. In the EU-15, we find convergence in 1960–1973, followed by levelling off up until 1986, and then a further period of convergence that came to an end around 2001. This was again followed by a levelling off in the development. The Great Recession and the economic and fiscal crisis in Europe have been a considerable shock to the development. As GDP per capita has fallen more in many of the poorer EU-15 countries, the convergence process had been scaled back by a little over twenty years by 2012.

The EU-27 has data from 1993 onwards. Here we see very little convergence in 1993–2000. Thereafter, convergence is rapid up until 2008, followed by a levelling off in the development. Because we saw divergence in the EU-15, we may expect there to have been continued convergence in the new member countries on average. We will look at this below. The EU-33 has data from the year 2000 onwards. We can see that the development is very similar to the development in the EU-27.
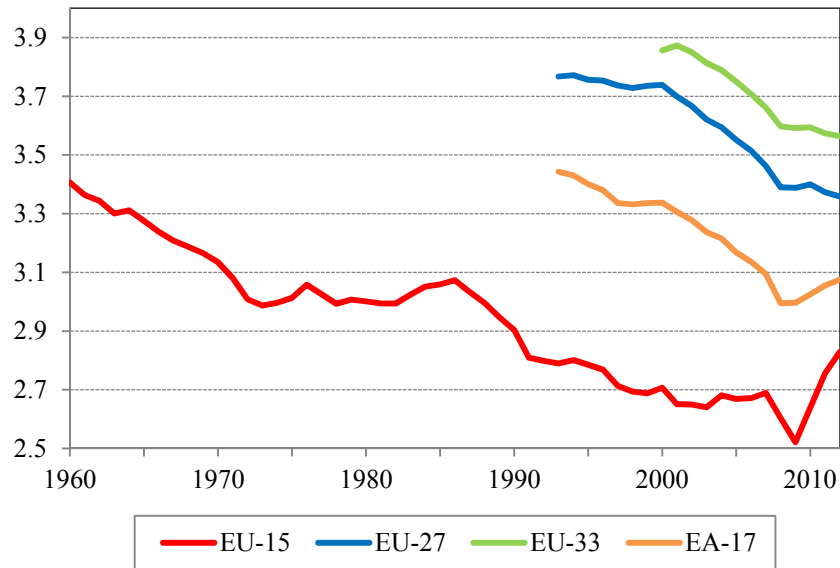
Figure 4   Sigma convergence of GDP per capita

Note: Without Luxembourg. Sources: Eurostat, own calculations.

The Euro Area (EA-17) is a combination of the development in the EU-15 and EU-27 as the curve moves slightly up in the Great Recession. Regardless, the continuing convergence during the euro era is a positive development from the point of view of the single currency. Also, the reversal during the Great Recession is not very steep.
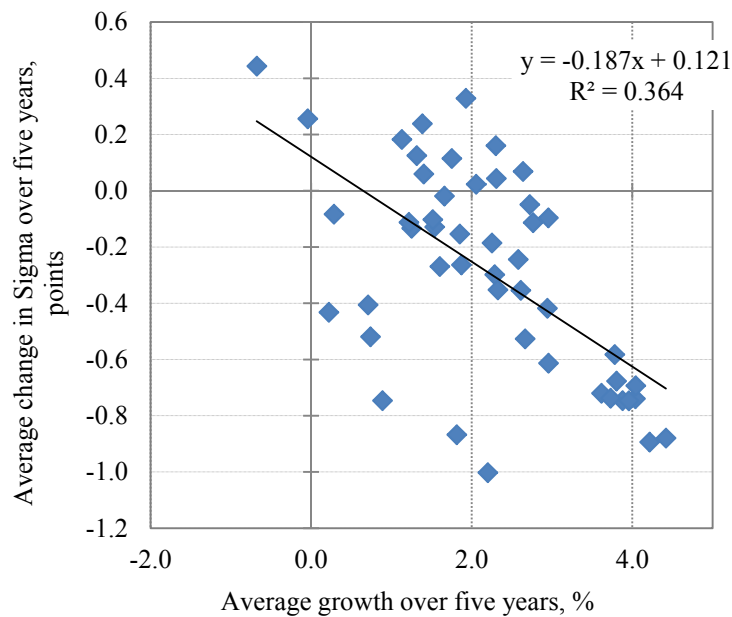
If we use the forecasts of the European Commission from spring 2013, we find that the Sigma convergence curves depicted in Figure 4 will continue in the same directions in 2013–2014 as they did in 2011–2012. Consequently, there will be further divergence in the EU-15 and the EA-17, but continuing convergence in the EU-27 and EU-33.

Overall, we witness long-term convergence in the EU-15. Convergence seems to have slowed down if we look at the graph. However, if we take logs of the Sigma values presented in Figure 4 the second convergence phase (1986–2001) was on average about as steep as the convergence that took place by 1973 (see Figure 5). In log terms, convergence in the Euro Area has been steeper than in the EU-15. It should further be noted that, due to the way convergence is calculated, Ireland raises the value of Sigma before the Irish real estate bubble started to deflate in 2007 and its GDP started to decline.

Figure 5   Logs of Sigma convergence of GDP per capita

Note: Without Luxembourg. Sources: Eurostat, own calculations.

Convergence may be a simpler task when the aggregate economy is growing faster. We see this in Figure 6, where rolling average GDP growth over five-year periods is compared with the average change in Sigma values over the same five years. In the case of the EU-15 with data starting in 1960, we have a clear correlation with faster overall GDP growth associated with larger advances in convergence.

Figure 6   GDP growth and Sigma convergence in the EU-15 in 1960–2012, rolling five-year averages

Note: Negative changes in Sigma imply convergence. Sources: Eurostat, own calculations.

Another way of looking at the question is to compare the lowest and highest GDP per capita lev-els relative to the average in the region. This is an important addition, because Sigma convergence can show positive convergence (at least up to a point) even if one country is for some reason left behind. The minimum value on the other hand does not overlook this possibility.
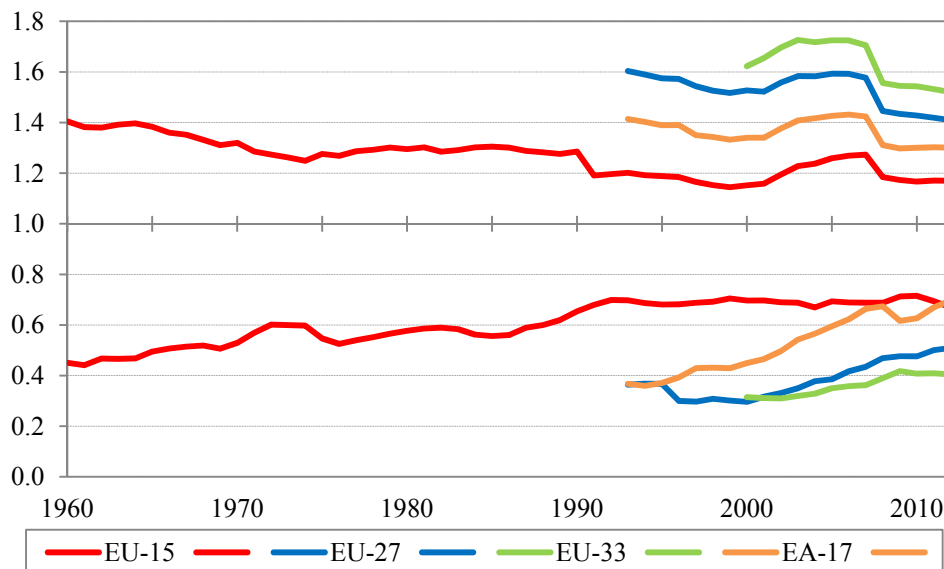
Over the long term, we thus confirm that purchasing power adjusted GDP per capita levels have been converging. Among the EU-15 countries (without Luxembourg), the ratio of the highest GDP per capita to the lowest in current market prices declined from 3.1 in 1960 to 1.8 in 1991. Thereafter the ratio has remained relatively stable. Among the EU-27 countries, the ratio declined from its peak of 5.2 in 2000 to 2.8 in 2012. In the EA-17, the ratio has declined from 3.1 in 1999 to 1.9 in 2012.

Figure 7 shows this development. The narrowing of the min-max spread in the EU-15 has been more a bottom-up development than vice versa with the poorest countries catching up with the (simple) average. This development continued until about 1992. By that time, the minimum value had risen from 0.45 to 0.70.[6] Meanwhile the maximum had declined from 1.40 to 1.20. After the early-1990s, the spread has remained rather stable if we disregard the Irish boom that lifted the maximum temporarily (see graph).

In the EU-27, the minimum declined relative to the average up until the year 2000 and then start-ed to catch up. This development has continued, despite the Great Recession. On the other hand, the catching up by the minimum in the EU-33 has levelled off.

In the EA-17 the minimum value has been catching up with the average much faster than in the other three regions analysed above. This is a positive development for the monetary union. Note that the EA-17 includes all 17 countries that were members in 2012 even before they joined the monetary union. If we take the Euro Area with its true membership each year the minimum does not change but the maximum rises because the new euro countries have always had below-average GDP per capita.

Figure 7   The minimums and maximums of GDP per capita in four groups of countries relative to the simple average in the respective region
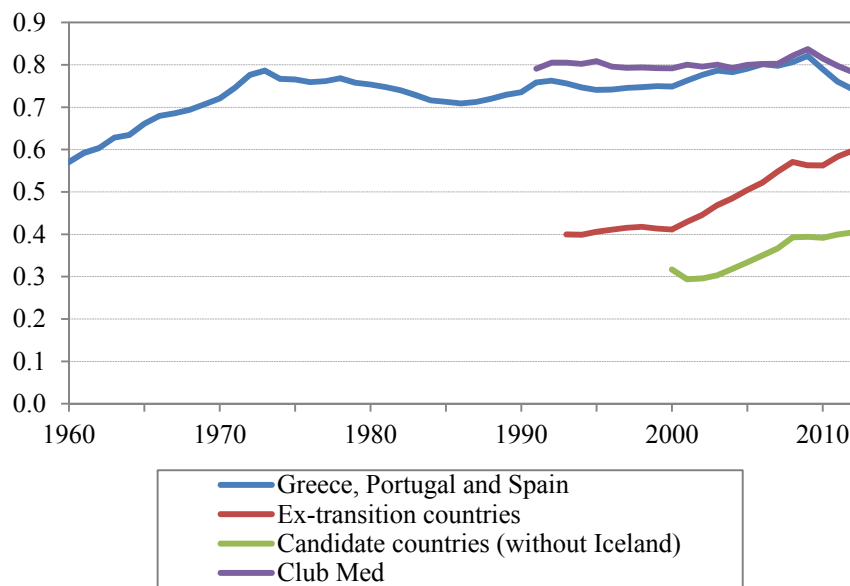

Note: Without Luxembourg. Sources: Eurostat, own calculations.

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[6] In 1960 Portugal–the poorest country–was not a member of the EU (then EEC). On the other hand, Portugal was a founding member of EFTA in 1960 so economic integration can be thought to have influenced the country's develop-ment in the 1960s.

Figure 8 shows the simple averages of GDP per capita in four additional groups of countries as per cent of the simple average of GDP per capita across the EU-15. The southern 'cohesion countries' Greece, Portugal and Spain were catching up with the EU-15 average up until 2009, but the recession has since then pushed the development back by 0.1 points to its 2000 level. If we enlarge this group with Cyprus, Italy and Malta, and rename it the Club Med, we see a similar but less dramatic development.

On the other hand, the ex-transition countries of Central and Eastern Europe have on average continued to converge with the EU-15 after a short pause in 2008–2010. The candidate countries' (now without Iceland because of its high GDP per capita) convergence has levelled off.

Figure 8   Simple averages of GDP per capita, % of EU-15 simple average

Note: Without Luxembourg. Ex-transition countries = Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia; Candidate countries (without Iceland) = Croatia, Macedonia FYR, Montenegro, Serbia and Turkey; Club Med = Cyprus, Greece, Italy, Malta, Portugal and Spain. Sources: Eurostat, own calculations.

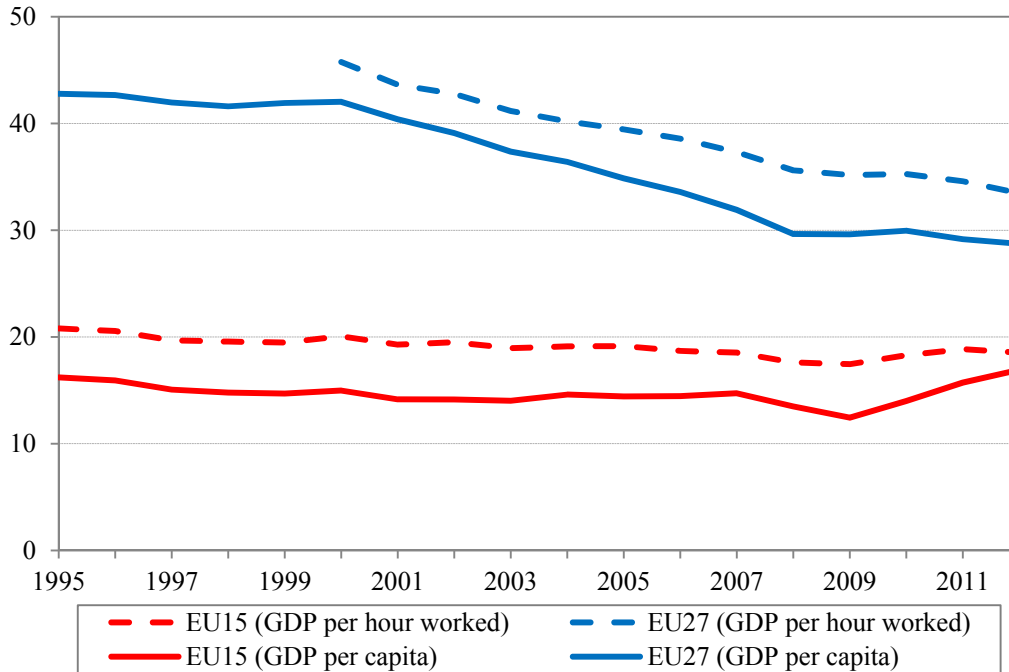## 4   Convergence of productivity

GDP per capita catching up may occur either through faster productivity growth and/or an increase in labour input relative to the population. In the long term, GDP per capita development is largely, if not solely, determined by the development of productivity. In the short to medium term, however, labour input may be important because in many of the poorer countries in south Europe also the employment rate is lower than the EU average. This is largely due to women participating less in the labour market than in the north of Europe. In the aftermath of the Great Recession, huge unemployment is of course another source of further labour input.

Figure 9 traces the differences between convergence of GDP per capita and GDP per hour worked (i.e. labour productivity) in the EU-15 and the EU-27. We see that the lines for GDP per capita are below the ones for productivity (GDP per hour worked). Consequently, there are smaller differences between the countries in terms of GDP per capita than in terms of productivity. This indicates that more hours are worked per total population in poorer countries than in wealthier ones.

We can also see that in the EU-27 the difference between the solid and the dotted lines increases after the year 2000. There has thus been more convergence in GDP per capita than in labour

productivity. The opposite happens in the EU-15: After the year 2000, there has been more convergence in productivity than in GDP per capita. This is largely due to a rise in unemployment in many crisis countries after 2008.

Figure 9 **Sigma convergence of GDP (PPS) per capita and per hour worked in the EU-15 and the EU-27**
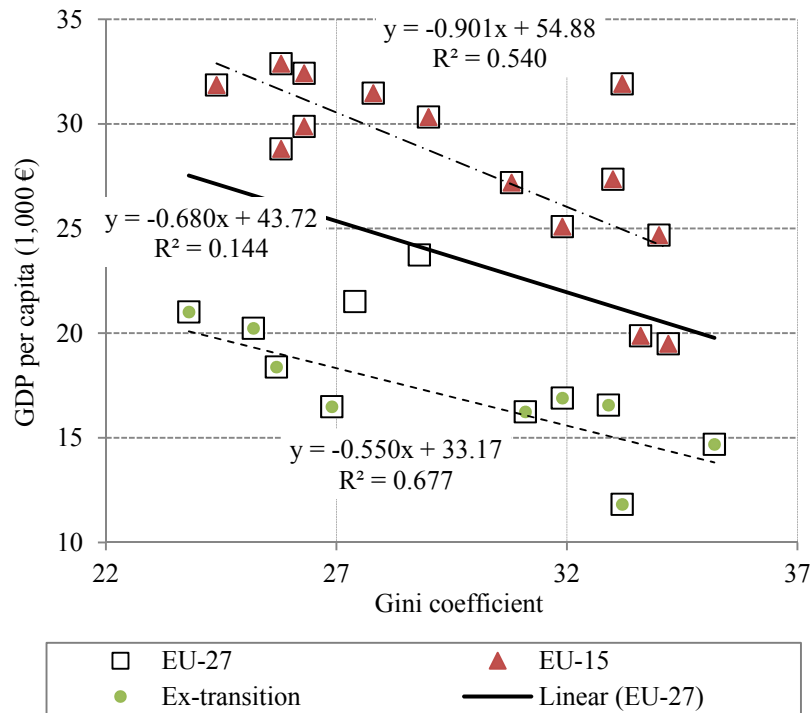

Note: A decline in the curves imply convergence. Without Luxembourg. Sources: Eurostat, own calculations.

5 GDP per capita, convergence and income distribution

GDP growth and convergence between countries can occur with or without an increase in income disparity within the countries. If a large part of the population is left outside the increase in average incomes, the development is not in line with the spirit of convergence in the EU. In this section we will analyse whether GDP per capita convergence has been accompanied by a change in the Gini coefficients. A rise in Gini implies an increase in income disparities within the countries. However, correlation does not imply causality here.

We first find that within the group of EU-15 countries, the EU-27 countries and the group of ex-transition countries GDP per capita is negatively correlated with the national Gini coefficients, i.e. the wealthier the country is the smaller is its internal income disparity on average (see Figure 10). This relation was stronger in 2011 than in 2000. For 2011, the R^2 value is much higher in the EU-15 group (0.54) and especially the ex-transition countries' group (0.68) than in the aggregate EU-27 scatter (0.14).

Figure 10   GDP (PPS) per capita at current market prices and the Gini coefficient in 2011

Note: Higher Gini coefficients imply higher income disparities. The member countries not included in the EU-15 or the group of ex-transition countries are Cyprus and Malta. Ireland's Gini coefficient is from 2010. Without Luxembourg and Bulgaria. Sources: Eurostat and own calculations.

How about the changes in the Gini coefficients? Let us first look at the aggregates. For the EU-15 as a whole, Eurostat statistics show that the Gini coefficient increased from 29.0 at the end of the 1990s to 30.8 in 2011. In the EU-27 the Gini coefficient stayed flat at about 30.5 in 2005–2011, the years we have data for. In the EA17-region, the Gini coefficient increased from 29.2 in 2005 to 30.5 in 2011. However, the EU-level Gini coefficients hide large differences in levels and changes between individual member countries as can be seen from the graphs.
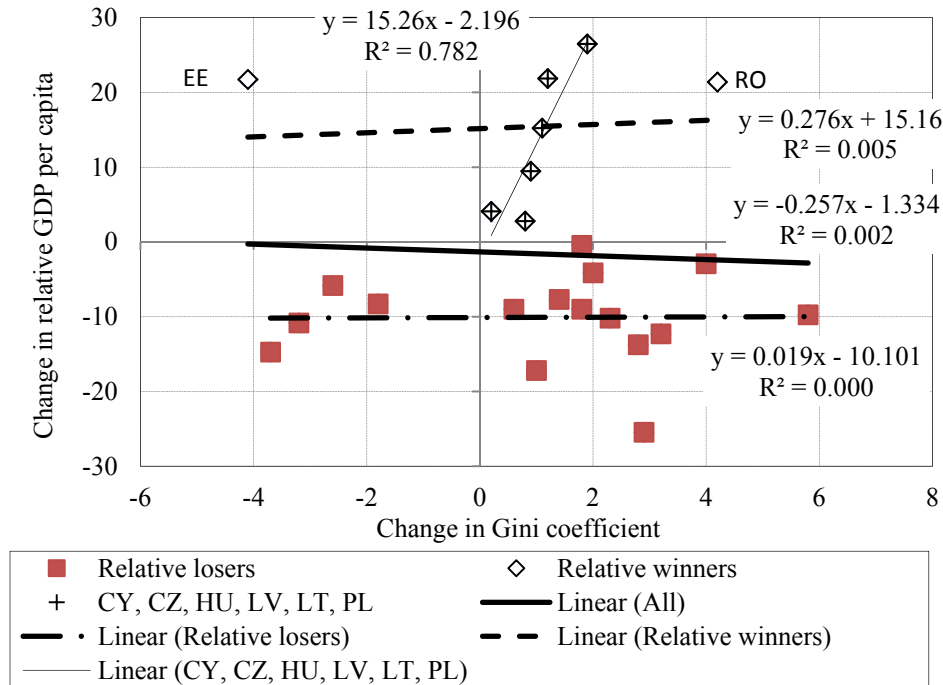
Let us now compare the development in Gini coefficients with the development in GDP per capita convergence. Here we have measured convergence by first calculating what individual countries' GDP per capita was in 2011 as a percentage of the EU-27 simple average and then compared that with the respective situation in 2000 by subtracting the two. Thus the measurement is a percentage point change relative to the average. The change in the Gini coefficient has been calculated by subtracting the values for those same two years (2000 and 2011) from each other.

We can first see in Figure 11 that the Gini coefficient has risen in all but five countries, namely Belgium, Estonia, Malta, the Netherlands and Portugal. In three countries (Denmark, Germany and Romania) the Gini coefficient has risen by at least four percentage points. We then divided the countries into two groups depending on whether they grew faster than the average (the 'relative winners') or slower (the 'relative losers'). We find no correlation between the development in the Gini coefficient and convergence in GDP per capita in either of these two groups, or the EU region as a whole. We also checked whether losing/gaining from a high level (above the average) is different from losing/gaining from a low level (below the average). We found no such evidence.

In the upper right-hand corner we find Romania with a large increase in its Gini coefficient and catching up in GDP per capita. On the other hand, in the upper left-hand corner we find Estonia with a large decline in its Gini coefficient and catching up in GDP per capita. As can be seen from the graph, Estonia and Romania flatten the trend for the group of relative winners. If these two

countries were to be removed, the linear trend would be very steep with an R^2 value of 0.78. This indicates a clear positive relation between a rise in the Gini coefficient and catching up in the group of six new member countries, namely Cyprus, the Czech Republic, Hungary, Latvia, Lithuania, and Poland.

Figure 11   GDP per capita convergence and change in the Gini coeffient in 2000–2011 in the EU-27

Note: Without Bulgaria, Luxembourg, and Slovakia. For Cyprus the Gini coefficient in 2000 is the average of 1997 and 2003, for Sweden the average of 1999 and 2001. The Czech Republic and Denmark in 2001–2011; Ireland in 2000–2010. See the text for an explanation as to how the data have been calculated. Sources: Eurostat, own calculations.

Malinen (2012) finds that income inequality is associated with lower long-run economic growth in developed countries. Desli (2009) analyses the implications of income inequality on per capita income growth and productive efficiency change. She finds that the degree of income inequality does not have a statistically significant effect on growth convergence, but that it contributes positively to the convergence of productive efficiency.
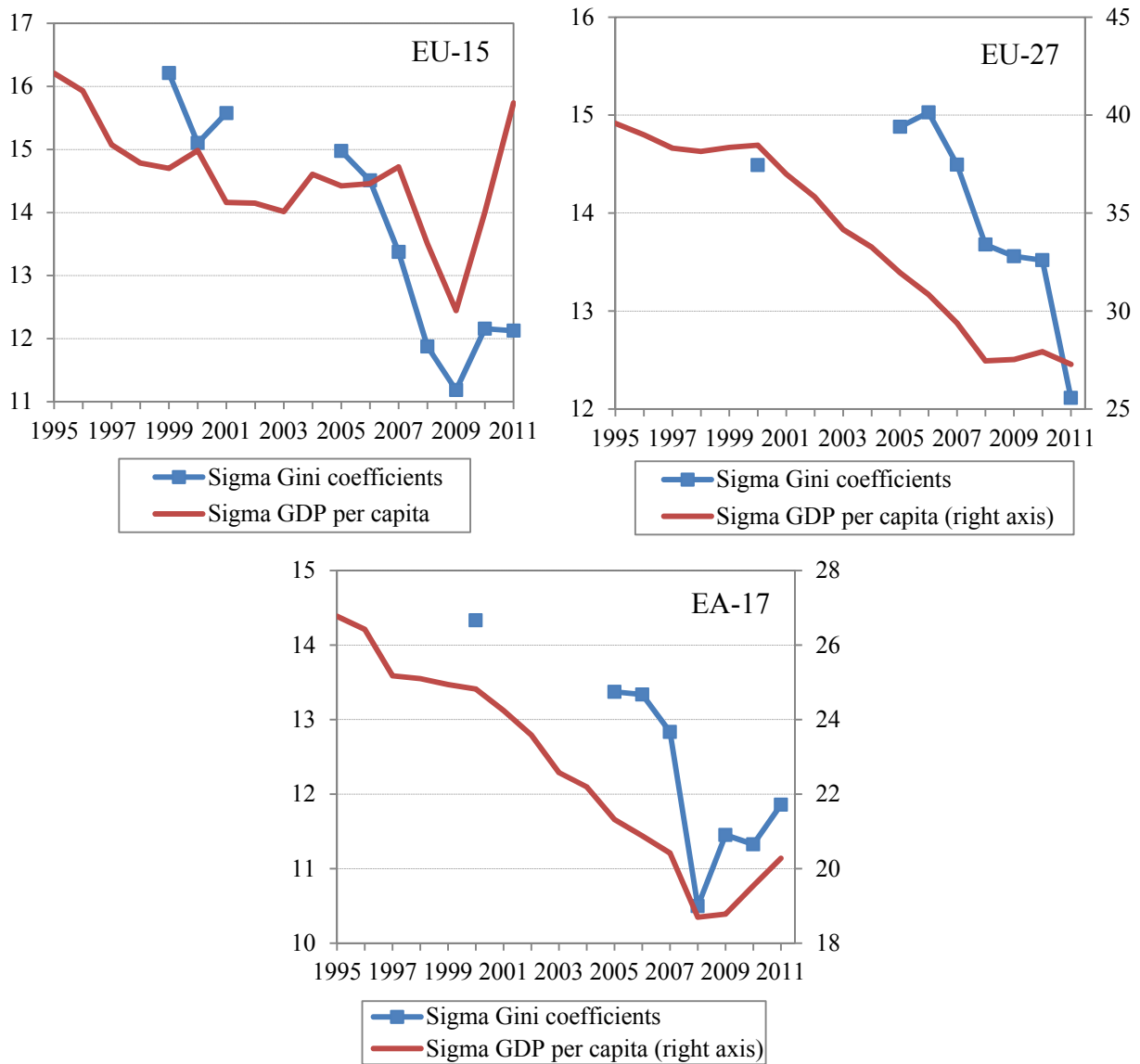
Ezcurra (2007) uses data from the European Community Household Panel for 1993–2002 to analyse the relationship between income inequality and economic growth in the NUTS-1 regions of eight EU countries (the old EU-12 less Denmark, Ireland, Luxembourg and the Netherlands). He finds that the degree of income dispersion is negatively associated with regional growth. The study controls for initial GDP per capita, the sectorial composition of economic activity, human capital stock, population density and market potential.

We saw above that the Gini coefficients and thus income disparities have tended to rise both at the aggregate EU level and in most individual member countries. But has there been any convergence in the Gini coefficients across the region, i.e. between the countries? To see whether this has happened, we calculated the Sigma convergence of the national Gini coefficients. For the EU-15 (without Luxembourg), we found considerable convergence from 19.0 in 1997 to 11.2 in 2009 followed by a rise to 12.2 in 2010. This means that the national Gini coefficients have converged considerably during these years.

In the EU-27 region, the Sigma convergence value of the national Gini coefficients declined from 15.0 in 2005 to 13.4 in 2010.[7] Consequently, the national Gini coefficients have converged a little. For the EA-17 countries we find that the Sigma convergence value declined from 13.3 in 2005 to 11.4 in 2010. If we disregard Slovakia, the decline from the year 2000 is from 14.3 to 11.3.

Figure 12 traces this development for the EU-15, EU-27 and EA-17 regions together with the development in respective GDP per capita convergence. We can see that there is considerable correlation between the two measures.

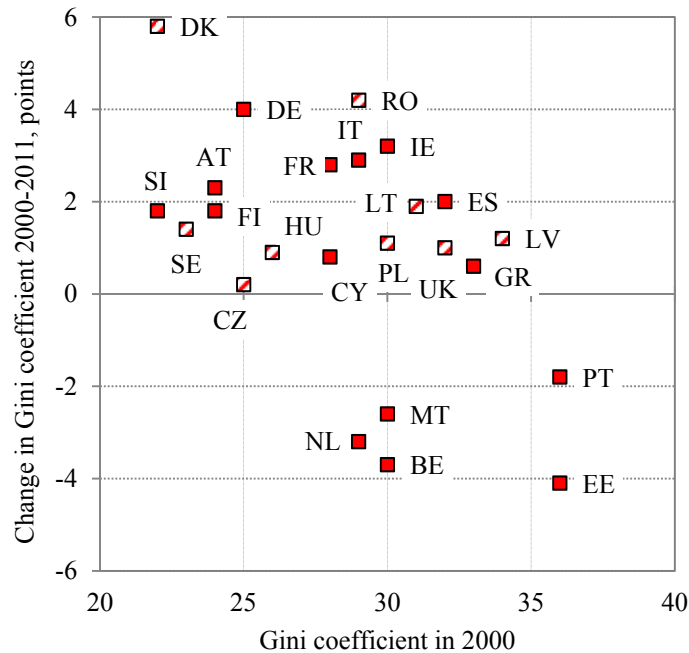**Figure 12   Sigma convergence of the national Gini coefficients and GDP per capita**

Note: Without Bulgaria, Luxembourg, and Slovakia. Ireland in 2011 is assumed to be the same as in 2010. Sources: Eurostat, own calculations.

Finally, we can see the convergence in Gini coefficients in Figure 13 where we have a scatter diagram of the coefficients in 2000 and their change in 2000–2011. The lower the coefficient was in 2000, the more it has risen on average. There are many factors, including social benefits and tax

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[7] If we use the 2001 figure for the Czech Republic and Denmark and disregard Slovakia to get a longer time period, the Sigma value for EU27 Gini coefficients declined from 14.4 in 2000 to 13.4 in 2010.

policies that affect the income distribution. The only countries with a decline in Gini coefficients are now Euro Area members.

Figure 13   Gini coefficients in 2000 and their change in 2000–2011

Note: Bulgaria, Luxembourg and Slovakia not included. For Cyprus the Gini coefficient in 2000 is the average of 1997 and 2003, for Sweden the average of 1999 and 2001. For Ireland the change is for 2000–2010. The EA-17 countries are with solid red squares and the other countries with diagonal lines. The R^2 for the linear trend for all the countries is 0.25. Sources: Eurostat, own calculations.

7   Conclusions

There has been a long-term trend of GDP per capita convergence in the European Union. Using Sigma convergence we find that the nominal purchasing power adjusted GDP per capita levels in the EU-15 countries (less Luxembourg) converged in 1960–1973, levelled off in 1973–1986, converged again in 1986–2001, and levelled off again until 2007. The second convergence phase was in relative terms about as steep as the first. The Great Recession was a considerable shock to the development with clear divergence in GDP per capita levels by 2012. This does not mean that convergence could not continue in due time. Convergence in the EU has historically been faster when aggregate GDP growth has been faster. It is thus important to get the EU back on a sustainable growth path.

In the EU-27 region we see very little convergence in 1993–2000. Thereafter, convergence is rapid up until 2008, followed by a levelling off in the development. The convergence process in the EU-15, EU-27 and EA-17 is confirmed by an analysis of minimum and maximum values and their ratios.

The new member countries that joined in 2004/2007 converged rapidly up until 2007 after which the development levelled off but picked up again in 2011–2012. The simple average of the ex-transition countries' GDP per capita was 41 per cent of the EU-15 simple average in 2000, but already 60 per cent in 2012. The ex-transition countries' convergence towards the EU-15 countries has slowed down but it has not stopped.

If we use the forecasts of the European Commission from spring 2013, we find that our Sigma convergence curves will continue in the same directions in 2013–2014 as they did in 2011–2012. Consequently, there will be further divergence in the EU-15 and the EA-17, but continuing convergence in the EU-27 and EU-33 regions.

We also analysed Gini coefficients in order to see whether GDP per capita convergence has been accompanied by changes in income disparities. If a large part of the population is left outside the increase in average incomes, the development is not in line with the spirit of convergence in the EU. First, we see that the Gini coefficients (i.e. income disparities) are negatively related to GDP per capita levels in the member countries. Second, at the aggregate EU-15, EA-17 and EU-27 levels, the Gini coefficients have risen a little, indicating an increase in region-wide income disparities. At the national level there are only five countries where the Gini coefficients declined in 2000–2011. However, GDP convergence has not been correlated with national changes in income distribution. As an exception we do find a positive relationship between the two measures in 2000–2011 for a group of six catching-up countries, namely Cyprus, the Czech Republic, Hungary, Latvia, Lithuania and Poland. Third, calculating the Sigma convergence for the national Gini coefficients we find that the levels have converged significantly in 2000–2011.

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