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Henry Goecke and Michael Hüther

Regional Convergence in Europe

Convergence among regions is explicitly defined as a political aim of the European Union. Overall, NUTS3 regions have indeed shown a path of convergence since the year 2000, but there are huge differences among the regions. Many Eastern European countries as well as several regions in Spain and Portugal are characterised by a convergence process. However, the opposite holds for many regions in Greece, Italy and the UK. The size of a region's manufacturing is important for the process of convergence, and the direction of subsidies from the EU to the right fields of activity also has a positive influence on the probability of a region to converge.

The European sovereign debt crisis forced the European Economic and Monetary Union to implement far-reaching adjustments and to launch a fundamental discussion about political institutions and system errors. Furthermore, the disintegration of national financial systems has resulted in ongoing doubts about the euro as a common currency. In the course of the global financial crisis of 2008-09 and the subsequent sovereign debt crisis, the true integration of Europe's economies has also been on trial.

That the economic structure binding the founding members of the European Economic Community (EEC) has loosened is apparent from the development of industrial gross value added. In 2013 the share of industrial gross value added in the original EEC Six (Belgium, France, Italy, Luxembourg, the Netherlands, Germany) ranged from 6.8 to 26.1%. This represents a considerable divergence since 2000, when the range (between 12.3 and 25.5%) was much narrower. What is more, this heterogeneity extends beyond the countries of the original EEC to the current EU28. In the European Union, the share of employment in the manufacturing sector at the end of 2015 varied between 5 and 27% (Figure 1).

From the very beginning, European integration has been based on two factors: peace and economic wealth in Europe. The continent's economic wealth has been de-

fined and measured as the convergence of the per capita gross domestic product in its individual countries. An initial study analysed the convergence among countries from a historical perspective.¹ The results, presented in the next section, show that after the global financial crisis, the convergence process – which had been occurring in Europe since integration began in 1950 – had reversed to a process of divergence.

Convergence at the national level

The EU15 is argued to have steadily converged at the national level since 1950.² Until 2012, countries that had relatively low per capita GDPs in 1950 had higher average annual growth rates than those that started with relatively high per capita GDPs (Figure 2).

Greece, Portugal and Spain had very similar GDP per capita levels of 40 to 45% of the EU15 average in 1950. From 1950 to 2012, GDP per capita in these countries grew by an average of more than three per cent every year. Thus, by 2012 Greece had improved its relative GDP per capita to 60% and Spain to 77% of the EU15 average.

Italy and Ireland, on the other hand, started in 1950 with higher levels of GDP per capita than in Greece, Portugal and Spain. GDP per capita in both countries was about 75% of the EU average. However, the development of this indicator in these two countries in subsequent decades differed significantly. Ireland achieved average growth rates of more than three per cent and by 2012 had increased its GDP per capita to 112% of the EU15 average. Italy, on the other hand, grew at a much lower average

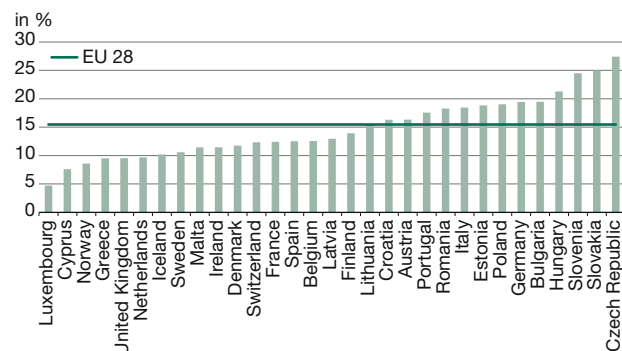
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1 H. Goecke: Europa driftet auseinander: Ist dies das Ende der realwirtschaftlichen Konvergenz?, in: IW Trends, No. 4, 2013.

2 Ibid.

Figure 1
Industrial employment (excluding construction) in the EU, 2015Q3



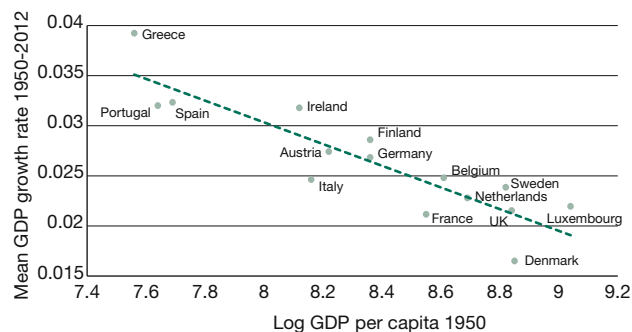
Source: Eurostat.

rate and improved its GDP per capita by only ten percentage points, reaching a value of 85% of the EU15 average in 2012.

Overall convergence within the EU15 can be analysed by applying a beta convergence analysis. This is based on neoclassical growth theory and predicts that countries with relatively low initial values of GDP per capita will grow faster in comparison with countries that start with higher values.³ The results of the total convergence process in the EU15 between 1950 and 2012 are presented in Figure 2. The significance of the estimated coefficient (p -value < 0.01) and the high R-squared value indicate a convergence process. As forecast by the theory, countries with low initial levels of GDP per capita (Greece, Spain and Portugal) grew at relatively high annual rates of above three per cent, whereas initially relatively rich countries like Denmark grew at average annual rates of below two per cent.

However, the convergence process among EU15 countries came to an end before 2012. While the specific year convergence ended varies by country, in recent years – and especially after the financial crisis in Greece, Ireland, Portugal, Spain and Italy – what was once a process of convergence has actually changed into one of divergence. Nevertheless, in the last few quarters a new turnaround has been observable in Portugal, Spain and especially Ireland. Competitiveness in these countries has improved as a result of structural reforms, creating

Figure 2
Historical convergence at the national level in the EU15



Source: H. Goecke: Europa driftet auseinander: Ist dies das Ende der realwirtschaftlichen Konvergenz?, in: IW Trends, No. 4, 2013.

opportunities for a new convergence process.⁴ However, since countries consist of different regions with huge differences in their economic strength and performance, we now move on from this national perspective to the regional level.

Convergence at the regional level

Regions within a country often differ in various respects. In many cases, regions in EU countries have closer ties to neighbouring regions across the border in another country than to distant regions in the same country. This makes analysis of the convergence process at the regional level a fruitful exercise.

The European Union is based on the four fundamental freedoms of movement (for goods, services, labour and capital), which are expected to result in the integration of different regions. The Euregio region was the EU's first official cross-border region. Established in 1985, it consists of 130 different communities along the Dutch-German border. Today, many such European cross-border co-operations exist. Additionally, convergence among regions is explicitly defined as a political aim. Article 174 of the Treaty on the Functioning of the European Union specifies that:

In order to promote its overall harmonious development, the Union shall develop and pursue its actions

3 W.J. Baumol: Productivity Growth, Convergence, and Welfare: What the Long-Run Data Show, in: American Economic Review, Vol. 76, No. 5, 1986, pp. 1072-1085; R.J. Barro, X. Sala-i-Martin: Economic Growth, Cambridge 2004, MIT Press.

4 M. Buti, A. Turrini: Three waves of convergence. Can Eurozone countries start growing together again?, vox.eu.org, 17 April 2015; J. Matthes: An assessment of structural reforms in the stressed euro area countries and their relevance for growth and for EMU, IW policy paper 5/2015.

leading to the strengthening of its economic, social and territorial cohesion.

In particular, the Union shall aim at reducing disparities between the levels of development of the various regions and the backwardness of the least favoured regions.

In view of this, it makes sense to undertake a convergence analysis at a regional level and to search here for the forces driving the convergence process. Our focus will be on the development of border regions and the efficiency of financial support from the European Union. Using this regional approach, the analysis comes closer to the economic and political reality than an approach at the country level. Due to data availability, the analysis focuses on the more recent past (since 2000).

The analysis is based on data from Eurostat, which defined the “Nomenclature of territorial units for statistics” (NUTS) as a statistical standard for regional data. The 28 member states are divided into three different NUTS categories, listed below with examples.

- NUTS1: Minimum population: 3 million; maximum population: 7 million. Examples include small member states such as Denmark or Slovenia, federal states in Germany and other large regions.
- NUTS2: Minimum population: 800,000; maximum population: 3 million. Examples include Spanish autonomous regions, the French regions and the Polish voivodeships.
- NUTS3: Minimum population: 150,000; maximum population: 800,000. Examples include the Finnish regions and the federal states of Sweden.

The present analysis uses the NUTS3 regions, the smallest available data level. At this level, the European countries are subdivided into more than 1,000 regions. The variable of interest is the real GDP per capita in purchasing power standard (PPS) of each region. Data is available for the period between 2000 and 2011. The determinants of the convergence process are therefore the real GDP per capita in the year 2000 and the yearly average growth rate of this variable between the years 2000 and 2011.

Convergence in Europe

The analysis of these two determining factors delivers interesting results at the regional level, especially in terms of geography. GDP per capita declines both from the north to the south of Europe as well as from the west to the east (Figure 3). The data shows particularly large differences

Figure 3
GDP in PPS per capita 2011



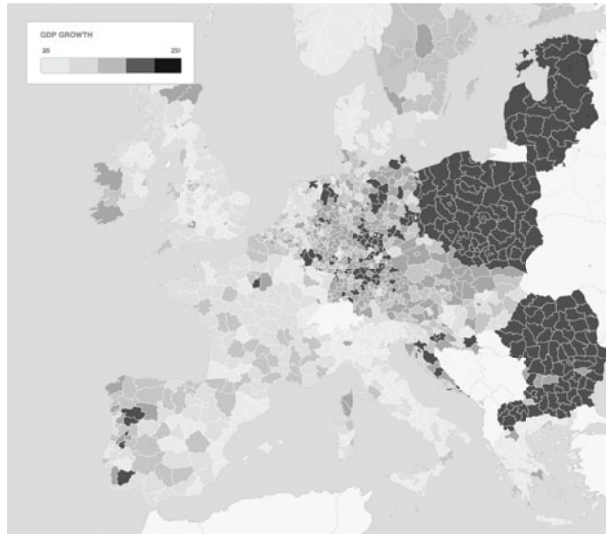
Source: Eurostat.

between Western and Eastern Europe. Very high levels of GDP per capita are found in the north of Europe, i.e. in the UK, the Scandinavian countries (Norway, Sweden, Finland and Denmark), Germany, France, the Netherlands, Belgium, Luxembourg, Austria and northern Italy. On the other hand, very low levels of GDP per capita characterise the majority of regions in Spain, Portugal, southern Italy and Greece. There is an even greater gap between GDP per capita in Poland and the Czech Republic and the rest of Europe, while the lowest values can be found in Latvia, Romania and Bulgaria.

At the NUTS3 level, the GDP per capita values differ not only between, but also within, countries. Large differences exist in Germany (economically strong regions in the south and west, economically weak regions in the east) and Italy (economically strong regions in the north and the area around Rome, economically weak regions in the south).

What is more, current levels of GDP per capita are only one aspect of the convergence process among countries or regions. The defining convergence characteristics are a GDP per capita level that is below average in the initial period and an above-average positive growth rate of this variable in the following period. Figure 4 shows the growth rate of GDP per capita between the years 2000 and 2011 in the European regions. The picture that emerges looks very different from the levels of GDP per capita presented in Figure 3, as the highest growth rates are observed in

Figure 4
GDP per capita growth 2000-2011



Source: Eurostat.

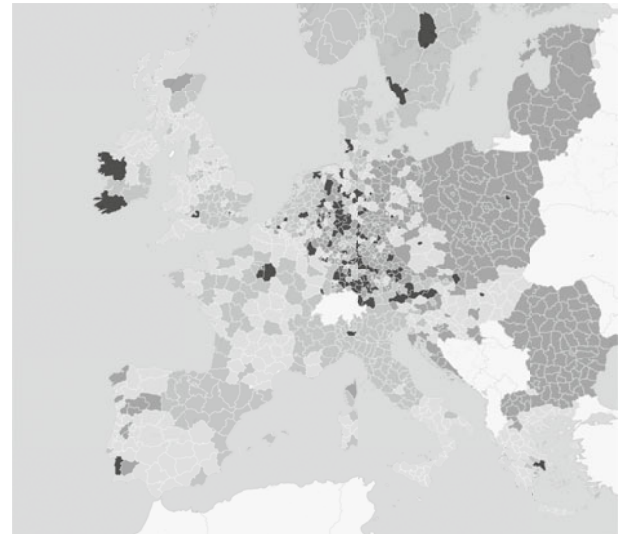
countries that started with low levels of GDP per capita in 2000, including Estonia, Latvia, Lithuania, Poland, Romania, Bulgaria and Slovenia. The same finding applies to regions in Spain and Portugal. Thus, to some extent at least, the nations of Eastern and Southern Europe seem to fulfil a convergence process.

In the last ten years, some economically strong countries have also performed well in terms of GDP per capita growth. These include Sweden, Finland, the Netherlands, Belgium, Germany, Austria and a majority of Irish regions. On the other hand, most regions in the United Kingdom, Italy and Greece started with relatively high economic wealth but then either did not grow at all or actually declined. Many regions in France also grew at a very slow pace. Of the original EU members, only Germany has maintained good economic performance, while regions with a similar economic structure to Germany's, such as Denmark and the northern regions of Italy, have performed much more poorly.

Figure 5 indicates the different combinations of the convergence determinants for the NUTS3 regions by colour:

- High starting level and high growth rate: darkest grey
- High starting level and low growth rate: dark grey
- Low starting level and high growth rate: light grey

Figure 5
Convergence in Europe



Sources: Eurostat; Cologne Institute for Economic Research.

- Low starting level and low growth rate: grey

A low starting level is defined as a value of real GDP per capita in 2000 that was lower than the EU28 average. The same approach was used for growth rates. According to the above definition, regions that converged are therefore those coloured light grey.

The results show that the economically strong southern and western parts of Germany grew faster than the EU average. The same holds true for the regions around the cities of Lisbon, Athens and Paris, as well as for some parts of Ireland and Sweden. In contrast to this pattern, many regions in Greece, Hungary, the Czech Republic, Spain, France, the United Kingdom and the south of Italy manifest below-average growth starting from a low level. Most countries are dominated by two different categories of regions. Germany is an exception in that all four types of regions are present in relatively equal shares, though the two types of regions with high growth predominate.

The other European countries, such as Spain, Italy, France, Hungary, Greece and the United Kingdom, are almost entirely represented by regions with low GDP per capita growth. France, Spain, Italy and the United Kingdom are characterised by a marked difference between two major regions, which indicates specific challenges for regional development. The pattern in many Eastern

Table 1
Results of the beta convergence at the NUTS3 level

Dependent variable:	N=1289	
Average value of the yearly real GDP per capita growth rate from 2000 to 2011	$R^2=0.24$	
Variable	Coefficient	p-Value
Log real GDP per capita in 2000	-0.01	0.000
Constant	0.13	0.000

Sources: Eurostat; Cologne Institute for Economic Research.

European countries, such as Lithuania, Poland and Romania, as well as parts of Spain and Portugal, is indicative of the convergence process.

Convergence: results of the regression analysis

The convergence process of the initially economically weaker regions suggested by the descriptive approach in the previous section is confirmed by a beta convergence analysis. The results are presented in Table 1. The analysis uses the log value of the starting value and the average growth rate of GDP per capita. The regression containing 1,289 European regions results in a statistically significant negative coefficient of the log value of the GDP per capita in the year 2000 and an R^2 value of 0.24. The estimated model thus has predictive power and shows that for the NUTS3 regions in the decade after the year 2000, a high starting level of GDP per capita does indeed correlate with a growth rate in this variable below the EU average.

In addition to the beta convergence, a sigma convergence can also be analysed to obtain details of the convergence process. The sigma convergence tests how regions converge over time with respect to the variance of GDP per capita.⁵ The variance is measured by using the coefficient of variation. The results for the EU28 are presented in Figure 6 and indicate that the variation shrank after 2000 but increased again in the last years of the data sample.

There are many possible reasons for variation in economic performance and convergence. Proximity to a national border could be a driving force behind a region's economic activity, as could EU subsidies. Other driving

5 S. Dowrick, D.-T. Nguyen: OECD Comparative Economic Growth 1950-85: Catch-Up and Convergence, in: American Economic Review, Vol. 79, No. 5, 1989, pp. 1010-1030; R.J. Barro, X. Sala-i-Martin: Convergence, in: Journal of Political Economy, Vol. 100, No. 2, 1992, pp. 223-251.

Figure 6
Coefficient of variation of the NUTS3 regions



Sources: Eurostat; Cologne Institute for Economic Research.

forces might be the regions' endogenous characteristics, such as the relative sizes of the industrial and tertiary sectors, or of spending on research and development.

Border regions are defined in the analysis as regions that share a land border with another EU28 country. Maritime borders are not considered. Per capita payments from the Cohesion Fund and the European Regional Development Fund between 2000 and 2006 are used as a proxy for EU subsidies. The aim of these funds is to promote economic, social and territorial cohesion as required by Article 174 of the Treaty on the Functioning of the European Union. Payments from these funds are mainly directed at regions with GDP per capita below the EU average. The allotted payments were disbursed at the beginning of the data sample and can be assumed to have developed their economic effects over the following years, thus potentially affecting GDP growth through 2011.

A convergence dummy is used to identify the driving parameters of convergence. The convergence dummy takes the value one if a region started in 2000 with a level of GDP per capita below the EU average and improved in the following decade (these are the regions coloured light green in Figure 5). A logit estimation is run by using the convergence dummy and the described variables. Insignificant variables are eliminated by sequentially t-testing. The results are shown in Table 2.

The results show that the relative size of the industrial sector correlates positively with the process of convergence, even after controlling for the Eastern European countries. Nevertheless, increasing the size of the industrial sector is not a silver bullet. The extent to which the composition of an economy – in terms of the relative sizes

Table 2
Determinants of regional convergence at the NUTS3 level

Dependent variable:		N=931
Convergence dummy		Pseudo R ² =0.27
Variable	Coefficient	p-value
Industrial employment (as a percentage)	0.05	0.000
Educational level (2011 share of higher education) ¹	0.08	0.000
Eastern Europe (dummy)	2.14	0.000
Border region (dummy)	0.26	0.162
Payment from EU regional funds (in euros per capita)	0.002	0.000
Constant	-8.71	0.000

¹ The education variable is only available for the NUTS2 level. The NUTS2 values have been inserted into the NUTS3 level.

Sources: Eurostat, European Commission; Cologne Institute for Economic Research.

of its manufacturing and service sectors – determines its success depends on the history of the economy or region involved.⁶ Payments from the EU regional funds also correlate positively with the probability of convergence. However, whether or not a region abuts an international border does not influence the probability of having converged.

Next, regional subsidies need to be categorised by sector, as the effect of a payment depends on the sector it is targeted at. The funds distinguish between the following categories:

- Agriculture
- Forestry
- Promoting the adaptation and the development of rural areas
- Fisheries
- Assisting large business organisations
- Assisting SMEs and the craft sector
- Tourism
- Research, technological development and innovation
- Labour market policy
- Social inclusion
- Developing education and vocational training
- Workforce flexibility, entrepreneurial activity, innovation, information and communication technologies

6 M. Grömling: Lässt sich der Aufstieg von Nationen mit dem sektoralen Strukturwandel erklären?, in: ifo Schnelldienst, Vol. 67, No. 14, 2014, pp. 3-7.

- Positive labour market actions for women
- Transport infrastructure
- Telecommunication infrastructure and information society
- Energy infrastructure
- Environmental infrastructure
- Planning and rehabilitation
- Social and public health infrastructure
- Technical assistance and innovative actions

For the purposes of this analysis, payments from the different funds were aggregated using these categories. The variable for each separate category replaced the overall payment variable in the model presented in Table 2. Afterwards, all categories that showed a significant correlation with the convergence process were put together in a model and estimated simultaneously. The results are presented in Table 3. A positive correlation can be found for financial support for assisting large business organisations, tourism, transport and environment infrastructure, as well as planning and rehabilitation.

The overall results show that regions with a higher industrial share and regions receiving subsidies from the EU tended to have a higher probability of convergence in the period from 2000 to 2011. Table 3 indicates that the extent to which payments influence the probability of convergence depends on the category involved. The greatest potential seems to be offered by financial support for assisting large business organisations, tourism, transport and environmental infrastructure (in contrast to Rodríguez-Pose and Fratesi, who analyse infrastructure at the aggregate level and find no effect),⁷ and planning and rehabilitation. The significant negative coefficients for payments in the category research and communication are counterintuitive. Separating the data set into regions that converged and those that did not reveals that twice the amount of money was paid in these categories to regions that have not converged. The regions involved could not converge by definition, because they started in the year 2000 with an above-average level of GDP per capita. The negative estimates are driven by the relatively high payments to regions that could not converge. On the other hand, this does not mean that payments to converging regions always have a positive effect on convergence. This can be seen by the plurality of insignificant estimators. Thus, not all regional support from the EU drives economic, social and territorial cohesion.⁸

7 A. Rodríguez-Pose, U. Fratesi: Between Development and Social Policies: The Impact of European Structural Funds in Objective 1 Regions, in: Regional Studies, Vol. 38, No. 1, 2004, pp. 97-113.

8 European Union: Consolidated version of the Treaty on the Functioning of the European Union, 2012, Article 174.

Table 3
Detailed EU fund payments and convergence

Dependent variable:		N=931				
Convergence dummy		Pseudo R ² =0.33		Average payment per capita in euros to...		
		Coef-ficient	p-value	Con-verged countries	Others	Quo-tient
Employment in industry		0.040	0.001			
Education		0.108	0.000			
Eastern Europe		2.000	0.000			
Border		0.240	0.269			
Payments to:	Rural development	-0.001	0.757	7.5	4.0	1.9
	Large businesses	0.005	0.059	39.8	14.6	2.7
	Assisting SMEs	0.001	0.462	70.6	47.3	1.5
	Tourism	0.006	0.069	25.0	16.2	1.5
	Research	-0.003	0.051	23.8	20.4	1.2
	Education	0.007	0.380	7.1	3.5	2.0
	Communication	-0.324	0.035	0.19	0.35	0.5
	Labour	0.484	0.162	0.1	0.1	1.0
	Transport	0.001	0.100	146.2	47.3	3.1
	Telecommunications	-0.008	0.306	8.8	7.0	1.3
	Environment	0.009	0.000	93.3	24.1	3.9
	Rehabilitation	0.006	0.024	45.9	28.3	1.6
	Health	0.003	0.305	28.3	9.0	3.1
Constant		-11.193	0.000			

The estimated coefficients that are highlighted are significant at the ten per cent level.

Sources: Eurostat, European Commission; Cologne Institute for Economic Research.

In the new scope of action, regions that want to receive payments from the EU in the period 2014-2020 have to fulfil the so-called “*ex ante* conditions”. The admirable aim of these conditions is to increase the effectiveness of subsidies. They include a regional innovation strategy and confirmation of an effective tendering process for public contracts. Another approach which would enhance efficiency is to organise EU payments at the regional level.

Regionalisation could reduce the amount of bureaucracy and provide an opportunity to identify shortages much earlier.⁹ Nevertheless, the effectiveness of subsidies also depends on the quality of the regional government structure administering them.¹⁰ The idea behind moving the competences more to the regional level is to link the area where the payment is effective with the project’s responsibility. This would also lead to more competition among regions and would force all participants to compete for the best solution. In deciding how subsidies are awarded, these factors have already been taken into account. Nevertheless, the EU must remain responsible for the payments and keep a sufficiently high level of control over this process.

The positive effect of the relative size of the manufacturing sector makes clear the importance of manufacturing for the convergence process in the EU from 2000 to 2011. This effect is based, *inter alia*, on the combination of industry and services. Added value is generated by applying services in industrial production. In 2011 the value added by these services reached 8.5% of total value added.¹¹ The manufacturing industry is therefore important for the process of convergence, but it is by no means a silver bullet. The optimal economic structure for a region also depends on its history. In addition to the role of the manufacturing industry, directing subsidies from the EU to the right fields of activity has a positive influence on the opportunity to converge.

9 Sachverständigenrat: Jahresgutachten 1988/1989 des Sachverständigenrates zur Begutachtung der gesamtwirtschaftlichen Entwicklung: Arbeitsplätze im Wettbewerb, 1989.

10 A. Rodriguez-Pose, E. Garcilazo: Quality of Government and the Returns of Investment. Examining the Impact of Cohesion Expenditure in European Regions, OECD Regional Development Working Papers, No. 12, Paris 2013.

11 R. Bertenrath, B. Busch, M. Fritsch, M. Grömling, K. Lichtblau, J. Matthes: Industry as a growth engine in the global economy, IW Consult, 2013.