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# Income convergence during the crisis: did EU funds provide a buffer?

SILVIA MERLER

## ABSTRACT

Economic convergence is at the heart of European Union integration. The importance of this objective has not diminished over time, and it is especially relevant in light of the economic crisis that has exacted a heavy toll on EU countries and created scepticism about the merits of EU policies.

We look at how economic convergence evolved in different regions during the crisis and assess the role played by those funds that are provided to the more disadvantaged regions, with the aim of facilitating their convergence to average EU income levels.

We ran both an absolute and a conditional convergence analysis, using regional data on per capita GDP in purchasing power standard. We find that convergence continued during the crisis for the EU as a whole, although at a slower pace, but for regions in the EU14, and especially in the euro area, convergence appears to have stopped during the crisis, or even switched to a divergence path.

We exploit features in the funds' eligibility rules in order to construct a quasi-experimental framework, based on comparable treatment and control group of regions. We find that regional policy played an important role in limiting the effects of the crisis at the region level, by providing an important anchor for convergence in those regions that benefited from the funds.



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## Introduction

The European Union's cohesion policy as we know it came into existence at the time of the Mediterranean enlargement, when the EU extended to include Spain, Portugal and Greece. The idea of cohesion policy was to complement the project for the completion of the single European market<sup>1</sup>. The Single European Act (SEA) of 1987 introduced the term 'cohesion'. Subsequent reforms in 1988 and 1993 significantly augmented the size of the new structural and cohesion funds (Marzinotto 2012, Hodson 2012).

In this paper, we look at how economic convergence evolved across European regions before and during the economic crisis. We focus on both the EU as a whole and on subgroups: the euro-area 18 (EA18, comprising all euro-area countries except Luxembourg), the euro-area 11 (EA11, comprising Austria, Belgium, Germany, Greece, Spain, Finland, France, Ireland, Italy, Netherlands, Portugal), the EU14 (comprising countries in EA11 plus the UK, Denmark and Sweden), the so-called euro-area core (Austria, Belgium, Germany, Finland, France, Netherlands) and the so-called euro-area periphery (Greece, Ireland, Italy, Portugal and Spain). We find that at the level of the EU as a whole, regions continued to converge during the crisis, while there is no statistically significant evidence of income convergence over the same period across regions within the EU14 and euro area 11 (EA11).

On the basis of these findings, it is important to investigate the role played during the crisis by those funds ('Objective 1') that the EU provides to the more disadvantaged regions to foster their convergence to average EU income levels. The rationale and functioning of structural funds have been subject to criticism, which we review. Assessing the link between structural funds and convergence is complicated because these funds by definition go to relatively backward regions. Economic theory predicts that capital should flow downhill, implying we should expect these areas to be recipients of capital. We exploit the rules determining convergence fund eligibility to construct a treatment/control framework based on two groups of comparable regions. We find that during the crisis those NUTS3 regions that were eligible for Objective 1 funds grew faster than the other comparable regions. We also find evidence of income convergence within this group, meaning that among those regions that received funds, per capita income in the relatively poorer regions grew faster or decreased less fast. The effect is stronger for the EU14, EA11 and especially for the so-called euro-area periphery, than for the EU as a whole. This suggests that convergence funds played an important role during the crisis, at least within the group of disadvantaged regions that were entitled to receive them, and especially in comparison to equally disadvantaged regions that were not.

These findings have important policy implications. The European Commission acknowledged the potential for cohesion policy to play a part in the European Economic Recovery Plan<sup>2</sup> and to help regions and member states tackle the extraordinary

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<sup>1</sup> The Treaty establishing the European Community defines economic and social cohesion as one of the priorities of the Union. Cohesion Policy should "*promote economic and social progress as well as a high level of employment, and achieve balanced and sustainable development*" (Art.2). The Community should in particular aim "*to reduce the disparities between the levels of development of the different regions and the backwardness of the least favoured regions*" (Art. 158).

<sup>2</sup> See <http://ec.europa.eu/social/main.jsp?catId=89&langId=en&newsId=422&furtherNews=yes>.

challenges brought on by the crisis. After 2008, the Commission proposed a series of initiatives to speed up the implementation of European cohesion policy programmes for the 2007-2013 period and to ensure that resources were fully mobilised<sup>3</sup>. That notwithstanding, in 2011 the main recipients of EU structural and cohesion funds still had to absorb considerable proportions of the amounts earmarked to them. Marzinotto (2011) argued that the debate on the European crisis was paying insufficient attention to the possible use of structural and cohesion funds for crisis management and resolution, in particular to compensate for the recessionary impact of fiscal consolidation and to preserve essential public investment in infrastructure, human capital and research. Faucher (2014) argued that cohesion policy was particularly important in offsetting lower public investment, showing that in 2013, the contribution of EU cohesion funds to public investment in regions was nine times higher than in 2007.

Over the years, EU cohesion policy has not been immune to criticism, with academics and policymakers often questioning its rationale, organisation and effectiveness (Manzella *et al*, 2009). Our results suggest that regional policy has played an important role in counteracting the effects of the crisis at the regional level, by providing an anchor for income convergence in those regions that benefitted from the funds. The effect is especially strong in those countries that were hit harder by the crisis and underwent macroeconomic adjustment programmes, possibly because of the tighter financial constraints that these regions had to face during the crisis. This is certainly a positive message, particularly relevant at a time when EU policies face stark criticism and Europeans seem to be growing disenchanted with the EU, which is often blamed for increasing rather than healing economic malaise at the domestic level.

## **Regional economic convergence during the crisis**

### **Literature review**

The empirical analysis of income convergence relies on work from the early 1990s by Barro and Sala-i-Martin, who proposed a growth equation derived from the transition path of the neoclassical growth model. The concept of convergence that stems from this approach is known as  $\beta$ -convergence, and it relates to the prediction that relatively poorer economies should grow faster than relatively richer ones. A variation on this theme predicts conditional  $\beta$ -convergence, which allows for different steady state levels of output in different countries.

The literature on convergence is abundant, in the European context, and results are sometimes contradictory. Barro and Sala-i-Martin (1992) did the groundwork and studied convergence across 48 US states using data on personal income since 1840 and data on state GDP since 1963 and up to the late 1980s. Barro and Sala-i-Martin (1991) looked at patterns of convergence for 73 regions of western Europe since 1950, finding that the process of convergence within European countries is similar to that for the United States, and in particular that the rate of convergence for European regions is also about 2 percent a year. Sala-i-Martin (1995) extended the empirical evidence on regional

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<sup>3</sup> See [http://ec.europa.eu/regional\\_policy/archive/funds/recovery/index\\_en.htm](http://ec.europa.eu/regional_policy/archive/funds/recovery/index_en.htm) and <http://ec.europa.eu/social/main.jsp?langId=en&catId=736>.

convergence to the US, Japan and five European countries, finding that the estimated speed of convergence was similar in different countries at the regional level and also that the interregional distribution of income shrank in all countries over time. Yin *et al* (2003) estimated both beta and sigma convergence using EU data for the period 1960-95, finding evidence of economic convergence within the EU except for the 1980-85 sub-period where weak divergence was indicated.

More recently, Eckey and Türk (2007) provided a review of studies testing for sigma and beta convergence at the country or regional levels. The early literature detects beta convergence among EU regions, at both EU15 and EU27 level, with the speed of convergence being rather low in the 1980s and higher afterwards. Kutan *et al* (2007) showed that EU integration is associated with an increased pace of overall growth because of capital accumulation. Their findings point to cohesion and structural funds playing an important role in helping the countries that joined the EU in 2004 and after to catch up with the older members' standards of living. Böwer *et al* (2010) investigated the accession-related economic boom in EU countries that joined the EU in 2004 and after. They found that the period of EU accession is characterised by significantly larger growth rates of per-capita GDP, even after controlling for a wide range of economic and institutional factors. This effect is robust and particularly strong for countries with relatively low initial income levels, weak institutional quality and lower financial development, suggesting that EU accession speeds up the catching-up process and improves the institutions of the laggards among EU joiners. Morgese Borys *et al* (2008) also focused on real convergence in candidate and potential candidate countries. They found evidence of conditional convergence in the transition countries of central, eastern and south-eastern Europe, controlling for the quality of institutions, the extent of market reforms and macroeconomic policies.

Próchniak *et al* (2013) analysed the time stability of GDP beta convergence in the EU27 from 1993–2010 and EU15 from 1972–2010. They found that EU27 countries converged at the rate of about 5 percent per annum and EU15 countries at 3 percent. Campos *et al* (2014) presented estimates of the benefits from economic and political integration. Using the synthetic counterfactuals method, they estimated how GDP per capita and labour productivity would have behaved for the countries that joined the EU in the 1973, 1980s, 1995 and 2004 enlargements, if those countries had not joined. They find large positive effects from EU membership but these differ for different countries and over time. Darvas (2011) assessed the impact of the 2008–09 global financial and economic crisis on the medium-term growth prospects of the countries of central and eastern Europe, the Caucasus and Central Asia. Using cross-country growth regressions, he found that the crisis had a major impact on the within-sample fit of the models used, and that the positive impact of EU enlargement on growth is less than shown by previous research. The crisis is found to have altered the future growth prospects of the countries studied, even in the case of a return to pre-crisis capital inflows and credit booms.

Kaitila (2013) found a long-term trend of GDP per capita convergence in the EU after 1960 and argued that the Great Recession was a shock to convergence, particularly affecting the EU15. Wunsch (2013) described European economic convergence before the crisis as a success story with many caveats, particularly because of the different evolution of convergence at country level versus convergence at regional level. Faucher (2014) found a reversal of the convergence trend in Europe during the crisis, leading to

the wealth disparities between regions in 2013 returning to the level observed in 2000. ECB (2015) found that while central and eastern European countries have caught up to the EU average over the past 15 years, real convergence among EA12 countries has been disappointing. Collado and Goedemé (2016) look at changes between 2005 and 2011 in the lowest household incomes in relation to the EU-wide median, for both the EU15 and countries that joined the EU in 2004 and after. They show that overall the convergence machine seemed to work well for the lowest incomes in the joiners, but not so much for those living in the EU15.

## Testing regional convergence during the crisis

Before assessing the performance of structural funds in promoting convergence, we run a simple test for the existence of beta convergence in the EU at NUTS2<sup>4</sup> region level during the crisis. Following Barro and Sala-i-Martin (1992) we define the average growth rate of income over the interval between any two points in time  $t_0$  and  $t_0 + T$  as:

$$\frac{1}{T} * \log\left(\frac{y_{i,t_0+T}}{y_{i,t_0}}\right) = A - \left(\frac{1 - e^{-\beta T}}{T}\right) * \log(y_{i,t_0}) + u_{i,t_0,t_0+T} \quad (a)$$

Where  $y_{i,t_0}$  is the initial level of Purchasing Power Standard (PPS) per capita GDP in country  $i$ , and  $y_{i,t_0+T}$  is the PPS per capita GDP in country  $i$  after  $T$  years. It is customary to use PPS per capita GDP as the reference variable for cross-section convergence analysis, because it allows all the differences in price levels between countries to be catered for. By using purchasing power parities (PPPs) rather than market exchange rates, GDP indicators are converted into an artificial common currency, which makes it possible to compare purchasing power in different regions of EU countries that use different currencies and where price levels are different<sup>5</sup>. For simplicity, we present the result from estimating the simpler linear specification below (equation b), where intuitively a negative estimated beta coefficient will provide evidence of beta convergence<sup>6</sup>. We use data on per capita PPS GDP for more than 200 EU NUTS2 regions from 2000-14<sup>7</sup>.

$$\frac{1}{T} * \log\left(\frac{y_{i,t_0+T}}{y_{i,t_0}}\right) = A + \beta * \log(y_{i,t_0}) + u_{i,t_0,t_0+T} \quad (b)$$

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<sup>4</sup> The NUTS classification (Nomenclature of territorial units for statistics) is a hierarchical system for dividing up the economic territory of the EU. NUTS1 refer to the major socio-economic regions; NUTS2 refer to the basic regions for the application of regional policies and NUTS3 refer to small regions for specific diagnoses.

<sup>5</sup> See Eurostat at [http://ec.europa.eu/eurostat/statistics-explained/index.php/GDP\\_at\\_regional\\_level](http://ec.europa.eu/eurostat/statistics-explained/index.php/GDP_at_regional_level).

<sup>6</sup> The non-linear specification gives consistent results, with the coefficients being slightly larger.

<sup>7</sup> While earlier regional data is available on demand from Eurostat, the fact that the statistical classification system (ESA) was changed in 1995 and in 2000 could potentially give rise to statistical breaks and bias convergence estimates. Regional data for the 2000-14 period is internally consistent from a statistical point of view and is complete.

<sup>8</sup> In all specifications, we exclude Luxembourg because it is a significant outlier in terms of per capita income measures, and Croatia, as the country only entered the EU in 2013 and our data ends in 2014. Notice that some countries have only one region, ie, Estonia, Cyprus, Malta, Lithuania and Latvia. They are included, but excluding them would not change the results.

When considering the EU as a whole, regions display absolute beta convergence at an estimated pace of 2 percent per year from 2000-14 (Table 1). When looking at EU14 or EA11, no significant convergence is detected over the whole period. The reason for this becomes clear when breaking the time series into sub-periods. From 2000-07, all three groups show very significant evidence of convergence, faster in the EU as a whole than in the EU14 and EA11. When looking at the period 2007-14, however, we find statistically significant evidence of divergence for both the EU14 and EA11, at a rate of about 1.4 percent per year. In EA11 and EU14 regions, the rate of divergence observed during the crisis is close to the rate of convergence observed before. At the level of the EU as a whole, by contrast, regions continued to converge during the crisis.

**Table 1– estimated absolute beta convergence coefficients at the regional level**

linear OLS				
	<b>EA11</b>	<b>EU14</b>	<b>EA18</b>	<b>EU</b>
<b>2000-2014</b>	.0003 [.0026]	.0006 [.0021]	-.0121*** [.0027]	-.022*** [.0015]
<b>2000-2007</b>	-.0154*** [.0031]	-.0136*** [.0025]	-.0282*** [.0032]	-.0275*** [.00183]
<b>2007-2014</b>	.0148*** [.0049]	.0137*** [.0039]	.0071 [.0046]	-.0177*** [.0026]

*Note: standard errors in brackets; \*\*\* equals significance at the 1percent level, \*\* at 5percent, \* at 10percent*

To check the robustness of these results, we also performed a conditional convergence analysis for EU regions. Table 2 presents the results of our linear specification when some important regional characteristics are explicitly controlled for. Many obvious control variables are not available at the regional level. We include population growth, R&D expenditure as percentage of GDP and the initial share of industry in regional value added. We find confirmation of strong and statistically significant convergence in the order of 2 percent for the EU and the EA18 over the full period, and not for the EU14 and EA11. As in the unconditional analysis, convergence is strong and statistically significant for all four groups in the pre-crisis period. After 2007, the coefficient switches sign to positive in the EU14 and EA11, although it is no longer significant when conditioning to these few regional characteristics.

Population growth tends to be significant and negatively correlated to per capita GDP growth, as the neoclassical growth theory would predict, with the exception of the EU14 and EA11 in the pre-crisis period. R&D expenditure positively and strongly correlates with growth over the entire period and during the crisis period, while it is not a significant explanatory variable in the pre-crisis period. This seems to suggest that investment in research and development tends to pay off more in crisis time, because it increases growth, all else being equal. The initial share of industry in regional value added tends not to be significant, but for the EU as a whole and the EA18 in the crisis

period. This interestingly suggests that within these groups, those regions that were more industrialised at the beginning of the period fared relatively better during the crisis.

**Table 2 – estimated conditional beta convergence at the regional level**

	2000-2014				2000-2007				2007-2014			
	EU	EA18	EU14	EA11	EU	EA18	EU14	EA11	EU	EA18	EU14	EA11
Initial income	-.024*** [.0020]	-.017*** [.0030]	-.003 [.0024]	-.003 [.0027]	.031*** [.0027]	.034*** [.0042]	.019*** [.0033]	.019*** [.0040]	.019*** [.0029]	-.002 [.0044]	.004 [.0041]	.004 [.0047]
R&D expenditure	.253*** [.0711]	.216*** [.0811]	.188*** [.0486]	.230*** [.0600]	.162 [.1008]	.084 [.1196]	.078 [.0689]	.099 [.0927]	.359*** [.0790]	.372*** [.0898]	.364*** [.0690]	.425*** [.0863]
Population growth	-.030*** [.0096]	-.032*** [.0100]	-.028*** [.0069]	-.025*** [.0076]	.014 [.0229]	.020 [.0235]	.052*** [.0164]	.056*** [.0185]	.097*** [.0242]	.095*** [.0275]	-.107*** [.0247]	-.097*** [.0281]
Initial industry share VA	.012 [.0095]	.021* [.0112]	.006 [.0075]	.009 [.0086]	.004 [.0134]	.022 [.0159]	.013 [.0105]	.013 [.0127]	.036*** [.0117]	.029** [.0147]	.018 [.0129]	.018 [.0151]
R2	0.61	0.36	0.22	0.27	0.49	0.36	0.18	0.18	0.43	0.31	0.32	0.35
Obs.	228	142	174	133	226	140	172	131	248	155	194	146

Note 1: standard errors in brackets; \*\*\* equals significance at the 1percent level, \*\* at 5percent, \* at 10percent

Note 2: EA11 refers to Austria, Belgium, Germany, Finland, France, Netherlands, Ireland, Greece, Italy, Portugal and Spain. EU 14 refers to EA11 plus Denmark, Sweden and UK. EA18 refers to

### **Cohesion policy rationale and criticisms**

EU cohesion policy has not been immune from criticism. Marzinotto (2012) reviewed how the objectives of this policy and the EU's approach to it have evolved over time. In the 1970s, when the European common market remained highly fragmented, the underlying theoretical framework was the neoclassical growth model, combined with the technological gap literature. Both strands of literature led to the expectation that poorer countries should grow faster than richer ones. The neoclassical model predicts that capital would flow downhill to poor regions, because decreasing returns to capital imply that investment would be more remunerative where the capital stock was low. The technological gap literature expects poor regions to grow faster because of technology imitation rather than innovation. Persisting market fragmentation in the EU seemed to be consistent with Lucas' argument that frictions may exist that prevented capital from flowing downhill, thus potentially preventing the poorer regions from catching-up. The late 1980s were associated with a paradigm shift in the understanding of growth dynamics and in the appreciation of regional policies (Marzinotto 2012). Cohesion



policy came into existence in 1988 shortly after the Mediterranean enlargement, with the objective of complementing the creation of the single European market. Cohesion policy resonated with the ideas of endogenous growth theory and new economic geography, according to which free markets would generate agglomeration effects and increase income disparities, because economic activities would concentrate in 'core' technologically advanced areas. Based on these grounds, EU cohesion policy aims to create the conditions for increased returns on investment in poorer areas in order to promote endogenously their convergence to average income levels. However, the policy's rationale, governance and effectiveness have faced substantial criticisms. Key criticisms are that cohesion policy has evolved into a 'catch-all' policy without a clear mission; that it insufficiently focuses on growth; that it has inadequate policy instruments; and that it is excessively complex and bureaucratic to administer<sup>9</sup>. The apparent difficulty of pinning down the economic effectiveness of cohesion policy – evident in the wide range of results reported in the literature – is obviously central to much of the criticism<sup>10</sup>. In this paper we focus on convergence funds, and assess whether they have been effective in helping income convergence in the least developed regions. A proper identification strategy is key to this question: convergence funds by their construction go to less-developed regions – making it complex to disentangle their specific impact on growth.

### **Convergence funds framework in the EU during the crisis**

One of the objectives of EU cohesion policy is to reduce the gap in the levels of development of different regions, in order to strengthen economic and social cohesion. To this end, the so-called Objective 1 funds are allocated to those NUTS2 regions where per capita GDP in purchasing power standard (PPS) is below 75 percent of the EU average.

The structure of cohesion policy for 2007-13 was changed compared to the previous years. In the 2000-06 period, cohesion policy was organised around four objectives and six instruments. For 2007-13, the architecture was simplified and was based on three objectives and three instruments (see European Commission, 2007). The three new objectives incorporate the missions of the previous Objectives 1, 2 and 3 and the previous Community initiatives Interreg III, Equal and Urban II. 'Objective 2' (ie economic and social conversion zones) and 'Objective 3' (ie training systems and employment policies) were combined into a single 'regional competitiveness and employment' objective. Objective 1 (ie regions lagging behind in development terms) was renamed the 'convergence' objective, which was to stimulate growth and employment in the least-developed regions. The EU's financial perspectives for 2007-13 allocated €347 billion (35.7 percent of the EU budget) to the structural and cohesion funds. Roughly 80 percent of this was allocated to the convergence objective (Hodson, 2012).

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<sup>9</sup> See Manzella (2009) for a comprehensive review of the criticism.

<sup>10</sup> See Manzella (2009) for a comprehensive review.

**Table 3 – Eligibility for Convergence Funds**

<b>Eligibility for the Convergence Objective – regional level</b>				
	<b>2000 – 2006</b>	<b>&gt;&gt;&gt;</b>	<b>2007 – 2013</b>	
<b>Objective 1</b>	NUTS 2 regions whose per capita GDP is less than 75 percent of Community average.	>>>	No change	<b>Convergence</b>
	Transitional support for regions and areas which were eligible for 1994–99, but in 2000–06 are no longer eligible for Objective 1 (phasing-out)	>>>	Tapering transitional support up to 2013 for regions who would have been eligible for the convergence objective if the threshold had remained 75 percent of the average GDP of the EU-15 and not the EU-25.	

*Source: EC (2007)*

**Table 4 – Eligibility for Cohesion Funds**

<b>Eligibility for the Convergence Objective – State level</b>				
	<b>2000 – 2006</b>	<b>&gt;&gt;&gt;</b>	<b>2007 – 2013</b>	
<b>Cohesion Funds</b>	Member States whose per capita gross national income (GNI) is below 90 percent of the Community average	>>>	No change	<b>Convergence</b>
		>>>	Tapering transitional support for Member States who would have been eligible for the Cohesion Fund objective if the threshold had remained 90 percent of average GNI of EU-15 and not EU-25	

*Source: EC (2007)*

The newly defined convergence objective combined the Objective 1 (eligibility for which is determined at the regional level) and the cohesion fund (eligibility for which is determined at the national level), which no longer functioned independently. Regions were eligible for Objective 1 funding if their per capita gross domestic product (GDP) was less than 75 percent of the EU average; member states were eligible for cohesion fund money if their per capita gross national income (GNI) was below 90 percent of the EU

average. Both schemes foresaw transitional support for those regions that would have been eligible based on the pre-enlargement benchmarks.

### **Identification strategy: formal eligibility**

To assess the impact of structural funds on regional income convergence during the crisis, we focus on the Objective 1 component of the convergence funds allocation, ie the part whose eligibility is determined at the regional level. As convincingly pointed out by Becker *et al* (2008), the way these funds are allocated resembles a quasi-experimental setting that can be exploited for empirical investigation. Eligibility for Objective 1 funds is determined at the regional NUTS2 level. More specifically, NUTS2 regions were considered eligible for funds for the 2007-13 allocation period if their GDP per capita, measured in purchasing power parities and calculated on the basis of figures for the period 2000 to 2002, was less than 75 percent of EU average GDP for the same reference period (European Commission, 2006<sup>11</sup>).

This rule creates a threshold: NUTS2 regions below 75 percent are entitled to the funds, while regions above are not. This rule is exogenous from the perspective of the smaller NUTS3 regions that belong to a certain NUTS2 region (Becker *et al*, 2008). As a result, it is perfectly possible that some NUTS3 regions in eligible NUTS2 areas have a per-capita GDP level higher than the threshold for eligibility at the NUTS2 level. These NUTS3 regions would not qualify to receive Objective 1 transfers if they had been assessed as independent entities, but in practice they qualify, because they are part of a relatively poor NUTS2 region. Similarly, some NUTS3 areas might be below the threshold if looked at individually, but the fact of belonging to a relatively rich NUTS2 region renders them ineligible for Objective 1 funds. We exploit this feature of the funds' allocation to understand the relationship between funds and convergence during the crisis.

Structural funds are allocated over a multiannual horizon. We focus on the allocation for the period 2007-13 and look at how formal eligibility for funds relates to the growth rate of per capita GDP between 2006 and 2013. We choose 2006 as the initial year, as this is the year before the start of the 2007-13 allocation period. We collect data on per capita GDP in PPS for more than 1300 NUTS3 regions<sup>12</sup> from 2006-13 and construct a dummy that equals 1 for all NUTS3 regions that were formally declared eligible for Objective 1 funds over the period. As previously pointed out, a NUTS3 region is formally eligible if its parent NUTS2 is eligible, regardless of the NUTS3 region's level of income<sup>13</sup>. We include also those regions that were deemed eligible for transitional Objective 1 support. The list of eligible NUTS2 regions, according to these criteria, includes the following territories.

- **Austria:** Burgenland (eligible for transitional support)
- **Belgium:** Province du Hainaut (eligible for transitional support)

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<sup>11</sup> See Chapter III, Article 5 of the General Regulation (EC 2006)

<sup>12</sup> We excluded some of the regions in the list because it was not possible to perfectly match them with the NUTS 2010 regional classification, in which the denomination and classification of some regions appears to have changed. This left us initially with 1319 regions, but for 18 of them the per capita PPS GDP is missing in either 2006 or 2013, so they are dropped from the regression.

<sup>13</sup> The list of the eligible NUTS2 is available in 'European Union, Cohesion Policy 2007-13, Commentary to the official texts'.

- **Bulgaria:** all territory
- **Czech Republic:** Střední Čechy, Jihozápad, Severozápad, Severovýchod, Jihovýchod, Střední Morava, Moravskoslezsko
- **Germany:** Brandenburg-Nordost, Mecklenburg-Vorpommern, Chemnitz, Dresden, Dessau, Magdeburg, Thüringen (eligible); Brandenburg-Südwest, Lüneburg, Leipzig, Halle (eligible for transitional support only)
- **Estonia:** all territory
- **Greece:** Anatoliki Makedonia, Thraki, Thessalia, Ipeiros, Ionia Nisia, Dytiki Ellada, Peloponnisos, Voreio Aigaio, Kriti (eligible); Kentriki Makedonia, Dytiki Makedonia, Attiki (eligible for transitional support only)
- **Spain:** Galicia, Castilla-La Mancha, Extremadura, Andalucía (eligible); Principado de Asturias, Región de Murcia, Ciudad Autónoma de Ceuta, Ciudad Autónoma de Melilla (eligible for transitional support only)
- **France:** Guadeloupe, Martinique, Guyane, Réunion
- **Italy:** Campania, Puglia, Calabria, Sicilia (eligible); Basilicata (eligible for transitional support only)
- **Latvia:** all territory
- **Lithuania:** all territory
- **Hungary:** Közép-Dunántúl, Nyugat-Dunántúl, Dél-Dunántúl, Észak-Magyarország, Észak-Alföld, Dél-Alföld
- **Malta:** all territory
- **Poland:** all territory
- **Portugal:** Norte, Centro, Alentejo, Região Autónoma dos Açores (eligible); Algarve (eligible for transitional support only))
- **Romania:** all territory
- **Slovenia:** all territory
- **Slovakia:** Západné Slovensko, Stredné Slovensko, Východné Slovensko
- **United Kingdom:** Cornwall and Isles of Scilly, West Wales and the Valleys (eligible); Highlands and Islands (eligible for transitional support only)

We then regress the 2006-13 growth rate of per capita PPS GDP on both the eligibility dummy and its interaction with the initial (ie 2006) income level. This specification allows us to assess the link between formal eligibility for Objective 1 funds and growth, but also to understand whether income levels in the formally eligible regions converged. We include country fixed effects, to control for potential factors common to all regions. Table 5 reports the results.

**Table 5 – objective 1 eligibility and convergence at NUTS3 level**

	EU	EA	EU14	EA11	EA Core	EA Periphery
Formal dummy	.092*** [.0193]	.212*** [.0281]	.219*** [.0322]	.236*** [.0336]	.238*** [.0499]	.249*** [.0445]
Formal * ln_Y0	-.009*** [.0020]	-.021*** [.0029]	-.022*** [.0033]	-.024*** [.0034]	-.024*** [.0051]	-.025*** [.0045]
R2	0.76	0.67	0.67	0.64	0.31	0.57
obs.	1301	920	1081	876	640	236
n° formal=1 / formal=0	427/874	239/681	212/869	197/679	87/553	110/126
country FE	yes	yes	yes	yes	yes	yes

Note: EA Core includes Austria, Belgium, Finland, France, Germany and the Netherlands; EA Periphery includes Greece, Ireland, Italy, Portugal and Spain.

The coefficient of the formal eligibility dummy is positive and significant at the EU level, suggesting that during the crisis period eligibility for structural funds was associated with higher growth. The result is valid for the euro area, EU14, EA11 and euro-area core and periphery, and interestingly the effect is greater at the EA11 level, especially for the euro-area periphery that includes all the countries undergoing EU/IMF macroeconomic adjustment programmes plus Italy. It is also consistent with previous evidence. For example, Cappelen *et al* (2003) find that EU regional support has a significant and positive impact on the growth performance of European regions, much stronger in more developed environments. The coefficient on the interaction term is negative, meaning that among those regions that were formally eligible for Objective 1 funds, income in the relatively poorer regions grew faster (or decreased less fast). For the euro area, this suggests that even during the crisis, those NUTS3 regions that were formally eligible for convergence aid kept converging, at a rate of about 2 percent per year<sup>14</sup>.

### Identification strategy: a treatment/control framework

To better assess the role of Objective 1 funds in fostering convergence, we use the NUTS3 data to mimic a treatment/control framework, exploiting the previously described rule for convergence funds eligibility.

First, we apply to each NUTS3 region the eligibility criteria that is normally applied to NUTS2 regions, ie we check whether each NUTS3 individual income is above or below the 75 percent of EU average benchmark<sup>15</sup>. We identify all those NUTS3 regions that

<sup>14</sup> This result is robust to the inclusion of NUTS2-level fixed effects instead of country fixed effects.

<sup>15</sup> More specifically, NUTS3 regions were considered eligible for funds for the 2007-13 allocation period if their GDP per capita, measured in purchasing power parities and calculated on the basis of Community figures for the period 2000 to 2002, was less than 75 percent of the average GDP of the EU25 for the same reference period. This is the formal criteria used for NUTS2 regions and detailed in European Commission (2006).

would be eligible if the threshold were applied to their individual income rather than that of their parent NUTS2 region.

Second, we match this ‘actual’ measure of eligibility with the ‘formal’ eligibility status of the same NUTS3 regions. This allows us to identify two sub-groups of regions: one group includes those NUTS3 regions that would be eligible based on their individual income *and* were also formally eligible based on their parent NUTS2 income; a second group includes those NUTS3 region that would be eligible based on their individual income *but* were not deemed formally eligible based on their parent NUTS2’s level of income. We can think of these two groups as a treatment and control group: regions in both groups have an individual income level that is below 75 percent of the EU average, but depending on their NUTS2 parent’s income some of them have been treated (ie deemed eligible for convergence funds) while others have not. Table 6 shows a comparison of formal eligibility with our measure of actual eligibility for some NUTS3 regions in different countries.

**Table 6 - actual vs. formal eligibility examples**

<b>region</b>	<b>Benchmark (2000-02 avg. per capita PPS GDP as percent EU25)</b>	<b>actual NUTS3 eligibility</b>	<b>formal NUTS3 eligibility</b>
NUTS2: DE80 - Mecklenburg-Vorpommern	79	no	yes
NUTS3: DE803 - Rostock, Kreisfreie Stadt	113	no	yes
NUTS3: DE804 - Schwerin, Kreisfreie Stadt	120	no	yes
NUTS3: DE80J - Mecklenburgische Seenplatte	81	no	yes
NUTS3: DE80K - Landkreis Rostock	74	yes	yes
NUTS3: DE80L - Vorpommern-Rügen	69	yes	yes
NUTS3: DE80M - Nordwestmecklenburg	67	yes	yes
NUTS3: DE80N - Vorpommern-Greifswald	68	yes	yes
NUTS3: DE80O - Ludwigslust-Parchim	66	yes	yes
NUTS2: ES11 - Galicia	80	no	yes
NUTS3: ES111 - A Coruña	82	no	yes
NUTS3: ES112 - Lugo	76	no	yes
NUTS3: ES113 - Ourense	74	yes	yes
NUTS3: ES114 - Pontevedra	80	no	yes
NUTS2: ITG2 - Sardegna	87	no	no
NUTS3: ITG25 - Sassari	83	no	no
NUTS3: ITG26 - Nuoro	86	no	no
NUTS3: ITG27 - Cagliari	101	no	no
NUTS3: ITG28 - Oristano	81	no	no
NUTS3: ITG29 - Olbia-Tempio	90	no	no
NUTS3: ITG2A - Ogliastra	69	yes	no
NUTS3: ITG2B - Medio Campidano	62	yes	no
NUTS3: ITG2C - Carbonia-Iglesias	71	yes	no

We restrict the sample to these two group of regions, and look at how the ‘treatment’ group fared compared to the control. While this is not a proper randomised treatment/control framework, the regions in the two groups are all in the same low income bracket and are expected to share comparable traits. From their perspective, treatment is random, because it depends on their parent region’s income level, which NUTS3 regions cannot directly influence. So this framework offers a good chance to understand whether the results in Table 5 are robust to a stricter definition of the sample. Table 7 below show the results.

**Table 7 – Convergence at NUTS3 level – Treatment and control group**

	EU	EA	EU14	EA11	EA Core	EA Periphery
Treatment	.060** [.0262]	.241*** [.0435]	.444** [.0899]	.460*** [.0908]	.172 [.1498]	.636*** [.1077]
Treatment. * ln_Y0	-.006** [.0027]	-.025*** [.0045]	-.046*** [.0093]	-.047*** [.0094]	-.018 [.0155]	-.066*** [.0111]
R2	0.80	0.84	0.84	0.84	0.23	0.83
obs.	347	170	139	133	78	55
n° in T = 1 / C = 1	303/44	128/42	96/43	91/42	43/35	48/7
country FE	yes	yes	yes	yes	yes	yes

The sign and significance on the ‘treatment’ dummy suggests that those NUTS3 regions that qualified for funds based on their own level of income, and that were also deemed eligible, grew faster than those NUTS3 regions that had a comparable level of income but were not deemed eligible for funds (consistent with what Becker *et al*, 2008, find for the 2000-06 period). The effect is particularly strong at the level of the EA11 and particularly in the euro-area periphery. The sign and significance of the interaction term suggests that among those regions that were ‘treated’, per capita income in poorer regions grew faster (or decreased less fast). The estimated pace of convergence varies among groups but it is especially strong for the EA11 and the euro-area periphery, while no significant effect is detected for regions in the euro-area core, which were less affected by the crisis.

## Conclusion and policy discussion

Economic convergence is at the heart of European economic integration. Cohesion policy was born in the 1980s with the aim of complementing the creation of a single European market and fostering the economic development of less advantaged EU regions. The importance of this objective has not diminished over time, and it is especially relevant in light of the economic crisis that has exacted a heavy toll on many EU countries and regions.

In this paper, we looked at how economic convergence evolved across European regions before and during the economic crisis. We ran both an absolute and a conditional convergence analysis, using regional data on per capita GDP in purchasing power standard. We find that convergence continued during the crisis for the EU as a whole, although at a slower pace, but for regions in the EU14, and especially in the euro area, convergence appears to have stopped during the crisis, or even switched to a divergence path.

In light of this evidence, we looked at the relationship between Objective 1 convergence funds (aimed at fostering regional convergence) and per capita income growth, during the crisis. Exploiting the quasi-experimental features of the rules determining eligibility for these funds, we find that during the crisis those NUTS3 regions that were formally eligible for Objective 1 funds grew faster than the others, and we also find evidence of income convergence within this group, at a pace of 2 percent per year. The effect is especially strong for the EA11, and comparable in magnitude across the euro-area core and periphery.

We then restricted the sample to a treatment and control group, which we identified assessing each NUTS3 region's individual income level against the benchmark used at the NUTS2 level to determine eligibility for Objective 1 funds. These two groups share a comparable level of income but differ in their treatment status. When restricting the sample to these groups, we find again a positive link between structural funds and growth in the treated regions compared to the control group, and the effect is greater than for the full sample. We also find evidence of income convergence among the treated regions. The results are stronger still for the EU14 and EA11 than for the EU as a whole, and they are especially strong for the euro-area periphery. On the contrary, no statistically significant effect is detected for regions in the so-called euro-area core.

The model we estimate is very simple. A more comprehensive assessment of the effectiveness of EU cohesion policy with respect to its stated objectives would probably need to encompass other factors. It would be important to look at the actual absorption of the funds (Tosun, 2013), and the extent to which EU funds have been truly able to enhance the marginal product of capital (Marzinotto, 2012) or the extent to which they have long-term political impacts (Huliara *et al*, 2016). Research also suggests that the allocation of structural funds is subject to intense bargaining between national governments and across layers of political governance (Bouvet *et al*, 2013) and that political factors and/or electoral institutions might bias the domestic allocation of the funds in ways that might not be in line with EU goals (Dellmuth *et al*, 2016).



This notwithstanding, the evidence presented in this paper is very relevant from a policy perspective. It suggests that convergence funds did play an important role in helping income convergence during a time of crisis, within the group of disadvantaged regions that were entitled to receive the funds, and especially in comparison to equally disadvantaged regions that were not eligible. This holds not only at the EU level, but also within the EU14 and EA11, for which we do not find evidence of convergence when running our absolute and conditional convergence analysis for all regions, without distinguishing for their eligibility for funds. Moreover, the effect appears to be especially strong for regions in those euro-area countries that were hardest hit by the crisis and/or underwent EU/IMF macroeconomic adjustment programmes, suggesting that the role of convergence in counteracting the effect of the crisis on growth and economic convergence was particularly important there, possibly because of the harder financial constraints that regions in those countries were facing. At a time when the merit of EU policies is often criticised, and Europeans are increasingly sceptical of the domestic economic implications of EU membership, this is a very relevant message.

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