Economic Convergence in Europe: arrested development?

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Abstract

Economic convergence is at the heart of EU integration. Cohesion policy was born with the aim to complement the creation of the Single Market and foster the economic development of the less advantaged regions in the EU. The importance of this objective has not diminished with aging, and it is especially relevant in light of the economic crisis that has exacted a heavy toll on EU countries and casted scepticism on the merit of EU policies. We look at how economic convergence evolved across regions during the crisis, assessing the role played by those funds that are provided to the more disadvantaged regions, with the aim of fostering their convergence to average EU income levels. We find that regional policy has played an important role in counteracting the effects of the crisis at the region level, by providing an anchor for convergence in those regions that benefitted from the funds.

Keywords: EU; European Integration; economic convergence; structural funds; cohesion policy

Introduction

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). The European Union's cohesion policy as we know it came into existence at the time of the Mediterranean enlargement (to Spain, Portugal and Greece), with the idea to complement the project for the completion of the Single European Market. The Single European Act (SEA) of 1987 introduced the term "cohesion" and 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 has evolved across European regions before and during the economic crisis. We find that at the level of the EU as a whole, regions have kept converging during the crisis, while no statistically significant evidence of income convergence is found over the same period in the EU-14 and Euro Area 11 (EA-11). On the basis of these findings, it is key to investigate the role played during the crisis by those funds ("Objective 1") that the EU provides to the more disadvantaged regions, with the aim of fostering their convergence to average EU income levels.

We find that during the crisis those NUTS3 regions that were eligible for "Objective 1" funds grew faster than the other regions, and we find evidence of convergence within this relatively disadvantaged group. We exploit the rules determining convergence funds eligibility, to construct a treatment/control framework based on two groups of comparable regions. This analysis confirms a positive link between structural funds and growth, as well as evidence of income convergence among the treated regions. The effect is stronger for EU-14, EA-11 and especially for the so-called EA 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 Commission acknowledged the potential for cohesion policy to play a part in the European Economic Recovery Plan[1] and help regions and member states tackle the extraordinary challenges brought on by the crisis. Since 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[2]. This notwithstanding, the main recipients of EU Structural and Cohesion Funds still had to absorb considerable proportions of the amounts earmarked to them, in 2011. 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 preserve essential public investment in infrastructure, human capital and research. Faucher (2014) argues that Cohesion Policy took on particular importance in offsetting lower public investment, showing that in 2013, the contribution of EU funds relating to Cohesion Policy to public investment in regions was nine times higher than in 2007.

Over the years, EU cohesion policy has not been immune from criticism, as both academics and policymakers often questioned its rationale, organisations and effectiveness (Manzella et al. 2009). The results shown in this paper strongly suggest that regional policy has played an important role in counteracting the effects of the crisis at the region 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. This is certainly a positive message, particularly relevant at a time when EU policies face stark criticism and Europeans seem to be growing disenchanted towards the EU, which is often blamed for increasing rather than healing economic malaise at the domestic level.

[1] See here: http://ec.europa.eu/social/main.jsp?catId=89&langId=en&newsId=422&furtherNews=yes
[2] See here: http://ec.europa.eu/regional_policy/archive/funds/recovery/index_en.htm and here: http://ec.europa.eu/social/main.jsp?langId=en&catId=736

Regional economic convergence during the crisis

Literature review

The empirical analysis of income convergence relies on Early-Nineties works 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 β-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 β-convergence, which allows for different steady state levels of output across countries.

The literature on convergence is abundant, in the European context, and results are sometimes contradictory. Barro and Sala-i-Martin (1992) set the grounds and studied convergence across 48 US States using data on personal income since 1840 and data on state gross product since 1963 and up to the late Eighties. Barro and Sala-i-Martin (1991) look at patterns of convergence across 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) extends the empirical evidence on regional convergence across the US, Japan and five European countries. They find that the estimated speed of convergence is similar across countries at the regional level and also that the interregional distribution of income has shrunk in all countries over time. Yin et al. (2003) estimate both beta and sigma convergence using EU data for the period 1960-1995, and they find 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) provide a review of studies testing for sigma and beta convergence at the country or regional level. The early literature detects beta convergence among EU regions, at both EU-15 and EU-27 level, with the speed of convergence being rather low in the Eighties and higher afterwards. Kutan et al. (2007) show that EU integration is associated with an increased pace of overall growth due to capital accumulation. Their findings point to an important role of Cohesion and Structural funds in helping the new members to catch up with the core members' standard of living. Böwer et al.

(2010) investigate the accession-related economic boom in EU New Member States. They find 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 has been speeding the catching-up process and improving the institutions of the laggards among NMS. Morgese Borys et al. (2008) also focus on real convergence in candidate and potential candidate countries. They find 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) analyse the time stability of GDP beta convergence in the EU27 during 1993–2010 and EU15 during 1972–2010. They find that EU27 countries converged at the rate of about 5percent per annum and EU15 countries at 3percent. Campos et al. (2014) present estimates of the benefits from economic and political integration. Using the synthetic counterfactuals method, they estimate 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 across countries and over time. Darvas (2011) assesses the impact of the 2008–2009 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, they find that the crisis has had a major impact on the within-sample fit of the models used, and that the positive impact of EU enlargement on growth is smaller 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) find a long term trend of GDP per capita convergence in the EU after 1960 and argues that the Great Recession has been a shock to convergence, which the EU-15 has been particularly affected from. Wunsch (2013) describes European economic convergence before the crisis as a success story with many caveats, particularly due to the different evolution of convergence at the country versus convergence at the regional level.

Faucher (2014) finds a reversal of the convergence trend in Europe during the crisis, leading to disparities of wealth between regions in 2013 returning to the level observed in 2000. ECB (2015) finds that while Central and Eastern European countries have been catching up to the EU average over the past 15 years, real convergence among EA-12 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 EU-15 and NMS. They show that overall the convergence machine seemed to work well for the lowest incomes in the NMS, but not so much for those living in the EU-15.

Testing regional convergence during the crisis

We run a simple test for the existence of beta convergence in the EU at NUTS2[3] region level, to understand how convergence evolved 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 $\mathbf{t_0}$ and $\mathbf{t_0 + T}$ as:

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

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 to cater for all the differences in price levels between countries. 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 across the regions of EU Member States that use different currencies and where price levels are different[4]. For

[3] 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

[4] See Eurostat at http://ec.europa.eu/eurostat/statistics-explained/index.php/GDP_at_regional_level

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[5]. We use data on per capita PPS GDP for more than 200 EU NUTS2 regions over the period 2000-2014[6][7].

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

When considering the EU as a whole, regions display absolute beta convergence at an estimated pace of 2 percent per year over 2000-2014 (Table 1). When looking at EU-14 or EA-11, no significant convergence is detected over the whole period. The reason for this becomes clear when breaking the time series into sub-periods. Over 2000-2007, all three groups show very significant evidence of convergence, faster in the EU as a whole than in the EU-14 and EA-11. When looking at the period 2007-2014, however, we find a statistically significant evidence of divergence for both the EU-14 and EA-11, at a rate of about 1.4 percent per year. Across EA-11 and EU-14 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, on the contrary, regions continued to converge during the crisis.

[INSERT TABLE 1]

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 controlled for. Many obvious control variables are not available at the region-level. We include population growth, R&D expenditure as percentage of GDP and the

[5] The non-linear specification gives consistent results, with the coefficients being slightly larger.

[6] While earlier regional data are available on demand from Eurostat, the fact that the statistical classification system (ESA) was changed in 1995 and in 2000 could potentially give raise to statistical breaks and bias convergence estimates. Regional data over the 2000-2014 period is internally consistent from a statistical point of view and is complete.

[7] 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 that are only made of one region, i.e., Estonia, Cyprus, Malta, Lithuania and Latvia. They are included, but excluding them would not change the results.

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 EA-18 over the full period, and not for the EU-14 and EA-11. 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 EU-14 and EA-11, 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 neoclassic growth theory would predict, with the exception of the EU-14 and EA-11 in the pre-crisis period. R&D expenditure is positively and strongly correlated with growth over the entire period and over 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, as it increases growth all else equal. The initial share of industry in regional value added tends not to be significant, but for the EU as a whole and the EA-18 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.

Convergence funds framework in the EU during the crisis

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

The structure of Cohesion Policy for the 2007-2013 period was changed compared to the previous years. In the 2000-2006 period, cohesion policy was organized around 4 objectives and 6 instruments. For the 2007-13 period, the architecture has been simplified and is based on 3 objectives and 3 instruments (see EC 2007). The three new objectives incorporate the missions

of the previous Objectives 1, 2 and 3 as well as the previous Community initiatives Interreg III, Equal and Urban II. "Objective 2" (i.e. economic and social conversion zones) and "Objective 3" (i.e. training systems and employment policies) have been combined into a single "regional competitiveness and employment" objective. "Objective 1" (i.e. regions lagging behind in development terms) has been renamed "convergence" objective, which aims to stimulate growth and employment in the least developed regions. The EU's financial perspectives for 2007–2013 allocated 347 billion euros (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).

[INSERT TABLE 3]

[INSERT TABLE 4]

The newly defined Convergence objective will combine the "Objective 1" (whose eligibility is determined at the regional level) and the Cohesion Fund (whose eligibility is determined at the State level), which will no longer function independently. Regions are eligible for "Objective 1" funding if their per capita gross domestic product (GDP) is less than 75percent of the Community average; Member States are eligible for Cohesion Fund if their per capita gross national income (GNI) is below 90percent of the Community average. Both schemes foresee a transitional support for those regions that would have been eligible based on the pre-enlargement benchmarks. In this section, we look at the role of Objective 1 funds in fostering regional income convergence during the 2007-2013 allocation period, which include the years of the economic crisis.

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, i.e. the one 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. The eligibility for "Objective 1" funds is determined at the regional NUTS2 level. More specifically, NUTS2 regions were considered eligible for funds for the 2007-2013 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 EU-25 for the same reference period (EC 2006[8]).

This rule creates a threshold: NUTS2 regions below 75percent 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 of NUTS3 areas may be below the threshold if looked at individually, but the fact of belonging to a relatively rich NUTS2 renders them ineligible for "Objective 1" funds. We exploit this feature of the funds' allocation to understand the relationship between these funds and convergence during the crisis.

Structural funds are allocated over a multiannual horizon. We focus on the allocation for the period 2007-2013 and look at how formal eligibility for funds relates to the growth rate of per capita GDP between 2013 and 2006 (i.e. the year before the start of the 2007-2013 allocation period). We collect data on per capita GDP in PPS for more than 1300 NUTS3 regions[9] over 2006-2013 and we 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 from the NUTS3 region's

[8] See Chapter III, Article 5 of the General Regulation (EC 2006)

[9] 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.

level of income[10]. 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)
- **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

[10] The list of the eligible NUTS2 is available in "European Union, Cohesion Policy 2007-13, Commentary to the official texts".

- **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 2006-2013 growth rate of per capita PPS GDP on both the eligibility dummy and its interaction with the initial (i.e. 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. Results are reported in Table 5.

[INSERT TABLE 5]

The coefficient of the formal eligibility dummy is positive and significant at the EU level, suggesting that during the crisis period the NUTS3 regions that were eligible for structural funds grew faster than those that were not. The result is valid for the EA, EU-14, EA-11 and EA Core and Periphery, and interestingly it is larger at the EA-11 level, especially for the EA 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, the relatively poorer regions grew faster. 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[11].

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, i.e. we check whether each NUTS3 individual income is above or below the 75percent of EU average benchmark[12]. We identify all those NUTS3 regions that 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 of a treatment and control group: regions in both groups have an individual income level that is below 75percent of the EU average, but depending on their NUTS2 parent's income some of them have been treated (i.e. 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.

[11] This result is robust to the inclusion of NUTS2-level fixed effects instead of country fixed effects.

[12] More specifically, NUTS3 regions were considered eligible for funds for the 2007-2013 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 EU-25 for the same reference period. This is the formal criteria used for NUTS2 regions and detailed in EC (2006).

[INSERT TABLE 6]

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 randomized 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.

[INSERT TABLE 7]

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. The effect is particularly strong at the level of the EA-11 and particularly in the EA Periphery. The sign and significance of the interaction term suggests that among those regions that were "treated", poorer regions grew faster. The estimated pace of convergence varies across groups but it is especially strong for the EA-11 and the EA Periphery, while no significant effect is detected for regions in the EA Core, which were less affected by the crisis.

Conclusion and policy discussion

Economic convergence is at the very heart of European economic integration. Cohesion policy was born in the Eighties with the aim to complement the creation of a Single European Market and foster the economic development of the less advantaged regions in the EU. The importance of this objective has not diminished with aging, 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 and the dispersion of income have evolved across European regions before and during the economic crisis. We run both an absolute and a conditional convergence analysis, using regional data on per capita GDP in purchasing power standard. We find that convergence has continued during the crisis for the EU as a whole, although at a slower pace, but for regions in the EU-14, 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 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 2percent per year. The effect is especially strong for the EA11, and comparable in magnitude across EA 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 larger than for the full sample. We also find evidence of income convergence among the treated regions. The results are still stronger for the EU-14 and EA-11 than for the EU as a whole, and they are especially strong for the EA Periphery. On the contrary, no statistically significant effect is detected for regions in the so-called EA 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 dimensions. It would be important to look at the actual absorption of the funds (Tosun 2013), asn well as 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 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 may bias the domestic allocation of the funds in ways that may 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 preserving income convergence during a time of crisis, within the group of disadvantaged regions that were entitled to receive them and especially in comparison to equally disadvantaged regions that were not eligible. This holds not only at the EU level, but also within the EU-14 and EA-11, for which we do not find evidence of convergence when running our absolute and conditional convergence analysis on all regions, without distinguishing for their funds eligibility. Moreover, the effect appears to be especially strong for regions in those EA countries that were hardest hit by the crisis and/or underwent EU/IMF macroeconomic adjustment programme, suggesting that convergence funds played a key role during the 2007-2013 period in counteracting the effect of the crisis on growth and economic convergence. 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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Tables

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

linear OLS

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

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

[SEE END OF DOCUMENT FOR TABLE 2]

Table 3 – Eligibility for Convergence Funds

	Eligibility for the Convergence Objective – regional level			
	2000 – 2006	**>>>**	**2007 – 2013**	
Objective 1	NUTS 2 regions whose per capita GDP is less than 75 percent of Community average. 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)	**>>>** **>>>**	No change 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.	**Convergence**

Source: EC (2007)

Table 4 – Eligibility for Cohesion Funds

	Eligibility for the Convergence Objective – State level			
Cohesion Funds	**2000 – 2006**	**>>>**	**2007 – 2013**	
	Member States whose per capita gross national income (GNI) is below 90 percent of the Community average	**>>>**	No change 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	**Convergence**

Source: EC (2007)

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.

Table 6 – actual vs. formal eligibility examples

region	Benchmark (2000-02 avg. per capita PPS GDP as percent EU25)	actual NUTS3 eligibility	formal NUTS3 eligibility
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

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

	EU	EA	EU14	EA11	EA Core	EA Periphery
Treatment	.060**	.241***	.444**	.460***	.172	.636***
	[.0262]	[.0435]	[.0899]	[.0908]	[.1498]	[.1077]
Treatment. * ln_Y0	-.006**	-.025***	-.046***	-.047***	-.018	-.066***
	[.0027]	[.0045]	[.0093]	[.0094]	[.0155]	[.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

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***	-.017***	-.003	-.003	-.031***	-.034***	-.019***	-.019***	-.019***	-.002	.004	.004
	[.0020]	[.0030]	[.0024]	[.0027]	[.0027]	[.0042]	[.0033]	[.0040]	[.0029]	[.0044]	[.0041]	[.0047]
R&D expenditure	.253***	.216***	.188***	.230***	.162	.084	.078	.099	.359***	.372***	.364***	.425***
	[.0711]	[.0811]	[.0486]	[.0600]	[.1008]	[.1196]	[.0689]	[.0927]	[.0790]	[.0898]	[.0690]	[.0863]
Population growth	-.030***	-.032***	-.028***	-.025***	.014	.020	.052***	.056***	-.097***	-.095***	-.107***	-.097***
	[.0096]	[.0100]	[.0069]	[.0076]	[.0229]	[.0235]	[.0164]	[.0185]	[.0242]	[.0275]	[.0247]	[.0281]
Initial industry share VA	.012	.021*	.006	.009	.004	.022	.013	.013	.036***	.029**	.018	.018
	[.0095]	[.0112]	[.0075]	[.0086]	[.0134]	[.0159]	[.0105]	[.0127]	[.0117]	[.0147]	[.0129]	[.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 EA11 plus Cyprus, Malta, Estonia, Latvia, Lithuania, Slovenia, Slovakia.