

Savoia, Francesco

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Income Inequality Convergence Across EU Regions

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Francesco Savoia

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Income Inequality Convergence Across EU Regions

Francesco Savoia[†]

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Abstract

Economic inequality has increased in many EU countries in the last decades. Yet, efforts assessing economic disparities across the EU regions mostly concentrate on convergence in average per capita incomes, offering little evidence on how regional income is distributed. Using data from Luxembourg Income Study (LIS) over the 1989-2013 period, this study contributes to fill this gap, focussing on whether there has been convergence of income inequality among EU regions, and on to what extent regional initial conditions and the Cohesion Policy funds affect the convergence process. Cross-section and panel convergence regressions, after a number of robustness checks, offer three findings. First, NUTS2 regions are converging to higher level of income inequality, so becoming equally more unequal. Second, this process is significantly faster when regions share similar structural characteristics, such as similar levels of governance quality. Finally, in regions eligible for Cohesion Policy funds the pace of inequality convergence has been significantly faster, suggesting therefore that they may be driving the convergence process

Keywords: Inequality, Income distribution, Convergence, Cohesion Policy, European Union.

JEL codes: O15, O52, D31, P48.

[†] University of Sannio, Department of Law and Economics - DEMM, Benevento (Italy); University of Modena and Reggio Emilia, Department of Economics “Marco Biagi”, Modena (Italy). E-mail: francesco.savoia@unimore.it

1. Introduction

Economic inequality has increased in many countries around the world in the last decades (e.g., OECD 2011, Morelli et al. 2015), exacerbated by the effect of the recent recession (e.g., Heathcote et al. 2010), rising to the fore in the policy debate. In the European Union (EU), the share of the population “at risk of poverty and social exclusion” has peaked in 2014, rising by more than 5 million since the beginning of financial crisis and so exceeding 122 million, which is approximately a quarter (24.4%) of the EU 28 population.¹ Nearly the 40% of total income goes on average to people in the highest income quintile, and less than 10% to people in the first quintile (Eurostat, 2014).

Rising inequality is reason for concern because of ethical considerations, as some literature on distributive justice has long argued (e.g., Solimano 1998), and because is now part of the next development goals (Goal 10 of the United Nations Sustainable Development Goals).² Should this not be enough, rising inequality is also reason for concern because of its social consequences (e.g., Klasen 2008, Dabla-Norris et al. 2015, and Hirschman 1973) and its economic effects (e.g., Ostry et al. 2014, Easterly 2007, Thorbecke and Charumilind 2002),³ implying that equity and efficiency are not separate or separable objectives and that there could be an efficiency gain from greater equality (e.g., see Klasen 2008). Regarding the causes of rising inequalities, recent contributions by Stiglitz (2012) and Piketty (2014) emphasised the role of political economy explanations (through the perpetuation of rent seeking activities) and the inherent features of capitalism (characterized by the tendency of returns on capital to exceed the rate of economic growth), as root causes of increasing inequalities. In empirical terms, according to Atkinson (2016), the change in the shape of the distribution driving the rise in inequality is the explosion of gains accruing to those at the very top of the income distribution, but the circumstances of those at the bottom have contributed too.

A crucial aspect to understand this phenomenon is its subnational dimension, especially in the case of large areas of economic integration, such as the European Union. Recent trends on income inequality in the EU confirm that, by decomposing overall inequality, 85% is explained by within countries inequality (Bonesmo Fredriksen 2012), while Barca (2009) notes how prosperous regions in EU countries show at the same time strong internal disparities. Furthermore, this aspect gained further

¹ This means that people were at least in one of the following conditions: at-risk-of-poverty after social transfers (income poverty), severely materially deprived or living in households with very low work intensity. The reduction of the number of persons at risk of poverty or social exclusion is one of the five key targets of the Europe 2020 strategy. For trends on these conditions, see: <http://ec.europa.eu/eurostat/>. For statistics on economic inequality in the EU, refer to: https://ec.europa.eu/eurostat/Income_inequalities; <https://ec.europa.eu/eurostat/statistics> (“Statistics in focus” 12/2014).

² The United Nations Sustainable Development Goal 10 aim at “reduce inequalities within and among countries”. For further details on facts, figures, and targets see: <http://www.un.org/sustainabledevelopment/inequality/>.

³ For example, increasing inequality may harm the process of economic growth by affecting human capital accumulation and by heightening social conflict. However, there is no consensus on the effects of inequality on growth; see Forbes (2000). On this point, for European regions, see Perugini and Martino (2008) among the others.

importance in the last decade with the integration process that brought part of Eastern bloc countries joining the EU (increasing, therefore, the diversity of regional inequality patterns).

Despite its relevance for social and economic outcomes, the increase of inequality in the EU regions and its importance at subnational level, the debate presents two key limitations that motivate this study. Firstly, there are very few studies investigating income inequality convergence and most of them are at cross-national level: the interest is on the country dimension, while the regional dimension has not been adequately investigated, in particular for the EU. Secondly, there has been considerable effort on studying regional convergence in income per capita levels (GDP) in the EU, almost implicitly considering such outcome as expressing both economic performance and social progress. The existing literature on the effectiveness of European regional policy seems to have conflated efficiency (economic growth convergence) and equity goals (disparities in income distribution), while the former does not necessarily imply the latter.⁴ In general, less attention has been paid to the redistributive aspects of economic integration. For example, it is not well understood whether the Cohesion Policy may have contributed to reduce the inequalities between countries or regions in terms of GDP per capita disparities, while failing to reduce inequalities in terms of income distribution within countries or regions.

This study contributes to fill this gap offering a systematic investigation of income inequality convergence in European regions. We provide a set of new stylized facts, testing whether EU regions with higher inequality levels experienced larger reductions in income concentration, so to close the gap with regions with lower inequality levels, as well as assessing which structural factors may affect the pace of convergence. In particular, we try to answer the following questions. Did convergence of income distribution occur among EU regions? Do regional initial conditions matter for the convergence process? Finally, what is relationship between less developed EU regions supported by the European Regional Policy and the speed of inequality convergence? Building on Ravallion (2003), we run cross-section and panel convergence regressions, as well as a number of robustness checks, to test if regional disparities in income concentration levels within each region have reduced (or increased). Our findings reveal a process of regional convergence, where EU regions are converging to a higher level of income inequality and so becoming “equally more unequal”. Sharing the same structural characteristics, such as similar levels of governance quality, significantly accelerates this process. Finally, the evidence also suggests that the pace of convergence in regions eligible for Cohesion Policy funds was significantly faster, suggesting therefore that they may be driving the convergence process. Apart

⁴ On the limits of GDP as indicator of economic performance and social progress, see the report by Stiglitz, Sen and Fitoussi (2010). Although GDP per capita is still seen as a popular indicator, the European Commission has adopted a communication in which outlined a range of actions to improve and complement GDP measures (“GDP and beyond: measuring progress in a changing world” (COM (2009) 433 final)).

from adding to the debate on the process of integration and on the socio-economic disparities in the EU, this study also adds to the broader literature on convergence, traditionally interested in disparities in national incomes, but much less in other development outcomes, such as poverty and inequality.⁵

The remainder of this paper is structured as follows. The second section provides a brief review of the literature. Section 3 illustrates the data used in the analysis, providing an initial illustration of how the distribution of inequality has changed over time at regional level in the EU. Sections 4 - 5 present the results, while the last one concludes.

2. On inequality convergence

Should we expect inequality convergence? The literature indicates that convergence is a possibility, resulting from “endogenous” and “exogenous” mechanisms. Regarding “endogenous” mechanisms, inequality convergence may derive from standard growth theory. Assuming that countries or regions have the same structural characteristics, the neoclassical growth model may be consistent with convergence both in the average income level and in the entire distribution of income, where convergence of income distribution is a mechanism of falling (rising) inequality in economies of high (low) initial disparities (Bénabou 1996). “Exogenous” mechanisms may be related to the redistributive consequences of major historical events or long-term changes in the global economy. For example, Ravallion (2003) argues that the institutional changes in the transition economies resulting from the end of the Cold War may have increased income inequality in such economies so that they are closer to the levels of traditional market economies. Similarly, changes in the global division of labour and in the patterns in international trade may have resulted in falling labour shares in more advanced economies and increasing labour shares in less developed ones. In turn, these changes in the functional distribution of income may have resulted into personal income inequality convergence, where advanced economies have seen rising levels of (personal) income inequality and developing economies have experienced a decrease. However, Dao et al. (2017) found that such pattern may be subject to significant heterogeneity (changes in labour share differ across groups of countries and when skilled/unskilled labour is taken into account).

⁵ Traditionally, empirical work in this area has been concerned with convergence in national income levels (e.g., Barro and Sala-i-Martin 1991, 1992; Sala-i-Martin, 1996). But recent analysis of convergence has also extended to the evolution of other development outcomes between countries. For example, Deaton (2004) and Canning (2012) looked at the evolution of health, showing convergence in life expectancy across countries. Noorbakhsh (2007) extended the concept of convergence to human development, finding evidence of weak absolute convergence over the period 1975-2002. However, findings from a long-run perspective seem to point to a partial catching up between the OECD countries and the rest taking place in the 1913-1970 period, with an overall widening of the human development gap since 1870 (Prados de la Escosura, 2015). Qualifying earlier findings, Ortega, Casquero and Sanjuán (2016) showed that the countries’ capacity for convergence in human development is subject to the level of corruption, and that convergence is more pronounced in countries with lower levels of corruption.

Ultimately, lacking a consolidated theory predicting convergence (or divergence), whether we should see convergence in income distribution is an empirical matter. But the empirical literature on inequality convergence is rather scant. The first study to discuss and test for the existence of a negative relationship between the change in inequality measure and its initial value was Bénabou (1996), who found initial evidence of unconditional inequality convergence on a panel of world countries between 1970 and 1990 using cross-national data. Ravallion (2003) provided the first systematic study. Revisiting Bénabou's findings with new data and correcting for measurement error in the initial inequality measure, it finds evidence of a rather slow convergence process across countries. Further evidence supporting the convergence hypothesis is in Bleaney and Nishiyama (2003), Alvaredo and Gasparini (2015) and Chambers and Dhongde (2016b)⁶, suggesting that income distributions across countries are becoming "equally unequal" (increasingly unequal, but more similar to each other). The cross-national evidence seems relatively robust across different dimensions: income inequality measure, dataset, panel structure and composition, and method of estimation, although the rate of convergence is sensitive to dataset choice (Lustig and Teles, 2016). Another set of studies has focussed on income inequality at sub-national level, within a federal state. Panizza (2001) and Lin and Huang (2011) test for and find convergence between U.S. states. Conversely, a recent contribution by Ho (2015), re-examining this hypothesis in a long run perspective, casts doubt on inequality convergence across U.S. states.

So far we have discussed the international evidence, but what do we know about the European regions? While there has been a considerable interest in studying the convergence of income per capita levels at disaggregated level, the literature has done much less regarding income inequality convergence. The process of European Integration, through the EU Cohesion Policy, may have facilitated convergence in regional income per capita, but it is less clear whether growth in average regional incomes has resulted in higher or lower income concentration. This could be empirically important. Indeed, Förster et al. (2005), analysing the Eastern European countries at regional level with LIS data in the 1990's, find that the overall inequality is dominated by inequalities within regions, rather than between them.⁷ Empirical research at regional level is very limited and it is based on the European Community Household Panel (ECHP) dataset, covering very short periods. Tselios (2009) directly tests and finds initial evidence of unconditional convergence, among European regions at NUTS 1 and NUTS 2 level, over the period 1995-2000. Ezcurra and Pascual (2005) do not directly test for income inequality convergence, but

⁶ Chambers and Dhongde (2016a) test also for σ convergence on decile income shares.

⁷ In general, as noted by Milanovic and Van der Weide (2014), also the literature on the relationship between growth and income inequality focuses exclusively on the effects on average incomes, suggesting that there has been little interest in the specific parts of the income distribution (the higher moments of the distribution).

provide descriptive evidence on convergence in income distribution within EU regions (based on density functions), for a panel of 65 NUTS 1 regions over 1993-1998.⁸

The empirical literature on income distribution on EU regions presents significant limitations. Partly, this has to do with the limited coverage of inequality data across countries and over time. Perhaps more significantly, limitations relate to the reliability of inequality statistics: differences in questionnaire designs and income definitions in the surveys are major sources of concern in terms of comparability across countries. Moreover, existing research has not provided a systematic assessment of inequality convergence yet. In this study, therefore, we investigate whether there is convergence in income distribution across European regions, testing the hypothesis of unconditional and conditional inequality β -convergence. We assess the importance of regional initial conditions, whether the speed of convergence has changed over time and if less developed regions eligible for Cohesion Policy funds played a role in this process. Importantly, we also overcome data comparability issues, using LIS data, and test for convergence over more than two decades, so reflecting the long term nature of inequality dynamics.

3. Data

This section introduces the dataset, describes the variables, and illustrates the procedure to generate the inequality measures at NUTS 2 level. Also, it provides descriptive evidence on income inequality trends at country and regional level.

The analysis of income distribution at regional level in the EU has been subject to limitations because of data availability and comparability. To improve on this, we opt for the Luxembourg Income Study database (LIS), since it allows studying a longer period and ensures clear comparability of inequality statistics.⁹ For EU countries, Eurostat provides household income and poverty micro data with two different surveys: first, via the European Community Household Panel (EHCP) and then, via the European Union Statistics on Income and Living Conditions (EU-SILC). Although they provide a fair coverage when combined together (in which case data range from 1994 to 2016, but with some missing years in the middle), it is unclear whether and to what extent they produce comparable statistics, because the EHCP and EU-SILC datasets have different data collection methodologies.¹⁰

⁸ Rodriguez-Pose and Tselios (2015) test and finds evidence of convergence in social welfare, using Sen's index.

⁹ LIS collects social and economic data from developed and developing countries, from national statistics institutes, and then conducts an ex post harmonisation to make them comparable. The LIS dataset for EU countries runs approximately from 1970 to 2014, structured in semi decadal waves until the year 2000 and then followed by three-years waves.

¹⁰ We have a standardised questionnaire across countries for ECHP (common survey instrument) and an ex ante standardised framework to collect data for EU-SILC (ex ante harmonised framework). Atkinson et al. (2010) recognise that the EU-SILC procedure results from a balance of considerations, because of its greater flexibility and because the "...tighter

Building on LIS effort to bring together and harmonise income microdata, we therefore construct regional measures of inequality at NUTS 2 level based on the disposable household income.¹¹ This is a harmonised variable including total monetary and non-monetary current income for the household, net of income taxes and social security contributions. In order to create a fully comparable income variable across countries, we first apply a common top-bottom procedure to delete extreme values in incomes and then we equivalise the variable using the LIS equivalence scale (i.e., the square root of the number of household members). Finally, given that we are interested in using an equivalised income variable, we apply the household weight multiplied by the number of household members, to weight by person ($hpopwgt*nbhmem$).¹²

Frequently, income microdata are not directly available at NUTS 2 level in the LIS database. Therefore, where the availability of territorial disaggregation of data (NUTS 1, NUTS 2, NUTS 3, or LAUs) is not regular over time, we carefully aggregated households' incomes at NUTS 3 or LAUs (lower levels) to reconstruct the NUTS 2 regions and generate regional inequality measures.¹³ In this process, we take into account for each country the administrative reforms that might have affected regional boundaries, using the Eurostat NUTS 2010 classification as common reference. In case of reforms with major changes of territorial boundaries, we preferred to exclude single regions (e.g. in Finland and Sweden) or the entire country (e.g. in Czech Republic) in order to avoid wrong imputations of household's residence.¹⁴

For all regions we compute the following inequality measures: Gini index and quintile income shares. The analysis covers different time spans and samples of NUTS 2 regions, with the longest period spanning from 1990 to 2013 and the biggest sample including 103 observations.¹⁵

requirements of standardisation (as in ECHP) may have a cost in terms of reduced accuracy in the final statistical outcomes". Furthermore, they underline that "... input harmonisation does not necessarily ensure output harmonisation" (p. 103).

¹¹ As for the representativeness of data when disaggregated at NUTS 2 level, LIS includes in the datasets the same weights provided by the national statistical office in charge of conduct the surveys. The samples are proportionally distributed on the regional level between urban and rural areas, in order to make them representative even for small regions.

¹² We bottom-code by setting all values less than zero to zero, and top-code by setting all values greater than ten times the median value to ten times the median value. We use inflated weights instead of normalized weights, since the analysis is restricted to EU countries, and therefore there is no huge discrepancy among the involved countries (for example, normalized weights are suggested in the case of country comparison as USA and Switzerland involved in the analysis).

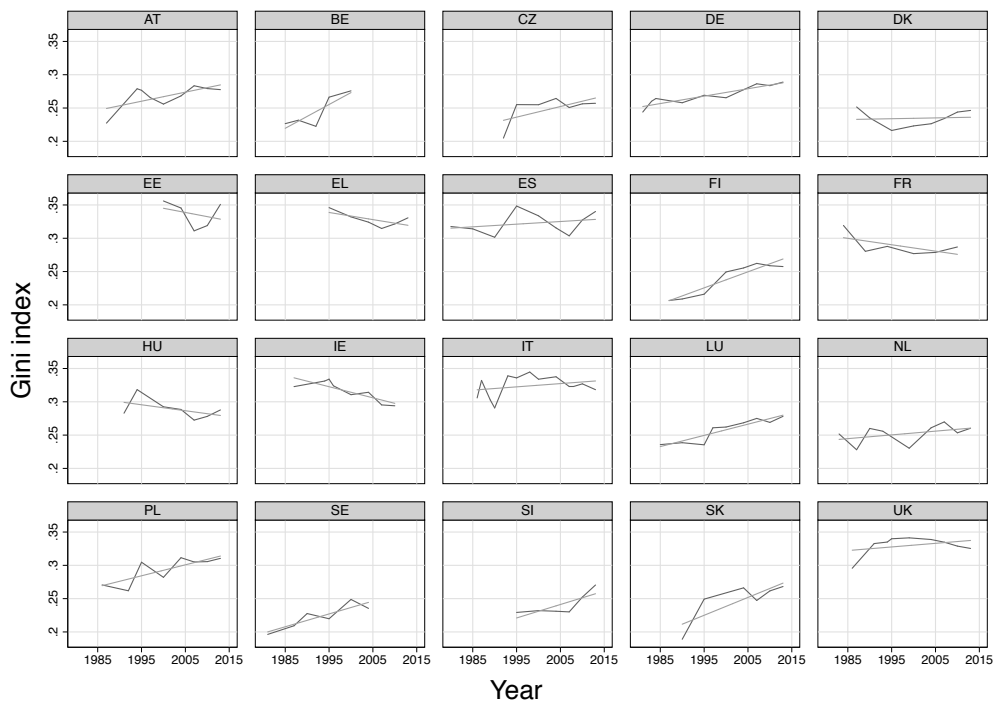
¹³ Data availability in some countries is not regular across waves, as well as the regional disaggregation captured by the variable *region_c*. The first sub-national data are available during the 70's for the UK (NUTS1), and extends gradually to the majority of countries in the end of 80's with a NUTS 2 level of disaggregation (or lower level). In 1995 and 2000 waves, inequality measures are estimated using the nearest LIS wave available for Austria and Spain.

¹⁴ Administrative reforms, for example, occurred in the Czech Republic in the wave III, in Sweden in the waves III and IV, and in Finland in the waves II, III and IV of LIS data.

¹⁵ To test for inequality convergence, we compute delta variables for each inequality measure using the "first" and "last" values according to the time spans considered for cross section regressions (1990-2013, 1995-2013, 2000-2013, 2004-2013), and to the four programming periods of European Regional Policy in the case of panel regressions (1989-1993, 1994-1999, 2000-2006, 2007-2013). When data are not available exactly in the corresponding first or last year of interest, we replace the nearest value of the related LIS wave, if available.

A first look at income inequality trends in EU countries since 1985 reveals two regularities (Figure 1). First, there is a nearly generalised increase in income inequality (in 14 countries out of twenty), where countries starting with traditionally low income concentration have seen a significant increase (except for Denmark). Second, in more unequal countries income inequality level increased marginally, such as Italy and Spain, or decreased as in Greece. However, this is a picture at country level, which could hide interesting variations if disaggregated at regional level.

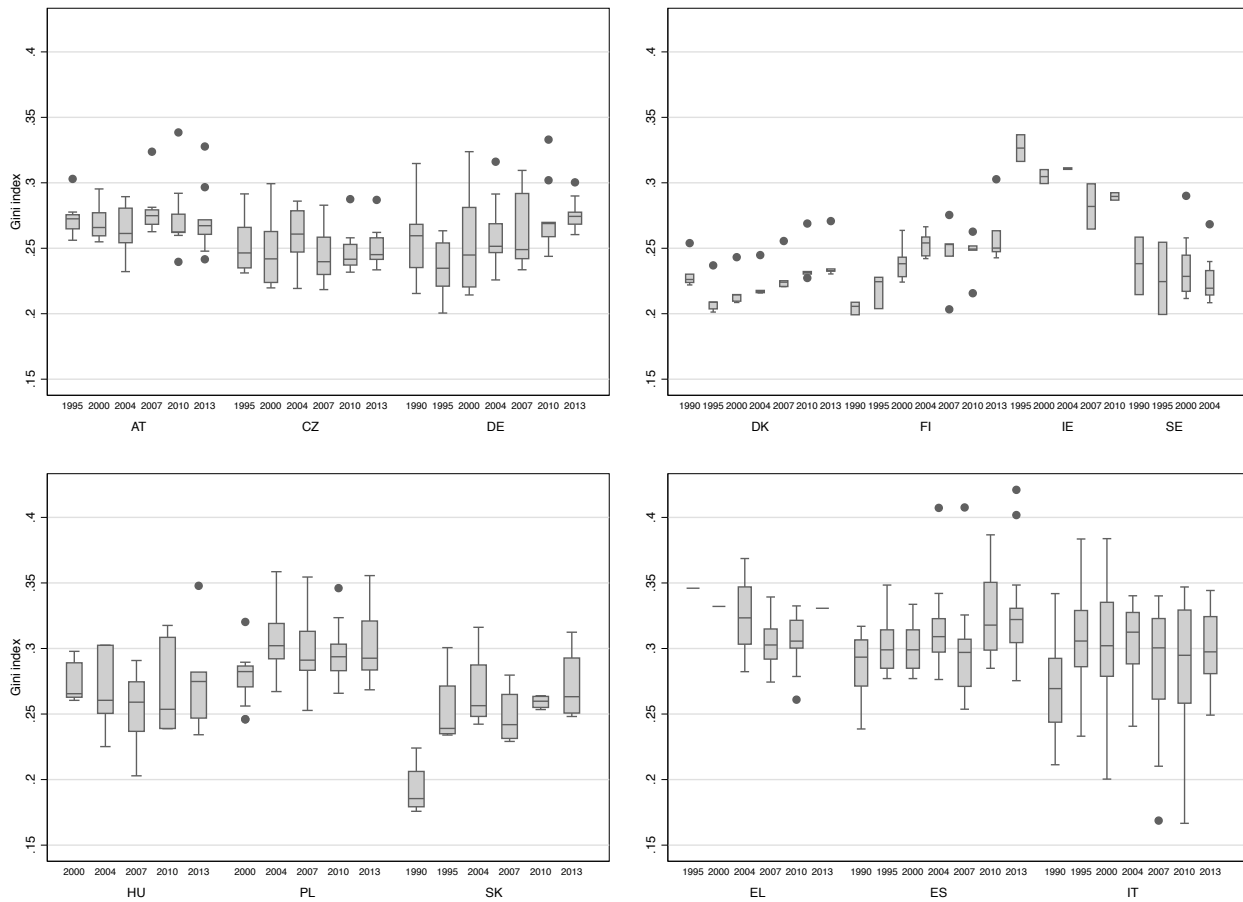
Figure 1 - Gini index in EU countries: 1985-2015



Notes: Gini index at country level calculated on equivalised disposable household income using Luxembourg Income Study (LIS) data.

Figure 2 presents the intra-country variations of income inequality at NUTS 2 level over time. We observe two facts. First, in general, national trends hide significant subnational disparities except for Northern countries reporting minor levels of variation. Second, despite highest within-country inequality characterised countries of Mediterranean area, the remarkable gap across regions decreased in the last available wave (around 2013). It is worth noting that the exceptional outside values for Spain (ES) in 2013 (with a Gini index of 0.421 and 0.401) refer respectively to the autonomous regions of Ceuta and Melilla, African enclaves in Morocco.

Figure 2 - Within country variation of income inequality: Gini index at NUTS 2 level



Notes: Gini index calculated on equivalised disposable household income at NUTS 2 level (all available years). Note that Luxembourg (LU), Estonia (EE) and Slovenia (SI) are considered as single NUTS2 regions and therefore excluded from the graph. Box plots for Germany (DE) based on nine NUTS 2 regions, and for Sweden (SE) on three regions in the waves 1990 and 1995.

Table 1 reports descriptive statistics for measures of inequality, at regional level, across four different samples, including initial and final year periods. The number of observations may range from 53 in 1990-2013 to 103 observations in 2004-2013. The main fact emerging from the figures is an overall increase in inequality, corresponding to a widening gap in the extreme parts of the entire distribution: on average, the poorest quintiles reduce their shares of total income, while the richest quintile gains.

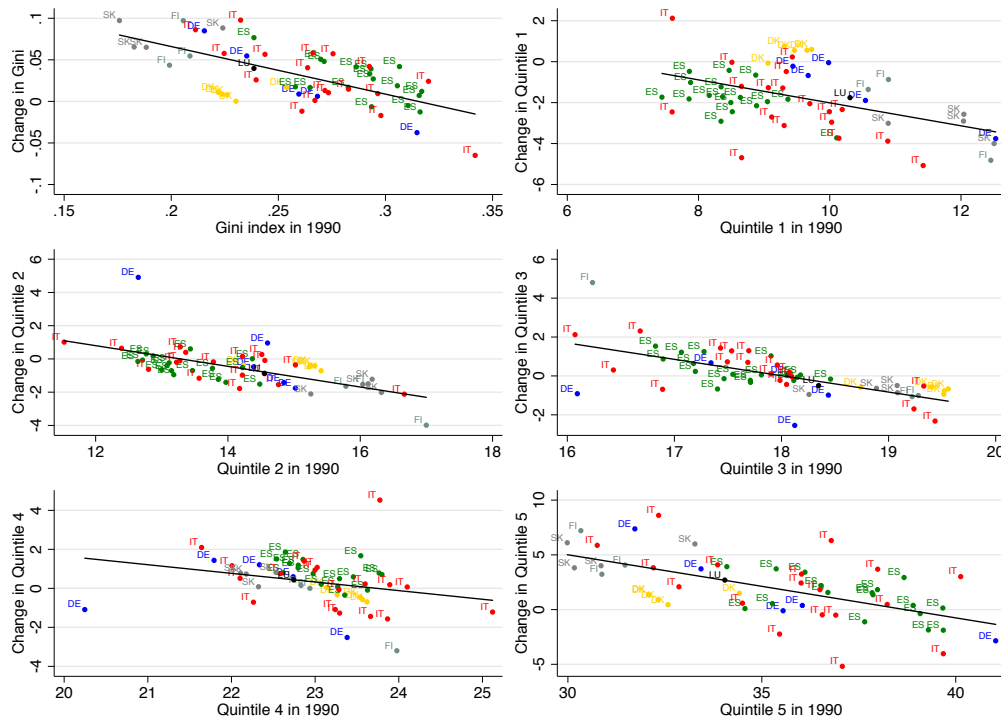
Table 1 - Income inequality across EU regions: summary statistics in four different samples

		SAMPLE 1		SAMPLE 2		SAMPLE 3		SAMPLE 4	
Year		1990	2013	1995	2013	2000	2013	2004	2013
GINI INDEX									
	mean	0.26	0.29	0.27	0.28	0.28	0.29	0.28	0.29
	cv	0.15	0.11	0.15	0.11	0.13	0.11	0.13	0.12
	N	53	53	75	75	98	98	103	103
	sd	0.04	0.03	0.04	0.03	0.04	0.03	0.04	0.03
	max	0.34	0.35	0.38	0.35	0.38	0.36	0.41	0.42
	min	0.18	0.23	0.20	0.23	0.20	0.23	0.22	0.23
QUINTILE 1									
	mean	9.52	7.78	8.83	8.23	8.88	8.22	8.69	8.22
	cv	0.14	0.19	0.17	0.18	0.15	0.17	0.15	0.17
	N	53	53	75	75	98	98	103	103
	sd	1.30	1.48	1.51	1.48	1.32	1.42	1.34	1.42
	max	12.53	10.32	12.56	10.42	12.13	10.54	12.07	10.54
	min	7.44	3.97	5.42	3.97	4.89	3.97	4.14	3.97
QUINTILE 2									
	mean	14.19	13.63	13.96	13.82	13.84	13.67	13.76	13.67
	cv	0.08	0.08	0.08	0.07	0.07	0.07	0.08	0.07
	N	53	53	75	75	98	98	103	103
	sd	1.20	1.04	1.10	0.96	0.91	0.99	1.07	1.01
	max	17.00	17.55	16.02	17.55	15.65	17.55	18.41	17.55
	min	11.52	12.18	10.77	12.18	11.59	11.41	10.58	11.11
QUINTILE 3									
	mean	17.96	18.01	18.13	17.99	17.93	17.98	17.69	17.94
	cv	0.05	0.05	0.04	0.05	0.05	0.06	0.06	0.06
	N	53	53	75	75	98	98	103	103
	sd	0.93	0.90	0.81	0.81	0.97	1.03	0.98	1.10
	max	19.56	21.03	20.27	21.03	22.78	24.12	19.31	24.12
	min	16.07	15.18	16.19	15.18	14.46	15.18	13.91	13.55
QUINTILE 4									
	mean	23.01	23.33	23.08	23.21	22.72	23.15	22.86	23.13
	cv	0.03	0.05	0.03	0.05	0.04	0.05	0.04	0.04
	N	53	53	75	75	98	98	103	103
	sd	0.76	1.25	0.72	1.14	0.90	1.04	0.96	1.03
	max	25.12	28.30	24.73	28.30	24.99	28.30	27.02	28.30
	min	20.25	19.16	20.33	19.16	18.33	19.16	20.49	19.16
QUINTILE 5									
	mean	35.31	37.26	36.01	36.74	36.63	36.98	36.99	37.05
	cv	0.09	0.07	0.08	0.07	0.08	0.07	0.08	0.08
	N	53	53	75	75	98	98	103	103
	sd	3.00	2.59	2.99	2.51	2.87	2.66	2.85	2.84
	max	41.03	43.14	45.09	43.14	45.21	43.33	44.89	47.99
	min	29.98	31.89	30.74	31.89	30.86	30.83	30.00	30.83

Notes: The 1990–2013 panel includes 53 regions of 7 countries (DE, DK, ES, FI, IT, LU, SK), while the 1995–2013 panel includes 75 regions of 10 countries (AT, CZ, DE, DK, ES, FI, IT, LU, SI, SK). The 2000–2013 panel includes 98 regions of 12 countries (AT, CZ, DE, DK, EE, ES, FI, HU, IT, LU, PL, SI). The 2004–2013 panel includes 103 regions of 13 countries (AT, CZ, DE, DK, EE, ES, FI, HU, IT, LU, PL, SI, SK).

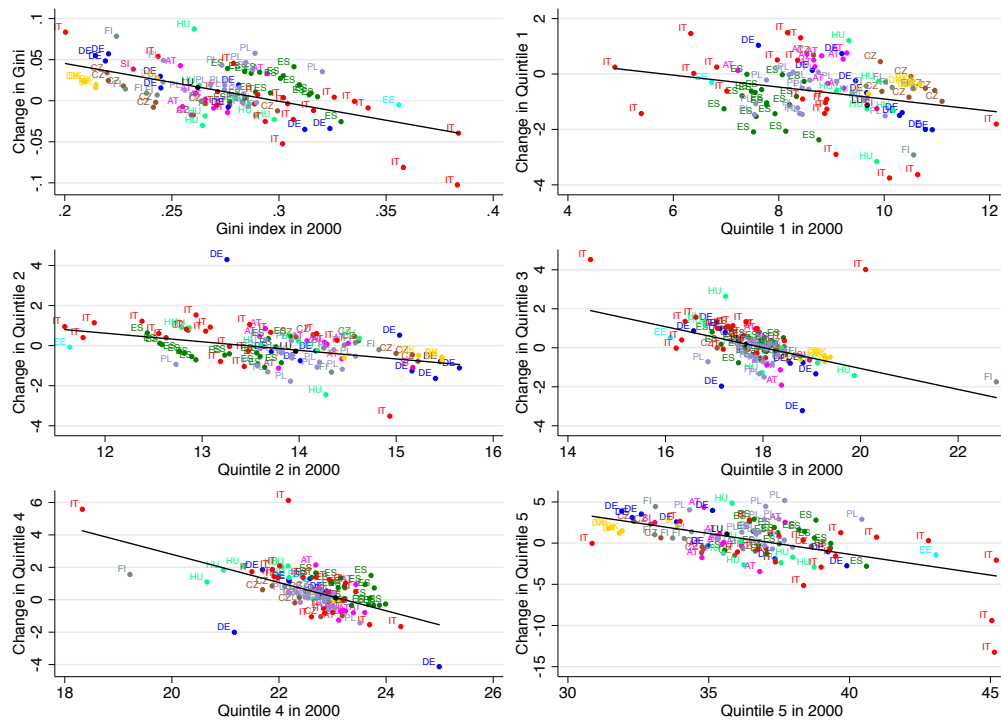
Figures 3 and 4 take a first look at convergence, reporting the scatter plots and fitting simple regression lines, for all measures of inequality for a couple of the samples analysed. Regions with higher levels of inequality seem to catch up with those having lower initial levels of inequality in 1990 and 2000, therefore providing suggestive evidence of unconditional convergence. However, these graphical illustrations do not reveal the significance and speed of the convergence process, which will be fully examined in regression estimates in the next section.

Figure 3 - Gini and quintile shares: Initial level in 1990 versus change 2013-1990



Notes: The period 1990–2013 includes 7 countries (DE, DK, ES, FI, IT, LU, SK).

Figure 4 - Gini and quintile shares: Initial level in 2000 versus change 2013-2000



Notes: The period 2000 – 2013 includes 12 countries (AT, CZ, DE, DK, EE, ES, FI, HU, IT, LU, PL, SI).

4. Inequality Convergence Tests

Following Ravallion (2003), let I_{it} denote the observed Gini index, or other measure of inequality, in a region i at time $t = 0$ and $t = T$, i.e., in the first and last year of the period considered, respectively. We regress the observed changes over time in a measure of inequality on the initial values across regions, estimating:

$$I_{iT} - I_{i0} = \alpha + \beta I_{i0} + \varepsilon_i \quad (i = 1, \dots, N) \quad (1)$$

where α and β are parameters to be estimated. A significant negative (positive) estimate of β implies that there is convergence (divergence).¹⁶

4.1 Unconditional convergence

Are more unequal European regions narrowing (or broadening) their gap in income concentration with less unequal regions? The top panel in Table 2 reports convergence test over the period 1990-2013, the longest available period, for Gini index and quintile shares. The coefficients of initial values are negative and statistically significant for all measures (except for the fourth quintile, but below we show that such result is not a general one, as it depends on an outlying region). Such results show that within region income inequality has been converging, since the initial year 1990, regardless of regional initial conditions, i.e., no matter of why EU regions are equal or unequal.

To give an appreciation of the speed of convergence, consider the Gini index in 1990 in Spanish region of La Rioja ES23 (scoring 0.3105) and the Finnish region of Helsinki-Uusimaa FI1B (scoring 0.2084). The two regions are positioned very close to the regression line, but nearly at its opposite extremes. According to our OLS estimates, the expected change in inequality will be $0.180 + (-0.572 \cdot 0.3105) = 0.002$, in the former case, and $0.180 + (-0.572 \cdot 0.2084) = 0.061$ in the latter. Such trends imply that, after 23 years, the two regions are predicted to reach an inequality level of $0.3105 + 0.002 = 0.313$ in La Rioja, and $0.2084 + 0.061 = 0.269$ in Helsinki-Uusimaa. At this pace, it would take approximately 39 years before Helsinki-Uusimaa catches up with La Rioja. This is indicative of a significant process of unconditional convergence, where inequality levels are converging, but to a higher level. Such trend implies also that EU regions are converging to an average Gini index level of $|0.180/-0.572| = 0.314$.

¹⁶ This corresponds to the concept of beta-convergence associated with the idea of convergence in country income levels, as developed by Barro and Sala-i-Martin (1991, 1992), where there is absolute beta-convergence if poor economies tend to grow faster than rich ones (Sala-i-Martin, 1996). Others have emphasized a different statistical notion of convergence (e.g., Quah, 1993): sigma-convergence, which looks at whether the cross-sectional dispersion across countries is decreasing, and for which beta-convergence is a necessary, but not sufficient, condition (see Sala-i-Martin, 1996). We do not pursue this approach here, because it would not allow us to focus on whether initial conditions matter for inequality convergence and on estimating its speed, while both are interesting aspects of the process of inequality dynamics we would like to document.

Instead, looking at the distribution in quintiles shares in 1990, the top quintile is converging to an average income share of 38.70 while the bottom quintile to a share of 6.41.

Finally, it is worth noting that the goodness of fit indicates that the initial level explains a sizable portion of the variation in the subsequent change of income inequality. This suggests that such estimates may be more than a descriptive result about the experience of low-inequality regions and hence indicate that some significant convergence mechanism is at work, although we cannot tell which one(s).

4.2 Robustness checks

We conduct two types of robustness checks. First, we repeat the analysis on different periods, including larger samples of regions. Second, we detect the effect of influential observations by re-estimating the regressions using Iteratively Reweighted Least Squares (IRLS). Table 2 reports unconditional convergence estimates also for the periods 1995-2013, 2000-2013 and 2004-2013. This allows to check if the speed of convergence changes during recent periods or if the tests include a larger sample of regions.¹⁷ OLS results are constant over the four periods examined and repeating convergence simulations leads to similar conclusions. The results are generally insensitive to checks for influential observations.

¹⁷ The estimated speed may also be biased in case the initial value of the inequality is measured with error: under (over) estimating the initial value would return to over (under) estimation of the convergence (divergence) trend. In cross-country datasets, this may be a major issue. Indeed, Ravallion (2003) corrects for measurement error instrumenting the current initial level of inequality measure with the one in the previous year. However, this should not be an issue in this case, as the LIS database ensures comparability across regions.

Table 2 - Unconditional convergence in inequality: OLS estimates

PANEL A	Change in Gini, 1990-2013	Changes in quintile shares, 1990 – 2013				
	GINI INDEX	QUINTILE 1	QUINTILE 2	QUINTILE 3	QUINTILE 4	QUINTILE 5
Initial value 1990	-0.572*** (0.094)	-0.561*** (0.131)	-0.622*** (0.125)	-0.841*** (0.191)	-0.443 (0.313)	-0.576*** (0.100)
Constant	0.180*** (0.025)	3.598*** (1.293)	8.264*** (1.827)	15.154*** (3.517)	10.512 (7.187)	22.301*** (3.503)
F-stat	36.700***	18.230***	24.756***	19.322***	2.000	33.508***
Adj. R-Sq.	0.421	0.207	0.382	0.428	0.058	0.358
Obs.	53	53	53	53	53	53
RMSE	0.026	1.376	0.939	0.898	1.187	2.282
Converging to:	0.314	6.41	13.2	18.01	22.9	38,7
PANEL B	Change in Gini, 1995-2013	Changes in quintile shares, 1995 – 2013				
	GINI INDEX	QUINTILE 1	QUINTILE 2	QUINTILE 3	QUINTILE 4	QUINTILE 5
Initial value 1995	-0.440*** (0.063)	-0.411*** (0.114)	-0.496*** (0.067)	-0.959*** (0.166)	-0.937*** (0.216)	-0.501*** (0.081)
Constant	0.132*** (0.017)	3.030*** (1.039)	6.789*** (0.955)	17.252*** (2.984)	21.747*** (4.997)	18.783*** (2.835)
F-stat	49.001***	13.043***	54.622***	33.310***	18.793***	38.197***
Adj. R-Sq.	0.382	0.202	0.319	0.474	0.251	0.348
Obs.	75	75	75	75	75	75
RMSE	0.022	1.197	0.788	0.815	1.149	2.026
Converging to:	0.299	7.37	13.68	17.98	23.22	37.47
PANEL C	Change in Gini, 2000-2013	Changes in quintile shares, 2000 – 2013				
	GINI INDEX	QUINTILE 1	QUINTILE 2	QUINTILE 3	QUINTILE 4	QUINTILE 5
Initial value 2000	-0.461*** (0.082)	-0.216*** (0.073)	-0.429*** (0.080)	-0.536*** (0.175)	-0.870*** (0.172)	-0.505*** (0.131)
Constant	0.138*** (0.022)	1.254* (0.648)	5.765*** (1.113)	9.665*** (3.117)	20.199*** (3.941)	18.846*** (4.697)
F-stat	31.678***	8.699***	28.920***	9.412***	25.495***	14.821***
Adj. R-Sq.	0.313	0.068	0.170	0.231	0.357	0.288
Obs.	98	98	98	98	98	98
RMSE	0.025	0.985	0.841	0.934	1.042	2.254
Converging to:	0.298	5.81	13.45	18.01	23.21	37.31
PANEL D	Change in Gini, 2004-2013	Changes in quintile shares, 2004 – 2013				
	GINI INDEX	QUINTILE 1	QUINTILE 2	QUINTILE 3	QUINTILE 4	QUINTILE 5
Initial value 2004	-0.331*** (0.076)	-0.196*** (0.073)	-0.491*** (0.140)	-0.787*** (0.219)	-0.758*** (0.123)	-0.418*** (0.099)
Constant	0.097*** (0.021)	1.235* (0.643)	6.664*** (1.905)	14.173*** (3.913)	17.582*** (2.831)	15.529*** (3.583)
F-stat	19.09***	7.14***	12.22***	12.91***	38.08***	17.74***
Adj. R-Sq.	0.190	0.067	0.271	0.329	0.337	0.203
Obs.	103	103	103	103	103	103
RMSE	0.024	0.922	0.853	1.087	1.012	2.319
Converging to:	0.293	6.30	13.57	18.00	23.21	37.12

Notes: changes in each measure of inequality are regressed against the respective initial values in four periods. The panel A includes 7 countries (DE, DK, ES, FI, IT, LU, SK) while the panel B includes 10 countries (AT, CZ, DE, DK, ES, FI, IT, LU, SI, SK). The panel C includes 12 countries (AT, CZ, DE, DK, EE, ES, FI, HU, IT, LU, PL, SI). The panel D includes 13 countries (AT, CZ, DE, DK, EE, ES, FI, HU, IT, LU, PL, SI, SK). Significance levels are defined as follows: 10% (*), 5% (**) and 1% (***). Heteroskedasticity robust standard errors are in parentheses.

IRLS regressions in Table 3, down-weighting potential outliers in the sample, largely confirm previous results. They also return a significant coefficient also for the fourth quintile in 1990-2013, suggesting that the earlier result indicating lack of convergence should be misleading. Indeed, a re-examination of this regression shows that this finding is not a general one: it is driven by an outlier, that is, the German region of Bremen (see also the scatter plot of the fourth quintile in the Figure 3). Finally, when looking at convergence of the Lorenz Curve, the trends imply that the three middle quintiles are converging to shares essentially similar to year 1990.

Table 3 - Unconditional convergence in inequality: IRLS estimates

PANEL A	Change in Gini, 1990 – 2013	Changes in quintile shares, 1990 – 2013				
	GINI INDEX	QUINTILE 1	QUINTILE 2	QUINTILE 3	QUINTILE 4	QUINTILE 5
Initial value 1990	-0.566*** (0.099)	-0.552*** (0.156)	-0.499*** (0.080)	-0.796*** (0.099)	-0.816*** (0.173)	-0.564*** (0.107)
Constant	0.179*** (0.026)	3.494** (1.503)	6.423*** (1.142)	14.372*** (1.784)	19.171*** (3.996)	21.840*** (3.808)
F-stat	32.415***	12.462***	38.641***	64.409***	22.206***	27.513***
Adj. R-Sq.	0.377	0.181	0.420	0.549	0.294	0.338
Obs.	53	53	53	53	52	53
RMSE	0.029	1.463	0.697	0.669	0.822	2.327
PANEL B	Change in Gini, 1995 – 2013	Changes in quintile shares, 1995 – 2013				
	GINI INDEX	QUINTILE 1	QUINTILE 2	QUINTILE 3	QUINTILE 4	QUINTILE 5
Initial value 1995	-0.426*** (0.070)	-0.373*** (0.095)	-0.476*** (0.075)	-0.828*** (0.086)	-0.898*** (0.145)	-0.476*** (0.080)
Constant	0.128*** (0.019)	2.713*** (0.854)	6.449*** (1.054)	14.959*** (1.554)	20.863*** (3.345)	17.916*** (2.906)
F-stat	37.596***	15.303***	39.951***	93.452***	38.424***	34.981***
Adj. R-Sq.	0.331	0.162	0.345	0.555	0.336	0.315
Obs.	75	75	75	75	75	75
RMSE	0.024	1.234	0.714	0.598	0.902	2.071
PANEL C	Change in Gini, 2000 – 2013	Changes in quintile shares, 2000 – 2013				
	GINI INDEX	QUINTILE 1	QUINTILE 2	QUINTILE 3	QUINTILE 4	QUINTILE 5
Initial value 2000	-0.391*** (0.071)	-0.154** (0.075)	-0.354*** (0.078)	-0.548*** (0.068)	-0.919*** (0.094)	-0.318*** (0.075)
Constant	0.118*** (0.020)	0.775 (0.672)	4.735*** (1.083)	9.850*** (1.216)	21.316*** (2.141)	12.130*** (2.754)
F-stat	30.249***	4.247***	20.521***	65.226***	95.234***	17.883***
Adj. R-Sq.	0.232	0.032	0.168	0.401	0.493	0.150
Obs.	98	98	98	97	98	97
RMSE	0.026	0.970	0.700	0.630	0.835	2.027
PANEL D	Change in Gini, 2004 – 2013	Changes in quintile shares, 2004 – 2013				
	GINI INDEX	QUINTILE 1	QUINTILE 2	QUINTILE 3	QUINTILE 4	QUINTILE 5
Initial value 2004	-0.311*** (0.067)	-0.179*** (0.066)	-0.286*** (0.071)	-0.494*** (0.062)	-0.766*** (0.081)	-0.417*** (0.080)
Constant	0.091*** (0.019)	1.211** (0.583)	3.883*** (0.975)	8.864*** (1.094)	17.771*** (1.848)	15.512*** (2.962)
F-stat	21.44***	7.31***	16.25***	64.24***	89.88***	27.25***
Adj. R-Sq.	0.167	0.058	0.131	0.385	0.466	0.205
Obs.	103	103	102	102	103	103
RMSE	0.025	0.898	0.693	0.560	0.784	2.301

Notes: The panel A includes 53 regions except in the 4th quintile where the German region of Bremen (DE50) is an outlier, and therefore dropped. The panel C includes 98 regions except in the 3rd and 5th quintile where the regions Valle d'Aosta (ITC2) and Abruzzo (ITF1) are outliers and dropped. The panel D includes 103 regions except in the 2nd and 3rd quintiles where Aland (FI20) is dropped. Significance levels are defined as follows: 10% (*), 5% (**), and 1% (***). Heteroskedasticity robust standard errors are in parentheses.

5. Conditional convergence

The first set of regressions revealed that inequality convergence at regional level occurred regardless their initial conditions, although at a relatively slow pace, and to a higher level of inequality. To what extent structural characteristics of the regions matter in this process? Is the speed of the convergence significantly faster if they share the same initial conditions? To this aim, we introduce in the baseline specification a set of variables to account for potential drivers of income inequality and so test for conditional convergence. We estimate:

$$I_{it} - I_{i0} = \alpha + \beta I_{i0} + \gamma \mathbf{X}_{i0} + \varepsilon_i \quad (i = 1, \dots, N) \quad (2)$$

The set of initial conditions, the vector \mathbf{X}_{i0} includes country dummies and the following variables: (i) the level of economic development (GDP per capita), as the different initial regional economic performance might have different effect on inequality following the Kuznets hypothesis of an inverted U-shaped relationship (Kuznets, 1955); (ii) the labour income share (captured by the compensation of employees/GDP per capita) and (iii) a measure of the capital share (reflected by the Gross Fixed Capital Formation, or GFCF), as global division of labour and international trade patterns may have resulted in falling labour shares in more advanced economies and increasing labour shares in less developed ones changing the functional distribution of income (Dao et al., 2017). In some specifications, only for the 2000-2013 period, we could also control for socio-economic variables including: (iv) measures of human capital and technological innovation, as there is growing evidence supporting the hypothesis that technological innovation lead to higher level of inequality through the job polarisation mechanism, with high demand for both high-skilled (well-paid) and low-skilled (low-paid) jobs to the detriment of middle-income jobs (Acemoglu, 2002; Autor and Dorn, 2013; and Goos et al., 2014 for evidence on Europe); (v) population density, to account for population dynamics and change in households structure, as a trend toward smaller households (e.g. for OECD countries) is likely to increase income inequality because they are less able to benefit from saving coming from pooling resources and sharing expenditures (OECD, 2011; Furceri and Ostry, 2019); (vi) finally, a composite indicator expressing the quality of institutions at regional level, as low levels of corruption and better institutions are supposed to provide economic opportunities to a broad cross-section of the population (Acemoglu, 2008).¹⁸

OLS results from conditional convergence regressions confirm that inequality has been converging in all our periods of investigation, with the coefficients of initial values negative and statistically significant for all measures of inequality. One should also note that the estimated coefficients for the initial values are larger than the coefficients estimated in the unconditional regression, in absolute terms. In this case, therefore, this suggests that if regions share the same level of economic development, the same functional distribution of income, this process is faster. How much faster is the convergence process? Comparing unconditional and conditional OLS estimates in 1990-2013, the magnitude of coefficients is substantially larger, both for Gini index and for quintile shares, with the exception of the fourth quintile (Table 4). We check the robustness of the results repeating the analysis on different periods, including different samples of regions. In 1995-2013, the coefficients remain essentially unvaried in terms of sign and significance, while the speed of the convergence process reduced or remained stable for Gini index

¹⁸ We use data from European Commission (Eurostat database, 2016), Cambridge Econometrics (European Regional Database-ERD, 2016) and Quality of Government Institute (European Quality of Government Index EQI, 2013).

and quintiles, except for the fourth quintile (Table A4 in the Appendix). This can be explained by the inclusion of more egalitarian regions of Czech Republic and Austria in such estimates.

Looking at control variables entering OLS regressions, regional initial conditions seems to contribute significantly in explaining the variation of inequality and quintiles shares of income. For the period 1990-2013, we find some evidence that economic development benefits only the bottom part of income distribution and no evidence supporting the Kuznets hypothesis. With respect to the functional distribution of income, a variation of capital share is significantly associated with an increase in income inequality and a widening gap between the top and bottom of the distribution of income; while there is no clear evidence on the role of labour share. Re-estimating the regressions by dropping influential observations (Panel B) and for the period 1995-2013 confirms the results. See Table A3 in the Appendix.

Table 4 - Conditional convergence in inequality: OLS 1990 - 2013

PANEL A	Change in Gini, 1990-2013	Changes in quintile shares, 1990-2013				
	GINI INDEX	QUINTILE 1	QUINTILE 2	QUINTILE 3	QUINTILE 4	QUINTILE 5
Initial value 1990	-0.858*** (0.136)	-1.258*** (0.221)	-0.694*** (0.126)	-1.068*** (0.194)	-0.697** (0.274)	-0.794*** (0.172)
GDP per capita (ln)	-0.137 (0.100)	7.721* (4.109)	6.326* (3.601)	5.385 (4.020)	-1.819 (4.791)	-14.913 (9.938)
GDP per capita squared (ln)	-0.016 (0.011)	0.821* (0.425)	0.716* (0.378)	0.560 (0.424)	-0.211 (0.518)	-1.578 (1.081)
GFCF	0.001** (0.000)	-0.053** (0.025)	-0.035** (0.015)	-0.022 (0.015)	-0.014 (0.025)	0.121*** (0.044)
Labour Income Share	0.018 (0.098)	-2.780 (3.120)	6.981* (3.938)	-4.778* (2.686)	-2.047 (4.832)	0.949 (9.986)
Constant	-0.045 (0.211)	28.941*** (9.534)	19.013** (7.398)	32.867*** (9.129)	13.632 (12.999)	-2.617 (21.356)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
F-stat	13.12***	14.20***	9.87***	12.20***	10.15***	8.15***
Adj. R-Sq.	0.601	0.571	0.600	0.612	0.108	0.434
Obs.	52	52	52	52	52	52
RMSE	0.022	1.021	0.758	0.741	1.166	2.155
PANEL B	Change in Gini, 1990-2013	Changes in quintile shares, 1990-2013				
	GINI INDEX	QUINTILE 1	QUINTILE 2	QUINTILE 3	QUINTILE 4	QUINTILE 5
Initial value 1990	-0.824*** (0.129)	-1.065*** (0.260)	-0.640*** (0.096)	-0.859*** (0.167)	-0.459* (0.264)	-0.733*** (0.150)
GDP per capita (ln)	-0.228*** (0.082)	9.726** (4.068)	9.180** (3.479)	4.080 (2.954)	2.345 (3.437)	-23.256*** (7.482)
GDP per capita squared (ln)	-0.025*** (0.009)	1.009** (0.412)	1.003*** (0.363)	0.419 (0.308)	0.215 (0.356)	-2.407*** (0.784)
GFCF	0.001*** (0.000)	-0.055** (0.023)	-0.041*** (0.015)	-0.015 (0.015)	-0.016 (0.024)	0.127*** (0.039)
Labour Income Share	0.221** (0.084)	-8.303** (3.858)	3.001 (4.330)	-8.066* (4.410)	-9.506* (5.071)	23.408** (9.171)
Constant	-0.346* (0.179)	34.005*** (10.044)	26.267*** (7.166)	27.802*** (6.546)	20.627* (10.346)	-33.319** (16.296)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
F-stat	54.66***	24.22***	22.14***	10.69***	4.73***	12.65***
Adj. R-Sq.	0.710	0.602	0.654	0.574	0.042	0.569
Obs.	50	50	50	50	50	50
RMSE	0.018	0.945	0.649	0.651	1.051	1.774

Notes: The panel 1990-2013 includes regions of 7 countries (DE, DK, ES, FI, IT, LU, SK). Berlin region (DE30) is excluded from the sample as control variables are unavailable in year 1990. Control variables are expressed in billions of euro and deflated to 2005 constant price euros using sectoral price deflators obtained from AMECO. Significance levels are defined as follows: 10% (*), 5% (**) and 1% (***). Heteroskedasticity robust standard errors are in parentheses.

We repeat the analysis also for 2000-2013 with a larger sample of regions and different specifications of the model. In this case, we can also add further variables to control for level of tertiary education (expressed as the percentage of the population 25/64 years old), technology (given by the number of patent applications to the European Patent Office per million inhabitants), population density (expressed as the population average per square kilometre), and the quality of regional institutions (given by the European Quality of Government Index - EQI).¹⁹ OLS estimates for 2000-2013 generally confirm previous results. However, in this case, the effect of GDP is to exacerbate the level of economic inequality and to widen the gap at the extremes of the distribution of income (See Tables A4 and A5 in the Appendix). More interestingly, these estimates add evidence on the role of institutional structural factors in this process. The EQI coefficient in the first panel of Table A5, negative and significant, indicates that improving the quality of regional institutions will result in a decrease of economic inequality. In addition, when looking at the quantile distribution of income at its extremes, the inverse sign of the coefficients for the lowest and the highest quintile confirms the potential “redistributive” effect of better regional governance. These results are generally confirmed also in the second panel, where further controls allow sharing the same level of regional education and technology, and the same population density.

5.1 Fixed Effects results

We also include Fixed Effects (FE) estimates, since they allow to control for time-invariant regional characteristics, eliminating therefore a potential source of omitted variable bias. FE estimates support the hypothesis of inequality convergence in all periods analysed, with the magnitude of Gini and quintile coefficients being larger, as all time-invariant regional initial conditions are held constant with this estimator. For 1990-2013, the evidence in Table 5 confirms the significant effect of GDP in widening income inequality in both stage of economic development, and a corresponding significant effect in decreasing lowest quintiles share of income and increasing the highest. Capital share variation is not associated with a significant change in inequality, while there is evidence on middle quintiles for labour share. Results are confirmed when dropping influential observations (Panel B) and for the period 1995-2013 (see Table A6 in the Appendix).

¹⁹ EQI is a composite indicator from Quality of Government Institute (Charron et al. 2013) capturing EU citizens’ perceptions and experiences with corruption (corruption pillar), and the extent to which they rate their public services as impartial (impartial pillar) and of good quality (quality pillar) across EU countries. Given the long term nature of institutional changes, we use data of first round collected in 2010 as a proxy for the initial values.

Table 5 - Conditional convergence in inequality: Fixed Effects (FE) 1990-2013

PANEL A	Change in Gini, 1990-2013	Changes in quintile shares, 1990-2013				
	GINI INDEX	QUINTILE 1	QUINTILE 2	QUINTILE 3	QUINTILE 4	QUINTILE 5
Initial value	-1.156*** (0.080)	-1.035*** (0.075)	-1.057*** (0.129)	-1.039*** (0.156)	-1.204*** (0.107)	-1.235*** (0.109)
GDP per capita (ln)	0.378*** (0.096)	-7.029 (4.610)	-8.161*** (2.875)	-7.133** (3.492)	-9.891 (6.856)	32.915*** (7.578)
GDP per capita squared (ln)	0.042*** (0.013)	-0.720 (0.591)	-0.848** (0.357)	-0.842* (0.477)	-1.398 (0.908)	3.916*** (1.071)
GFCF	0.001 (0.001)	-0.011 (0.017)	-0.003 (0.014)	-0.015 (0.015)	-0.023 (0.022)	0.057 (0.042)
Labour Income Share	0.048 (0.051)	-3.664 (2.319)	-5.940** (2.667)	7.255** (2.822)	-0.687 (5.057)	2.279 (5.530)
Constant	1.137*** (0.187)	-5.938 (9.155)	-1.932 (5.572)	0.492 (6.566)	11.151 (11.848)	112.494*** (14.570)
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
F-stat	36.92***	41.85***	15.26***	7.75***	29.69***	22.90***
Adj. R-Sq.	0.650	0.618	0.509	0.493	0.560	0.653
Obs.	196	196	196	196	196	196
Regions	52	52	52	52	52	52
RMSE	0.018	0.710	0.624	0.684	0.867	1.557

PANEL B	Change in Gini, 1990-2013	Changes in quintile shares, 1990-2013				
	GINI INDEX	QUINTILE 1	QUINTILE 2	QUINTILE 3	QUINTILE 4	QUINTILE 5
Initial value	-1.178*** (0.079)	-1.022*** (0.067)	-1.021*** (0.133)	-1.107*** (0.184)	-1.230*** (0.120)	-1.272*** (0.105)
GDP per capita (ln)	0.284*** (0.075)	-3.131 (4.563)	-7.484*** (2.775)	-7.533* (4.010)	-6.907 (6.156)	25.092*** (4.700)
GDP per capita squared (ln)	0.030*** (0.010)	-0.320 (0.624)	-0.798** (0.344)	-0.835 (0.539)	-0.875 (0.803)	2.764*** (0.670)
GFCF	0.001 (0.000)	-0.018 (0.015)	-0.006 (0.015)	-0.012 (0.016)	-0.016 (0.021)	0.055 (0.040)
Labour Income Share	0.023 (0.063)	-4.690* (2.660)	-6.643** (3.088)	8.991*** (3.292)	3.465 (4.726)	-3.094 (5.614)
Constant	0.975*** (0.144)	3.436 (8.318)	-0.256 (5.570)	-0.859 (7.199)	13.377 (11.215)	103.829*** (12.517)
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
F-stat	42.54***	43.45***	14.87***	8.17***	21.29***	24.50***
Adj. R-Sq.	0.667	0.635	0.494	0.503	0.566	0.673
Obs.	188	188	188	188	188	188
Regions	50	50	50	50	50	50
RMSE	0.018	0.666	0.618	0.652	0.844	1.504

Notes: The panel includes regions of 7 countries (DE, DK, ES, FI, IT, LU, SK). Berlin region (DE30) is excluded from the sample as control variables are unavailable in year 1990. Control variables are expressed in billions of euro and deflated to 2005 constant price euros using sectoral price deflators obtained from AMECO. Significance levels are defined as follows: 10% (*), 5% (**) and 1% (***). Clustered standard errors at regional level are in parentheses.

For 2000-2013, with an extended sample, the role of the economic development in widening the level of inequality is not confirmed and estimates indicate a significant effect of a mechanism operating in the direction of reduce inequality, although for some quintiles of income distribution (Table A7 in the Appendix). This is not surprising as the empirical evidence on the inequality-growth relationship seems to depend on identification strategy, data and countries involved.

With respect to the functional distribution of income, a variation of capital share is involved with an increase in income inequality and a widening gap of top-bottom quintiles (in the first specification). On the other side, the labour share has a significantly compensating role operating on the overall level of inequality and at the extremes of the quintile distribution (in both specifications). It is worth noting that with FE the technology and the population dynamics have a significant effect in shaping, respectively, part of the quintile distribution and the overall level of inequality. No effect of human capital is

detected with this specification. In this setting, we cannot re-estimate the effect of the quality of regional institutions (EQI) as available data do not allow to perform FE regressions. Finally, also in this case, we estimate results for different samples and specifications, or dropping potential influential observations. This does not significantly change the results.²⁰

6. EU Cohesion Policy and the convergence process

Did the EU Cohesion Policy affect the speed of convergence? The purpose of this section is to provide initial evidence on the role played by the European Regional Development Policy, focussing on two aspects: (i) whether the process of convergence changed over time as a result of the transition from one programming period to the next over 1989-2013; and (ii) whether the speed of convergence is different in less developed regions eligible for Cohesion Policy funds (CP, hereafter).²¹ We begin by estimating:

$$I_{iT} - I_{i0} = \alpha + \beta_1 I_{i0} + \sum_{t=2}^4 \beta_t \cdot \gamma_t I_{i0} + \gamma_t + \varepsilon_i \quad (i = 1, \dots, N) \quad (3)$$

where our dependent variable captures the variation of the inequality measure for each region in each programming period γ_t (capturing the common shocks related to a specific programming period), β_1 is the coefficient of the initial value of inequality in the first programming period (which we use as benchmark), while β_t represent the four coefficients of the interaction terms between the time dummies and the initial value of income inequality.

Instead, to investigate the role played by regions receiving CP funds in the convergence process, we estimate the following extension of equation (3):

$$I_{iT} - I_{i0} = \alpha + \beta_1 I_{i0} + \sum_{Treat=1}^4 \beta_t \cdot Treat_t I_{i0} + Treat_t + \gamma_t + \varepsilon_i \quad (i = 1, \dots, N) \quad (4)$$

where β_t represent the four coefficients of the interaction terms between the dummies indicating the CP “treatment” and the initial value of inequality. $Treat_t$ represent the dummy “treatment” for each of the four episodes over the period 1989-2013: it identifies whether a specific region has received CP funds in a specific programming period. Finally, γ_t captures common shocks related to a specific programming period (like a time effect dummy).

Table 6 presents pooled OLS and FE estimates for Gini coefficient in the four programming periods of the European Regional Policy, with different samples of NUTS 2 regions and model specifications. Here, following equation (3), we look at how the speed of convergence depends also on the

²⁰ Full regression outputs are all available on request.

²¹ Following the 1988 reform of European Regional Policy, the four programming periods are: 1989-1993, 1994-1999, 2000-2006, 2007-2013. See at http://ec.europa.eu/regional_policy/en/policy/what/history/. Regions supported by Cohesion Policy funds have been identified according to the EU official documents of each programming period.

programming period. In the first set of regressions (Panel A) suggests that it does: the speed of convergence accelerated in the programming periods following the first one in 1989-1993.

The coefficients of the pooled OLS specification with interaction terms, due to high collinearity with the initial value of Gini, appear to be statistically insignificant (the Variance Inflation Factor is above 150). However, they turn significant both when testing the nonlinear restrictions that each programming period has no effect on the speed of convergence and when running Fixed Effects (FE) regressions.²² Hence, pooled OLS and FE estimates confirm evidence of convergence in income inequality, suggesting that it may be faster in more recent programming periods.

The second set of regressions (Panel B) confirms this, by estimating the speed of convergence for each programming period in cross-section regressions. Results for the first period seems to reveal that no convergence occurred during 1989-1993, given that the coefficient is not statistically significant. A possible explanation for such result is to impute to the limited number of observations. However, estimates for the remaining three programming periods show that there has been a significant increase in the speed of convergence, with the convergence parameter reaching 0.33 in the most recent programming period.

The appendix reports further regressions, for each of the five quintiles (Tables A8 - A12). The results show the same pattern for each quintile, suggesting that moving from one programming period to the next has affected the speed of convergence in all parts of the distribution.

²² Performing linear restriction tests, we assess magnitude and significance of the speed of convergence for each programming period, that is: $\beta_1 + \beta_2 = 0$, $\beta_1 + \beta_3 = 0$, and $\beta_1 + \beta_4 = 0$. The results reveal that the coefficients turn significant and in line with the other estimates. The second linear restriction tests that the three interaction terms in the programming periods PP2, PP3, PP4 are identical. In Pooled OLS the test fails to reject the null hypothesis $H_0 = \beta_2 = \beta_3 = \beta_4$, suggesting that the speed of convergence is different across periods, while rejecting the null hypothesis in FE estimates, thus proving inconclusive evidence on whether the change in convergence speed is the same across programming periods.

Table 6 - Speed of convergence in different Programming Periods: Gini index, 1989-2013

Estimator:	PANEL A: Change in Gini over all programming periods (PPs), 1989-2013						PANEL B: Change in Gini in each programming period (PP)			
							PP1	PP2	PP3	PP4
							1989-1993	1994-1999	2000-2006	2007-2013
	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	Pooled OLS	Pooled OLS	Pooled OLS
Gini initial value	-0.299*** (0.054)	-1.124*** (0.076)	-0.292*** (0.050)	-1.129*** (0.072)	-0.234 (0.173)	-0.910*** (0.152)	-0.234 (0.174)	-0.267*** (0.065)	-0.295*** (0.056)	-0.333*** (0.093)
Dummy pp2			-0.017*** (0.006)	0.001 (0.004)	-0.008 (0.044)	0.033 (0.034)				
Dummy pp3			-0.018*** (0.005)	-0.001 (0.004)	-0.002 (0.048)	0.072** (0.036)				
Dummy pp4			-0.005 (0.006)	0.008* (0.004)	0.022 (0.051)	0.127*** (0.037)				
Gini 1994*dummy pp2					-0.033 (0.159)	-0.121 (0.124)				
Gini 2000*dummy pp3					-0.062 (0.174)	-0.269** (0.128)				
Gini 2007*dummy pp4					-0.099 (0.185)	-0.437*** (0.132)				
Constant	0.089*** (0.015)	0.315*** (0.021)	0.098*** (0.015)	0.314*** (0.020)	0.083* (0.048)	0.255*** (0.042)	0.083* (0.048)	0.075*** (0.017)	0.081*** (0.015)	0.105*** (0.026)
F-stat	30.39***	221.53	12.96***	66.24***	9.02***	57.38***	1.80	17.06***	28.21***	12.89***
Adj. R-Sq.	0.148	0.598	0.205	0.615	0.200	0.643	0.023	0.187	0.182	0.173
Obs.	336	336	336	336	336	336	49	75	108	104
Regions	114	114	114	114	114	114	49	75	108	104
RMSE	0.027	0.017	0.026	0.016	0.026	0.016	0.034	0.024	0.023	0.026
$\beta_1 + \beta_2 = 0$					-0.267***	-1.031***				
$\beta_1 + \beta_3 = 0$					-0.295***	-1.179***				
$\beta_1 + \beta_4 = 0$					-0.333***	-1.347***				
$\beta_2 = \beta_3 = \beta_4$ (p-value)					0.828	0.001				

Notes: The Panel A includes 15 countries (AT, CZ, DE, DK, EE, ES, FI, HU, IE, IT, LU, PL, SE, SI, SK). The Panel B includes 6 countries in 1989-1993 (DE, DK, ES, FI, IT, LU), 10 countries in 1994-1999 (AT, CZ, DE, DK, ES, FI, IE, IT, LU, SE), 14 countries in 2000-2006 (AT, CZ, DE, DK, EE, ES, FI, HU, IE, IT, LU, PL, SE, SI), and 13 countries in 2007-2013 (AT, CZ, DE, DK, EE, ES, FI, HU, IT, LU, PL, SI, SK). Programming period 1 (PP1) is used as benchmark and therefore is excluded in the regressions. Significance levels are defined as follows: 10% (*), 5% (**) and 1% (***). Clustered standard errors at regional level are in parentheses.

In Table 7, we test if less developed regions eligible for CP funds, defined as “Objective 1” (and later as “Convergence Objective”), have converged at different speed. To this aim, following equation (4), we identify such regions with a dummy in each programming cycle of the Policy (1 if “treated” and 0 otherwise), using as reference category all regions not financed by CP funds. Then, we interact them with the initial level of inequality, assuming therefore that the effect of initial level of inequality on its subsequent change (in each programming period) depends also on having received the CP funds. Referring to the full sample spanning the period 1989-2013, we find evidence of faster speed of convergence for Objective 1 regions for all programming periods. Indeed, the estimated difference in speed of convergence between regions receiving CP funds and regions not financed seems substantial in all the programming periods (except for 1994-1999). This suggests that less developed EU regions may be driving therefore the convergence process.

Table 7 - Speed of convergence in EU regions receiving Cohesion Policy funds: Gini index, 1989 - 2013

	(1) Four PPs	(2) Four PPs	(3) Four PPs	(4) Four PPs
Estimator:	Pooled OLS	FE	Pooled OLS	FE
Gini initial value	-0.316*** (0.049)	-1.107*** (0.074)	-0.314*** (0.075)	-1.015*** (0.087)
dummy_t1	0.036*** (0.010)	0.017* (0.009)	0.214** (0.084)	0.145** (0.065)
dummy_t2	0.002 (0.006)	0.002 (0.006)	0.003 (0.036)	0.002 (0.038)
dummy_t3	0.002 (0.005)	-0.004 (0.006)	-0.004 (0.027)	0.093*** (0.028)
dummy_t4	0.000 (0.005)	0.004 (0.006)	-0.028 (0.026)	0.137*** (0.034)
dummy_t1 * Gini 1989			-0.627** (0.289)	-0.482** (0.215)
dummy_t2 * Gini 1994			-0.005 (0.124)	-0.028 (0.124)
dummy_t3 * Gini 2000			0.023 (0.100)	-0.360*** (0.100)
dummy_t4 * Gini 2007			0.105 (0.093)	-0.487*** (0.119)
Constant	0.092*** (0.014)	0.303*** (0.021)	0.092*** (0.020)	0.280*** (0.025)
Time dummies	Yes	Yes	Yes	Yes
F-stat	8.56***	52.61***	8.95***	50.61***
Adj. R-Sq.	0.248	0.624	0.261	0.655
Obs.	336	336	336	336
Regions	114	114	114	114
RMSE	0.025	0.016	0.025	0.015
$\beta_1 + \beta_2 = 0$			-0.940***	-1.497***
$\beta_1 + \beta_3 = 0$			-0.319***	-1.043***
$\beta_1 + \beta_4 = 0$			-0.291***	-1.375***
$\beta_1 + \beta_5 = 0$			-0.209***	-1.502***
$\beta_2 = \beta_3 = \beta_4 = \beta_5$ (p-value)			0.065	0.002

Notes: The sample 1989-2013 includes 15 countries (AT, CZ, DE, DK, EE, ES, FI, HU, IE, IT, LU, PL, SE, SI, SK). Significance levels are defined as follows: 10% (*), 5% (**) and 1% (***). Clustered standard errors at regional level are in parentheses.

7. Conclusions

While convergence in income per capita in the EU has traditionally received much scrutiny, convergence in other equally important development outcomes is not well understood. This paper contributes to fill this gap by asking whether EU regions are becoming more (or less) similar with respect to their income distribution. We test for unconditional and conditional income inequality convergence, providing new stylised facts.

Both cross section and panel estimates support the idea of inequality convergence among EU regions. In particular, our findings indicate that inequality among NUTS 2 regions is converging, but to a higher level, so that they have tended to become *equally more unequal*. This process is significantly faster when regions share the same structural features, such as the same level of economic development and the same functional distribution of income and the same level of education and technology. In addition, our results suggest that sharing the same level of the quality of regional institutions may also accelerate the convergence process.

Furthermore, we investigate if the pace of the convergence process changed over time and if less developed regions eligible for Cohesion Policy funds played a significant role in this process. Panel estimates find that the allocation of EU funds related to second, third and fourth programming periods are driving the convergence effect, where the transition from one programming period to another suggest that the Cohesion Policy accelerated the process of (unconditional) convergence. Finally, the evidence also suggests that regions eligible for Cohesion Policy funds significantly accelerated the pace of inequality convergence, driving therefore the catch-up process. For the first programming period, the estimates find no effect, perhaps because of the sample composition and the limited number of observations.

Our findings have two types of implications. The first one is that, as NUTS2 regions seem to be converging to higher levels of income inequality, planning future EU policies ought not to ignore distributive consequences and perhaps put increasing effort into pursuing growth with equity. The second one relates to future research. Our findings call for more analysis, looking at the effects of specific interventions and specific channels through which the allocation of EU funds may affect the inequality convergence process we documented in this paper. This means shifting the focus from the macro level to sectoral and micro level analysis.

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Appendix

Table A1 displays the number of observations (NUTS 2 regions) across countries for each wave of LIS database.

Table A1 - Number of observations for each country

		Wave III	Wave IV	Wave V	Wave VI	Wave VII	Wave VIII	Wave IX
		1990	1995	2000	2004	2007	2010	2013
Austria	AT		9	9	9	9	9	9
Czech Republic	CZ		8	8	8	8	8	8
Germany	DE	5	9	9	9	9	9	9
Denmark	DK	5	5	5	5	5	5	5
Estonia	EE			1	1	1	1	1
Greece	EL				13	13	13	
Spain	ES	17	17	17	18	19	19	19
Finland	FI	3	3	5	5	5	5	5
Hungary	HU			7	7	7	7	7
Ireland	IE		2	2	2	2	2	
Italy	IT	18	18	19	19	19	19	19
Luxembourg	LU	1	1	1	1	1	1	1
Poland	PL			16	16	16	16	16
Sweden	SE	3	3	8	8			
Slovenia	SI		1	1	1	1	1	1
Slovak Republic	SK	4	4		4	4	4	4

Notes: Slovenia (SI) is treated as a single NUTS2 region in the framework of EU Cohesion Policy and therefore aggregated in the analysis. Data for inequality measures have been interpolated in wave IV in Austria (AT) and in waves IV and V in Spain (ES).

Table A2 - Number of households for each wave in LIS

			1990			1995			2000			2004			2007			2010			2013		
NUTS CODE	not rural	rural	total	not rural	rural	total	not rural	rural	total	not rural	rural	total	not rural	rural	total	not rural	rural	total	not rural	rural	total		
AUSTRIA																							
AT11			-	973	1032	2005	-	54	175	229	57	148	205	72	135	207	0	200	200				
AT12			-	2131	841	2972	-	501	493	994	574	537	1111	603	546	1149	438	738	1176				
AT13			-	3065	0	3065	-	875	0	875	1068	0	1068	1315	0	1315	1280	0	1280				
AT21			-	1583	236	1819	-	150	222	372	166	271	437	182	235	417	206	173	379				
AT22			-	1865	937	2802	-	350	491	841	309	444	753	349	479	828	403	406	809				
AT31			-	2521	725	3246	-	579	337	916	673	401	1074	678	400	1078	376	627	1003				
AT32			-	1900	176	2076	-	174	115	289	226	150	376	273	152	425	251	104	355				
AT33			-	1779	673	2452	-	169	237	406	218	230	448	235	282	517	187	286	473				
AT34			-	1929	297	2226	-	190	36	226	200	35	235	208	43	251	172	62	234				
				17746	4917	22663		3042	2106	5148	3491	2216	5707	3915	2272	6187	3313	2596	5909				
CZECH REPUBLIC																							
CZ01			-			2048	1587	0	1587	469	0	469	951	0	951	871	0	871	932	0	932		
CZ02			-			3144	351	335	686	254	205	459	616	656	1172	530	473	1003	426	493	919		
CZ03			-			3475	554	308	862	323	201	524	819	564	1383	609	497	1106	525	527	1052		
CZ04			-			3465	632	355	987	335	145	480	890	419	1309	647	287	934	563	226	789		
CZ05			-			4203	654	355	1009	372	238	610	1000	636	1636	754	473	1227	704	436	1140		
CZ06			-			4696	712	393	1105	373	285	658	981	793	1774	811	630	1441	731	550	1281		
CZ07			-			3482	477	382	859	291	258	549	780	677	1457	543	529	1072	545	428	973		
CZ08			-			3635	730	148	878	440	162	602	1152	460	1612	886	326	1212	668	299	967		
						28148	5697	2276	7973	2857	1494	4351	7189	4205	11294	5651	3215	8866	5094	2959	8053		
DENMARK																							
DK01			4252			25932			26335			26477			26657			27055			27659		
DK02			1818			11407			11757			12004			12310			12300			12569		
DK03			2720			13813			14177			14442			18278			18355			18704		
DK04			2901			16630			17071			17480			18570			18938			19371		
DK05			1204			7240			7453			7577			8854			8997			9214		
			12895			75022			76793			77980			84669			85645			87517		
ESTONIA																							
EE00			-		-		3771	2297	6068	2406	1763	4169	2748	1996	4744	2795	2198	4993	3396	2474	5870		
FINLAND																							
FI19			3411			2672			2850			3005			2863			2550			2905		
FI1B			2706			2190			2512			2651			2600			2291			2284		
FI1C			2435			1985			2271			2371			2264			2087			2878		
FI1D			3137			2385			2730			3099			2678			2315			2760		
FI20			60			30			60			103			67			108			141		
			11749			9262			10423			11229			10472			9351			10968		
GERMANY																							
DE30	183	0	183	325	0	325	487	0	487	463	0	463	452	0	452	674	0	674	661	0	661		
DE40			-	12	276	288	37	466	503	43	433	476	43	431	474	60	626	686	55	571	626		
DE50	59	0	59	57	0	57	100	0	100	88	0	88	84	0	84	123	0	123	127	0	127		
DE60	108	0	108	83	0	83	182	0	182	180	0	180	188	0	188	270	0	270	272	0	272		
DE80			-	25	178	203	40	249	289	40	238	278	40	240	280	48	365	413	44	313	357		
DEC0	269	48	317	291	60	351	552	170	722	522	156	678	128	0	128	167	0	167	145	0	145		
DEE0			-	96	244	340	139	369	508	134	340	474	125	317	442	202	457	659	197	389	586		
DEF0	76	74	150	72	81	153	158	209	367	155	210	365	130	204	334	176	432	608	171	401	572		
DEG0			-	94	228	322	145	353	498	141	325	466	147	333	480	227	427	654	203	397	600		
	695	122	817	1055	1067	2122	1840	1816	3656	1766	1702	3468	1337	1525	2862	1947	2307	4254	1875	2071	3946		
GREECE																							
EL30			-			-			-	1383	132	1515	1827	226	2053	1225	217	1442			-		
EL41			-			-			-	0	128	128	0	152	152	0	158	158			-		
EL42			-			-			-	52	118	170	45	146	191	46	124	170			-		
EL43			-			-			-	175	177	352	171	202	373	162	216	378			-		
EL51			-			-			-	79	295	374	98	334	432	73	386	459			-		
EL52			-			-			-	540	549	1089	576	621	1197	479	630	1109			-		
EL53			-			-			-	0	188	188	0	205	205	0	217	217			-		
EL54			-			-			-	62	132	194	40	157	197	63	156	219			-		
EL61			-			-			-	200	257	457	196	254	450	206	297	503			-		
EL62			-			-			-	0	102	102	0	105	105	0	92	92			-		
EL63			-			-			-	89	288	377	155	282	437	184	352	536			-		
EL64			-			-			-	68	226	294	79	250	329	60	285	345			-		
EL65			-			-			-	30	298	328	31	352	383	53	348	401			-		
										2678	2890	5568	3218	3286	6504	2551	3478	6029					
HUNGARY																							
HU10			-			-			463			552			580			607			611		
HU21			-			-			232			197			202			226			218		
HU22			-			-			191			204			207			194			197		
HU23			-			-			209			215			188			193			196		
HU31			-			-			274			259			258			246			253		
HU32			-			-			285			350			315			296			306		
HU33			-			-			359			281			274			286			280		
									2013			2058			2024			2048			2061		
IRELAND																							
IE01			-			886			929			1592			1311			1175			-		
IE02			-			1983			1935			4493			3936			3158			-		
						2869			2864			6085			5247			4333					

Table A2 - Number of households for each wave in LIS (cont.)

		Table A2 - Number of households for each wave in LIS (cont.)																									
		1990				1995				2000				2004				2007				2010				2013	
ITALY																											
ITC1	Piemonte	572	50	622	574	88	662	628	104	732	565	160	725	652	137	789	640	71	711	633	92	725					
ITC2	Valle d'Aosta	-	-	-	-	-	-	25	0	25	22	22	44	22	23	45	22	24	46	21	22	43					
ITC3	Liguria	449	24	473	366	20	386	291	25	316	348	23	371	291	24	315	290	21	311	305	42	347					
ITC4	Lombardia	755	25	780	761	63	824	781	79	860	733	110	843	722	122	844	733	70	803	855	89	944					
ITF1	Abruzzo	240	99	339	212	99	311	188	40	228	176	44	220	178	23	201	202	0	202	203	1	204					
ITF2	Molise	44	0	44	85	0	85	83	0	83	78	21	99	113	25	138	94	22	116	89	22	111					
ITF3	Campania	683	50	733	645	64	709	726	89	815	527	99	626	545	82	627	662	90	752	628	88	716					
ITF4	Puglia	658	0	658	520	0	520	471	0	471	428	22	450	429	22	451	434	20	454	430	23	453					
ITF5	Basilicata	63	40	103	93	34	127	67	28	95	81	45	126	83	45	128	83	43	126	83	45	128					
ITF6	Calabria	207	25	232	233	29	262	173	37	210	146	47	193	145	45	190	151	45	196	195	22	217					
ITG1	Sicilia	748	0	748	559	0	559	630	0	630	569	21	590	494	22	516	565	22	587	596	22	618					
ITG2	Sardegna	193	75	268	204	91	295	205	103	308	181	149	330	211	133	344	211	131	342	210	133	343					
ITH3	Veneto	421	0	421	474	2	476	403	36	439	510	68	578	537	64	601	485	27	512	477	22	499					
ITH4	Friuli-Venezia Giulia	217	26	243	250	63	313	219	36	255	206	44	250	231	22	253	214	0	214	214	0	214					
ITH5	Emilia-Romagna	644	47	691	661	64	725	701	50	751	610	68	678	660	60	720	641	67	708	607	70	677					
ITI1	Toscana	643	0	643	589	0	589	598	0	598	618	23	641	596	11	607	614	1	615	605	0	605					
ITI2	Umbria	150	97	247	200	88	288	198	73	271	217	66	283	200	67	267	211	66	277	213	64	277					
ITI3	Marche	325	46	371	315	58	373	258	70	328	322	67	389	302	52	354	311	44	355	301	44	345					
ITI4	Lazio	378	23	401	338	73	411	351	74	425	342	83	425	350	63	413	389	63	452	409	43	452					
		7537	651	8188	7268	867	8135	7133	868	8001	6783	1229	8012	6868	1109	7977	7064	887	7951	7225	931	8156					
LUXEMBOURG																											
LU00	Luxembourg			1957			1813			2433			3622	3031	748	3779	4230	1234	5464	2015	1847	3862					
SPAIN																											
ES11	Galicia			1739		-	-			-	608	303	911	602	325	927	589	290	879	445	366	811					
ES12	Asturias			443		-	-			-	453	140	593	481	142	623	432	134	566	328	170	498					
ES13	Cantabria			362		-	-			-	241	103	344	273	116	389	293	123	416	221	74	295					
ES21	Basque Community			1360		-	-			-	649	82	731	623	91	714	662	85	747	641	55	696					
ES22	Navarre			367		-	-			-	250	179	429	260	189	449	253	181	434	259	167	426					
ES23	La Rioja			357		-	-			-	287	124	411	271	126	397	305	142	447	269	116	385					
ES24	Aragon			1105		-	-			-	331	251	582	315	254	569	341	271	612	342	199	541					
ES30	Madrid			764		-	-			-	772	29	801	945	44	989	1176	62	1238	1078	56	1134					
ES41	Castile-Leon			3162		-	-			-	447	466	913	445	442	887	432	449	881	500	345	845					
ES42	Castile-La Mancha			1694		-	-			-	191	489	680	194	442	636	207	501	708	220	344	564					
ES43	Extremadura			830		-	-			-	0	554	554	0	534	534	0	496	496	144	362	506					
ES51	Catalonia			1644		-	-			-	1182	194	1376	1200	226	1426	1253	212	1465	1095	169	1264					
ES52	Valencian Community			1704		-	-			-	932	157	1089	876	155	1031	878	147	1025	697	194	891					
ES53	Balearic Islands			429		-	-			-	322	186	508	304	160	464	244	143	387	238	135	373					
ES61	Andalusia			3674		-	-			-	1003	607	1610	998	569	1567	906	565	1471	888	590	1478					
ES62	Region of Murcia			526		-	-			-	359	198	557	339	189	528	321	167	488	346	153	499					
ES63	Ceuta			-		-	-			-	-		-	127	0	127	113	0	113	139	0	139					
ES64	Melilla			-		-	-			-	-		-	124	0	124	112	0	112	119	0	119					
ES70	Canary Islands			772		-	-			-	543	99	642	535	98	633	535	89	624	430	71	501					
											8835	4161	12996	8912	4102	13014	9052	4057	13109	8399	3566	11965					
SLOVAK REPUBLIC																											
SK01	Bratislava	1264	23	1288			1487			-	620	21	641			541			464			632					
SK02	West Slovakia	2777	2614	5391			6140			-	1319	516	1835			1969			1890			1910					
SK03	Central Slovakia	2763	2187	4950			4300			-	996	312	1308			1413			1368			1455					
SK04	East Slovakia	2433	1928	4361			4409			-	958	405	1363			1527			1478			1493					
		9237	6752	15990			16336				3893	1254	5147			5450			5200			5490					
SLOVENIA																											
SI00	Eastern+Western Slovenia			-			2577			3859			3725			3697			3924			3663					
SWEDEN																											
SE11	Stockholm			2210			3709			2934			3539			-			-			-					
SE12	Östra Mellansverige (East Middle)			-			-			2436			2752			-			-			-					
SE21	Småland med öarna (Småland and the Islands)			-			-			1328			1417			-			-			-					
SE22	Sydsverige (South)			2680			3551			2054			2376			-			-			-					
SE23	Västsverige (West)			1072			1960			2833			3130			-			-			-					
SE31	Norra Mellansverige (North Middle)			-			-			1419			1432			-			-			-					
SE32	Mellersta Norrland (Middle Norrland)			-			-			645			675			-			-			-					
SE33	Övre Norrland (Upper Norrland)			-			-			842			947			-			-			-					
				6688			5669			14491			16268														

Notes: * LIS data for Saarland region (DEC0) includes data for Rheinland-Pfalz until 2004. Slovenia (SI) is treated as a single NUTS2 region in the framework of EU Cohesion Policy and therefore aggregated in the analysis.

Tables A3-A5 report further OLS conditional convergence estimates for the periods 1995-2013 and 2000-2013 (See results presented in the section 5).

Table A3 - Conditional Convergence: OLS 1995-2013

PANEL A	Change in Gini, 1995-2013	Changes in quintile shares, 1995-2013				
	GINI INDEX	QUINTILE 1	QUINTILE 2	QUINTILE 3	QUINTILE 4	QUINTILE 5
Initial value 1995	-0.521*** (0.124)	-0.742*** (0.170)	-0.689*** (0.151)	-1.051*** (0.213)	-1.254*** (0.235)	-0.491*** (0.149)
GDP per capita (ln)	0.034 (0.064)	1.141 (2.757)	2.223 (3.746)	2.586 (2.886)	-3.153 (3.555)	2.001 (6.006)
GDP per capita squared (ln)	0.003 (0.007)	0.124 (0.304)	0.273 (0.404)	0.326 (0.307)	-0.316 (0.382)	0.145 (0.684)
GFCF	0.001 (0.000)	-0.038* (0.022)	-0.034 (0.021)	-0.011 (0.017)	-0.007 (0.025)	0.068 (0.044)
Labour Income Share	0.021 (0.020)	-1.105 (0.801)	0.166 (1.246)	0.804 (0.971)	0.551 (1.262)	0.177 (1.757)
Constant	0.234* (0.125)	8.831 (5.939)	13.452 (9.098)	23.298*** (7.550)	22.018** (9.418)	23.926* (12.339)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
F-stat	33.48***	33.12***	35.46***	14.90***	8.16***	15.75***
Adj. R-Sq.	0.582	0.543	0.423	0.510	0.343	0.402
Obs.	75	75	75	75	75	75
RMSE	0.018	0.906	0.726	0.786	1.075	1.940
PANEL B dropping infl. obs.						
	GINI INDEX	QUINTILE 1	QUINTILE 2	QUINTILE 3	QUINTILE 4	QUINTILE 5
Initial value 1995	-0.537*** (0.125)	-0.631*** (0.192)	-0.760*** (0.159)	-0.956*** (0.226)	-1.480*** (0.212)	-0.515*** (0.150)
GDP per capita (ln)	-0.017 (0.071)	3.648 (2.710)	4.974 (4.567)	0.247 (3.374)	-0.214 (4.643)	-2.509 (7.387)
GDP per capita squared (ln)	-0.003 (0.008)	0.390 (0.288)	0.580 (0.494)	0.073 (0.363)	0.004 (0.491)	-0.358 (0.815)
GFCF	0.001* (0.000)	-0.045** (0.022)	-0.041* (0.021)	-0.001 (0.018)	-0.015 (0.027)	0.078* (0.046)
Labour Income Share	0.030 (0.019)	-1.737** (0.744)	-0.388 (0.875)	0.968 (0.833)	0.180 (1.150)	1.242 (1.868)
Constant	0.130 (0.139)	13.184** (5.737)	20.316* (11.039)	16.650* (9.060)	33.376*** (10.492)	15.089 (14.668)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
F-stat	32.67***	36.66***	32.96***	15.11***	11.03***	14.37***
Adj. R-Sq.	0.571	0.519	0.466	0.557	0.376	0.377
Obs.	73	73	73	73	73	73
RMSE	0.018	0.849	0.698	0.732	1.034	1.931

Notes: The panels include 10 countries (AT, CZ, DE, DK, ES, FI, IT, LU, SI, SK). Control variables are expressed in billions of euro and deflated to 2005 constant price euros using sectoral price deflators obtained from AMECO. Significance: 10% (*), 5% (**) and 1% (***). Heteroskedasticity robust standard errors are in parentheses.

Table A4 - Conditional convergence in inequality: OLS 2000 - 2013

	Change in Gini, 2000-2013	Changes in quintile shares, 2000-2013				
	GINI INDEX	QUINTILE 1	QUINTILE 2	QUINTILE 3	QUINTILE 4	QUINTILE 5
Initial value 2000	-0.691*** (0.094)	-0.532*** (0.112)	-0.701*** (0.253)	-0.478** (0.223)	-1.001*** (0.152)	-0.606*** (0.154)
GDP per capita (ln)	0.180** (0.090)	-4.447 (2.748)	-2.788 (4.104)	-0.847 (2.923)	-4.975 (3.406)	12.327* (7.076)
GDP per capita squared (ln)	0.022* (0.011)	-0.589* (0.322)	-0.353 (0.463)	-0.136 (0.333)	-0.517 (0.374)	1.535* (0.860)
GFCF	0.000 (0.000)	-0.024* (0.014)	-0.017 (0.017)	-0.016 (0.016)	-0.001 (0.014)	0.067** (0.033)
Labour Income Share	0.093** (0.046)	-4.005*** (1.415)	-1.076 (1.977)	-2.267 (1.555)	-0.735 (1.956)	6.462 (4.508)
Constant	0.491*** (0.164)	-1.910 (5.178)	5.019 (9.350)	8.436 (6.265)	13.583* (8.111)	42.044*** (14.634)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
F-stat	209.89***	63.71***	165.49***	342.77***	41.61***	11.51***
Adj. R-Sq.	0.512	0.354	0.271	0.317	0.439	0.419
Obs.	98	98	98	98	98	98
RMSE	0.021	0.820	0.788	0.879	0.973	2.035

Notes: The panel includes 12 countries (AT, CZ, DE, DK, EE, ES, FI, HU, IT, LU, PL, SI). Control variables are expressed in billions of euro and deflated to 2005 constant price euros using sectoral price deflators obtained from AMECO. Significance: 10% (*), 5% (**) and 1% (***). Heteroskedasticity robust standard errors are in parentheses.

Table A5 - Conditional convergence in inequality: OLS 2000 - 2013 (with further controls)

PANEL A with EQI		Change in Gini, 2000-2013				
	GINI INDEX	QUINTILE 1	QUINTILE 2	QUINTILE 3	QUINTILE 4	QUINTILE 5
Initial value 2000	-0.785*** (0.104)	-0.696*** (0.130)	-0.657*** (0.238)	-0.473** (0.233)	-1.042*** (0.133)	-0.768*** (0.163)
GDP per capita (ln)	0.192* (0.101)	-5.885* (3.141)	-0.984 (4.761)	-2.887 (3.116)	-9.590** (3.931)	17.403** (8.488)
GDP per capita squared (ln)	0.021* (0.012)	-0.712* (0.367)	-0.133 (0.545)	-0.345 (0.366)	-1.053** (0.442)	2.004* (1.071)
GFCF	0.000 (0.000)	-0.014 (0.014)	-0.020 (0.017)	-0.007 (0.013)	0.007 (0.016)	0.040 (0.030)
Labour Income Share	0.085** (0.040)	-3.881*** (1.386)	-0.645 (2.022)	-2.305 (1.616)	-1.798 (1.896)	6.710* (3.762)
EQI	-0.015*** (0.006)	0.782** (0.316)	-0.157 (0.275)	0.597* (0.322)	0.497 (0.317)	-2.130*** (0.669)
Constant	0.570*** (0.186)	-4.414 (5.788)	7.749 (10.717)	3.527 (7.971)	5.617 (8.791)	60.891*** (17.377)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
F-stat	296.75***	97.42***	143.68***	289.60***	46.51***	7.95***
Adj. R-Sq.	0.579	0.435	0.262	0.356	0.465	0.503
Obs.	90	90	90	90	90	90
RMSE	0.019	0.756	0.787	0.831	0.954	1.885

PANEL B with EQI-Eurostat		Change in Gini, 2000-2013				
	GINI INDEX	QUINTILE 1	QUINTILE 2	QUINTILE 3	QUINTILE 4	QUINTILE 5
Initial value 2000	-0.855*** (0.126)	-0.689*** (0.165)	-0.697*** (0.262)	-0.449 (0.273)	-1.136*** (0.120)	-0.850*** (0.193)
GDP per capita (ln)	0.146 (0.126)	-6.032 (3.921)	0.522 (5.840)	-3.054 (4.299)	-10.390** (4.224)	13.453 (10.986)
GDP per capita squared (ln)	0.016 (0.015)	-0.705 (0.441)	0.001 (0.643)	-0.339 (0.492)	-1.115** (0.466)	1.567 (1.358)
GFCF	0.000 (0.000)	-0.018 (0.014)	-0.019 (0.014)	-0.011 (0.012)	0.005 (0.015)	0.047 (0.029)
Labour Income Share	0.089** (0.042)	-3.968** (1.641)	-0.048 (2.295)	-2.735 (1.819)	-3.509 (2.182)	7.858** (3.830)
Tech. innovation	-0.000 (0.000)	0.002 (0.002)	0.001 (0.002)	0.002 (0.002)	-0.000 (0.002)	-0.001 (0.003)
Tertiary education	-0.001 (0.001)	0.025 (0.031)	-0.030 (0.042)	0.041 (0.035)	0.076* (0.041)	-0.098 (0.073)
Population density	0.000* (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.001 (0.001)
EQI	-0.014** (0.006)	0.751** (0.328)	-0.268 (0.295)	0.565 (0.363)	0.533 (0.322)	-2.096*** (0.692)
Constant	0.518** (0.222)	-5.643 (8.124)	11.838 (13.966)	1.825 (11.526)	5.431 (8.520)	57.388*** (19.444)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
F-stat	1.3e+10***	5.5e+09***	4.7e+10***	4505.76***	1.6e+09***	7.8e+10***
Adj. R-Sq.	0.581	0.423	0.256	0.337	0.484	0.501
Obs.	85	85	85	85	85	85
RMSE	0.020	0.786	0.808	0.860	0.962	1.931

Notes: The first panel includes 11 countries (AT, CZ, DE, DK, EE, ES, FI, IT, LU, PL, SI), while in the second panel Denmark (DK) is excluded due to missing initial values for Eurostat controls. Control variables are expressed in billions of euro and deflated to 2005 constant price euros using sectoral price deflators obtained from AMECO. Significance: 10% (*), 5% (**) and 1% (***). Heteroskedasticity robust standard errors are in parentheses.

Tables A6 - A7 report further Fixed Effects (FE) conditional convergence estimates for the periods 1995-2013 and 2000-2013 (See results presented in the sub-section 5.1).

Table A6 - Conditional Convergence: Fixed Effects (FE) 1995-2013

PANEL A	Change in Gini, 1995-2013	Changes in quintile shares, 1995-2013				
	GINI INDEX	QUINTILE 1	QUINTILE 2	QUINTILE 3	QUINTILE 4	QUINTILE 5
Initial value	-1.106*** (0.127)	-1.041*** (0.099)	-1.118*** (0.141)	-0.960*** (0.186)	-1.058*** (0.104)	-1.126*** (0.156)
GDP per capita (ln)	0.180* (0.092)	0.316 (3.314)	-3.077 (2.716)	-7.853** (3.489)	-5.607 (4.057)	17.547** (7.183)
GDP per capita squared (ln)	0.015 (0.010)	0.012 (0.321)	-0.223 (0.310)	-0.657* (0.375)	-0.473 (0.410)	1.510* (0.777)
GFCF	0.000 (0.001)	-0.022 (0.018)	0.006 (0.018)	0.017 (0.018)	0.000 (0.018)	-0.000 (0.055)
Labour Income Share	-0.051* (0.030)	1.406 (0.934)	0.512 (1.374)	1.143 (1.234)	-1.035 (1.424)	-2.518 (2.561)
Constant	0.807*** (0.237)	9.729 (8.370)	6.529 (5.840)	-4.298 (8.469)	9.939 (9.817)	88.069*** (18.997)
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
F-stat	13.25***	18.53***	15.12***	6.31***	23.82***	10.44***
Adj. R-Sq.	0.514	0.537	0.458	0.468	0.501	0.508
Obs.	216	216	216	216	216	216
Regions	75	75	75	75	75	75
RMSE	0.016	0.610	0.581	0.582	0.741	1.398

PANEL B dropping infl. obs.	GINI INDEX	QUINTILE 1	QUINTILE 2	QUINTILE 3	QUINTILE 4	QUINTILE 5
Initial value	-1.076*** (0.125)	-1.035*** (0.102)	-1.078*** (0.141)	-0.909*** (0.210)	-1.056*** (0.106)	-1.102*** (0.159)
GDP per capita (ln)	0.125 (0.078)	2.466 (2.892)	-2.224 (2.792)	-6.390* (3.425)	-7.045* (4.163)	15.069** (7.136)
GDP per capita squared (ln)	0.009 (0.008)	0.231 (0.277)	-0.136 (0.320)	-0.499 (0.375)	-0.616 (0.422)	1.248 (0.776)
GFCF	0.000 (0.001)	-0.029 (0.017)	0.004 (0.019)	0.013 (0.018)	0.004 (0.018)	0.006 (0.056)
Labour Income Share	-0.054* (0.030)	1.595* (0.919)	0.651 (1.355)	1.098 (1.280)	-1.137 (1.423)	-2.706 (2.568)
Constant	0.672*** (0.205)	14.681* (7.545)	7.903 (5.894)	-1.951 (7.808)	6.524 (9.999)	81.642*** (19.268)
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
F-stat	13.13***	17.02***	15.34***	4.92***	23.58***	9.51***
Adj. R-Sq.	0.513	0.544	0.437	0.405	0.503	0.497
Obs.	212	212	212	212	212	212
Regions	73	73	73	73	73	73
RMSE	0.016	0.593	0.572	0.583	0.742	1.379

Notes: The panels include 10 countries (AT, CZ, DE, DK, ES, FI, IT, LU, SI, SK). Control variables are expressed in billions of euro and deflated to 2005 constant price euros using sectoral price deflators obtained from AMECO. Significance: 10% (*), 5% (**) and 1% (***). Clustered standard errors at regional are in parentheses.

Table A7 - Conditional convergence: Fixed Effects (FE) 2000-2013 (with further controls)

PANEL A		Changes in quintile shares, 2000-2013				
	Change in Gini, 2000-2013					
	GINI INDEX	QUINTILE 1	QUINTILE 2	QUINTILE 3	QUINTILE 4	QUINTILE 5
Initial value	-1.269*** (0.138)	-1.455*** (0.136)	-1.453*** (0.128)	-1.349*** (0.260)	-1.265*** (0.116)	-1.219*** (0.161)
GDP per capita (ln)	0.065 (0.139)	7.927* (4.664)	2.194 (3.579)	-10.513** (4.895)	-11.787*** (3.905)	13.060 (11.515)
GDP per capita squared (ln)	0.001 (0.013)	0.705 (0.439)	0.377 (0.347)	-0.722* (0.426)	-0.914** (0.349)	0.717 (1.064)
GFCF	0.001* (0.001)	-0.037* (0.021)	-0.028** (0.014)	-0.017 (0.025)	-0.041* (0.022)	0.109** (0.048)
Labour Income Share	-0.070* (0.038)	2.158** (1.068)	1.848 (1.963)	2.581 (2.216)	0.553 (1.776)	-5.888* (3.355)
Constant	0.631* (0.348)	32.738*** (11.555)	22.018** (8.865)	-7.861 (15.696)	-3.909 (11.138)	87.950*** (28.531)
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
F-stat	20.34***	31.79***	28.11***	9.54***	26.78***	19.48***
Adj. R-Sq.	0.637	0.691	0.758	0.569	0.731	0.600
Obs.	196	196	196	196	196	196
Regions	98	98	98	98	98	98
RMSE	0.013	0.470	0.403	0.536	0.538	1.251
PANEL B with EUROSTAT						
	GINI INDEX	QUINTILE 1	QUINTILE 2	QUINTILE 3	QUINTILE 4	QUINTILE 5
Initial value	-1.295*** (0.142)	-1.433*** (0.141)	-1.469*** (0.133)	-1.355*** (0.254)	-1.313*** (0.102)	-1.251*** (0.159)
GDP per capita (ln)	0.040 (0.132)	8.367** (3.981)	3.229 (3.444)	-9.856* (5.304)	-12.045*** (3.898)	11.312 (11.624)
GDP per capita squared (ln)	-0.002 (0.013)	0.664* (0.384)	0.517 (0.345)	-0.561 (0.457)	-0.832** (0.349)	0.410 (1.094)
GFCF	0.001 (0.001)	-0.024 (0.022)	-0.028* (0.016)	-0.031 (0.028)	-0.049* (0.025)	0.117** (0.055)
Labour Income Share	-0.101** (0.040)	3.440*** (1.154)	2.741 (1.801)	2.251 (2.150)	-0.296 (1.781)	-7.186** (3.392)
Tech. innovation	-0.000 (0.000)	0.012*** (0.004)	0.006 (0.004)	-0.004 (0.005)	-0.008** (0.004)	-0.007 (0.013)
Tertiary education	-0.000 (0.001)	-0.027 (0.031)	0.021 (0.031)	0.053 (0.033)	0.035 (0.031)	-0.069 (0.073)
Population density	0.000** (0.000)	-0.001 (0.001)	-0.004*** (0.002)	-0.002 (0.002)	-0.004** (0.002)	0.010* (0.005)
Constant	0.590* (0.322)	34.447*** (10.089)	24.144*** (8.580)	-7.909 (16.784)	-4.071 (10.878)	87.021*** (28.318)
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
F-stat	14.24***	20.94***	20.79***	9.05***	23.07***	13.82***
Adj. R-Sq.	0.652	0.729	0.772	0.593	0.750	0.606
Obs.	191	191	191	191	191	191
Regions	98	98	98	98	98	98
RMSE	0.013	0.445	0.397	0.527	0.525	1.258

Notes: The panel includes regions of 12 countries (AT, CZ, DE, DK, EE, ES, FI, HU, IT, LU, PL, SI). Control variables are expressed in billions of euro and deflated to 2005 constant price euros using sectoral price deflators obtained from AMECO. Significance levels are defined as follows: 10% (*), 5% (**) and 1% (***). Clustered standard errors at regional level are in parentheses.

Tables A8 - A12 report pooled OLS and FE estimates for each of the five quintiles in the four programming periods of the European Regional Policy (as presented in the section 6).

Table A8 - Speed of convergence in different Programming Periods: Quintile 1 share of income, 1989 - 2013

	PANEL A:						PANEL B:			
	Change in Gini over all programming periods (PPs), 1989-2013						Change in Gini in each programming period (PP)			
							PP1	PP2	PP3	PP4
							1989/1993	1994/1999	2000/2006	2007/2013
	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	Pooled OLS	Pooled OLS	Pooled OLS
Q1 initial value	-0.258*** (0.045)	-0.983*** (0.079)	-0.245*** (0.040)	-1.022*** (0.070)	-0.307 (0.233)	-0.768*** (0.198)	-0.307 (0.235)	-0.226*** (0.077)	-0.283*** (0.056)	-0.202** (0.088)
dummy_pp2			0.714*** (0.200)	-0.094 (0.145)	-0.032 (2.315)	1.588 (1.834)				
dummy_pp3			0.827*** (0.207)	0.027 (0.158)	0.586 (2.070)	4.144** (1.657)				
dummy_pp4			0.121 (0.197)	-0.620*** (0.185)	-0.837 (2.260)	2.919 (1.824)				
Q1 94 * dummy pp2					0.081 (0.264)	-0.179 (0.205)				
Q1 00 * dummy pp3					0.024 (0.231)	-0.455** (0.185)				
Q1 07 * dummy pp4					0.105 (0.256)	-0.390* (0.206)				
Constant	1.971*** (0.399)	8.446*** (0.705)	1.386*** (0.400)	8.997*** (0.682)	1.970 (2.081)	6.659*** (1.801)	1.970 (2.093)	1.939*** (0.680)	2.557*** (0.513)	1.133 (0.779)
F-stat	32.80***	155.28	19.77***	62.24***	16.76***	94.51***	1.71	8.66***	25.78***	5.28**
Adj. R-Sq.	0.103	0.506	0.208	0.584	0.203	0.615	0.041	0.161	0.191	0.050
Obs.	336	336	336	336	336	336	49	75	108	104
Regions	114	114	114	114	114	114	49	75	108	104
RMSE	1.001	0.661	0.941	0.607	0.944	0.584	1.298	0.783	0.746	1.036

Notes: The Panel A includes 15 countries (AT, CZ, DE, DK, EE, ES, FI, HU, IE, IT, LU, PL, SE, SI, SK). The Panel B includes 6 countries in 1989-1993 (DE, DK, ES, FI, IT, LU), 10 countries in 1994-1999 (AT, CZ, DE, DK, ES, FI, IE, IT, LU, SE), 14 countries in 2000-2006 (AT, CZ, DE, DK, EE, ES, FI, HU, IE, IT, LU, PL, SE, SI), and 13 countries in 2007-2013 (AT, CZ, DE, DK, EE, ES, FI, HU, IT, LU, PL, SI, SK). Programming period 1 (PP1) is used as benchmark and therefore is excluded in the regressions. Significance levels are defined as follows: 10% (*), 5% (**) and 1% (***). Clustered standard errors at regional level are in parentheses.

Speed of convergence in EU regions receiving Cohesion Policy funds: Quintile 1 share of income, 1989 - 2013

	(1)	(2)	(3)	(4)
	Pooled OLS	FE	Pooled OLS	FE
Q1 initial value	-0.271*** (0.039)	-1.025*** (0.069)	-0.311*** (0.053)	-0.993*** (0.079)
dummy_t1	-1.231*** (0.373)	0.065 (0.329)	2.933 (3.119)	1.569 (2.760)
dummy_t2	-0.527*** (0.200)	0.007 (0.214)	-2.337** (0.972)	-0.804 (1.103)
dummy_t3	-0.214 (0.144)	0.165 (0.242)	-0.070 (0.849)	3.503*** (1.085)
dummy_t4	-0.038 (0.198)	0.055 (0.238)	-2.752*** (0.842)	2.626** (1.056)
dummy_t1 * Q1			-0.460 (0.361)	-0.135 (0.327)
dummy_t2 * Q1			0.218* (0.117)	0.134 (0.123)
dummy_t3 * Q1			-0.018 (0.089)	-0.369*** (0.108)
dummy_t4 * Q1			0.306*** (0.088)	-0.285** (0.111)
Constant	2.055*** (0.442)	8.984*** (0.666)	2.437*** (0.572)	8.632*** (0.771)
Time dummies	Yes	Yes	Yes	Yes
F-stat	12.24***	33.77***	12.66***	50.74***
Adj. R-Sq.	0.259	0.580	0.289	0.612
Obs.	336	336	336	336
Regions	114	114	114	114
RMSE	0.910	0.610	0.891	0.586

Notes: The sample 1989-2013 includes 15 countries (AT, CZ, DE, DK, EE, ES, FI, HU, IE, IT, LU, PL, SE, SI, SK). Significance levels are defined as follows: 10% (*), 5% (**) and 1% (***). Clustered standard errors at regional level are in parentheses.

Table A9 - Speed of convergence in different Programming Periods: Quintile 2 share of income, 1989 - 2013

	PANEL A:						PANEL B:			
	Change in Gini over all programming periods (PPs), 1989-2013						Change in Gini in each programming period (PP)			
							PP1	PP2	PP3	PP4
							1989/1993	1994/1999	2000/2006	2007/2013
	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	Pooled OLS	Pooled OLS	Pooled OLS
Q2 initial value	-0.445*** (0.082)	-1.132*** (0.110)	-0.439*** (0.078)	-1.095*** (0.113)	-0.348** (0.170)	-0.771*** (0.190)	-0.348** (0.171)	-0.384*** (0.096)	-0.396*** (0.096)	-0.546*** (0.157)
dummy_pp2			0.403*** (0.152)	0.101 (0.137)	0.905 (2.289)	3.934* (2.234)				
dummy_pp3			0.511*** (0.142)	0.256* (0.150)	1.171 (2.756)	6.743*** (2.158)				
dummy_pp4			0.103 (0.142)	-0.002 (0.149)	2.863 (3.107)	6.547*** (2.127)				
Q2 94 * dummy pp2					-0.036 (0.168)	-0.277* (0.158)				
Q2 00 * dummy pp3					-0.047 (0.200)	-0.469*** (0.154)				
Q2 07 * dummy pp4					-0.198 (0.227)	-0.471*** (0.154)				
Constant	6.072*** (1.124)	15.646*** (1.533)	5.712*** (1.064)	15.017*** (1.614)	4.445* (2.308)	10.533*** (2.665)	4.445* (2.322)	5.351*** (1.386)	5.617*** (1.348)	7.309*** (2.154)
F-stat	29.77***	105.74	10.77***	33.48***	7.04***	31.10***	4.16**	15.94***	17.05***	12.12***
Adj. R-Sq.	0.230	0.532	0.266	0.544	0.267	0.572	0.137	0.223	0.161	0.337
Obs.	336	336	336	336	336	336	49	75	108	104
Regions	114	114	114	114	114	114	49	75	108	104
RMSE	0.869	0.572	0.848	0.565	0.848	0.548	0.841	0.822	0.846	0.871

Notes: The Panel A includes 15 countries (AT, CZ, DE, DK, EE, ES, FI, HU, IE, IT, LU, PL, SE, SI, SK). The Panel B includes 6 countries in 1989-1993 (DE, DK, ES, FI, IT, LU), 10 countries in 1994-1999 (AT, CZ, DE, DK, ES, FI, IE, IT, LU, SE), 14 countries in 2000-2006 (AT, CZ, DE, DK, EE, ES, FI, HU, IE, IT, LU, PL, SE, SI), and 13 countries in 2007-2013 (AT, CZ, DE, DK, EE, ES, FI, HU, IT, LU, PL, SI, SK). Programming period 1 (PP1) is used as benchmark and therefore is excluded in the regressions. Significance levels are defined as follows: 10% (*), 5% (**) and 1% (***). Clustered standard errors at regional level are in parentheses.

Speed of convergence in EU regions receiving Cohesion Policy funds: Quintile 2 share of income, 1989 - 2013

	(1)	(2)	(3)	(4)
	Pooled OLS	FE	Pooled OLS	FE
Q2 initial value	-0.461*** (0.080)	-1.089*** (0.111)	-0.493*** (0.132)	-0.972*** (0.145)
dummy_t1	-0.838*** (0.256)	-0.467 (0.311)	4.049 (3.114)	0.760 (4.972)
dummy_t2	-0.017 (0.231)	0.062 (0.286)	-1.254 (2.522)	1.929 (2.788)
dummy_t3	-0.041 (0.163)	0.170 (0.231)	-2.586 (2.671)	5.453** (2.648)
dummy_t4	-0.119 (0.169)	-0.147 (0.227)	-1.022 (2.285)	7.634*** (2.369)
dummy_t1 * Q2			-0.368 (0.232)	-0.073 (0.371)
dummy_t2 * Q2			0.091 (0.178)	-0.127 (0.196)
dummy_t3 * Q2			0.184 (0.193)	-0.381** (0.188)
dummy_t4 * Q2			0.065 (0.169)	-0.556*** (0.168)
Constant	6.304*** (1.131)	15.099*** (1.615)	6.766*** (1.865)	13.416*** (2.092)
Time dummies	Yes	Yes	Yes	Yes
F-stat	7.60***	20.52***	7.86***	27.61***
Adj. R-Sq.	0.282	0.553	0.286	0.579
Obs.	336	336	336	336
Regions	114	114	114	114
RMSE	0.839	0.560	0.837	0.543

Notes: The sample 1989-2013 includes 15 countries (AT, CZ, DE, DK, EE, ES, FI, HU, IE, IT, LU, PL, SE, SI, SK). Significance levels are defined as follows: 10% (*), 5% (**) and 1% (***). Clustered standard errors at regional level are in parentheses.

Table A10 - Speed of convergence in different Programming Periods: Quintile 3 share of income, 1989 - 2013

	PANEL A:						PANEL B:			
	Change in Gini over all programming periods (PPs), 1989-2013						Change in Gini in each programming period (PP)			
							PP1	PP2	PP3	PP4
							1989/1993	1994/1999	2000/2006	2007/2013
	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	Pooled OLS	Pooled OLS	Pooled OLS
Q3 initial value	-0.493*** (0.092)	-1.057*** (0.132)	-0.492*** (0.092)	-1.056*** (0.130)	-0.568*** (0.215)	-1.052*** (0.154)	-0.568** (0.217)	-0.456*** (0.126)	-0.280*** (0.077)	-0.668*** (0.154)
dummy_pp2			0.005 (0.170)	-0.050 (0.143)	-2.020 (4.423)	-2.130 (4.188)				
dummy_pp3			0.013 (0.146)	-0.098 (0.161)	-5.177 (3.965)	-2.384 (4.643)				
dummy_pp4			0.025 (0.186)	0.018 (0.162)	1.820 (4.646)	3.264 (4.663)				
Q3 94 * dummy pp2					0.112 (0.246)	0.116 (0.231)				
Q3 00 * dummy pp3					0.288 (0.220)	0.128 (0.255)				
Q3 07 * dummy pp4					-0.100 (0.259)	-0.181 (0.257)				
Constant	8.798*** (1.647)	18.940*** (2.378)	8.779*** (1.631)	18.965*** (2.324)	10.141*** (3.857)	18.892*** (2.797)	10.141** (3.880)	8.121*** (2.258)	4.964*** (1.413)	11.961*** (2.760)
F-stat	28.49***	63.83	7.62***	18.15***	6.08***	37.07***	6.88**	13.04***	13.29***	18.79***
Adj. R-Sq.	0.212	0.495	0.205	0.493	0.221	0.506	0.271	0.190	0.097	0.284
Obs.	336	336	336	336	336	336	49	75	108	104
Regions	114	114	114	114	114	114	49	75	108	104
RMSE	0.924	0.636	0.928	0.637	0.919	0.629	0.928	0.834	0.786	1.086

Notes: The Panel A includes 15 countries (AT, CZ, DE, DK, EE, ES, FI, HU, IE, IT, LU, PL, SE, SI, SK). The Panel B includes 6 countries in 1989-1993 (DE, DK, ES, FI, IT, LU), 10 countries in 1994-1999 (AT, CZ, DE, DK, ES, FI, IE, IT, LU, SE), 14 countries in 2000-2006 (AT, CZ, DE, DK, EE, ES, FI, HU, IE, IT, LU, PL, SE, SI), and 13 countries in 2007-2013 (AT, CZ, DE, DK, EE, ES, FI, HU, IT, LU, PL, SI, SK). Programming period 1 (PP1) is used as benchmark and therefore is excluded in the regressions. Significance levels are defined as follows: 10% (*), 5% (**) and 1% (***). Clustered standard errors at regional level are in parentheses.

Speed of convergence in EU regions receiving Cohesion Policy funds: Quintile 3 share of income, 1989 - 2013

	(1)	(2)	(3)	(4)
	Pooled OLS	FE	Pooled OLS	FE
Q3 initial value	-0.525*** (0.093)	-1.051*** (0.124)	-0.441*** (0.116)	-0.918*** (0.182)
dummy_t1	-0.880*** (0.287)	-0.499 (0.329)	5.363 (3.298)	2.918 (3.770)
dummy_t2	-0.186 (0.195)	-0.118 (0.237)	5.380 (3.436)	5.283 (4.305)
dummy_t3	-0.131 (0.166)	0.262 (0.257)	0.246 (3.407)	6.745* (3.708)
dummy_t4	-0.138 (0.200)	-0.032 (0.200)	3.304 (2.969)	12.439*** (4.091)
dummy_t1 * Q3			-0.351* (0.181)	-0.185 (0.203)
dummy_t2 * Q3			-0.314 (0.197)	-0.299 (0.244)
dummy_t3 * Q3			-0.019 (0.188)	-0.363* (0.202)
dummy_t4 * Q3			-0.192 (0.164)	-0.704*** (0.224)
Constant	9.678*** (1.699)	19.038*** (2.278)	8.152*** (2.115)	16.620*** (3.325)
Time dummies	Yes	Yes	Yes	Yes
F-stat	4.62***	13.44***	7.17***	124.99***
Adj. R-Sq.	0.223	0.502	0.228	0.520
Obs.	336	336	336	336
Regions	114	114	114	114
RMSE	0.918	0.632	0.915	0.620

Notes: The sample 1989-2013 includes 15 countries (AT, CZ, DE, DK, EE, ES, FI, HU, IE, IT, LU, PL, SE, SI, SK). Significance levels are defined as follows: 10% (*), 5% (**) and 1% (***). Clustered standard errors at regional level are in parentheses.

Table A11 - Speed of convergence in different Programming Periods: Quintile 4 share of income, 1989 - 2013

	PANEL A:						PANEL B:			
	Change in Gini over all programming periods (PPs), 1989-2013						Change in Gini in each programming period (PP)			
							PP1	PP2	PP3	PP4
							1989/1993	1994/1999	2000/2006	2007/2013
	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	Pooled OLS	Pooled OLS	Pooled OLS
Q4 initial value	-0.795*** (0.123)	-1.109*** (0.103)	-0.803*** (0.126)	-1.125*** (0.104)	-1.092*** (0.277)	-1.429*** (0.423)	-1.092*** (0.279)	-0.464** (0.190)	-0.983*** (0.267)	-0.733*** (0.093)
dummy_pp2			-0.077 (0.143)	0.010 (0.131)	-14.539* (8.613)	-14.912 (11.516)				
dummy_pp3			-0.121 (0.161)	-0.030 (0.174)	-2.667 (8.656)	-0.682 (10.570)				
dummy_pp4			0.136 (0.183)	0.317 (0.209)	-8.118 (6.410)	-10.523 (9.820)				
Q4 94 * dummy pp2					0.629* (0.373)	0.649 (0.499)				
Q4 00 * dummy pp3					0.109 (0.377)	0.026 (0.458)				
Q4 07 * dummy pp4					0.359 (0.279)	0.473 (0.426)				
Constant	18.297*** (2.833)	25.486*** (2.357)	18.478*** (2.884)	25.747*** (2.361)	25.133*** (6.372)	32.732*** (9.753)	25.133*** (6.410)	10.595** (4.419)	22.466*** (6.102)	17.015*** (2.157)
F-stat	41.81***	116.19	13.40***	30.75***	10.24***	32.23***	15.36***	5.94**	13.60***	62.66***
Adj. R-Sq.	0.364	0.539	0.366	0.553	0.388	0.587	0.484	0.192	0.485	0.310
Obs.	336	336	336	336	336	336	49	75	108	104
Regions	114	114	114	114	114	114	49	75	108	104
RMSE	0.925	0.730	0.923	0.718	0.907	0.691	0.934	0.782	0.870	1.010

Notes: The Panel A includes 15 countries (AT, CZ, DE, DK, EE, ES, FI, HU, IE, IT, LU, PL, SE, SI, SK). The Panel B includes 6 countries in 1989-1993 (DE, DK, ES, FI, IT, LU), 10 countries in 1994-1999 (AT, CZ, DE, DK, ES, FI, IE, IT, LU, SE), 14 countries in 2000-2006 (AT, CZ, DE, DK, EE, ES, FI, HU, IE, IT, LU, PL, SE, SI), and 13 countries in 2007-2013 (AT, CZ, DE, DK, EE, ES, FI, HU, IT, LU, PL, SI, SK). Programming period 1 (PP1) is used as benchmark and therefore is excluded in the regressions. Significance levels are defined as follows: 10% (*), 5% (**) and 1% (***). Clustered standard errors at regional level are in parentheses.

Speed of convergence in EU regions receiving Cohesion Policy funds: Quintile 4 share of income, 1989 - 2013

	(1)	(2)	(3)	(4)
	Pooled OLS	FE	Pooled OLS	FE
Q4 initial value	-0.812*** (0.130)	-1.150*** (0.102)	-0.846*** (0.177)	-1.188*** (0.113)
dummy_t1	-0.071 (0.337)	-1.058* (0.540)	2.279 (11.580)	1.842 (16.361)
dummy_t2	0.437** (0.193)	-0.422 (0.383)	-4.563 (7.280)	-11.143 (7.133)
dummy_t3	-0.012 (0.175)	-0.445 (0.355)	-0.795 (5.847)	1.536 (5.247)
dummy_t4	-0.253 (0.208)	-0.630* (0.358)	-5.228 (5.615)	-2.481 (7.647)
dummy_t1 * Q4			-0.103 (0.502)	-0.126 (0.709)
dummy_t2 * Q4			0.218 (0.313)	0.467 (0.305)
dummy_t3 * Q4			0.034 (0.255)	-0.084 (0.229)
dummy_t4 * Q4			0.219 (0.244)	0.085 (0.332)
Constant	18.723*** (3.051)	26.752*** (2.420)	19.488*** (4.132)	27.626*** (2.695)
Time dummies	Yes	Yes	Yes	Yes
F-stat	12.93***	22.45***	18.64***	23.47***
Adj. R-Sq.	0.370	0.569	0.366	0.577
Obs.	336	336	336	336
Regions	114	114	114	114
RMSE	0.920	0.705	0.923	0.699

Notes: The sample 1989-2013 includes 15 countries (AT, CZ, DE, DK, EE, ES, FI, HU, IE, IT, LU, PL, SE, SI, SK). Significance levels are defined as follows: 10% (*), 5% (**) and 1% (***). Clustered standard errors at regional level are in parentheses.

Table A12 - Speed of convergence in different Programming Periods: Quintile 5 share of income, 1989 - 2013

	PANEL A:						PANEL B:			
	Change in Gini over all programming periods (PPs), 1989-2013						Change in Gini in each programming period (PP)			
							PP1	PP2	PP3	PP4
							1989/1993	1994/1999	2000/2006	2007/2013
	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	FE	Pooled OLS	Pooled OLS	Pooled OLS	Pooled OLS
Q5 initial value	-0.363*** (0.073)	-1.170*** (0.096)	-0.354*** (0.068)	-1.174*** (0.094)	-0.426** (0.182)	-1.086*** (0.158)	-0.426** (0.183)	-0.303*** (0.083)	-0.393*** (0.098)	-0.330*** (0.080)
dummy_pp2			-0.971** (0.485)	0.187 (0.314)	-5.409 (5.347)	-0.872 (4.262)				
dummy_pp3			-1.295*** (0.421)	0.017 (0.306)	-2.486 (6.149)	5.402 (5.817)				
dummy_pp4			-0.355 (0.459)	0.437 (0.355)	-3.834 (6.457)	7.539 (5.562)				
Q5 94 * dummy pp2					0.123 (0.149)	0.028 (0.115)				
Q5 00 * dummy pp3					0.034 (0.172)	-0.149 (0.157)				
Q5 07 * dummy pp4					0.097 (0.180)	-0.197 (0.151)				
Constant	13.593*** (2.605)	42.880*** (3.470)	14.008*** (2.543)	42.812*** (3.380)	16.609** (6.562)	39.658*** (5.754)	16.609** (6.600)	11.200*** (2.945)	14.123*** (3.480)	12.775*** (2.874)
F-stat	25.01***	149.65	8.65***	41.00***	6.52***	26.83***	5.41**	13.47***	16.17***	16.78***
Adj. R-Sq.	0.183	0.609	0.215	0.611	0.211	0.619	0.124	0.180	0.214	0.172
Obs.	336	336	336	336	336	336	49	75	108	104
Regions	114	114	114	114	114	114	49	75	108	104
RMSE	2.235	1.414	2.191	1.409	2.197	1.394	2.753	1.964	2.154	2.109

Notes: The Panel A includes 15 countries (AT, CZ, DE, DK, EE, ES, FI, HU, IE, IT, LU, PL, SE, SI, SK). The Panel B includes 6 countries in 1989-1993 (DE, DK, ES, FI, IT, LU), 10 countries in 1994-1999 (AT, CZ, DE, DK, ES, FI, IE, IT, LU, SE), 14 countries in 2000-2006 (AT, CZ, DE, DK, EE, ES, FI, HU, IE, IT, LU, PL, SE, SI), and 13 countries in 2007-2013 (AT, CZ, DE, DK, EE, ES, FI, HU, IT, LU, PL, SI, SK). Programming period 1 (PP1) is used as benchmark and therefore is excluded in the regressions. Significance levels are defined as follows: 10% (*), 5% (**) and 1% (***). Clustered standard errors at regional level are in parentheses.

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	(1)	(2)	(3)	(4)
	Pooled OLS	FE	Pooled OLS	FE
Q5 initial value	-0.382*** (0.067)	-1.162*** (0.095)	-0.402*** (0.092)	-1.025*** (0.126)
dummy_t1	2.867*** (0.815)	1.704** (0.774)	23.636*** (8.439)	26.634*** (8.994)
dummy_t2	0.185 (0.469)	0.459 (0.466)	-0.261 (5.650)	3.330 (5.482)
dummy_t3	0.325 (0.440)	-0.228 (0.515)	-3.033 (4.225)	13.726*** (4.706)
dummy_t4	0.302 (0.404)	0.745 (0.552)	-5.708 (4.100)	17.021*** (5.266)
dummy_t1 * Q5			-0.560** (0.233)	-0.691*** (0.237)
dummy_t2 * Q5			0.013 (0.149)	-0.093 (0.143)
dummy_t3 * Q5			0.092 (0.120)	-0.386*** (0.131)
dummy_t4 * Q5			0.164 (0.114)	-0.450*** (0.144)
Constant	14.037*** (2.354)	41.762*** (3.456)	14.732*** (3.234)	37.052*** (4.512)
Time dummies	Yes	Yes	Yes	Yes
F-stat	6.35***	31.23***	8.04***	38.80***
Adj. R-Sq.	0.253	0.626	0.267	0.652
Obs.	336	336	336	336
Regions	114	114	114	114
RMSE	2.138	1.383	2.117	1.333

Notes: The sample 1989-2013 includes 15 countries (AT, CZ, DE, DK, EE, ES, FI, HU, IE, IT, LU, PL, SE, SI, SK). Significance levels are defined as follows: 10% (*), 5% (**) and 1% (***). Clustered standard errors at regional level are in parentheses.