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Income Inequality, Urban Size and Economic Growth in OECD Regions

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INCOME INEQUALITY, URBAN SIZE AND ECONOMIC GROWTH IN OECD REGIONS

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The purpose of this paper is to understand how income inequality is associated with economic growth in OECD regions and whether the degree and type of urban concentration affects this relationship. Both income inequality and urban concentration can be seen as patterns of resource allocation that are particularly interlinked at the regional level. We combine household survey data and macroeconomic databases, covering a period ranging from 2004 to 2012 for comparable regions in 15 OECD countries. Econometric results show that, at least for the short period under consideration, there is a general negative association between inequalities and economic growth, especially since the start of the economic crisis. This relationship is sensitive to the type of urban structure. Higher inequalities seem to be more detrimental for growth in large cities, while regions characterised by small cities and rural areas are less affected.[1]

JEL classification: R11, R12, O15.

Keywords: Inequality, economic growth, urban, OECD regions.

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1. This paper uses authors' estimates of income distribution based on data provide by national institutes of statistics. Indicators are based on a number of household surveys (the Eurostat's 2004-2012 European Survey on Income and Living Conditions –EU-SILC – for most European countries; the Encuesta de Caracterización Socioeconómica Nacional – CASEN – for Chile; the Encuesta Nacional de Ingreso y Gastos de los Hogares (ENIGH) for Mexico; the Current Population Survey (CPS) for the United States; the Survey of Labour and Income Dynamics (SLID) for Canada; and the Korean Labour & Income Panel Study (KLIPS) for Korea. Authors used the OECD Income Distribution Database when data were not publicly available. Errors in the interpretation of the data or in the calculations from micro-data, and the responsibility for all conclusions drawn from the data lie entirely with the authors.

This work was undertaken in the context of the OECD project "How's life in your region: Measuring regional and local well-being for policy making" carried out by the OECD Public Governance and Territorial Development under the guidance of the Working Party on Territorial Indicators (WPTI). WPTI Delegates are kindly acknowledged for their comments.

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INCOME INEQUALITY, URBAN SIZE AND ECONOMIC GROWTH IN OECD REGIONS

1. Introduction

Since the start of the economic crisis of the late 2000s, increasing concerns have emerged in most developed countries on the distributional effect of the crisis and on those of the recovery. In most OECD countries, the gap between rich and poor has widened and growth in GDP per capita has not fully trickled down to household incomes (OECD, 2011). Several authors have emphasised the role of the current crisis on the increasing inequality (Krugman, 2008; Stiglitz, 2009; Brescia, 2010; Rajan, 2010; OECD, 2014a). Such an increase can have economic implications, since growth does not automatically benefit all sectors of society. Recent evidence shows that income inequality, especially when driven by the gap between low-income earners and the rest of the population, is associated with lower social mobility through lower investment in human capital (Cingano, 2014). Others distinguish between equality of opportunities and equality of outcomes as two parallel and differentiated components of inequality (World Bank, 2006), or between structural and market inequality (Easterly, 2007), with the latter having an expected positive effect on economic growth.

Understanding how inequality affects economic growth has been attracting growing interest by both scholars and policy makers. Notwithstanding a vast theoretical and empirical literature on this topic, results are still inconclusive. The literature has analysed different transmission channels of inequality on economic growth, some of them negative (socio-political instability, political economy issues, credit-market imperfections, market size and fertility) and others positive (higher aggregate savings, investment indivisibilities and incentives promotion) (Neves and Silva, 2014). Empirically, differences in estimation methods, length of the time horizon, data quality and sample coverage substantially affect the magnitude of the estimated effect of income inequality on economic growth (De Dominicis et al., 2008).

The goal of achieving economic growth that benefits the largest possible number of people has been made increasingly explicit in recent years. This is reflected, for example, in the European Union's 2020 Strategy or by the Inclusive Growth Initiative of the OECD (OECD/The World Bank, 2012). Achieving inclusive growth also requires the benefits of development to be shared across all regions. Material conditions and quality of life can be remarkably different across space while, at the same time, local conditions can affect individual opportunities, especially for young people. Recent OECD work has provided evidence of large disparities in socio-economic conditions across regions, highlighting that regions do not simultaneously enjoy high or low performance in all well-being dimensions in any country (OECD, 2014b). Thus, developing metrics of inequalities at sub-national level and advancing the understanding of the role of inequalities for regional economic growth can be useful in designing more effective policies to improve individuals' well-being.

There are several reasons why considering the inequality-growth relationship at regional or sub-national level is relevant. First, empirical analyses at regional level can reduce the bias due to omitted variables and mitigate issues of incomparability across countries by focusing on smaller spatial entities, which better reflect the actual conditions where people live. The use of regional data also helps to magnify how small disparities in initial conditions affect economic growth (Partridge, 2005) and it allows to better account for the patterns of urban agglomeration. Such patterns are certainly linked to inequalities through, among others, mechanisms of sorting of the most talented individuals, selection of the most productive firms and agglomeration advantages taking place in cities (Behrens et al., 2014). Finally, the mechanisms underlying the link between inequality and economic growth as well as the possible policy options can have a different relevance at the regional scale than at the national one. For example, income redistributive

taxes are for a large part defined at the national level (political economy channel), while other factors connected with living conditions (e.g. crime) are likely to be more important at the local level. Both aspects can affect inequality as well as economic performance, but they are not likely to play the same role at the national level as they do at the regional level.

The purpose of this paper is to provide new empirical evidence on the relationship between income inequalities and economic growth in OECD regions. The analysis is carried out on a panel of comparable regions from 15 different OECD countries covering three continents over the period between 2004 and 2012. To our knowledge, only a few other works have tried to understand such a relationship at the regional scale, in large part because of data constraints. Most of these works refer to regions within a single country, especially the United States (Fallah and Partridge, 2007; Frank, 2009; Janikas and Rey, 2008; Panizza, 2002; Partridge, 1997, 2005, 2006), although some analyses were done for a set of European regions (Ezcurra, 2010; Perugini and Martino, 2008; Rodríguez-Pose and Tselios, 2010; Rooth and Stenberg, 2012).

This paper also focuses on the role of urbanisation as a potential transmission channel of inequality on economic growth, by using a consistent economic definition of cities applied to the countries under analysis. The use of such a definition of cities is another novel aspect of this study; it helps identify the extent of urbanisation within regions while at the same time limiting the bias introduced by different administrative definitions across countries. The main findings show that inequality and economic growth are negatively associated, especially when differences between continents are accounted for. This negative relationship has been particularly evident since the start of the economic crisis, suggesting that more inclusive societies might help regional resilience to economic shocks. Moreover, we found that the link between inequality and growth is affected by urban size. Inequalities are, on average, higher in larger cities. And, for the period under analysis, the negative link between inequality and growth becomes larger in magnitude with city size.

Section 2 provides the rationale for analysing the relationship between inequality and growth at the sub-national level. It also reviews, drawing from the existing literature, the mechanisms through which inequality can affect economic growth. Section 3 presents the empirical model and the data description, while section 4 presents the main results. Finally, section 5 provides some concluding remarks.

2. Theoretical arguments and empirical findings: A view from the literature

The way that inequality may affect economic growth has attracted much attention in academic research. Comprehensive overviews of theories and empirical evidence on such a relationship are provided by Ehrhart (2009) and Galor (2009), while a more recent critical survey of the empirical works is provided by Neves and Silva (2014). The bulk of this literature is devoted to an analysis of the inequality-growth relationship at the national level, but only a few studies have tried to understand such a relationship at the regional or, more generally, sub-national level. However, there are specific reasons why a regional perspective is relevant. First, what individuals perceive and how they behave as citizens and economic agents are likely to be affected, at least partially, by local conditions. The socio-economic characteristics of the place and of the communities where individuals actually live can have an important role in shaping the opportunities available and the incentives for individuals and firms to take decisions yielding different economic outcomes. Investment in human capital, for example, can be shaped by different local conditions, including life expectancy (Rodríguez-Pose and Tselios, 2010), which in turn can be very different across regions and groups of people. For example, the difference between the best and the worst performing OECD region in terms of life expectancy is 15 years, more than double that among countries. Within the United States, such a difference is six years (OECD, 2014b).

Regarding the main mechanisms underlying the relationship between inequality and economic growth with a specific regional focus, it is worth acknowledging that no general theory – nor empirical evidence – exist that identify a stable and clear relationship between inequality and growth. Recent evidence at the national level shows that while in the short run a positive relationship predominates, in the long run the reverse is observed (Halter et al., 2014). Table 1 summarises several arguments that have been put forth to uncover the mechanisms underlying such a complex relationship. Some of these mechanisms act as growth-enhancing factors, while others act as growth-hindering ones.

Table 1. Mechanisms underlying the relationship between income inequality and economic growth

Inequality as a growth-enhancing factor	Inequality as a growth-hindering factor
Accumulation of physical and human capital	
Higher physical capital investment (rich people have higher saving rates) (Barro, 2000; Dynan et al., 2004; Kaldor, 1957)	Lower human capital accumulation, under credit market imperfections (Bénabou, 2002; Galor and Zeira, 1993; Easterly, 2001)
Economic incentives	
Higher incentives for competition and risk taking (Rebelo, 1991; Voitchovsky, 2005)	Lower incentives to borrow (Aghion et al., 1999a)
Political economy arguments	
Higher wealth can induce less effort in the presence of market imperfections due to moral hazard (Aghion et al., 1999a) Higher taxes allow investment in public education and health (Aghion and Bolton, 1990; Saint-Paul and Verdier, 1993)	Voters opt for higher taxation and redistribution, decreasing incentives to invest and reducing growth (Alesina and Rodrik, 1994; Persson and Tabellini, 1994)
Political and macroeconomic instability	
	Higher political instability creates uncertainty and reduces investment, hindering economic growth (Alesina and Perotti, 1996)
Demand-side dynamics	
Dynamic price effect (higher income people may be more willing to pay for new goods, stimulating investment and innovation) (Bertola et al., 2006)	Market size effect (fewer consumers can afford to buy new goods) (Bertola et al., 2006)

Accumulation of physical and human capital. Two different theoretical traditions provide conflicting views on the direction of the inequality-growth relationship, based on the role it gives to physical and human capital accumulation in the process of development. These two approaches might be called the classical approach and the modern paradigm, respectively (Galor, 2000).

The classical approach suggests that saving rates increase with wealth and that wealthier people have a higher *marginal* propensity to save (Kaldor, 1957; Dynan et al., 2004). This implies that in a system where resources are more concentrated among individuals, aggregate investment in physical capital will be relatively higher, fostering economic growth (Barro, 2000).

The modern paradigm, on the other hand, focuses on the role of human capital accumulation rather than on investment in physical capital, the former being the major driver of growth in developed economies (Galor and Moav, 2004). The increased importance of human capital accumulation in later stages of development reverses the link between inequality and growth. As human capital is by definition embedded in individuals, its whole stock will be larger if more people invest in its accumulation. More equal societies give people greater opportunities to invest in human capital because of imperfections in the financial and credit markets that prevent worse-off individuals from carrying out such costly investments (Galor and Zeira, 1993; Bénabou, 2002). In this view, more equal societies can be seen as opportunity-enhancing ones, given the decreasing returns of investment in education at the individual level and the fact that households' wealth is a major determinant of such investments. Recent empirical analyses at the national level further support the idea that the negative relationship between inequality and growth might be driven by obstacles to human capital accumulation (Cingano, 2014). Other evidence from developed countries shows that increases in income inequality are negatively associated with intergenerational earning mobility, which in turn yields greater polarisation in educational and health outcomes (Causa and Johansson, 2009). In addition, higher income inequalities were found to slow skill development among individuals whose parents come from a poorer background, while they did not affect that of individuals with a richer background (OECD, 2014a). These findings suggest that inequality is more likely to harm economic growth when such inequality is driven by the lower part of the distribution, meaning that the lower and middle classes lag behind and lose opportunities (Cingano, 2014).

Compared with countries, regions are much more open economies. Capital and labour – particularly a highly educated workforce – can move across regions at a lower cost and tend to move to places where they can enjoy higher returns. Cities and metropolitan areas certainly have an advantage in attracting capital and labour, thanks to more efficient provision of public services (due to economies of scale) and agglomeration economies. In principle, perfectly mobile production factors should yield, in equilibrium, an optimal allocation of resources with no spatial inequalities. However, even in the presence of perfect factor mobility, differences in initial factor endowments, sectoral specialisation and agglomerations externalities can actually widen inter-regional disparities (Rice and Venables, 2003). More specifically, an initial higher specialisation in sectors requiring more high-skilled workers can attract further high-skilled labour and increase the gap in earnings. As a result, it may turn out that factor mobility increases income inequalities in relatively rich regions, while reducing those in worse-off ones (Perugini and Martino, 2008). This might determine the co-existence of a positive relationship between inequality and growth at regional level with a negative relationship at the country level (Fallah and Partridge, 2007).

Economic incentives. A common hypothesis among economists is that inequalities are growth-enhancing by encouraging competition and investment. Societies where ability is rewarded stimulate individual effort, productivity and risk taking (Voitchovsky, 2005: 276). These economic incentives can also affect the accumulation of human capital and the effort to seize the returns of skills. However, while positive incentives can work along the whole income distribution, those for workers with very low wages can be counterbalanced by feelings of unfairness (Akerlof and Yellen, 1990). Borrowers may also tend to invest less effort if such effort is unobservable (Aghion et al., 1999a). As above, these incentives may be larger in large cities, which enjoy agglomeration economies and where the most talented individuals tend to sort (Behrens et al., 2014).

Political economy. Inequalities might negatively affect economic growth through an effect on taxation. This idea was put forward by Persson and Tabellini (1994) and Alesina and Rodrik (1994), who argued that in relatively more unequal societies, people would vote for higher taxation and redistribution. Higher taxation has a negative effect on the incentives to invest, which, in turn, negatively affects economic growth. This idea is supported by the negative correlation often found in cross-sectional regressions at the country level between initial income inequality and subsequent economic growth.

However, the political economy argument under which higher redistribution generates lower growth is not fully supported by empirical evidence. Aghion et al. (1999a) demonstrated that in the presence of *ex-ante* moral hazard and imperfections in the credit market, greater inequality reduces aggregate incentives to wealth accumulation, since individuals' efforts decrease their wealth. Political economy arguments are expected to be much less important when focusing on regions, given the weaker tax-redistribution mechanisms usually available at sub-national level (Partridge, 1997; Panizza, 2002). On the contrary, social expenses and public services are usually provided locally. If this redistributive channel were applied favouring education and the accumulation of human capital, a positive impact on long-run growth could be expected (Aghion and Bolton, 1990; Saint-Paul and Verdier, 1993).

Political and macroeconomic instability. Another channel through which inequalities can affect economic growth is political instability. Alesina and Perotti (1996) provided cross-country evidence that income inequalities, through the generation of social discontent, generate higher political instability, which in turn yields lower investment and hence lower economic growth. Macroeconomic instability can be generated by inequalities in the access to investments, under the hypothesis of credit-market imperfections. The idea is that higher inequality might imply that only a small fraction of the population has the possibility to invest (Aghion et al., 1999b). At the regional level, this channel would play a role through higher crime rates rather than institutional instability.

Demand-side dynamics. On the demand side and in the short run, the link between inequalities and growth depends on the balance between two different effects: the market size and the dynamic price effect. The idea is that, in a short time horizon, innovation is affected by the demand for new products. The latter require innovation, which in turn drives economic growth. In a more equal society, more individuals will be able to buy a new product, hence stimulating innovation by firms and generating economic growth. However, the richest individuals have a higher willingness to pay for new goods and the higher price that can be applied by monopolistic producers can stimulate further innovation and growth (Bertola et al., 2006).

3. Data and facts

Income inequality within regions

Our data set includes 214 TL2 regions[2] from 15 OECD countries, of which ten are European (Belgium, Czech Republic, Estonia, Finland, France, Greece, Italy, Luxemburg, Spain and the United Kingdom), four American (Canada, Chile, Mexico and the United States) and one Asian (South Korea). Indicators of inequality at regional level were computed using micro-data from household income surveys publicly available or made available through the OECD Income Distribution Database, following the method applied by Piacentini (2014). Details on the data sources are provided in Annex 1. For reasons of robustness, inequalities within regions were computed using several indicators related to equivalised household annual disposable income: the Gini Index, the top-bottom quintile ratio (*p80-20*), the top-bottom decile ratio (*p90-10*), the bottom decile ratio (*p50-10*), the top decile ratio (*p90-50*), and the relative poverty rate using two alternative poverty lines, at 40% and at 60% of the median income. In general, our analysis uses the 2004-2012 income reference period. In particular, we have selected four time points: 2004, 2007, 2010 and 2012, with some adjustments due to data availability in the case of Chile and Mexico. For two countries, Korea and the United Kingdom, it was not possible to cover all the time points, but only three and two, respectively. Lastly, we used three-year averages of inequality measures for the

[2] TL2 regions are the higher level of OECD regions, which correspond in most cases to the principal sub-national unit of government (states or provinces).

United States in order to increase the precision of the estimates due to relatively small sample sizes at the state level from the Current Population Survey.

A set of control variables was included to account for socio-economic and institutional factors that can have a role for regional economic growth. These factors include the degree and type of urban concentration, demographic (e.g. age structure) and institutional/cultural characteristics (religion, as in Rodríguez-Pose and Tselios, 2010 and Rodríguez-Pose, 2013), education, the sectoral composition of the economy and labour market characteristics. Definitions and sources for all of the variables can be found in Annex 2. Urban concentration was measured through the share of regional population living in cities, accounting for the size of the latter. More specifically, three classes of urban size were considered: less than 500,000 inhabitants, between 500,000 and 1.5 million inhabitants and beyond 1.5 million. Urban boundaries and population were identified according to the OECD definition of functional urban areas (FUAs) which are consistently identified in 29 OECD countries on the basis of population density and commuting flows (OECD, 2012).

On the whole, no dramatic changes in income inequality within regions occurred between 2004 and 2012. Figures 1 and 2 show the main trends of regional inequality in the 15 OECD countries considered. None of the indicators display a strong variation, as most of the points are close to the bisector of the plot, which represents the *status quo* over time. Thus, over the last years, both increasing and decreasing inequality are observed within regions, an aspect that is confirmed by the evolution of the Gini Index reported in Table 2. Nevertheless, a slightly decreasing trend can be observed until 2010, which then started increasing during the Great Recession. Table 3 summarises the basic statistics of the income distribution indicators and of the other variables considered in the remainder of this analysis. The variability of each indicator was broken down into between and within the standard deviation, reflecting the variation between regions and over time, respectively. Given the short period under consideration, most of the variation in inequality measures is due to cross-sectional differences, being the variation in time much smaller. This result is similar to other variables, with the exception of the ones the most affected by the business cycle, such as the unemployment rate or the relative share of the construction sector in terms of gross value added.

Table 2. Gini Index statistics

Year	Observations	Mean	Standard deviation	Minimum	Maximum
2004	196	0.364	0.075	0.217	0.546
2007	197	0.359	0.078	0.214	0.523
2010	209	0.355	0.068	0.227	0.529
2012	203	0.359	0.070	0.224	0.513

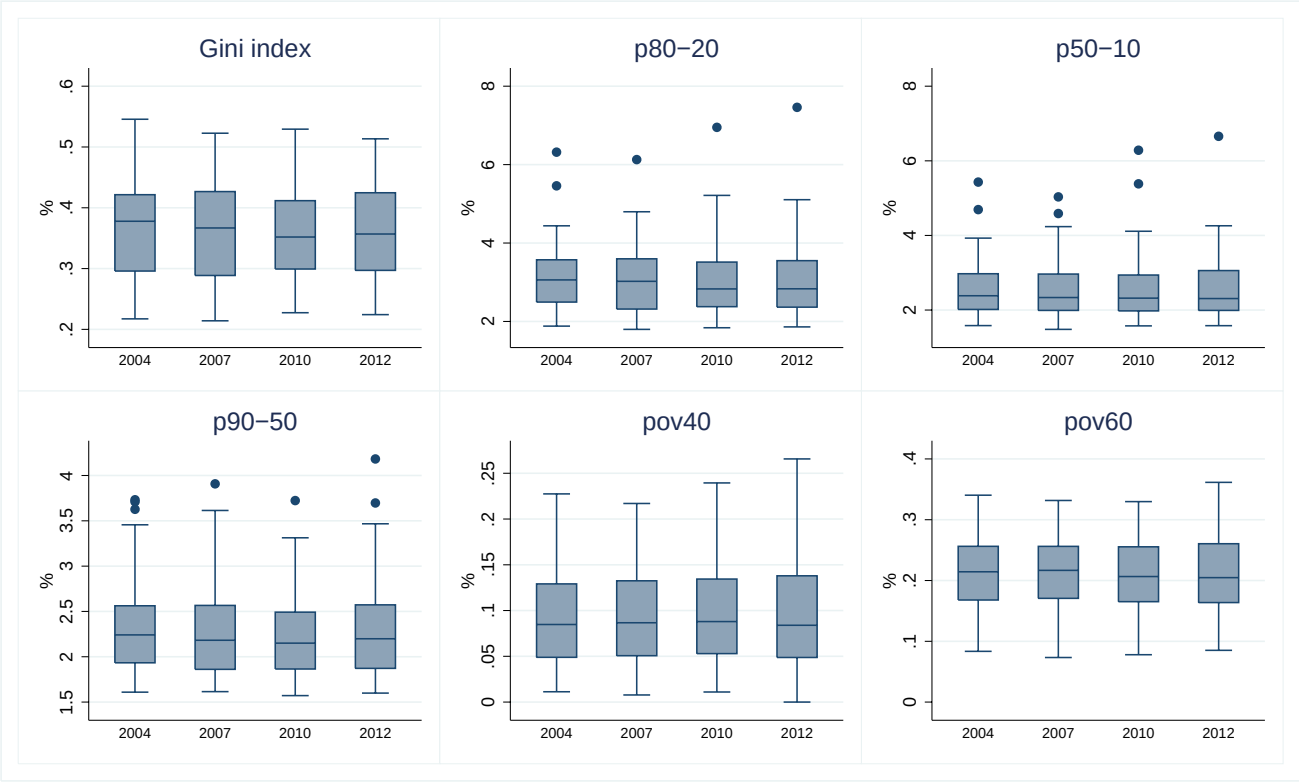
Source: Authors' elaboration based on national income household surveys.

Table 3. Data descriptive statistics

		Standard deviation					Number of
	Mean	Overall	Between	Within	Minimum	Maximum	regions
Total population	3,551,698	4,292,552	4,289,136	317,815	25,392	38,041,430	214
GDP per capita (in scale)	10.146	0.543	0.569	0.099	8.274	11.957	214
Two-year GDP growth rate	0.021	0.035	0.018	0.031	-0.179	0.206	214
Two-year GDP per capita growth rate	0.012	0.035	0.017	0.030	-0.189	0.187	214
Gini Index	0.359	0.073	0.070	0.018	0.214	0.546	209
p80-20	3.026	0.778	0.748	0.202	1.798	7.461	209
p90-10	5.815	2.342	2.253	0.605	2.587	20.819	209
p90-50	2.252	0.444	0.414	0.149	1.571	4.128	209
p50-10	2.521	0.683	0.654	0.197	1.483	6.658	209
pov40	0.092	0.049	0.047	0.014	0.000	0.266	209
pov60	0.209	0.057	0.053	0.018	0.073	0.361	209
Urbanisation	0.579	0.212	0.212	0.015	0.076	1.163	203
Religion diversity	1.530	0.376	0.367	0.084	1.062	2.948	214
Agriculture share	0.032	0.030	0.029	0.008	0.000	0.260	198
Industry share	0.203	0.104	0.103	0.022	0.015	0.871	199
Construction share	0.068	0.027	0.025	0.011	0.009	0.177	199
Education share in lower levels	31.46	18.47	18.34	3.93	2.86	82.54	211
Education share in average levels	44.84	17.41	17.21	2.66	7.16	82.71	211
Education share in high levels	23.15	7.81	7.17	3.00	6.9	54.11	211
Elderly rate	20.12	7.76	7.66	1.31	3.55	43.93	214
Unemployment rate	7.51	4.86	4.04	2.70	0.24	38.55	214
Voters	66.91	13.62	12.39	5.31	31.00	94.00	214
Murder rate (homicides per 100 000 inhabitants)	50.84	83.63	62.33	50.93	0.00	1,214.16	214

Source: Authors' elaboration based on national household income surveys, various years. Sources and definitions of the variables are displayed in Annex 2.

Figure 1: Indicators of inequality within OECD regions: Distributional changes over time (2004-2012)

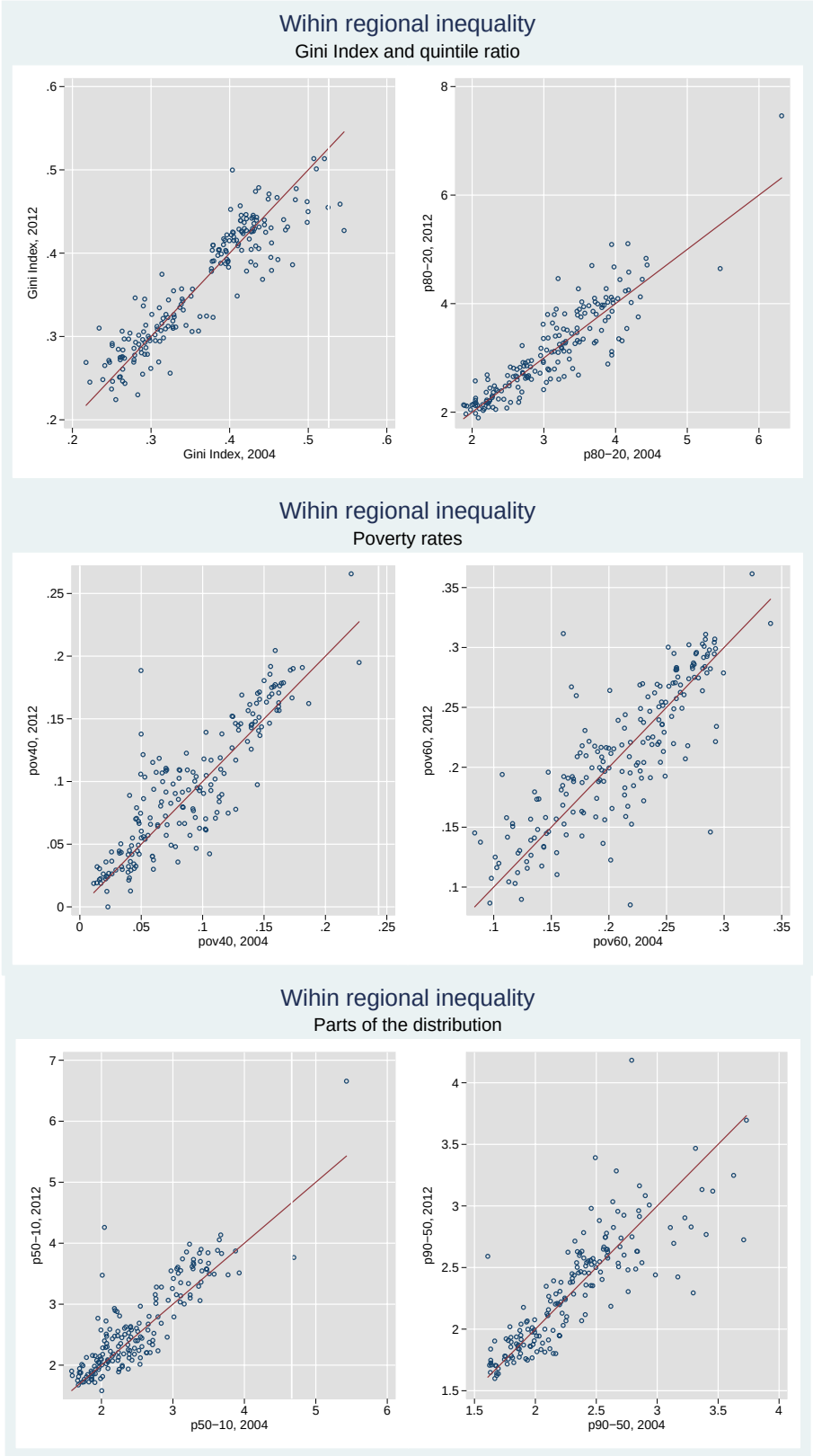


Source: Authors' elaboration based on national household income surveys, various years.

Inequality and economic growth

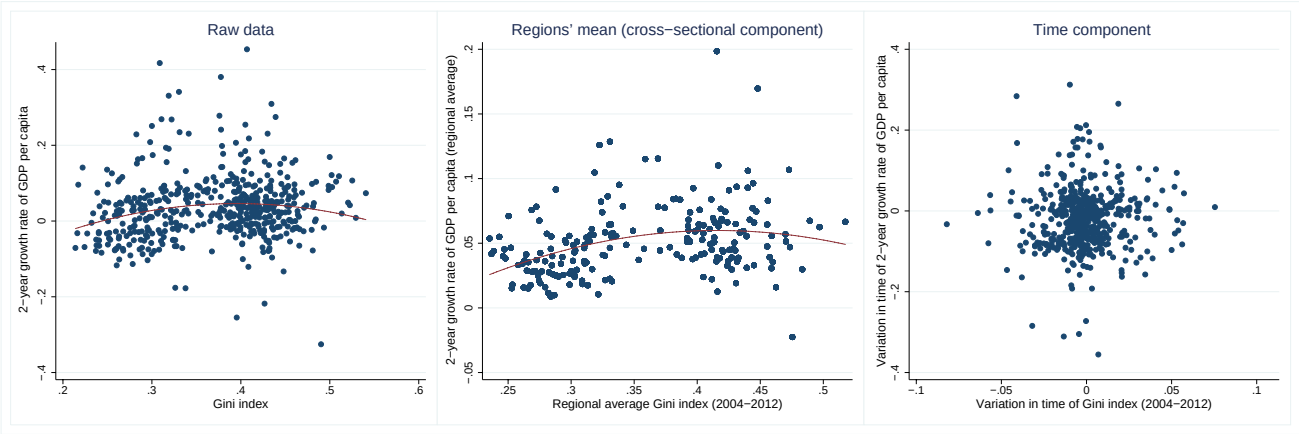
The strong decline in economic growth rates subsequent to the Great Recession has been heterogeneous across regions and countries (OECD, 2013). In order to provide a first overall picture on how regions with higher or lower levels of inequality have experienced higher or lower economic growth rates, Figure 3 plots the relationships between a measure of income inequality (Gini Index) and the two-year growth rate of GDP per capita in constant PPP dollars (Annex 3 displays the same relationship by using the remaining inequality indicators). Figure 3 represents this relationship from three different angles: using raw data (left panel); considering every region's mean (middle panel), which highlights cross-sectional variation; and, finally, considering region demeaned data (right panel), which only reports variations in time. While the time dimension does not reveal particularly striking patterns, the cross-sectional variation suggests either an inverse U-shaped pattern or a bi-modal one.

Figure 2. Change over time of income inequality within OECD regions (2004-2012)



Source: Authors' elaboration based on national household income surveys, various years.

Figure 3. Inequality (Gini Index) and GDP per capita growth: Cross-sectional and time components, OECD regions



Source: Authors' elaboration based on national household income surveys, various years.

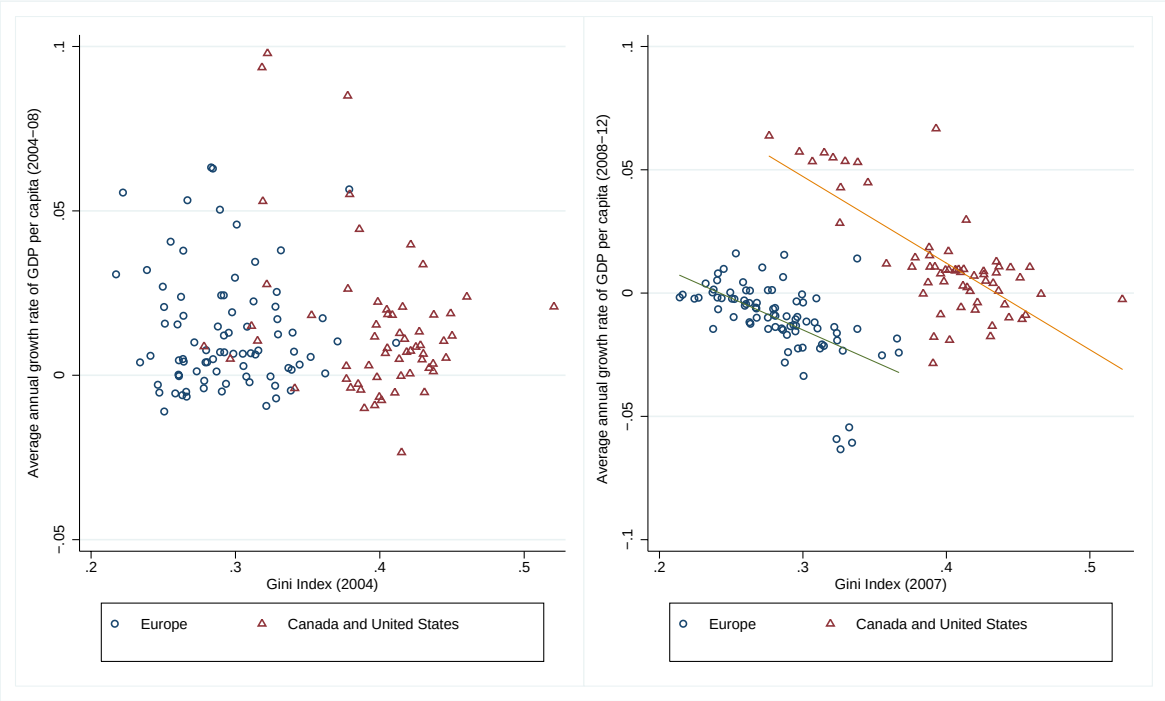
The raw correlation between economic growth and inequality is slightly positive (Table 4). This is more evident when the top decile ratio indicator is considered as a measure of inequality and it should be viewed together with recent findings which show that the increase of inequality during the crisis was mainly characterised by increasing wage differentials, with increases in the richest 10% earners over the poorest 10% earners ratio (Cingano, 2014). However, the sign of the correlations changed when controlling for regions and time-fixed effects (Table 4). A closer look at the data shows that, in OECD regions, the relationship between inequality and growth seems to have changed in the periods before and after the economic crisis (Figure 4). In addition, strong macro-regional patterns emerge. By considering European and North American regions separately, it emerges more clearly that after the crisis more unequal regions grew relatively slower.

Table 4. Correlation coefficients between GDP and GDP per capita growth and inequality

	Gini Index	p80-20	p50-10	p90-50	pov60	pov40
			Raw data			
GDP growth	**0.117**	**0.101**	0.052	**0.143**	0.061	0.054
GDP per capita growth	0.050	0.058	0.044	**0.073**	0.023	0.040
			Adjusted data			
GDP growth	-0.011	-0.026	**-0.091**	-0.001	-0.034	-0.063
GDP per capita growth	0.002	-0.025	**-0.078**	0.004	-0.033	-0.047
Observations	597	588	587	588	597	597

Note: Bolded correlations are significant. Adjusted data controls for region and time-fixed effects.

Figure 4. Income inequality and growth of GDP per capita: Pre- and post-crisis



Source: Authors' elaboration based on national household income surveys and on the OECD Regional database.

The role of urban concentration

Urbanisation and income inequality can be interpreted as the concentration of human and physical capital in the process of development (Castells-Quintana and Royuela, 2014). By determining the allocation of resources across space and individuals, the interaction between urbanisation and inequality is therefore expected to have implications in terms of economic growth. The first step to enlightening this issue is to assess the levels of inequality in regions by distinguishing the type and size of urban settlements. Urban population was identified using the OECD functional urban areas (FUAs), which allows urban population within regions to be identified according to a consistent economic definition of city. Detailed explanations of this method are provided by OECD (2012). The idea is that FUAs are defined by first looking at high-density places (urban cores) through a 1 km^2 global population grid and then by adding to the cores the surrounding territories that are connected to them through commuting flows. The use of a consistent definition of city across countries, based on functional criteria, is a relevant contribution of this study since it helps assess the extent of urban concentration within a region without relying on countries' existing administrative definitions of cities, which can be very different across countries and introduce biases in the analysis.

By matching regional (TL2) and urban (FUAs) boundaries it is possible to compute the share of urban population in each region by size of cities. In this respect, regions were classified in three groups: 88 regions where the largest urbanisation share is observed in smaller cities (less than 500,000 inhabitants), 63 in medium-sized cities (between 500,000 and 1.5 million inhabitants) and 53 in large cities (more than 1.5 million inhabitants). On the whole, inequalities are smaller the lower the size of cities, though a large heterogeneity emerges (Figure 5). More specifically, inequalities are, on average, higher in regions where the largest proportion of people lives in cities with more than 1.5 million inhabitants. This general evidence is robust to the use of several indicators of inequality, as reported in Table 5. Differences are particularly strong for poverty rates and for the bottom decile ratio (p50-10).

Figure 5. Income inequality by urban size, OECD regions (2004-2012)

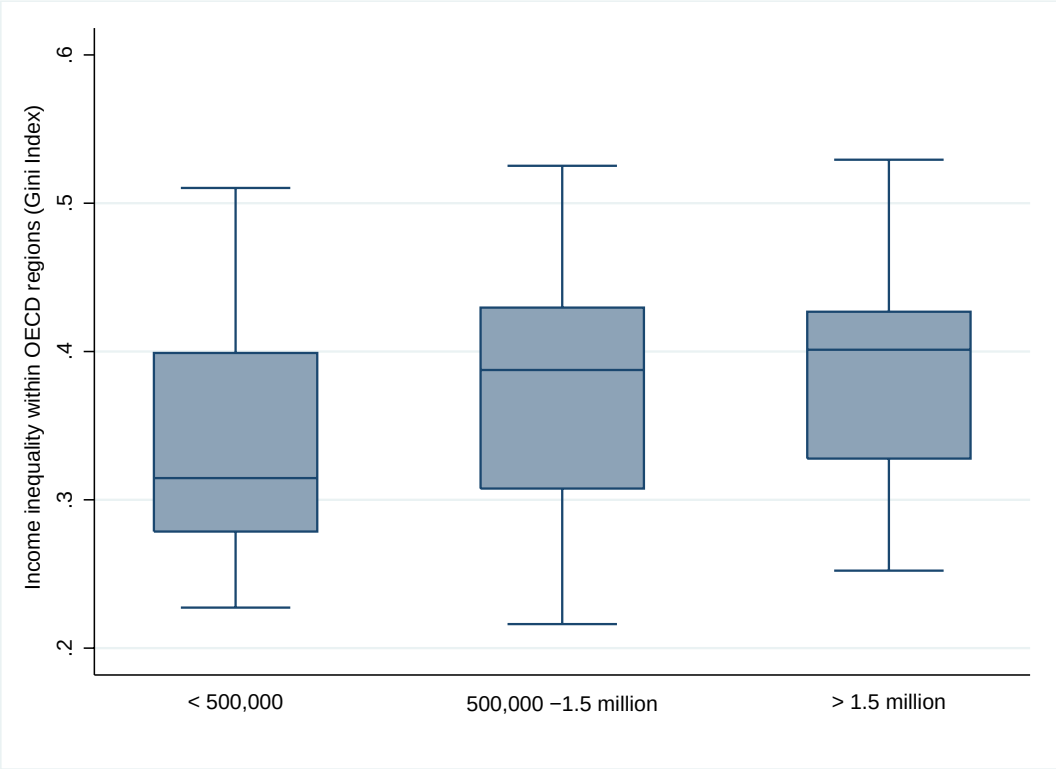


Table 5. Correlation between inequality and urbanisation rates

	Gini Index	p80-20	p90-10	p90-50	p50-10	pov40	pov60
Share of people living in FUAs of small size (<500,000)	**-0.163**	**-0.160**	**-0.155**	**-0.123**	**-0.127**	**-0.132**	**-0.135**
Share of people living in FUAs of medium size (500,000-1.5 million	**0.086**	0.033	0.030	-0.012	**0.098**	0.013	-0.001
Share of people living in FUAs of large size (>1.5 million)	**0.186**	**0.224**	**0.239**	**0.228**	**0.144**	**0.190**	**0.198**
Share of regional population living in FUAs (regardless of size)	**0.168**	**0.169**	**0.191**	**0.166**	**0.161**	**0.132**	**0.126**

Note: Bold numbers report significant correlations at 10%.

Several arguments can be put forward as a possible interpretation. First, more talented individuals tend to sort in large cities, where the returns to talent are higher and where there are more productive firms paying higher wages (Behrens et al., 2014). Second, agglomeration economies, reflected by urban size, can be source of additional wage premia, increasing in turn the level of inequalities. And finally, as proposed in the classic Harris and Todaro (1970) model, the expected income of a potential immigrant depends on the probability of finding a job, which is more likely to happen in expanding cities. Nevertheless, it can be the case that the inflow of workers in the urban sector exceeds urban labour demand, even when accompanied by growth of urban employment, which is the so-called Todaro paradox. This situation results in increasing unemployment in cities, which in turn increases inequality. This result, usually posed in rural-urban migration models, can also arise in situations where international migrants are directed to gateway cities, which are usually the larger ones (Royuela, forthcoming). As stressed recently in Lee et al. (2014), employment growth is more effective in reducing poverty and inequality than output growth. Overall,

inequalities are becoming more important within cities and metropolitan areas than between regions (Weeks et al., 2006). Table 6 shows how regions with larger cities grew more than regions with smaller cities.

Table 6. Inequality and economic growth measures by urban size, OECD regions (2004-2012)

	Cities < 500,000		Cities 500,000-1.5 million		Cities > 1.5 million	
	Mean	Std. dev	Mean	Std. dev	Mean	Std. dev
Gini Index	0.338	0.073	0.368	0.073	0.384	0.062
p80-20	2.803	0.692	3.070	0.729	3.347	0.864
p90-10	5.150	1.974	5.907	2.123	6.819	2.805
p50-10	2.346	0.598	2.496	0.614	2.838	0.795
p90-50	2.148	0.440	2.321	0.456	2.346	0.395
pov60	19.39%	5.55%	21.01%	5.56%	23.18%	5.34%
pov40	7.90%	4.57%	9.07%	4.73%	11.36%	5.15%
GDP growth	1.81%	3.79%	2.22%	3.45%	2.22%	2.98%
GDP per capita growth	1.11%	3.73%	1.18%	3.35%	1.21%	2.90%

4. Empirical analysis

Model specification

The standard procedure for estimating the impact of inequality on growth is to assume a simple linear relationship, where the growth rate of GDP per capita is regressed on a number of explanatory variables potentially explaining differences in such growth rates, including a measure of income inequality. Specifically,

$$\ln y_{it} - \ln y_{it-\tau} = \alpha + \beta \ln y_{it-\tau} + \gamma x_{it-\tau} + \theta Z_{it-\tau} + \varepsilon_{it} \quad [1]$$

where $\ln y_{it}$ is the logarithm of GDP per capita in region i at time t; $x_{it-\tau}$ represents an income inequality measure (e.g. the Gini Index), $Z_{it-\tau}$ is a set of factors that explains economic growth and that is used as controls, and ε_{it} a random error term that varies across regions and periods. In this model, the coefficient β will be related to the convergence rate across economies, while the coefficient γ will allow the impact of income inequality within regions on growth to be assessed. As previously mentioned, studies based on cross-sectional regressions typically report a negative and significant relationship between initial income inequality and growth. The negative coefficient holds for different measures of inequality, samples of countries and time periods.

One of the main critiques to this kind of regression is that cross-sectional estimates may be biased due to omitted variables. Factors such as technology, climate, institutions and any other country-specific variable may be important determinants of growth rates and may be correlated with the explanatory variables considered in the model. Although a list of control variables can be included into the model, many other factors are typically unobservable. By assuming those factors are constant over time and using longitudinal rather than cross-sectional data, the suggested specification results in a modified panel data version of the previous equation, where one can control for unobservable factors using a fixed or random effects model. In particular, the modified model will adopt the following form:

$$\ln y_{it} - \ln y_{it-\tau} = \alpha + \beta \ln y_{it-\tau} + \gamma X_{it-\tau} + \theta Z_{it-\tau} + \Xi + \eta_t + \varepsilon_{it}, \quad [2]$$

where η_t represents a time-specific effect and Ξ is a vector of region effects.

The empirical model to be estimated faces a list of econometric problems: reverse causality, unobserved time-invariant region-specific characteristics and the presence of initial income as a regressor. The option of estimating a dynamic panel model using the System GMM estimator (Blundell and Bond, 1998), as in Halter et al. (2014), was discarded due to the too-short time dimension of our data set. Using regional fixed effects (FE) the estimated coefficients only reflect the time variation within regions. This procedure is supposed to account for the omitted variable bias. Nevertheless, it has a list of disadvantages: it reduces the degrees of freedom, the measurement-error bias is aggravated, as the signal-to-noise ratio is further reduced by only using variation within region. When the phenomenon under analysis mostly varies cross-sectionally, the FE methods may produce inaccurate results (Partridge, 2005). In our sample, the overall standard deviation of the Gini Index is 0.073, with the between standard deviation at 0.070 and the within standard deviation 0.018. Consequently, the FE models would only be using a small fraction of the variation of inequality, and "the long-run cross-sectional effects would be subsumed into the fixed effects" (Fallah and Partridge, 2007: 381), in turn producing potentially misleading results (Barro, 2000). In addition, the short time intervals considered in this work and in other similar analysis (Rodríguez-Pose and Tselios, 2010) further question the use of FE to account for the omitted variables bias.

The reverse causality problem in the context of the inequality-growth relationship will depend on the correlation between the error term and the regressors, such as the lagged endogenous and also the measurement of inequality. The choice between various different techniques to estimate the panel data model is governed by assumptions on such a correlation. Fixed effects models are helpful to partially solve this correlation. However, this approach is not appropriate to analyse the effect of variables that are fairly constant over time, or that will affect growth only in the long run, which could be the case for at least some of the mechanisms through which inequality can affect growth.

As none of the alternatives is optimal, we estimated all of the models in a panel framework: pooled regression, fixed and random effects estimates and the between models. This way we could also consider the possibility of different speeds of alternative transmission channels of inequality, as proposed in Halter et al. (2014). Indeed, in a model where the explanatory variables affect the endogenous variable by means of a distributed lag structure, the panel between estimates would capture the long-run effect while the fixed effects specification would capture short-run effects. Finally, the OLS and random effects models would report estimates averaging the long- and short-run specifications (Baltagi and Griffin, 1984; Pirotte, 1999). The potential endogeneity of the lagged value of GDP per capita and inequality was dealt with through an instrumental variable approach.

We have instrumented both inequality and lagged GDP per capita by means of the following variables: the murder rate, the share people with no religious affiliation and the share of Christians (which would be proxies of institutions and social issues), total population, the elderly rate and the urbanisation disaggregated by city size (which capture demographic characteristics and the spatial distribution of population), the average unemployment rate for the three previous years (a variable linked to labour market institutions) and finally, the lagged value of the interaction between inequality and GDP per capita, an internal instrument which is not capable of identifying transmission channels but works as a statistically sound instrument.

In order to account for the omitted-variable bias without incurring in the above-mentioned problems, we included 'macro-regional' dummies, which control for the continent where the region is located.[3] In addition, a set of control variables were chosen according to the related literature. These included the sectoral share of the economy (agriculture, industry and construction), the urbanisation rate, the education

[3] Another possible option is the inclusion of country fixed effects. Nevertheless, several countries have a limited number of regions (two of them, Estonia and Luxemburg, have only one region) which poses some doubts on this strategy.

levels, the labour market participation rate and one variable related to religion at the country level, based on a Herfindahl Index of diversity in religion. We also include time-fixed effects.

Econometric results

Table 7 shows the estimates of the pooled OLS panel estimates for different inequality measures.[4] All specifications show a negative and significant coefficient associated to inequality. GDP per capita convergence arises only in two models, while disaggregated urbanisation is not significantly associated with economic growth. The labour force participation rate is always significant, while low education levels report statistically significantly negative coefficients. The sectoral composition shows significant parameters which, interestingly, are significantly positive for regions with high shares in construction. Finally, the variables related to religion report insignificant results.

The random effects and fixed effects specifications reported in Table 8 show that the long-run impact of inequality on economic growth in the analysed regions is clearly negative. On the contrary, the short-run fixed effects estimations report non-significant parameters. Finally, the specifications controlling for potential endogeneity of inequality and lagged level of GDP per capita report similar results: a non-significant impact of the evolution of inequality on GDP per capita growth rates and a negative impact of inequality levels on subsequent economic growth. This result reinforces the negative impact of inequality on economic growth, as far as the difference between the OLS and the instrumental variables (IV) estimates, which captures the size of endogeneity, implies a positive result, and consequently any endogeneity biases of OLS estimates tend to reduce the magnitude of the parameter of inequality.

It has to be acknowledged that the results emerging from the analysis carried out in the short time-horizon considered here are hardly comparable with works such as Partridge (2005) which covers a period of 40 years. In this latter work, a positive link between inequality and long-run economic growth was found for US states, while the FE results were much more ambiguous. Rodríguez-Pose and Tselios (2010) also found a positive link in OLS estimates and non-significant results for the FE results. Another important difference between their results and the ones shown here is that the years between 2004 and 2012 embed the deepest part of the economic crisis which began in 2008. Our results show that during the crisis inequality and economic growth were negatively associated. This confirms the intuitive correlations plotted in Figure 4 and suggests that more inclusive societies might represent an element of regional resilience. In terms of the channels that might underlie these results, it is possible that credit constraints and market size effects have been particularly important, which is a hypothesis that could be explored in further research.

The first stage of the instrumental variables analysis (not reported here, but available from the authors on request) allows the factors affecting inequality to be inspected: education, sectoral composition (with a strong influence of the construction sector) and labour market characteristics. These aspects also matter for economic growth. For example, persistent levels of unemployment combined with increasing inequality were found to harm economic growth (Castells-Quintana and Royuela (2012). A final factor that matters for inequality is the urban structure of the regions, an aspect that is further analysed in the remainder of this section.

Accounting for urban size

Table 9 reports the estimation of the previous model, incorporating inequality (Gini Index) multiplied by the three dummies for every type of region, plus the urban population shares in every type of city as

[4] We assume that the estimation of the top decile income in small samples, such as the ones considered at the analysed regions, can be problematic. Consequently, such results must be interpreted with caution.

control variables. The results are presented for a set of alternative techniques. Two types of results deserve particular attention, on urbanisation and on inequality. First, the share of people living in larger cities displays a significant and positive result. This suggests that agglomeration economies allow regions to enjoy higher growth rates over the analysed period. Interestingly, the fixed effects model reports significant results for all urbanisation rates. This is in line with Barca et al. (2012), who report that economic growth does not need to depend on increasing urban concentration and, consequently, all types of growth processes are possible, not only the ones associated with regions with larger agglomerations.

Second, regions with higher levels of inequality are associated with lower economic growth, in line with previous results shown in Tables 7 and 8. What is new in Table 9 is that the magnitude of the negative association between inequality and economic growth increases with city size. Thus, in regions mainly characterised by small cities or rural areas, the relationship between inequality and growth was weaker than in the rest of the regions.

These results are robust to various cross-sectional specifications (pooled OLS, between, random effects and instrumental variables). In summary, not only are inequalities are becoming more important within large cities and metropolitan areas, but in such regions the negative association between inequality and economic growth have been higher than in other regions. Again, the channels associated with such effects may be linked with credit market imperfections and to market size effects. One possible explanation might be related to stronger social ties in small cities and rural areas, which could limit the consequence of the imperfections in the credit markets. As for the market size effect, this might be linked to the high costs people face for living in cities (Combes et al., 2012), which are likely to depress particularly fixed salaries and government transfers and social benefits, usually established nationally rather than adjusted to local prices. Too high inequality might result in a weaker middle class, which can in turn harm economic growth (Partridge, 2005).

Table 7. Pooled OLS estimates

VARIABLES	(1) Gini	(2) p80-20	(3) p90-10	(4) p90-50	(5) p50-10	(6) pov40	(7) pov60
ln GDP per capita	-0.0110*	-0.0072	-0.0072	-0.0100*	-0.0073	-0.0094	-0.0093
	(0.0061)	(0.0065)	(0.0065)	(0.0060)	(0.0067)	(0.0065)	(0.0067)
Inequality	-0.1178**	-0.0084**	-0.0031**	-0.0153**	-0.0076**	-0.1039**	-0.0800**
	(0.0472)	(0.0037)	(0.0012)	(0.0076)	(0.0033)	(0.0474)	(0.0398)
Urbanisation < 500,000	0.0031	0.0016	0.0036	-0.0002	0.0048	0.0046	0.0037
	(0.0109)	(0.0115)	(0.0115)	(0.0111)	(0.0114)	(0.0111)	(0.0111)
Urbanisation 500,000-1.5 million	0.0034	-0.0005	0.0008	0.0012	0.0004	0.0015	0.0012
	(0.0084)	(0.0087)	(0.0086)	(0.0085)	(0.0086)	(0.0086)	(0.0087)
Urbanisation > 1.5 million	0.0101	0.0030	0.0038	0.0050	0.0032	0.0067	0.0068
	(0.0073)	(0.0072)	(0.0072)	(0.0074)	(0.0072)	(0.0072)	(0.0073)
Labour force participation rate	-0.0006**	-0.0007**	-0.0007**	-0.0006**	-0.0006**	-0.0006**	-0.0005**
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)
Education share in low levels (0-2 ISCED)	-0.0005***	-0.0005**	-0.0005***	-0.0004**	-0.0005***	-0.0006***	-0.0006***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Education share in high levels (5-6 ISCED)	0.0001	0.0002	0.0002	0.0002	0.0001	0.0000	0.0000
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Industry share	0.0410*	0.0322	0.0310	0.0421*	0.0303	0.0373*	0.0399*
	(0.0211)	(0.0210)	(0.0211)	(0.0215)	(0.0210)	(0.0207)	(0.0210)
Agriculture share	0.1196	0.1039	0.1010	0.1143	0.0973	0.1050	0.1104
	(0.0751)	(0.0730)	(0.0729)	(0.0737)	(0.0733)	(0.0736)	(0.0740)
Construction share	0.2523***	0.2471***	0.2409***	0.2332***	0.2468***	0.2762***	0.2677***
	(0.0701)	(0.0741)	(0.0731)	(0.0719)	(0.0747)	(0.0762)	(0.0736)
Religion diversity	0.0086	0.0072	0.0072	0.0079	0.0055	0.0061	0.0064
	(0.0086)	(0.0089)	(0.0088)	(0.0089)	(0.0088)	(0.0086)	(0.0087)
Constant	0.1700**	0.1200*	0.1134	0.1516**	0.1164	0.1318*	0.1323*
	(0.0691)	(0.0717)	(0.0729)	(0.0716)	(0.0737)	(0.0729)	(0.0742)
Continent fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	537	528	527	528	527	537	537
R^2	0.493	0.482	0.482	0.480	0.478	0.488	0.487

Note: Robust standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table 8. Between, random, fixed effects and instrumental variables estimations of models for the Gini Index

VARIABLES	(1) **Between estimation**	(2) **Random effects estimation**	(3) **Region fixed effects**	(4) **Random eff. est. with country fixed effects**	(5) **Pool-instrumental variables**	(6) **Region fixed effects - Instrumental variables**
ln GDP per capita	-0.0091**	-0.0110***	-0.1878***	-0.0053	-0.0120	-0.1625
	(0.0041)	(0.0040)	(0.0379)	(0.0061)	(0.0100)	(0.1285)
Inequality	-0.1248***	-0.1178***	-0.0987	0.0046	-0.2647**	-0.0127
	(0.0395)	(0.0347)	(0.0673)	(0.0451)	(0.1052)	(0.1620)
Urbanisation < 500,000	0.0008	0.0031	0.5289*	-0.0072	-0.0020	0.9759
	(0.0100)	(0.0101)	(0.2894)	(0.0111)	(0.0152)	(0.6355)
Urbanisation 500,000-1.5 million	0.0021	0.0034	1.0591***	-0.0066	-0.0005	1.3847**
	(0.0078)	(0.0081)	(0.3201)	(0.0084)	(0.0107)	(0.5431)
Urbanisation > 1.5 million	0.0085	0.0101	0.9236***	-0.0054	0.0082	1.3853***
	(0.0071)	(0.0074)	(0.3027)	(0.0083)	(0.0090)	(0.4970)
Labour force participation rate	-0.0006**	-0.0006**	-0.0005	-0.0004	-0.0003	0.0013
	(0.0003)	(0.0003)	(0.0008)	(0.0003)	(0.0004)	(0.0014)
Education share in low levels (0-2 ISCED)	-0.0004**	-0.0005***	0.0000	-0.0001	-0.0003	0.0019
	(0.0001)	(0.0001)	(0.0008)	(0.0003)	(0.0002)	(0.0020)
Education share in high levels (5-6 ISCED)	0.0003	0.0001	-0.0005	0.0006	0.0001	0.0003
	(0.0002)	(0.0002)	(0.0011)	(0.0004)	(0.0002)	(0.0021)
Industry share	0.0483***	0.0410***	-0.0695	0.0185	0.0042	-0.2289
	(0.0122)	(0.0124)	(0.1060)	(0.0167)	(0.0232)	(0.2273)
Agriculture share	0.1325**	0.1196*	0.0915	0.0902	0.1880*	1.2132*
	(0.0630)	(0.0633)	(0.2989)	(0.0631)	(0.1081)	(0.6269)
Construction share	0.1748***	0.2523***	0.9071***	0.1745**	0.2263***	1.0845***
	(0.0595)	(0.0570)	(0.1623)	(0.0739)	(0.0826)	(0.3091)
Religion diversity	0.0110	0.0086	-0.0052	0.0185	0.0177	-0.0807*
	(0.0083)	(0.0075)	(0.0244)	(0.0232)	(0.0122)	(0.0454)
Constant	0.1289**	0.1700***	1.5186***	0.0364	0.1970**	-0.0478***
	(0.0603)	(0.0476)	(0.3867)	(0.0708)	(0.0835)	(0.0059)
Fixed effects	Continent	Continent	Region	Country	Continent	Region
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	537	537	537	537	350	348
R^2	0.408	0.4926	0.6093	0.5319	0.5487	0.7053
Shea's partial R^2 -log GDP_{t-1}					0.46	0.2493
Shea's partial R^2 -Ineq $_{t-1}$					0.4047	0.3291
K-P p-value					0.000	0.000
Hansen p-value					0.2071	0.2509

Notes: Estimations using robust standard errors. *p<0.10, **p<0.05, ***p<0.01. Shea's partial R² measures the relevance of the excluded instruments. K-P is the Kleibergen-Paap LM statistic, which tests for the null hypothesis that the matrix of the reduced-form coefficients in the first-stage regression is under-identified. The Hansen J statistic tests the null hypothesis of instrument validity under the assumption of heteroskedasticity.

Table 9. Estimations of models for the Gini Index interacted with urban size

VARIABLES	(1) Pooled OLS	(2) Between estimation	(3) RE	(4) Region FE	(5) RE country FE	(6) Pooled-IV	(7) Region FE-IV
ln GDP per capita	-0.0117***	-0.0101**	-0.0117***	-0.1852***	-0.0091	-0.0122	-0.0942
	(0.0041)	(0.0041)	(0.0041)	(0.0379)	(0.0063)	(0.0079)	(0.1472)
Ineq * Urb < 500,000	-0.0912**	-0.0974**	-0.0912**	0.0069	0.0175	-0.2207***	0.0544
	(0.0366)	(0.0413)	(0.0366)	(0.0943)	(0.0462)	(0.0752)	(0.2464)
Ineq * Urb 500,000-1.5 million	-0.1153***	-0.1166***	-0.1153***	-0.2354**	-0.0044	-0.2486***	0.0121
	(0.0345)	(0.0388)	(0.0345)	(0.1106)	(0.0452)	(0.0706)	(0.2400)
Ineq * Urb > 1.5 million	-0.1434***	-0.1449***	-0.1434***	-0.1263	-0.0190	-0.2747***	0.0698
	(0.0374)	(0.0414)	(0.0374)	(0.1888)	(0.0490)	(0.0734)	(0.6120)
Urbanisation < 500,000	0.0018	0.0004	0.0018	0.5723**	-0.0066	-0.0039	0.8294
	(0.0101)	(0.0099)	(0.0101)	(0.2904)	(0.0112)	(0.0131)	(0.6536)
Urbanisation 500,000-1.5 million	0.0160	0.0123	0.0160	1.0476***	0.0070	0.0142	1.4570***
	(0.0111)	(0.0106)	(0.0111)	(0.3202)	(0.0116)	(0.0140)	(0.5655)
Urbanisation > 1.5 million	0.0346***	0.0313***	0.0346***	0.9230***	0.0139	0.0329**	1.3874***
	(0.0114)	(0.0107)	(0.0114)	(0.3024)	(0.0138)	(0.0145)	(0.5237)
Labour force participation rate	-0.0005*	-0.0005	-0.0005*	-0.0005	-0.0003	-0.0002	0.0015
	(0.0003)	(0.0003)	(0.0003)	(0.0008)	(0.0003)	(0.0004)	(0.0014)
Education share in low levels (0-2 ISCED)	-0.0005***	-0.0004**	-0.0005***	0.0001	-0.0000	-0.0003	0.0018
	(0.0001)	(0.0001)	(0.0001)	(0.0008)	(0.0003)	(0.0002)	(0.0020)
Education share in high levels (5-6 ISCED)	-0.0000	0.0002	-0.0000	-0.0005	0.0006	0.0000	-0.0001
	(0.0002)	(0.0002)	(0.0002)	(0.0011)	(0.0004)	(0.0003)	(0.0023)
Industry share	0.0421***	0.0498***	0.0421***	-0.0790	0.0266	0.0069	-0.3185
	(0.0123)	(0.0120)	(0.0123)	(0.1060)	(0.0172)	(0.0160)	(0.2485)
Agriculture share	0.1139*	0.1230**	0.1139*	0.0734	0.0882	0.1921**	1.1796*
	(0.0630)	(0.0619)	(0.0630)	(0.2991)	(0.0631)	(0.0865)	(0.6439)
Construction share	0.2445***	0.1677***	0.2445***	0.9047***	0.1721**	0.2184***	0.9657***
	(0.0569)	(0.0589)	(0.0569)	(0.1623)	(0.0747)	(0.0705)	(0.3286)
Religion diversity	0.0110	0.0144*	0.0110	0.0006	0.0191	0.0212**	-0.0849*
	(0.0075)	(0.0082)	(0.0075)	(0.0246)	(0.0231)	(0.0105)	(0.0478)
Constant	0.1624***	0.1201**	0.1624***	1.4776***	0.0587	0.1708**	-0.0492***
	(0.0474)	(0.0593)	(0.0474)	(0.3871)	(0.0714)	(0.0770)	(0.0064)
Fixed effects	Continent	Continent	Continent	Region	Country	Continent	Region
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	537	537	537	537	537	350	348
R^2	0.501	0.405	0.524	0.613	0.518	0.558	0.696
Shea's partial R^2 - log GDPt-1						0.439	0.201
Shea's partial R^2 - Ineq t-1 (URB < 500,000)						0.385	0.270
Shea's partial R^2 - Ineq t-1 (URB 500,000-1.5 million)						0.399	0.396
Shea's partial R^2 - Ineq t-1 (URB > 1.5 million)						0.420	0.209
Under identification test - Anderson canon. corr. LM statistic (P value)						0.000	0.000
Hansen p-value						0.269	0.340

Notes: Estimations using robust standard errors. *p<0.10, **p<0.05, ***p<0.01. Shea's partial R^2 measures the relevance of the excluded instruments. K-P is the Kleibergen-Paap LM statistic, which tests for the null hypothesis that the matrix of the reduced-form coefficients in the first-stage regression is under-identified. The Hansen J statistic tests the null hypothesis of instrument validity under the assumption of heteroskedasticity.

Sensitivity analysis: Time of inequality

The variability in the results of the impact of inequality on economic growth has been a constant in the applied literature. The changing sign of the inequality-growth relationship is linked to the transmission channel playing a major role, which is likely to change in different circumstances. Thus, positive and negative results have been found depending on the level of a country's development (Partridge, 1997; Barro, 2000), on the initial income distribution itself (Chen, 2003), on the profile of inequality (Voitchovsky, 2005) or on the process of urbanisation (Castells-Quintana and Royuela, 2014). Similarly, the time horizon perspective has been underlined as a variable showing different parameters for the inequality-growth relationships (Forbes, 2000; Halter et al., 2014).

The impact of inequality on economic growth in OECD regions has changed over time. The period of analysis of this research is clearly influenced by the Great Recession that started in 2007/08. The available sample includes information of inequality in four points of time: 2004, 2007, 2010 and 2012. As for GDP growth, the last available year is 2010. Consequently, we can only divide the sample into two sub-periods: 2004-2007 and 2007-2010.

The results, reported in Table 10, show a negative and significant inequality-growth relationship after 2007, while non-significant parameters were found for the previous period. This confirms the idea that inclusiveness might have been relevant as an element of regional resilience against the shock of the crisis. When we disaggregate the results by urban size, we find the same results as above, but again only in the second sub-period. Regions with smaller cities show a positive and significant impact of inequality. This result suggests, consistently with Castells-Quintana and Royuela (2014), that places with lower levels of inequality – as regions with relatively small cities – might have space for increasing inequality by increasing the spatial concentration of economic activity. As large cities have a relatively high inequality, regions characterised by small and medium-sized cities can still benefit from urban concentration, but at the cost of higher inequalities. This hypothesis might explain the positive coefficient encountered between inequality and growth for less urbanised regions.

Table 10. Estimation of models by sub-periods

VARIABLES	Pooled OLS	Pooled IV	Pooled OLS	Pooled IV	Pooled OLS	Pooled IV	Pooled OLS	Pooled IV
Period	2004-07	2004-07	2007-10	2007-10	2004-07	2004-07	2007-10	2007-10
Inequality	0.0615	-0.0873	-0.2485***	-0.329***				
	(0.047)	(0.081)	(0.057)	(0.089)				
Ineq * Urb < 500,000					0.0885*	0.1499*	-0.2214***	-0.221***
					(0.049)	(0.085)	(0.058)	(0.075)
Ineq * Urb 500,000-1.5 million					0.0649	0.0494	-0.2493***	-0.249***
					(0.047)	(0.065)	(0.056)	(0.071)
Ineq * Urb > 1.5 million					0.0391	0.0484	-0.2755***	-0.275***
					(0.051)	(0.084)	(0.062)	(0.074)
Observations	351	338	362	537	351	318	362	350
R^2	0.595	0.527	0.541	0.546	0.604	0.555	0.549	0.558
Shea's partial R^2 - log GDPt-1		0.2732		0.6104		0.3454		0.4281
Shea's partial R^2 - Ineq t-1		0.1778		0.5629				
Shea's partial R^2 - Ineq t-1 (URB < 500,000)						0.2399		0.3827
Shea's partial R^2 - Ineq t-1 (URB 500,000-1.5 million)						0.3591		0.3963
Shea's partial R^2 - Ineq t-1 (URB > 1.5 million)						0.2515		0.4173
Under identification test (P value)		0.000		0.000		0.0438		0.0000
Hansen p-value		0.1408		0.1044		0.1576		0.1867

Note: All estimates include controls, continent-fixed effects and time-fixed effects.

5. Concluding remarks

The first objective of this paper was to analyse the relationship between income inequality and economic growth in a panel of regions from 15 different OECD countries covering three continents over the period between 2004 and 2012. With this aim, we have computed indicators of inequality at regional level using micro-data from the household income surveys available in each country and have regressed the growth rate of GDP per capita on these indicators together with the usual controls in the literature. The obtained results, which have been subjected to several robustness checks, provide support of the negative correlation between inequality and economic growth, especially since the start of the economic crisis.

The second objective of this paper was to analyse how the relationship between inequality and growth changes with the degree and type of urban concentration. The considered regions were grouped into three classes: less than 500,000 inhabitants; between 500,000 and 1.5 million inhabitants; and more than 1.5 million inhabitants. A descriptive analysis showed that inequalities are lower the lower the size of the city. Econometric results have then shown that the association between inequality and economic growth is sensitive to the type of urban structure. Higher inequalities seem to be more detrimental in regions with medium-large cities, while small cities and rural areas with higher levels of inequalities grow faster. Credit market imperfections and market size effects could be part of the story behind the obtained results. If imperfections in the credit market are lower in less-populated areas due to less-asymmetric information flows and higher proximity and closer contacts, this could lead to lower inequality and, at the same time, to better incentives to wealth accumulation and higher economic growth. The market size channel could operate in the opposite direction: the higher costs of living in an urban area are not equally shared by its inhabitants, thus increasing within-regional inequalities and, at the same time, depressing economic growth due to the fact that fewer consumers can afford to buy more goods. A sensitivity analysis was developed in order to check for a changing relationship over time and over different groups of regions by level of inequality. The results stress the role of the Great Recession, which arises as the main driver for empowering the negative channels of inequality. From another perspective, this result suggests that having low inequality might improve regions' resilience to shocks, such as economic crises.

Future research could advance in two different, although related, directions: first, exploring the reasons underlying the increasing importance of inequality within cities and metropolitan areas than between regions is a relevant and scarcely analysed topic and, second, testing alternative theories on the mechanisms through which urban size can alter the relationship between inequality and economic growth.

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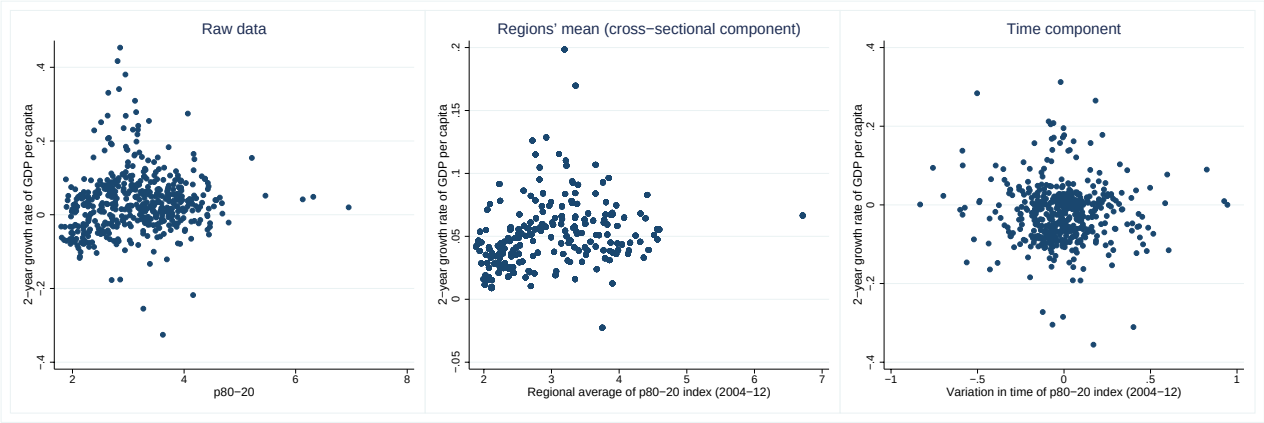
Annex 1. Data sources for income inequality measures

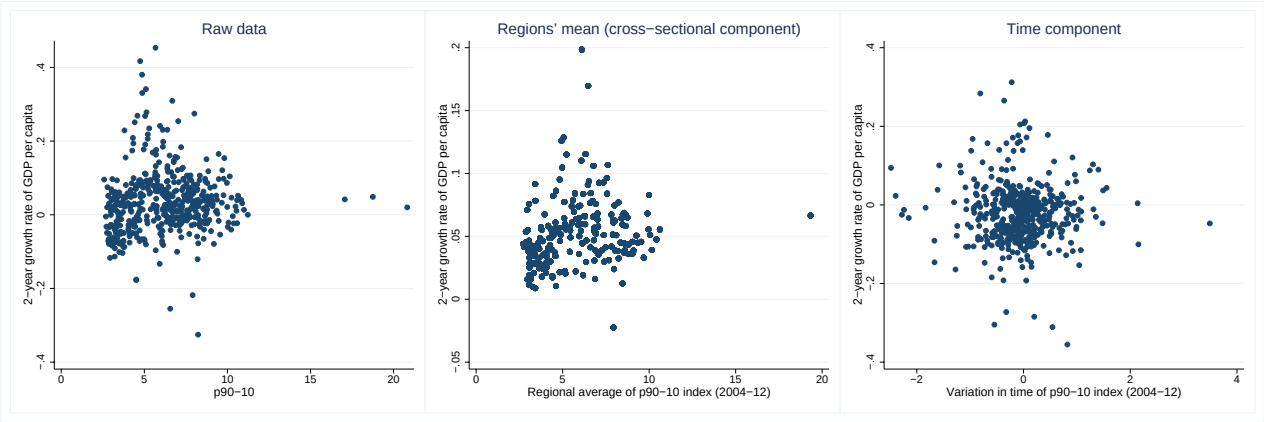
Country	Data source	Waves	Number of regional units (TL2)
Belgium	European Union Statistics on Income and Living Conditions (EU-SILC)	2004, 2007, 2010, 2012	3 regions
Canada	Survey of Labour and Income Dynamics (SLID)	2004, 2006, 2008, 2010	10 regions
Chile	Encuesta de Caracterización Socioeconómica Nacional (CASEN)	2003, 2006, 2009, 2011	15 regions
Czech Republic	European Union Statistics on Income and Living Conditions (EU-SILC)	2005, 2007, 2010, 2012	8 regions
Estonia	European Union Statistics on Income and Living Conditions (EU-SILC)	2004, 2007, 2010, 2012	1 region
Finland	European Union Statistics on Income and Living Conditions (EU-SILC)	2004, 2007, 2010, 2012	4 regions
France	European Union Statistics on Income and Living Conditions (EU-SILC)	2004, 2007, 2010, 2012	22 regions
Greece	European Union Statistics on Income and Living Conditions (EU-SILC)	2004, 2007, 2010, 2012	4 regions
Italy	Indagine sulle condizioni di vita (UDB IT SILC)	2004, 2007, 2010, 2012	21 regions
Korea	Korean Labour & Income Panel Study (KLIPS)	2004, 2006, 2008	6 regions
Luxembourg	European Union Statistics on Income and Living Conditions (EU-SILC)	2005, 2007, 2010, 2012	1 region
Mexico	Encuesta Nacional de Ingreso y Gastos de los Hogares (ENIGH)	2005, 2008, 2010, 2012	32 regions
Spain	European Union Statistics on Income and Living Conditions (EU-SILC)	2004, 2007, 2010, 2012	19 regions
United Kingdom	European Union Statistics on Income and Living Conditions (EU-SILC)	2010, 2012	12 regions
United States	Current Population Survey (CPS)	2002-2003-2004, 2005-2006-2007, 2008-2009-2010, 2011-2012	51 regions

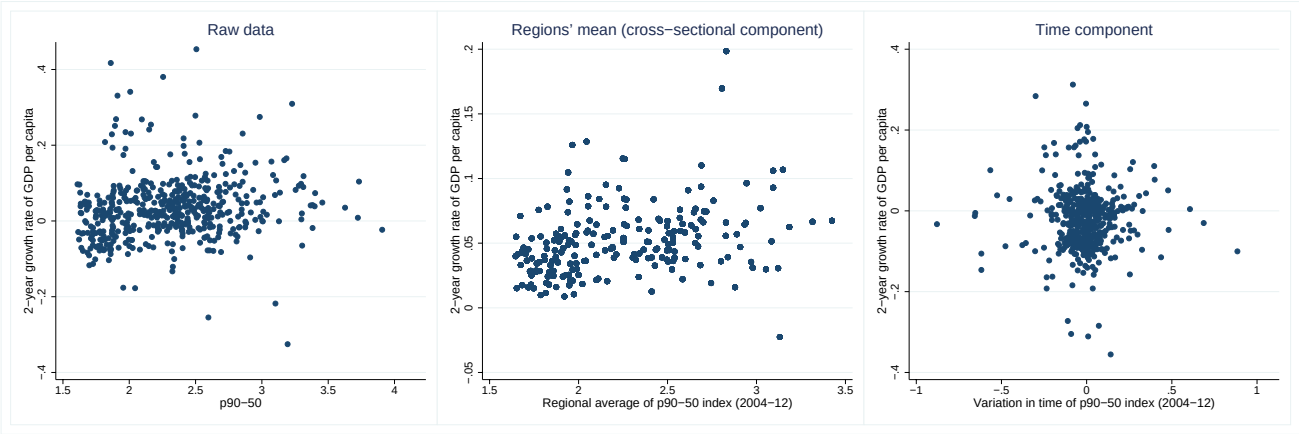
Annex 2. Data description

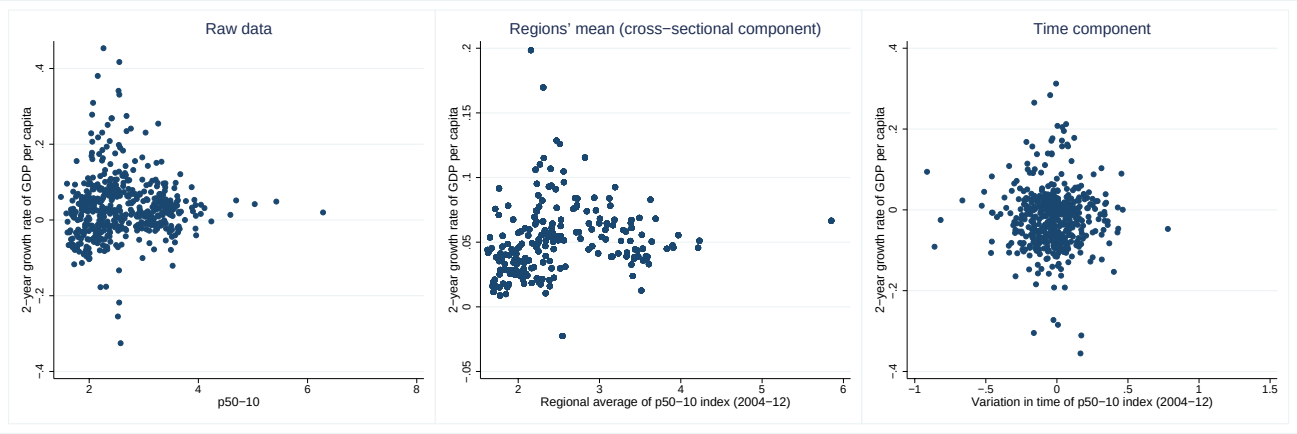
Variable	Definition	Source
ln GDP per capita	Log of per capita GDP in constant millions of USD PPP (reference year 2005)	OECD Regional Statistics
Gini	Gini Index of household income	Authors' calculations based on national income household surveys
p80-20	Quintile ratio	Authors' calculations based on national income household surveys
p90-10	Decile ratio	Authors' calculations based on national income household surveys
p90-50	Top decile ratio	Authors' calculations based on national income household surveys
p50-10	Bottom decile ratio	Authors' calculations based on national income household surveys
pov40	Poverty: poverty line at 40% of national median income	Authors' calculations based on national income household surveys
pov60	Poverty: poverty line at 60% of national median income	OECD Regional Statistics
Urbanisation	Share of regional population living in OECD functional urban areas (FUA)	OECD Regional and Metropolitan Statistics (OECD, 2012)
Total population	Total regional population (log)	OECD Regional Statistics
Religion diversity	Inverse of Herfindahl Index on the shares of different religions (no sub-aggregates)	World Religion Dataset, ATLA
Share of the most popular religion	Share of the most popular religion (no sub-aggregates considered)	World Religion Dataset, ATLA
Agriculture share	Share of gross value added (GVA) in agriculture, forestry and fishing over total GVA	OECD Regional Statistics
Industry share	Share of GVA in industry, including energy, over total GVA	OECD Regional Statistics
Construction share	Share of GVA in construction over total GVA	OECD Regional Statistics
Education share in low levels	Share of the labour force in lower education levels (0-2 ISCED groups)	OECD Regional Statistics
Education share in average levels	Share of the labour force in middle education levels (3-4 ISCED groups)	OECD Regional Statistics
Education share in high levels	Share of the labour force in higher education levels (5-6 ISCED groups)	OECD Regional Statistics
Elderly rate	Elderly rate (ratio between people aged 65 years or more and people aged 15-64 years), expressed in percentage	OECD Regional Statistics
Unemployment rate	Proportion of unemployed people over total labour force	OECD Regional Statistics
Labour force participation rate	Participation rate (labour force divided by the working-age population 15-64 years old), expressed in percentage	OECD Regional Statistics
Voters	Percentage of registered voters who voted during general elections	OECD Regional Statistics
Murder rate	Ratio of total murders over 100,000 people	OECD Regional Statistics

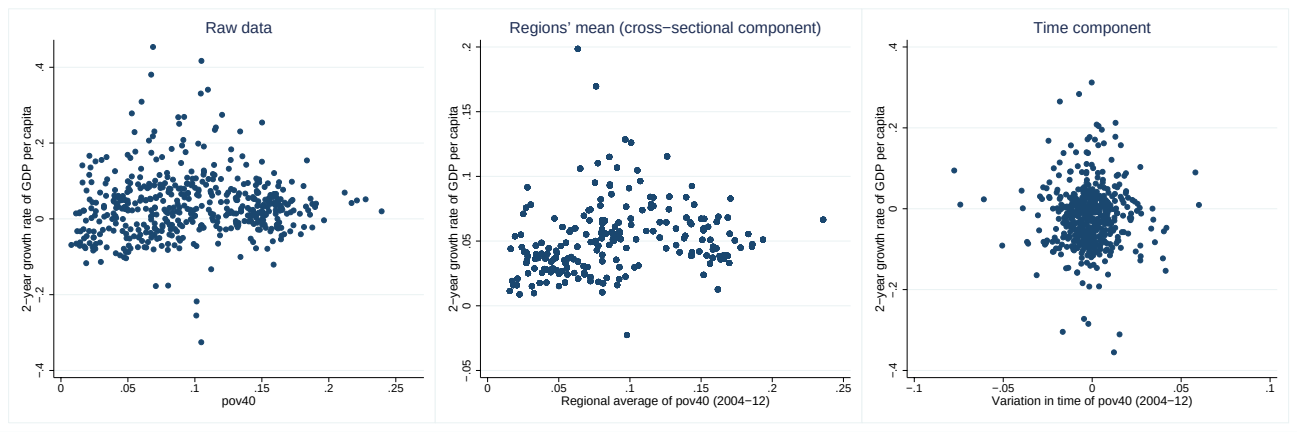
Annex 3. Inequality and GDP per capita growth rates, according to different indicators of inequality

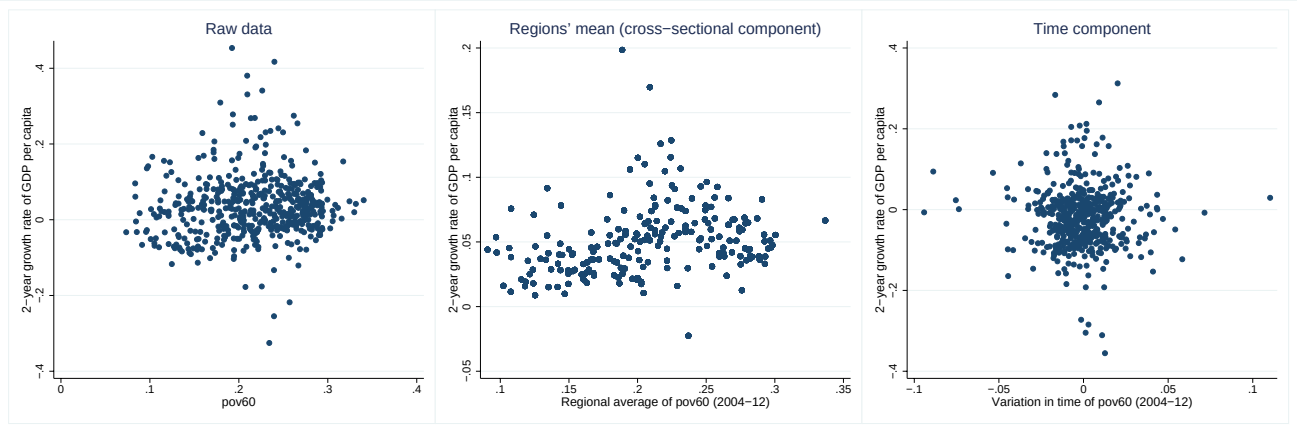







Raw data
Regions' mean (cross−sectional component)
Time component
2−year growth rate of GDP per capita
p50−10
Regional average of p50−10 index (2004−12)
Variation in time of p50−10 index (2004−12)


Raw data
Regions' mean (cross−sectional component)
Time component
2−year growth rate of GDP per capita
pov40
Regional average of pov40 (2004−12)
Variation in time of pov40 (2004−12)


Raw data
Regions' mean (cross−sectional component)
Time component
2−year growth rate of GDP per capita
pov60
Regional average of pov60 (2004−12)
Variation in time of pov60 (2004−12)