“Inequalities, spatial disparities and agglomeration of economic activity in European regions”

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Inequalities, spatial disparities and agglomeration of economic activity in European regions

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Abstract

European Union defines economic and social cohesion as one of the main priorities, however some theoretical and empirical evidence of regional inequalities in Europe, indicates that a process of convergence has been taking place between countries but not within regions inside countries.

The first aim of the paper is that of giving an assessment of the existing spatial inequalities and of their recent evolution in the last 15 years for regions of 22 EU members. Our empirical evidence confirms wider disparities at regional level than at country level, and a growing disconnection between the geography of production, that becomes more unequal, and the geography of incomes (so that we might have regional convergence but not regional cohesion). Also in the case of Italy this seems to be proved.

The second objective of the present work is twofold: on the one hand it investigates how the process of spatial economic concentration is affecting growth and disparities among European regions. On the other hand, the paper takes the opportunity to verify the impact of spatial inequalities to social inequalities. Our results suggest that interpersonal inequalities are affected by spatial disparities and agglomeration of economic activity has a defined role in this process. Other determinants, such as social expenditure and the level of wealth, mitigate but do not cancel the effect of spatial inequalities. Moreover, the positive relationship between growth of regional disparities and GDP could suggest a possible trade-off between spatial equity and growth with the implication that on policy ground EU has to make a choice whether reversing or not the process of economic concentration. In addition to this the recent changes in inter-regional inequalities advises a reconsideration of the usual framework underlying policy, especially the people-versus-place division in policy formulation.

JEL classification: R11, R12, R58

Keywords: dynamic panel, economic geography, European Union, regional inequality, spatial agglomeration.
1. Introduction

In the process of integration, EU defines cohesion among regions as one of the main operational goals, to be achieved through the promotion of growth-enhancing conditions and the reduction of disparities between regional development levels. Although European regional policies explicitly target the decrease in regional inequalities, empirical research shows that there are still deep income disparities, which have widened in the past two decades (Muštra and Škrabić, 2014).

The viability of the project of convergence, socially and politically requires that the gains of increased output and efficiency are equally distributed across countries and regions, with the implication that Europe has been allocating a significant share of its budget to regional policies; in 2017, 34% of the total budget was assigned to Objective 1b, i.e. economic, social and territorial cohesion1.

This is clearly specified in some articles and Title XVII of the Treaty establishing the EU: according to the second article of the mentioned treaty, cohesion policy should “promote economic and social progress as well as high level of employment and achieve balanced and sustainable development”. Furthermore, article 158 underlines “in particular the Community aims to reduce the disparities between the levels of development of the different regions and the backwardness of the least favoured regions or islands, including rural areas”.

The implied sense of the article is broad because the reduction of inequalities could be referred to countries or to regions inside countries. Additionally, regional policies are often part of a broader objective to reduce inequalities between the poor and the rich, and cohesion on a regional ground seems to be a compulsory prerequisite for cohesion on a social ground. The implicit assumption could be that the spatial dimension of inequalities could be an important determinant of inequalities at national level, so that social transfer that are not spatially defined might not ensure social cohesion at country level (Martin 2009).

Therefore, actual regional policies can be questionable, both from an empirical and theoretical point of view, if we review the existing evidence on European integration, showing a process of convergence between countries but not within regions inside countries. Giannetti (2002) analyses the European experience in which, since the early 1980s, convergence among countries has not been accompanied by convergence among regions. She argues that sectorial specialization may help to explain this outcome. Economic integration accelerates growth at country level but increases within-country spatial disparities given

1https://europa.eu/european-union/about-eu/money/expenditure_en
that those regions specialized in high-tech sectors benefit more from knowledge spillovers, whereas the opposite happens in regions whose specialization is in more traditional sectors.

Inequality in Europe has risen quite substantially since the mid 1980’s, and towards the end of 2000s income distribution in Europe was more unequal than in average OECD countries. While the EU enlargement process has contributed to this evolution, it is not the only explanation, since inequality has increased also within a core of 8 countries (Bonesmo Fredriksen, 2012). Actually this is not uniquely a European problem, but it is common to many countries, both developed and developing; the inequality in income per person among US metropolitan areas was 30% higher in 2016 than in 1980 (Ganong and Shoag, 2015).

This paper intends to give an updated assessment of the existing inequalities and of their recent evolution in the last 15 years, in order to verify whether there is a growing disconnection between the geography of production, that becomes more unequal, and the geography of incomes (so that we might have regional convergence but not regional cohesion). Sections 2 deals with the following topics: after a brief presentation of measures of convergence (par. 2.1), some descriptive evidence about global convergence and local divergence at European level are given (par. 2.2) and at national level for Italy (par. 2.3).

The second objective of the work is twofold: on the one hand it investigates how the process of spatial economic concentration (usually leading to efficiency gains, as theory and evidence suggest) is affecting growth and disparities among European regions. On the other hand the paper takes the opportunity to verify the impact of spatial inequalities to social inequalities (as regional policies that decrease the first should decrease also the second). Furthermore, section 3 recalls a theoretical framework for the interrelations between inequality, growth and agglomeration, underlying the recent contributions of the New Economic Geography (NEG) in explaining the concentration of economic activity and providing additional empirical evidence to this regard (par. 3.1). The subsequent paragraph (3.2) analyzes the link between growth and regional disparities, with the related policy implications for the trade-off of equity versus efficiency. Econometric analysis of the relationship between spatial and individual inequalities is presented in section 4. The last section (5) concludes with final considerations about possible specifications of regional policy in Europe.

2. Global convergence versus regional divergence in Europe

2.1 Measures of convergence

The concept of beta and sigma convergence are those usually used in literature. The first refers to a process in which poor regions grow faster than rich ones and therefore catch up on them and is directly related to neo-classical growth theory.
Since the 90's a huge amount of empirical literature has been produced to detect and measure the extent of beta-convergence in various contexts, but only later contributions also introduce the spatial dimension in the formulation of the problem (omission of space is likely to produce biased results, (Baumont et al. 2003), Dall'Erba and Le Gallo (2006)), highlighting the relevance of regional data and the specific issue of spatial dependence, as well the possibility of spatial heterogeneity.

While beta-convergence has the focus on the possible catching-up processes, sigma convergence refers to the reductions of disparities among regions over time. It is clear the two concepts are strongly interrelated, and formally the first is necessary but not sufficient for the second. A number of limitation of the Beta-convergence-approach has led many economists to suggest that the sigma is more revealing and realistic since it describes the distribution of income across economies without relying on the estimation of particular model.

The most used summary measures of sigma convergence are the standard deviation of regional GDP per capita. However other indices exist with interesting properties, among which the coefficient of variation\(^2\) which is a normalized measure of dispersion of a probability distribution, defined as the ratio of the standard deviation to the mean. Regions are usually weighted by their population in their computations\(^3\), but since the weighting schemes and implicit welfare functions vary across measures, these measures may not rank two distributions the same way. It is therefore required to compute a variety of indicators to draw firm conclusions about the evolution of disparities.

Also, it is important to underline that while summary measures can be particularly convenient for synthesizing complex information, they are blind for a number of aspects that are instead crucial to assess convergence among regions.

2.2 The evolution of regional disparities

\(^2\) Monfort (2008) offers a detailed review of five measures of inequality: the coefficient of variation, the Gini coefficient, the Atkinson index, the Theil index and Mean Logarithmic Deviation.

\(^3\) If the aim is to capture the spatial inequality perceived by a randomly-drawn individual, then weighting by population is advisable. But if the analysis of regional growth is interested in the effects of physical geography, institutions and policies, it might be sensible to give regions equal weight even when their size is different, rather than allow the results to be dominated by the characteristics of the largest regions (Milanovic 2005).
Spatial inequalities have developed among the countries’ own internal regions in different ways.

Duro (2001) has shown that up the mid-eighties GDP (he considers a period going from 1982 to 1997) per capita inequalities among member states represented half of the inequalities among regions, and inequalities among regions within each state were the other half. Then inequalities by state have decreased about 25%, but those within have increased by 10%. In other words, Europe is experiencing a process of convergence among states and a non-convergence across regions, so that convergence across region is explained by convergence across countries. Borsi and Metiu (2013) find the presence of convergence clubs, on the basis of geographic regions, between 1970 and 2010, with a separation between new and old member states and along the south-east vs north-west dimension form the 90s. Rodriguez-Pose and Tselios (2009) found that in the period 1995-2000 (102 NUTS1 or 2 in EU-13) inequality slowly decreased, and this was due to the within component, which also explained the bulk of the total inequality (around the 80%).

The evolution of disparities, calculated with the coefficient of variation is given by Monfort (2008), for the EU-15 and the EU-27, from 1979 to 2004. In line with the findings of the literature (Neven and Gouyette 1995, Ertur et al. 2006), it can be inferred that the process of convergence was strong up the mid-90s, but then it lost momentum. There is a clear downward trend from 1980 to 1996, but then the index stays within a band of values, possibly reflecting the possible influence of the business cycle on the extent of disparities. When we analyse the evolution of the EU-27 index, there is a clear falling of the index from 0.43 in 1995 to 0.35 in 2005. The plausible interpretation is that if convergence is still at work in the enlarged EU, it is due to the fact the poorest regions of the new member states are catching up on the richest ones, while among the EU-15 regions convergence is no longer taking place (Monfort, 2008).

Table 1

Evolution and growth rate of regional disparities in per capita GDP within the member states, 2000-2016

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Source: Our elaborations on Regio Database, Eurostat. CV is calculated on purchasing power standard (PPS) per inhabitant in percentage of the EU average, with population weights. Estonia, Croatia, Cyprus, Latvia, Lithuania, Luxembourg and Malta were excluded from the set because only with one region at the NUTS2 level.

**Figure 1**

![Evolution of regional disparities By and within CV](source)

Source: Our elaborations on Regio Database, Eurostat.

One of the contribution if this paper is to update the evolution of disparities, from 2000 to 2016, calculating the Coefficient of Variation (CV), on PPS in % of the EU average, defined as the standard deviation $\sigma$ to the mean $\mu$, $CV = \frac{\sigma}{\mu}$.

For the majority of countries disparities have increased and only one third of the countries exhibit a downward trend, i.e. old members such as Germany, Belgium, Italy, Portugal and Austria (Table 1). Disparities at regional level (within) are clearly wider than at country level (by), as it is shown by Figure 1. Since 2000 there is a
decline in both the indices, but in 2009, regional inequalities seem to slowly go up, while they are quite stationary at country level.

Behind the mild increase of regional disparities, considering Europe as a whole, there are some strong increases for some countries, and this stems from the fact that in each country the process of growth presents significant local differences and is usually limited to a number of regions generally including the capital city regions.

This is consistent with the complexity of the EU panorama in terms of regional inequalities. On one hand there is persistent dichotomy between dynamic large urban agglomerations and stagnating industrialised and remote regions, on the other a number of capital metro regions have been hit by the crisis while some rural and intermediate regions have shown more resilience. The result is a territorial patchwork of diverging real incomes between states and regions, within regions, between core and peripheral areas, between prosperous and less prosperous metropolitan regions (Iammarino et al. 2018).

2.3 The possible divergence between geography of production and income, the case of Italy

At a first glance spatial inequalities seem to be increased, but a different scenario comes out if we consider regional inequalities of disposable income, that is income net of transfers. At European level, the picture is that depicted by figure 2, showing the evolution of CV of disposable income at regional level\(^4\): when compared with the evolution of spatial disparities (CV of per capita GDP, Figure 1), it is quite clear that this one is lower, so indicating a divergence between the so called geography of production and the geography of income\(^5\).

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\(^4\) In the considered period it decreases of 16% vs a decrease of 8% of spatial disparities.

\(^5\) We intend the geography of production being expressed by the CV of per capita GDP and geography of income by the CV of per capita disposable income.
We extend the analysis to a specific country, that is Italy, and we plot the evolution of the coefficient of variation of GDP (that can be intended as geography of production). The trend is clearly upwards, with an increase of 7% for the period 2000-2014 (Figure 3). The evolution of the CV of disposable income is just opposite (with a decrease of 8%, see Figure 4), and again we can confirm the possible interpretation is that there is a growing disconnect between the geography of production, more unequal, and the geography of incomes becoming more equal (Davezies 2001). Also France, for the two the preceding decades, exhibits a similar behaviour for the mentioned measures; regional convergence cannot be always considered a synonymous of regional cohesion. Inter-regional income transfers are important even though it is quite hard to quantify the impact of public versus private transfers, in explaining differences between GDP and disposable income.

Figure 3
3. Regional inequality, national growth and spatial agglomeration

3.1 Theory and empirical evidence

The NEG theory
The geographical concentration of production is a clear evidence of the pervasive influence of some kinds of increasing returns. The interaction of transport costs may explain why regions with no obvious comparative advantages may become centres of production. The seminal model explaining the underlying mechanisms is that of Krugman (1991), at the origin of New Economic Geography (NEG). After developing a formal model of spatial agglomeration, the policy implications of NEG models have been attracting growing interests thanks to contributions of Martin (2009), Baldwin et al. (2003), Brakman et al. (2009), and the idea of the trade-off between regional inequality and national growth has figured explicitly.

According to NEG models the spatial structure of the economy is the outcome of two sets of opposing forces. On one hand NEG models predict that in presence of imperfect competition, increasing returns to scale and factor mobility there are strong centripetal forces that determine spatial concentration (agglomeration) of economic activity. On the other there are other centrifugal processes, such as transport costs, restricted factor mobility, market and local congestions effects that encourage geographical dispersion of firms and workers. When transport costs are high, distant provision of goods is too costly, they have to be provided locally and firms will disperse around immobile markets. When transport costs and inter-regional transaction costs get lower immobile markets can be provided effectively at a distance and this pushes firms to agglomerate and gain from the various economies of scale and externalities. Agglomeration forces usually dominate in this kind of models, regional inequality increases and this turns fuels to further agglomeration since firms want to locate where demand and income are the highest and where the scope for inter-firm are linkages are high. Also workers are attracted by agglomeration because of more job opportunities (the home market effect). The result is a positive relationship between agglomeration and regional inequality (curve AA, in Figure 5).

Figure 5
The relationship between national growth, agglomeration and regional income inequality
The spatial concentration of economic activities, through localized positive spillovers, has a beneficial effect on innovation and hence on national economic growth, via an increase of productivity and real output. The relationship between the degree of spatial agglomeration (regional concentration of economic activities) at national level and the rate of growth of the country (the local spillover effect, the curve SS) is positive. At the same time, a higher innovation rate attracts new firms that compete with incumbent firms thereby lowering profit rates, and this leads to reduction of regional disparities (“the competition effect”). Also the attraction of firms on the rich agglomeration region produces, at some point, to congestion effects and negative externalities which reduce again regional inequalities. Hence there is another relationship coming out, that is the agglomeration-competition and congestion relationship (the RR curve).

The equilibrium and the trade-off

NEG models at this point give an equilibrium (resulting from the intersection of the curves AA and RR), that determines the level of agglomeration, inequality and national growth. If policy makers want to reduce inequality through interventions that disperse economic activity from spatial agglomeration (or though redistributive fiscal and monetary measures) the curve RR shifts towards RR₁, with a
decrease or regional inequality to $r_1$. The transfer of purchasing power to the poorer region increase market demand and attracts new firms, but since the decrease in spatial agglomeration is less conducive to spillovers and innovation this causes a fall in national growth. A trade-off between regional equality and national growth is predicted.

A similar trade-off come out also within regions, since spatial agglomeration within a region raises its own growth rate, with the assumptions that agglomerated regions will grow faster than the other ones. Then the implication is that policies that stem spatial agglomeration in an effort to close inter-regional (or intra-regional) disparities will be inefficient from a national growth point of view. Also Martin (2009) to this extent argues that there is no need for European regional policy to deal with intra-national regional inequalities. And, likewise, Lees (2007) in a UK treasure paper recognizes a positive relationship between regional disparities and national growth, forming a policy trade-off between economic efficiency and a regionally equitable spread of economic activity.

Some evidence about agglomeration

The issue of how to measure agglomeration will not be tackled within the present study, Gardiner et al. (2010) offer to this extent a comprehensive review of alternative measures.

We decided to use the coefficient of variation of manufacturing employment, weighted for NACE employment, coherently with the utilization of the measure within the econometric analysis. A process of concentration can be observed for the distribution of manufacturing activity, across states and regions, so that the index of geographical concentration at regional level is always higher than the same index calculated at national level (Figure 6). This confirms the evidence observed for a precedent time span going from the eighties to 2005, based on both the coefficient of variation (Midelfart-Knarvik and Overman 2002, from 1980 to 1995) and the Theil index (Tsiapa 2013, from 1995 to 2005). The broad stability over time of concentration for all spatial NUTS level (Gardiner et al. 2010 use various agglomeration measures for a time span going from 1980 to 2007) suggests that agglomeration is unlikely to explain completely cyclical growth patterns, but it could be better-suited to explain long-run effect in national average growth.
A closer look at country level of CV reveals that there is a general trend towards agglomeration, with a major variation for some countries (Bulgaria, Greece, Ireland and Romania) that register increases going from 20% to 50%. We also test the goodness of this result calculating for some specific countries the locational
Gini coefficients: a small, stable increase, is present for all the considered countries (figure 7).

To empirically assess the impact of agglomeration on national growth across the EU, we analyse whether regions with high density growth of economic activity are associated with high growth rate of productivity. To this regard Ciccone (2002) shows that employment density and agglomeration effects have a positive effects on productivity levels. In contrast Bosker (2007) in a study of 280 regions across Europe (1977-2002) found that regions with dense agglomeration of economic activity grew slowly than other regions, indicating a negative agglomeration effect.

In Figure 8 regions from EU 15 are considered, and in line with Gardiner et al. (2010), a positive relationship comes out, but not of the sort assumed or implied by NEG theory models.

![Figure 8](image)

Source: Our elaborations on Eurostat Regio Database. Employment density is given by the ratio between the number of total employees (in thousands) and surface of region NUTS2 (in km²). Productivity per employee is given by the ratio between the gross value added and the number of employees. Countries are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom. Denmark and Luxembourg are excluded the first for missing values and the second for lack of regions.

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7 Gardiner et al. (2010) test the relationship also for NUTS0, NUTS1 and NUTS3, but evidence is mixed. As specified before, NEG models predict that regions with high employment densities should exhibit faster growth rates.
Finally we examine how the two different measures of concentration of economic activity (CV of GDP and CV of manufacturing activities) affect individual inequalities\(^8\). The dispersion graphs (Figures 9-10) exhibit a clear positive relationship, and this could be a first hint that territorial disparities have a role in shaping social disparities. However, the econometrics section will better investigate this link, after controlling for other possible determinants of inter-individual inequalities.

\(^8\) Individual inequalities are defined in Table 3.
Also for unemployment polarization seems to take place. In the mid-eighties regions starting with low or high unemployment rates saw little changes, while regions with high or low initial unemployment rates moved towards extreme values, thus reflecting agglomeration effects of economic integration. The fate of a region is more correlated to the results of the neighbouring regions than to that of the country it belongs (for the period going from 1986 to 1996, Overman and Puga 2002). Actually for the following decennium a more recent study finds a convergence period for unemployment rates (mainly due to country factors), and again polarization up to 2003, that can be attributed to country and regions fluctuations (Beyer and Stemmer, 2016).

3.2 Growth, equity and efficiency in regional policy

Since the reform of structural funds in 1989, the EU has made the principle of cohesion one of the key policies. The funds made available to support cohesion policies have more than doubled since the late 1980s, and for the period 2007-13, €347 billion (at current prices) has been allocated for this purpose, more than 80% of which is targeted at promoting convergence.

A motivation for public intervention at regional level is that of efficiency, but much of the language of European cohesion policy eschews the idea of a trade-off between equity and efficiency, indicating that it is possible to maximize overall growth while achieving regional convergence in outcome and productivity.

Actually, the motivation of efficiency is much less clear than the equity based motivation; if the phenomenon of spatial concentration is given by the existence of economies of scale, there is a clear relationship between spatial agglomerations and economic gains. Firms benefit from the proximity of other firms of the same sectors to lower their transport or fixed costs (specific inputs at a greater variety and lower cost), will increase their productivity through transfers of knowledge from other neighbouring business (i.e. localized technological spillovers) and will benefit from a large spatial concentration of specialized workers (labour market pooling). In economic literature we have plenty of studies about agglomerations gains, starting from Marshall in 1890, that go from the example of the Silicon Valley in USA, to that of districts in Italy.

______________
9Source: Commission, DG Region; see «http://ec.europa.eu/regional_policy/policy/fonds/index_en.htm».
When policy intends to promote a greater dispersal of economic activity, the idea behind is that the economic geography produced by market forces alone is too concentrated. Efficiency may demand more or less spatial concentration, in the first case because of economic gains from agglomeration, in the second case because of effects of congestion. If in Europe country convergence goes along with local divergence, then the first argument has been getting priority, that is efficiency gains with spatial concentration. Excessive equality may be detrimental to growth if it involves limiting productivity and innovation enhancing effects of agglomeration, while some degree of inter-regional inequality may raise the overall rate of growth (Farole et al. 2011). Therefore, a trade-off between equity and spatial efficiency appears and it cannot easily be assessed (Martin 2009).

In Figure 11 the relation between the level of disparities and the level of GDP per capita is showed, for 22 member states in 2015. The poorest countries are also those with the lowest level of disparities (Hungary, Portugal, Bulgaria, Greece, Poland, Croatia, Slovenia), while the group of rich countries exhibits an intermediate level of disparities (Spain, Italy, France, Finland, Denmark, Austria, The Netherlands, Sweden, Ireland and Belgium). The highest level of disparities is held by UK, followed by Slovakia and Germany\(^{10}\) (probably due to the strong growth of the capital city region). A positive sign could be supposed in this case, and the next figure (n. 12) seems to confirm this hypothesis. The relationship between the annual growth rate of disparities (expressed by the standard deviation) and growth rate of GDP could suggest a possible trade-off between spatial equity and growth.

To this regard an evidence is provided by Crozet and Koenig (2005), who estimate the influence of income dispersion within NUTS1 regions (for 14 European countries, 1995-2000) on their economic growth: there is a strong evidence that greater spatial disparities foster growth (at least for northern regions), so that a 10% increase in the standard deviation of GDP per capita leads to 1.6% increase in regional GDP per capita.

\[^{10}\text{Eurostat data in 2015 show that this is due to the strong GDP growth of the capital city regions.}\]
The first implication of the existence of a trade-off is relative to the definition and the quantification of objectives of regional policy, so that a choice has to be made between the objective of lowering absolute differences in GDP per capita among regions inside countries and that of fastening convergence towards the rest of EU. It is a strategic choice between internal and external convergence, to which the financing and the location of infrastructural projects is connected.
Equity is the other important goal for regional policy. Economic agents are mobile and immobile (as NEG emphasizes), hence the second have to stay in poor or declining regions from which the mobile factors have departed. The labor demand is low in such regions, or the labor market suffers of rigidities so that wages adjust downward or do not in adjust at all and unemployment will increase. Consumers staying in these regions will see deteriorate their welfare and will not be able to buy certain goods and services (now produced elsewhere) for high transaction costs. Also diversity of goods declines. Mobile agents are usually those with the highest level of human capital in terms of education, knowledge and experience, and have positive externalities that have a positive impact on real wages of other workers. When they leave regions in decline, there will be a negative impact on the remaining workers that are the most disadvantaged. The possibility of a market failure (in the sense of absence of market coordination, agents decide on their location without taking into account the effect of their choice on other agents) invokes the public intervention.

In Europe recent changes in inter-regional inequalities suggest a reconsidering the usual frameworks underlying policy, especially the people-versus-place division in policy formulation. There is evidence that the growth of inter-regional inequalities is underpinned by the existence of some group of regional economies that are quite structurally different. Theory predicts slow convergence through diffusion processes and labor mobility, but these mechanisms do not seem to work any longer to trigger economic convergence. Instead strong barriers in terms of skill structures and formal and informal institutions are at work against territorial development. Inter-regional inequality may represent not only an economic problem but also a source of political and social instability (Iammarino et al. 2018).

4. **The interrelation between spatial and social inequalities**

4.1 A significant example

The principle of cohesion indicates the reduction of disparities in economic outcomes and opportunity among the European regions. The reduction of regional inequalities is thought as part of the wider objective of decreasing inequalities between individuals, hence spatial cohesion is a part of the overall objective of social cohesion, based on the belief that regional policy can reduce spatial disparities and consequently individual inequalities. But it is not so obvious that countries that are spatially more unequal are also those with a more unequal income distribution, it is fundamental the process of aggregation.
### Table 2
An example of spatial and social inequality, 2 countries with 2 regions

<table>
<thead>
<tr>
<th>Country (j)</th>
<th>$F_j$ (average country GDP)</th>
<th>Regions (i) of country (j)</th>
<th>Spatial inequality $Y_{iA} / Y_{iB}$ (Ratio of GDP of the rich region to the poor one)</th>
<th>Population (n. of individuals)</th>
<th>Distribution of income between individuals</th>
<th>Social (overall) inequality (% of income that goes to the richest 10%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country A</td>
<td>1.9</td>
<td>Region 1A</td>
<td>1.9</td>
<td>50</td>
<td>S 5 individuals earn 10 (total=50); 45 individuals earn 1 (total=45)</td>
<td>100/190= 53% very unequal society</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Region 2A</td>
<td>No spatial inequality</td>
<td>50</td>
<td>S 5 individuals earn 10 (total=50); 45 individuals earn 1 (total=45)</td>
<td></td>
</tr>
<tr>
<td>Country B</td>
<td>1.9</td>
<td>Region 1B</td>
<td>2.3</td>
<td>50</td>
<td>S 10 individuals earn 5.5 (total 55); 40 individuals earn 1.5 (total 60)</td>
<td>55/190= 29% less unequal society</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Region 2B</td>
<td>There is spatial inequality</td>
<td>50</td>
<td>50 individual earn 1.5 (total 75)</td>
<td></td>
</tr>
</tbody>
</table>


The example in the above table can be very clear to this regard. Spatial inequality, given by the difference in per capita regional income does not generate a social inequality, i.e. an unequal distribution of income, if we adopt a space based redistributive policy from region 1B to region 2B, it would seem unfair to the poor of region 1B. A possible transfer from rich people of region 1B to poor of region 2B will create an artificial inequality between the poor of 1B and the poor of region 2B. Furthermore, similar transfer might even increase some measures of income inequality. The possible relationship between social (interpersonal) and spatial inequalities will be therefore tested with an econometric exercise, in paragraph 4.3.

### 4.2 Description of Data and Variables

Data and variables used for the econometric models reflect the idea that social inequality can be induced by spatial (regional) inequality, as well as by other
determinants. A detailed description of data is given by Table 3, which defines for each one, name, acronym, source and definition.

### Table 3

**Description of the variables in the panel estimate**

<table>
<thead>
<tr>
<th>Name of the variable</th>
<th>Acronym</th>
<th>Source</th>
<th>Definition</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Index of Interpersonal inequality</td>
<td>INEQ_{i,t}</td>
<td>Eurostat Regio</td>
<td>Logarithm of the ratio of the mean net income of the top decile to the bottom decile. Net income is the disposable income in purchasing power standard based on final consumption per inhabitant. It is calculated among all regions (NUTS2) being part of the country.</td>
<td>Social/interpersonal/income-inequality/disparity</td>
</tr>
<tr>
<td>Coefficient of Variation of GDP per capita</td>
<td>CV_{gdp, i,t}</td>
<td>Eurostat Regio</td>
<td>Coefficient of Variation (standard deviation/mean) on GDP per capita at regional level (NUTS2), in purchasing power parities in percentage of the EU average. The analytical weights are given by the population.</td>
<td>Spatial/territorial-inequality/disparity in production; Geography of production</td>
</tr>
<tr>
<td>GDP per capita</td>
<td>GDP_{i,t}</td>
<td>Eurostat Regio</td>
<td>Gross Domestic Product per capita in pps in percentage of EU Average, (NUTS0)</td>
<td>Well-being/wealth</td>
</tr>
<tr>
<td>Expenditure per capita in social protection</td>
<td>SE_{i,t}</td>
<td>Eurostat Regio</td>
<td>Expenditure in social protection in Purchasing power standard (PPS) per inhabitant (NUTS0)</td>
<td>Country preference for redistribution</td>
</tr>
<tr>
<td>Dispersion of unemployment</td>
<td>DU_{i,t}</td>
<td>Eurostat Regio</td>
<td>Coefficient of variation of regional unemployment rates (NUTS2). CV is defined as the ratio of standard deviation to the mean. This CV is multiplied by 100 to make a percentage.</td>
<td>Cohesion (another measure of spatial inequality)</td>
</tr>
<tr>
<td>CV of manufacturing activity</td>
<td>CV_{man, i,t}</td>
<td>Eurostat Regio</td>
<td>Coefficient of variation of regional manufacturing employment (NUTS2). The analytical weights are given by total employment in NACE sectors</td>
<td>Geographic concentration of economic activity (manufacturing)</td>
</tr>
</tbody>
</table>
4.3 The econometric model: specification, methods and results

A dynamic panel data analysis is conducted for our sample of 22 European countries for the period between 2000-2016, with the aim of testing the relationship between social and spatial inequalities, i.e. between the index of interpersonal inequality (based on net income) and different measures of territorial disparities at regional level, combined with other variables we repute relevant in explaining social disparities. All the variables are calculated for each country at NUTS2 regional level or at NUTS0, as reported in Table 3. The focus is not only on spatial dispersion of income, as responsible of inequalities, but also on the changes in the organization through agglomeration processes that we introduce in the model with a measure of dispersion of economic activity.

Methodology

We apply the difference-generalized method of moments (GMM) framework, as proposed by Arellano and Bover (1995) and Blundell and Bond (1998). This estimator overcomes a potential weakness in the Arellano and Bond (1991) estimator. Instead of only lagged levels, which are often poor instruments for first differenced variables, especially if they follow a random walk, the estimator includes lagged differences in addition to lagged levels.

If a model for panel data includes lagged dependent explanatory variables, the simple estimation procedures are asymptotically valid only when there are a large number of observations in the time dimension (T). The currently available response to this problem (Arellano and Bond, 1991; Holtz-Eakin, 1988; Hsiao, 2003) is to first difference the equation to remove individual effects and then estimate using instrumental variables (IV), given by the values of the dependent variable. This treatment leads to consistent but not efficient estimates, because it does not make use of all the available moment conditions.

The model

Hence, we use the difference-generalized method of moments (GMM) framework to estimate the following equation:

$$\Delta \ln(INEQ_{i,t}) = \beta_1 \Delta \ln(INEQ_{i,t-1}) + \beta_2 \Delta \ln(GDP_{i,t}) + \beta_3 \Delta \ln(CVgdpi_{i,t}) + \beta_4 \Delta \ln(SE_{i,t}) + \beta_5 \Delta \ln(DU_{i,t}) + \beta_6 \Delta \ln(CVmani_{i,t}) + \Delta \varepsilon_{i,t},$$

where $$\Delta \varepsilon_{i,t} = \Delta u_{i,t} + \Delta v_{i,t},$$

the subscripts $$i = 1, \ldots, N$$, $$t = 1, \ldots, T$$ indicate respectively the number of individuals (22 European countries) and the period of time (T=16 years), and all the variables being first differences, i.e. $$\Delta \ln X_{i,t} = \ln X_{i,t} - \ln X_{i,t-1}$$. All the variables are described in the above Table. $$\varepsilon_{i,t}$$ is the random error of the model. Fixed effects are decomposed into unobservable effects ($$u_{i,t}$$) and omitted observable effects
this implying that the differences between the units can be captured by differences in the constant term. Because of the double-logarithmic form of the model, its parameters can be interpreted as elasticities. For instance, parameter $\beta_1$ indicates to what degree current inequality is determined by the value of previous inequality in percentage terms (or values). The empirical results are presented in Table 4. Note that the coefficients are significant and the signs are those expected. The models are estimated with the two-step GMM with Windmeijer (2005) corrected standard errors.

The diagnostic tests

For the $J$-statistic (Sargan test) of the validity of overidentification restriction and Arellano-Bond test for serial correlation, $p$-values are reported. The null hypothesis of the Sargan test is $H_0$: overidentifying restrictions are valid. The null hypothesis of the Arellano-Bond test for serial correlation is $H_0$: no autocorrelation. As it is possible to notice, our estimations produce all statistically significant results in all the three models, which are moreover well specified, as it is possible to see from the $J$-statistics (Sargan test), with a $p$-value greater than 0.05. The AB tests reveal that there is first-order autocorrelation in the disturbances of the first-difference equations at 10% significance level in the first model, but not for the second and the whole GMM model. Most importantly, the absence of the second-order serial correlation in disturbances is not rejected for the three GMM models.

The results

We produced 3 different models, adding variables from the first to the full model. The main interpretations of the estimated coefficients are the following:

a. Previous inequalities have clearly a weight on actual inequalities, with a positive and persistent effect (second and third model). Inequalities persist and create a sort of path dependence, correlated to proximity in space.

b. Spatial inequalities in GDP strongly affect interpersonal inequalities, so that an increase of 10% of the dynamics of $CV_{gdp}$ has a positive impact on $INEQ$ equal to almost 0.16% in the second and the full model.

<p>| Table 4 |
|------------------|------------------|------------------|
| <strong>GMM-Difference dynamic panel-data estimation.</strong> |
| Dependent variable: $INEQ$ |</p>
<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>Independent Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>Independent Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>$lnINEQ_{i,t-1}$</td>
<td>-1.8973***</td>
<td>0.0426</td>
<td>$lnINEQ_{i,t-1}$</td>
<td>0.5524***</td>
<td>0.0047</td>
<td>$lnINEQ_{i,t-1}$</td>
<td>0.5458***</td>
<td>0.0026</td>
</tr>
</tbody>
</table>
### Table 1: Regression Results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>lnGDP_{it}</td>
<td>-0.9384***</td>
<td>0.0318</td>
</tr>
<tr>
<td>lnCVgdp_{it}</td>
<td>0.1026***</td>
<td>0.0089</td>
</tr>
<tr>
<td>lnSE_{it}</td>
<td>-0.0265***</td>
<td>0.0008</td>
</tr>
<tr>
<td>lnCVman_{it}</td>
<td>0.0171***</td>
<td>0.0039</td>
</tr>
<tr>
<td>lnDU_{it}</td>
<td>-0.0043*</td>
<td>0.0025</td>
</tr>
</tbody>
</table>

### J-statistic and Prob(J-statistic)

<table>
<thead>
<tr>
<th>J-statistic</th>
<th>Prob(J-statistic)</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.35849</td>
<td>0.498645</td>
</tr>
<tr>
<td>17.79052</td>
<td>0.469531</td>
</tr>
<tr>
<td>15.0479</td>
<td>0.658675</td>
</tr>
</tbody>
</table>

### Arellano-Bond Serial Correlation Test

<table>
<thead>
<tr>
<th>AR(1) p-value:</th>
<th>AR(2) p-value:</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0056</td>
<td>0.7647</td>
</tr>
<tr>
<td>0.0995</td>
<td>0.9912</td>
</tr>
</tbody>
</table>

### Additional Analysis

c. The per capita expenditure on social transfer affects negatively social inequalities, as we could expect. It is interesting to notice that the introduction of such a measure of national redistribution only mitigates the impact of spatial disparities without compensating them completely (compared to model 1 in which social expenditure was not present).

d. GDP per capita has a negative and highly statistically significant coefficient, meaning that an income increase of 10% reduces social inequality (by around 0.3 percent in the 1st model and 0.1 per cent in the full model). It can noticed that the effect of GDP per capita is lower in the full model where we introduce other measures of dispersion.

e. In the full model we consider other variables of spatial inequality, such as DU, (considered by the EC as a measure of cohesion, i.e. regional dispersion of unemployment rates in each country), and a measure of geographic concentration of economic activity (CVman), in order to test the effects of agglomeration on social disparities. Both the variable are significant, and the sign of CVman is positive as expected by theories of NEG, so that more agglomeration, induced by increasing returns of scale in production, increases disparities. The sign of DU is negative, differently from the other measure of dispersion (CVgdp), with the possible interpretation that in those regions where unemployment is high and persistent and phenomena of polarization take place, (therefore cohesion is low), dispersion is getting lower and this has a positive effect on inequalities.\(^{11}\)

\(^{11}\) Martin (2009) obtains similar results when considering the impact of cohesion (dispersion of regional unemployment rates) on social inequalities.
Regional Inequalities in Europe exist, persist and are pervasive. Our study has focused on recent evolution of regional disparities at spatial and social level for 22 countries from 2000 to 2016. Empirical evidence indicate that geographical disparities are wider than at country level, with a mild increase in recent years. Some countries experiment strong increases, and this can stem from the fact that the process of growth presents significant local differences and is usually limited to a number of regions generally including the capital city. This process of convergence between countries but not within regions can be explained with regional divergence in production and in some specific cases, like Italy and France, in more equal geography of disposable income, so generating a sort of “scissor effect” between geography of production and income. The implication is that national measures of redistribution (that are not connected to regional policies) have compensated the increase in production inequality. Hence, regional convergence (that we can read in the evolution of dispersion of net disposable income) cannot be considered a synonym a regional cohesion (given by the evolution of dispersion of regional unemployment and GDP).

The main prediction of NEG, that is a positive relationship between agglomeration and regional inequality has been empirically tested and results suggest that at regional level agglomeration of economic activities is higher than at country level (with some strong increases for specific countries) and the persistence of spatial disparities (both related to the geography of production and of manufacturing activity) affect social disparities. The dynamic panel estimate confirms a scenario in which countries with major regional inequalities are also those with more individual inequalities, showing also a mitigating effect of social expenditure and GDP per capita. Conversely other measures of disparity (what the EU defines the dispersion of unemployment rates among regions) seems to slightly diminish inequalities, but this is probably due to the typical process of polarization which is typical of unemployment.

The relationship between growth and regional disparities has been tested for European regions in the mentioned period. The positive sign of it calls for policy interventions and reflections on the possible trade-off between equity and efficiency (generated by growth induced by agglomerative processes), which is crucial when speaking of public economic policy.

European regional policy cannot claim legitimacy on either grounds. NEG theory predicts that agglomeration process of economic activity, based on increasing

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12 We interpret the first as an indicator of country preferences for redistribution and the second as a measure of well-being.
returns to scale generates efficiency gains, and empirical evidence about European disparities indicate that the definition of regional policy should take into consideration these gains. On the equity ground national redistribution schemes that are not spatially oriented\textsuperscript{13} may even reduce spatial inequalities, but may not be effective in reducing interpersonal inequalities.

If a large share of regional inequalities come from interpersonal inequalities (themselves produced by differences in individual characteristics, such as the education level), regional policies consisting of subsidizing industries to incentivate them to relocate in disadvantaged regions or financing infrastructure projects in those poor regions, may have a perverse effect on individual inequalities\textsuperscript{14}. Policies concentrating on education may be more efficient.

Therefore, EU either puts its efforts on slowing down the process of spatial economic concentration at national level, or decides to speed up the process of convergence between poor and rich countries. Another aspect to consider is that rich countries can much more easily redistribute from rich to poor regions than poor countries. Given these transfer at national level, regional European policy not necessarily has to focus on intra-national regional inequalities.

In literature a different approach to policy framework is emerging: if the European scenario is that of different structural development groups with weak convergence and diffusion mechanisms, the standard distinction between people-based policies (mobility and education) and place-placed approaches (job development, innovation support) is not effective and should be replaced by “place-sensitive approaches”, based on individual and territorial logics of tackling diverse development trajectories, without referring to the conventional notions of convergence and redistribution (Iammarino et al. 2018)\textsuperscript{15}. This takes into account the fact that factor mobility generates significant agglomeration effects from which prosperity does not descend sufficiently for all regions. European integration tends to concentrate high-skilled people and knowledge in few core places, so that Europe-wide general-purpose policies cannot address the problems of spatially uneven development.

Social inequalities can be tackled moving from spatial inequalities if we are able to collocate the last in the right structural group of regional economies: in this case

\textsuperscript{13} Income taxes, social transfers, etc.

\textsuperscript{14} This is due to the fact that if capital is mobile, subsidizing the return of capital in on region equals to increasing its returns in all regions, and if the return is higher in one region than in another, relocation will take place until the returns are equalised. The result is actually a transfer from the poor to the rich region, as the increase in the return of capital will benefit the region with the highest share of capital (Dupont and Martin, 2003).

\textsuperscript{15} In the cited work place-sensitive strategies are identified and specified for different structural groups of regions: very-high-income, high-income, low income, middle-income regions.
the right mix of instruments should be tailored to the structural prospects of different kinds of European regions. The disaggregation of different development realities within a place-sensitivity approach should allow to combat under-utilization of regions' resources, to distribute more widely development and unleash the potential output of all regions. It is essential to take into account the potential barriers to people mobility and to spreading employment, especially for those groups of regions that have middle income and low income.

The middle income regions experience traditional slow-growing industrial peripheries, declining industrial areas, poor-quality government, pervasive corruption, collusion, lack of trust, a fraying social capital. In this case individual inequalities can be reduced increasing the productivity of individuals and systems by enhancing education and labour force participation. Making significant investment in re-skilling, more attractive inward investment flows, a stronger participation on global production networks, the realization of knowledge links between university and industry and of networks between workers, universities, investors and government could represent ad hoc place-sensitive strategies.

The second group suffers from limited skills and assets in technology and organization, but their backwardness presents important differences between the eastern and the southern EU peripheries. These regions are not attractive for business, their key supply factor, labour, is not fully mobilized and they have limited intra-regional and external networks. Jointly with dysfunctions in government and governance, lagging behind regions remain far better connected to core cities than to less developed areas. European integration, can accelerate youth loss to higher income places (as NEG theory predicts) so undermining the economic and social potential. All these forces can combine in limiting their size and ability to capture infrastructure and logistics, with the result that they have a very narrow margin to exploit their initial comparative advantage of low cost labour and land. The range of interventions is wide: investment in infrastructure with intra-periphery connections, policies and reform to increase labour force participation, creation of start-ups, education reforms, job-skills matching, university-industry linkages, identification of complementarities across agriculture, manufacturing and services and support to social network to risk-taking and openness.

The final consideration is relative to agglomeration and regional growth: the underlying assumptions of NEG models are sometimes simplistic and ignore various spatial negative externalities associated with spatial agglomeration. Instead of using abstract simplified models, it could be useful to measure empirically the effects of spatial agglomeration/regional inequalities. The evidence we produced within this work, on the possible relationship between individual inequalities, spatial
disparities and agglomeration of economic activity, can offer essential hints to build a model that captures the mechanism involved.

6. References


Duro, J.A. (2001), Regional income inequalities in Europe: An updated measurement and some decomposition results, Mimeo, Instituto de Análisis Económico, CSIC.


