



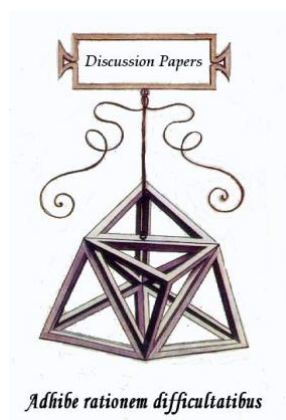
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# **Polycentricity and regional development: an analytical framework and some evidence from Italy**

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## **Abstract**

This paper analyses the relationships between polycentricity and regional development, under a multi-dimensional and policy oriented conceptualization of development. We provide an analytical framework and an explorative analysis of Italian regions, by taking into account several aspects of spatial structure. We found that competitiveness is positively associated with agglomeration and negatively with polycentricity. However, larger regions show to be less inclusive, while there is a positive association between polycentricity and social cohesion. Our results allow for a discussion on regional polycentricity and its effectiveness when planning and evaluating public policies, possibly enriching the debate on regional policy assessment and implementation.

**Keywords:** regional development, regional urban systems, polycentric urban regions, inequalities.

**JEL:** R11, R12, R14

## 1. Introduction

*“Polycentric development can create critical mass by combining the efforts of urban centres, while delivering more balanced development between regions and more cooperative and functional urban-rural linkages”*

(European Spatial Planning Observation Network, ESPON, 2018a, 2)

After its entrance in the European political agenda, back in 1999 when the European Spatial Development Perspective (ESDP) came out, the concept of polycentric development has gained rising attention, becoming one of the key concepts for spatial planning and development policies. Recently, a working paper and a policy brief by the European Spatial Planning Observatory Network (ESPON, 2018a, 2018b) asserted the crucial role of polycentric development in pursuing the goals set by policies within the European Union and called for its integration in sectoral policies - in particular at the regional and local scale (that is, more integration between spatial planning and territorial development).

By searching for keywords like “polycentric urban region” or “polycentric development” in databases of peer-reviewed literature like Elsevier’s Scopus, we also notice an increasing amount of research and scientific publications (Figure 1).<sup>1</sup>

<sup>1</sup> For more detailed figures on the presence of polycentricity in research and on the most influential papers, see the scientometric analysis provided by Van Meeteren et al. (2016).

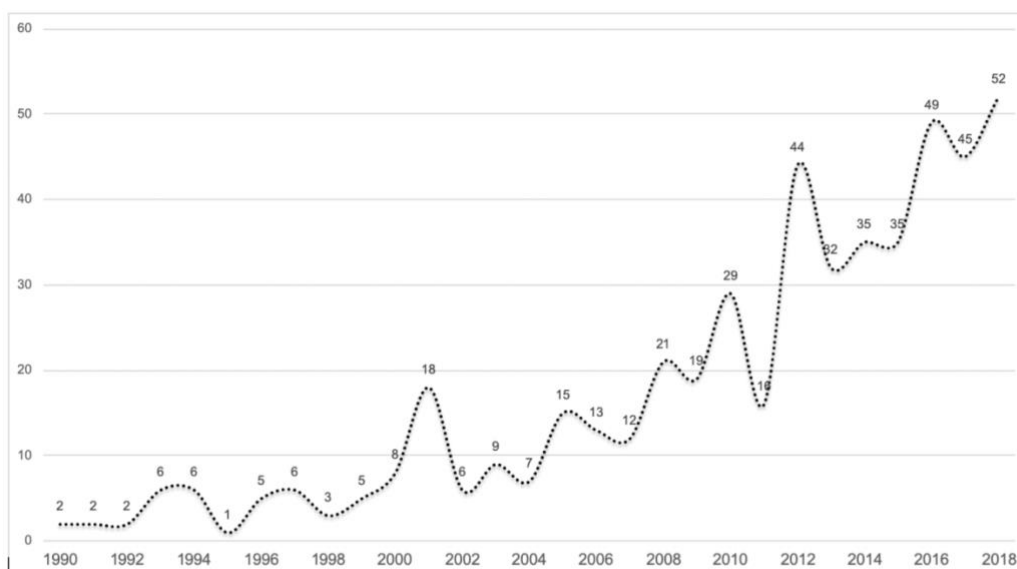


Figure 1. Number of published research articles on polycentricity, polycentric development and polycentric regions

Note: search made on title, abstract and keywords on a list of selected scientific journals

Source: own elaboration from Scopus.com

However, it has also been stressed how there are many aspects which are still unclear, resulting in the fact that research is continuously calling for further analysis and clarification on some critical aspects. A recent article by Rauhut (2017), for instance, reviews the points of fuzziness of polycentricity - which actually are the same concerns raised by other authors, such as Kloosterman and Musterd (2001), Davoudi (2003), Waterhout et al. (2005), Halbert et al. (2006), Meijers (2008), Burger and Meijers (2012).

Notwithstanding that there is no “one-size-fits-all” concept (Halbert et al., 2006), polycentricity has continued to be included in many planning and development policies, in different contexts and at different scales. Hence, polycentric development seems to have entered the domain of ‘isomorphic policies’, i.e. identical recipes to be replied in several contexts without considering the differences and their implications (Chien, 2008; Barca et al., 2012; Rodriguez-Pose, 2013). Often, policies just seem aimed at imitating successful cases which may represent the exception, rather than the norm. The successful history of the Randstad polycentric metropolis provides an example, since it has been often recalled in a sort of bandwagon effect.

To sum up, having become a sort of “Babel’s Tower” in the literature (Van Meeteren et. al, 2016), polycentric development has also become a sort of stereotyped pseudo-technicism to be used by policies, together with other ‘buzz-words’ such as “regional resilience”, “smart regions”, “circular economy” and so on.

We argue that, given the current debate on the future of regional policies in the EU, there is a serious risk that this phenomenon will continue to be at stake. Hence, a framework about the links between polycentricity and development should be included in the research agenda, especially at a regional level. The thesis to be tested is whether regional development is linked with regional structure, which in turn is made by the social and economic relationships involving the territories within each region. Those performances can be described and analysed both considering their aggregate dimension (regional level or growth rate) and their distribution within regions.

Our contribution aims to set a first step towards the above-described research agenda, by analysing the links between the dimensions of polycentricity (being polycentricity one dimension of regional spatial structure) and the dimensions of development. Italy provides an interesting case study. As in other Countries, polycentric development has become, in the last decades, a target expressed in many planning and development strategies made by the Italian NUTS-2 Regions<sup>2</sup> (from here onwards “regions”), including Tuscany, Emilia-Romagna, Marche, Piedmont, Campania and others. Additionally, Italian regions have been characterised by remarkable spatial phenomena, such as urbanization, territorial coalescence and shrinking inner areas, which affected their spatial structure and development patterns. The presence of polycentricity in regional planning, along with the heterogeneity in regional spatial development and the widely-known (and growing) regional disparities (OECD, 2018), allow Italy to be an interesting case study.

For each region a set of indexes of urban spatial structure (agglomeration, polycentricity and accessibility) has been computed and compared. The choice of the three aspects is related to their links with social and economic relationships in regions and the possibility to be addressed by regional authorities. Results show a trend towards increasing functional polycentricity, but also a high level of heterogeneity.

Then, regional structure has been linked with regional development, considering both the aggregate level and the spatial distribution of performance. Development has been conceptualized by considering the new EU Cohesion

<sup>2</sup> For a review of past planning policies incorporating polycentricity in Italy, see Salone (2005).

framework “post 2020”, which adopt five major goals to be achieved for Europe and its regions: “smarter”, “greener”, “more connected”, “more social” and “closer to citizen”.

The article is organized as follows. The next section describes the current context of regional development. The third section defines the dimensions of regional polycentricity and draws the links between polycentricity and regional development. The fourth section reports the case study of Italian regions. The last section summarizes the article and provides conclusions and suggestions for further research.

## 2. Regional development and polycentricity in an age of inequalities

Economic activities and their performances have always been unevenly distributed across space. Nowadays, this phenomenon is particularly evident, given the growing patterns of spatial polarization and geographic inequalities (Storper, 2018), at many levels of analysis, such as considering spatial units (Alvaredo et al., 2018) or people (Oxfam, 2019). Inequality is particularly noticeable taking into account regions and urban areas, since empirical evidence has shown that inequalities increased especially across regions *within* countries (Ballas et al., 2017; Rosés and Wolf, 2019).

Territorial imbalances have been boosted by long run factors such as globalization, trade openness and technological development, which have caused an unbalanced re-distribution of opportunities and wealth across space, resulting in uneven patterns of development (Iammarino et al., 2018): in some areas, the above-mentioned patterns have caused a growing demand for goods and services locally produced, and hence stimulated employment and wages, while for some other areas the opposite has happened - with heavy impacts on key development factors such as employment (Moretti, 2012) or migration (World Bank, 2018). In general, large metropolitan agglomerations represent the “winners”, meaning that they are the economic hubs of an increasingly ‘urban’ world. Additionally, they are gradually connected to each other, thus reinforcing their centrality (Taylor and Derudder, 2016). Large urban agglomerations have also been shown higher resilience during

the Great Recession (Capello et al., 2015), despite being heavily affected in the first phases of the crisis (Dijkstra et al., 2015). Conversely, regions apart from metropolitan agglomerations, such as manufacturing districts or remote and rural areas, i.e. the “peripheries” of countries, have been negatively affected by the outcomes of the crisis (Iammarino et al., 2018).

Hence, inequalities between regions have been growing (Charron, 2016; Le Galès and Pierson, 2019). In Europe, rising inequality is characterized by the decline of some formerly prosperous regions (Rosés and Wolf, 2019). This phenomenon called into question the effectiveness of European cohesion policies (Fratesi and Wislade, 2017; Fiaschi et al., 2018) and it is animating a debate about the consequences in terms of economic, social and political instability (Rodríguez Pose, 2018; Bussolo et al., 2019), given the political and social tensions which are in place in many regions, such as the wave of protests and populism that has recently spread over Europe (Dijkstra et al., 2019).

Hence, a reflection on how to rethink regional development and cohesion policies is called for, both regarding policy setting (Bachtler and Begg, 2018; Iammarino et al., 2018; Rodríguez-Pose, 2018) and implementation (Capello and Perucca, 2018).

The debate on regional policy assessment and implementation has been revitalized in the last years, starting from a series of highly influential reports such as the *Reshaping Economic Geography* by the World Bank (2009), and the *An Agenda for a Reformed Cohesion Policy* (Barca, 2009), which have been followed by other publications (see, e.g. OECD, 2009; European Commission, 2010; Barca et al., 2012; Rodríguez-Pose, 2013; Camagni and Capello, 2016).

From these contributions and the subsequent debate, two main approaches to regional issues have emerged: the place-neutral (or ‘people-based’) versus the place-based approach. The former, which is advocated by the World Bank Report, was turned into the advice to enhance institutions (‘spatially blind policies’) and to promote growth in “leading areas” where investments are likely to have higher returns and spillovers, while compensating “lagged areas” with interventions based on people rather than local specificities (World Bank, 2009, 238-240). The latter, on the contrary, focuses on localized specificities in order to enhance development targeting the tools to regions, instead that people or social groups. The divide between place and people has been recently recomposed into a call for “place-



sensitive” policies (Iammarino et al., 2018; ESPON, 2018a): policies should use a set of integrated instruments and tools, addressing both individual and territorial issues - the latter being common to similar ‘clubs’ of regions (Iammarino et al., 2017) - thus exploiting the regional potential for balanced growth.

Within this context, it might be argued that polycentric development can play a role in fostering regions, by overcoming the trade-offs between different dimensions of development, thus enhancing the territorial potentials, especially in the European context: hence, it could represent a “place-sensitive” instrument.

Polycentricity is widely recognized as one of the key-concepts in territorial development, especially at the European level, being present and promoted in all key strategic documents of European spatial policy. It has become successful starting from the Principles agreed by European Governments in 1994, later developed into the ESDP (1999), and then followed by the Territorial Agenda (2007). The latter stressed territorial cohesion, following the general framework stated by the Fourth Report on Economic and Social Cohesion that had been launched immediately before. The Territorial Agenda was then updated by the ‘Territorial Agenda of the European Union 2020’, agreed in 2011 (released in order to adapt spatial policy to the ‘Europe 2020 Strategy’). Today, the debate on the EU cohesion policy in the next programming period 2021-2027 is again renewing the role of polycentricity.

In the meantime, research has highlighted how the term could have been misused (van Meeteren et al., 2016), turning into “a vague, fuzzy and wobbly catch-all concept that can be stretched to mean practically anything” (Rauhut, 2017, 338). The fuzziness relates to all aspects of analysis: its definition and measurement, the relevant spatial scale, its effects (including the spatial interlinkages) and its policy implementation.

Taking into account the regional scale, we argue that there are two general questions that need to be addressed. The first question (analytical) and relates to the effects, if there are, of polycentric spatial structure on development. The second question (normative) relates to the fact whether polycentricity should be an explicit goal to be pursued, or alternatively a spontaneous phenomenon. Subsequently, one might ask about the difficulties in implementing polycentricity into policies. In fact, although present in many policy documents and strategies, polycentric development is often lost in the translation into practice, or just partially implemented (Faludi,

2015; Rauhut, 2017). Those aspects make rather difficult and complex tackling polycentricity when evaluating regional policies and their effects.

### 3. Analysing regional spatial structure and regional development

#### 3.1 The dimensions and measurement of regional spatial structure

Polycentricity is one of the dimensions that characterize the spatial structure of an area, and can be defined, by a socio-economic point of view, as the form in which economic activities are organized across space. When looking at the regional level, we might distinguish between three main relevant dimensions: agglomeration, polycentricity, accessibility.

Agglomeration, which is probably the most relevant 'place-based' concept in economic research, refers to the concentration of economic activities across space. Hence, is usually measured by size and density of economic activity. Additionally, the metropolitan dimension which characterise some regions has to be taken into account, given their role of "hubs", providing high level services and acting as engines for wider regional development.

Notwithstanding the role of agglomeration, the performance of territories can be conditioned by the characteristics of their internal structure and therefore by the number, size and functional composition of the urban centres (Camagni et al., 2015). This leaves space for the concept of polycentricity.

Even if there is no univocal definition on "polycentricity" (Davoudi 2003; Meijers et al., 2007, Meijers, 2008, Rauhut 2017) it generally refers to a balanced organization of a spatial system, as opposed to 'monocentrism'. Moreover, polycentricity is a multi-scale concept (Davoudi, 2003) and multi-dimensional concept. The latter is particularly relevant at the regional level (and, as shown later in the article, is relevant for Italy), especially considering the distinction between morphological and functional polycentricity. The former concentrates on the boundaries and the separation of the centres, which "must not be too dissimilar in terms of dimensions, since there must be no evidence of primacy at the top of

distribution" (Hall, 2009, 261). The latter focuses on the distribution of functions across space and, that is on the hierarchy that emerge within a localized network. The regional hierarchy between cities is evaluated in terms of interaction or interdependence.

The fact that polycentricity is a rather fuzzy concept, used with different dimensions and in more disciplinary areas, makes also its measurement not unique (Green 2007, Meijers 2008). Several polycentricity measures have been proposed, such as the rank-size distribution of centres (Burger and Meijers 2012), the index of morphological primacy (Burger et al. 2011), the functional polycentricity indices (Green 2007), and others.

With reference to morphological polycentricity, indicators aim to assess whether the condition of "territorial balance" holds, that is in many cases if there is a lack absolute dominance of the main city. Indexes of concentration, such as the Herfindahl–Hirschman index (Meijers et al., 2018), or rank-size estimations (Meijers, 2008b) are commonly used.

In our research, we adopted a novel measure of regional morphological polycentricity based on rank-size regressions, which is expressed as the ratio between the logarithm of the largest regional city and is the intercept of the rank size regression. This measure of morphological polycentricity allows us to compare the different regions, considering the aspects of regional hierarchy and the primacy of the main centre.

Functional polycentricity is evaluated by using interaction measures, often based on the flow of people, goods or information, by making use of tools borrowed from network analysis. It usually focuses on connectedness and centrality of commuting flows, especially at the intra and inter-urban scale (De Goei et al., 2010). In our analysis we used the Special Functional Polycentricity Index (PSF) proposed by Green (2007)<sup>3</sup>. The main advantage of this index is that combines in an aggregate measure two features of functional polycentricity: the spatial distribution of centres and the density of functional relations that take place within a region. Hence, the degree of spatial integration within regions is taken into account. While all type of

<sup>3</sup> For the details about the computation of the PSF index in regions by using commuting data, see, e.g. Green (2007) and, Burgalassi and Luzzati (2015).

flows between centres can be used in the index, data availability makes commuter flows the most commonly used, as we did in our research.<sup>4</sup>

Given the multi-scalar nature of polycentricity, considering different spatial scales can lead to different conclusions (Brezzi and Veneri, 2015). For regional analysis, an aspect deserving attention is, within each region, the level of intra-regional polycentricity. Actually, the structure of the local and urban systems in a region can determine whether the aggregate regional structure is balanced (i.e. the local areas present a similar structure) or polarized (that is, if for instance one city is highly polycentric, and the other are monocentric, or vice versa). Following Meijers et al. (2018) we computed for each region an index of polycentricity by taking into account the average value of the Herfindahl Index of distribution of population within Local Labour Market Areas, which represent the functional areas identified by the Italian Statistical Bureau. In order to account for the spatial distribution within of intra-urban polycentricity within each region, we also considered the coefficient of variation. Together, the average value and the coefficient of variation of the Herfindahl Index provide an overview of the intra urban spatial structure that characterise a region.

Accessibility is another important issue. Similarly to polycentricity, also accessibility represents a complex and multi-scalar concept. The aspect is quite interesting to be included among the dimensions of spatial structure in the European context, and particularly in Italy, since it has become a key concept for the identification of the territories to be included into the National Strategy for Inner Areas (NSIA), which is one of the most important place-based policies implemented in Italy for the recovery of (mostly) remote and rural territories.

A proxy for structural accessibility is calculated as the share of the surface of the region which is classified as peripheral or ultraperipheral within the NSIA framework. Peripheral inner areas are those municipalities that are located between 40 and 75 minutes of driving distance from an urban centre. 'Ultra-peripheral' inner areas are located over 75 minutes of driving distance. This indicator is meant to reflect the structural and geographical characteristics of each region in terms of

<sup>4</sup> For the details about the computation of the PSF index in regions by using commuting data, see, e.g., Burgalassi and Luzzati (2015).

potential accessibility (*ceteris paribus*, a region which is more mountainous is bound to have a lower accessibility for orographic reasons).

Table 1 summarises the indicators of spatial structure which have been used in our analysis.

Table 1: dimensions and indicators of spatial structure

Dimension	Variable name	Conceptual meaning	Description
<b>Agglomeration</b>	Size	Agglomeration effects (proximity)	Regional population
	Density	Agglomeration effects (proximity)	Population per square km
	Metro	Presence of metropolitan environment (and functions)	Share of population living in metropolitan areas
<b>Polycentricity</b>	Morphological	(Flat) hierarchy within region	Index of primacy (computed on size-rank regressions based on municipalities within regions)
	Functional	Functional integration between centres within region	Special Functional Polycentricity Index, computed using commuting data for municipalities
	Sub-regional	Intra-urban polycentricity within the region	Average value inverse of the Herfindahl–Hirschman index computed on population within regional Local Labour Systems
	Sub-regional (heterogeneity)	Degree of variability of intra-urban polycentricity (polarization)	Coefficient of variation of the Herfindahl–Hirschman index computed on population within regional Local Labour Systems
<b>Accessibility</b>	Accessibility	Structural potential accessibility to services	Inverse of the share of peripheral and ultra-peripheral areas over the regional territory

*Note: for all indicators, primary data are provided by Italian Statistical Bureau (ISTAT). The primary data for the indicator of accessibility are provided by the Italian Government – Territorial Cohesion Dept.*

### 3.2 Linking spatial structure to regional development

In order to assess the effect of polycentricity on development, it is necessary to define - and subsequently measure - the notion of development itself, which is multidimensional, by shifting from a mono-dimensional and aggregate measurement (i.e. the use of GDP) to a multidimensional and spatially disaggregate set of measures. In a European perspective, a reference to define development has been given by the EU Framework Regional Development and Cohesion Policy for the 2021-2027 programming period, according to which there are five policy objectives for Europe and its regions:

- “a Smarter Europe, through innovation, digitisation, economic transformation and support to small and medium-sized businesses;
- a Greener, carbon free Europe, implementing the Paris Agreement and investing in energy transition, renewables and the fight against climate change;

- a more Social Europe, delivering on the European Pillar of Social Rights and supporting quality employment, education, skills, social inclusion and equal access to healthcare;
- a more Connected Europe, with strategic transport and digital networks;
- a Europe closer to citizens, by supporting locally-led development strategies and sustainable urban development across the EU”.<sup>5</sup>

These goals might reflect five relevant dimensions included in the concept of regional development: economic competitiveness, social cohesion, environmental sustainability, connectivity and infrastructures, provision of public services. The first three goals - “smarter”, “greener”, “social Europe” - are already presented in the *Europe 2020 Strategy* by the European Commission (2010) and its spatial policy counterpart, the *Territorial Agenda of the European Union 2020. Towards an Inclusive, Smart and Sustainable Europe of Diverse Regions* (2011). The dimensions of connections and infrastructure and of the closeness to citizen have been also recognized as crucial to enhance development and wellbeing. In all those aspects, regional spatial structure - and polycentricity in particular - may play a role.

#### *Competitiveness*

With reference to “smart” development, the role of agglomeration is crucial, well known and widely recognized (World Bank, 2009). However, the consolidated wisdom on the role of urban size has recently been questioned (Camagni et al., 2016). Studies on city-networks (Camagni, 1993; Camagni and Salone, 1993) and polycentric systems (Kloosterman and Lambregts, 2001; Davoudi, 2003; Parr, 2004; Meijers, 2008a; Meijers et al., 2017) have shown that urban competitiveness depends on its regional context, that is the functions provided by other centres, their size, distance and (above all) their mutual relationships. Metropolitan functions, which can today depend more on the presence of networks rather than size and density, can also be crucial (Meijers et al., 2015). This aspect is relevant in strategic terms for European cities (mostly of medium and small size), which might exploit the ‘regionalization’ of agglomeration effects by means of ‘borrowed size’ (Burger and Meijers, 2016). This mechanism requires functional integration, co-operation and complementarities among the centres within the region (Van Oort et al., 2010), otherwise “summing small cities does not make a large city” (Meijers, 2008a). From

<sup>5</sup> [https://ec.europa.eu/regional\\_policy/en/2021\\_2027/](https://ec.europa.eu/regional_policy/en/2021_2027/)

this perspective, a crucial issue is represented by fragmentation, in terms of institutions and infrastructures, could harm the effects (Lambregts, 2006): hence, a role for regional accessibility.

#### *Social cohesion*

The second pillar of the EU view of development is related to the distribution of the benefits generated by economic wealth. Hence, it refers to income redistribution policies and to enhancement of individual capabilities (Sen, 2003). Key aspects to be considered in regional analysis are represented by labour market conditions, income distribution, poverty.

Already in 1947, Jean-François Gravier in "Paris et le désert français" (Paris and the French desert) warned about the strong territorial disparities generated by highly polarized spatial systems, which can also hinder the national development: this evidence constituted the premise of the policy of "métropoles d'équilibre" (balanced metropolis), investing in cities outside of Paris. In a certain sense, this policy has anticipated the promotion of polycentricity.

While agglomeration might originate a more or less inclusive development, the role of polycentricity for cohesion has been largely stressed by policies. However, compared to research on the relationships between polycentricity and economic performance, less attention has been devoted to the effects of polycentricity on social cohesion (Malý, 2016). Moreover, the few empirical research gives contrasting results (see, e.g., Meijers and Sandberg, 2008; Veneri and Burgalassi, 2012; Mulíček and Malý, 2019).

When assessing cohesion at a regional level, it is crucial to consider both the performance of the indicators and their distribution across space. Otherwise, there is high risk of fallacy of generalization that will corrupt the results. For instance, usually statistics about the income distribution are provided at regional level. However, given the different spatial structures in regions, the same value of the income distribution at regional level could be the result of a more or less balanced distribution across the regional localizations.

#### *Environmental sustainability*

Spatial structure may affect the quality of the environment through several links. The two main drivers refer transport and energy efficiency of the residential sector, which in turn represent two of the most important sources of emissions. Spatial structure

affects residential and mobility choices, including commuting. While density has been recognized as a driver for higher efficiency of transport, and thus for reduction of the environmental pressure (also as opposed to dispersed forms of spatial development), the role of polycentricity is still unclear<sup>6</sup>. For However, polycentricity might orient policy choices aiming to minimize the environmental costs of transport, such as the provision of an efficient public transport system.

Another factor linking spatial structure and the quality of the environment is given to land use. The main argument for polycentric regions is that they might avoid urban sprawl, which in turn is a factor for transport emissions. In fact, polycentric regions are poles apart both from monocentric regions and sprawled regions. However, polycentricity taken alone is not sufficient. Other aspects of urban spatial structure, such as compactness and physical separation between centres, are also to be taken into account.

#### *Connectivity and infrastructures*

This dimension of development is functional to the goals of competitiveness, inclusion and sustainability. So, investments in connecting places and increasing flows of people, goods and information have been traditionally promoted both by spatially-blind and place based approaches, and they have been particularly carried on at European level (Crescenzi and Rodríguez-Pose, 2012). The literature on the economic impact of transport infrastructure investments is vast and heterogeneous. Accessibility and network efficiency affect regional development both at the local level (usually associated with equal access to opportunities and services) and at the broader level, since better connected regions are more exposed to global markets and are forced to increase their competitiveness in the long and medium term. Local development requires not only an adequate combination of private production factors (capital and labour) but depends also on the presence of public capital, particularly in the form of transport and communication infrastructures (Rietveld e Nijkamp, 1992).

#### *Provision of public services*

The last dimension of development, aiming to reach “a Europe closer to citizen”, is highly related to the regional and local scale. Moreover, it can directly associated to

<sup>6</sup> For a review about the linkages between spatial structure and environmental pressure, see Burgalassi and Luzzati (2015). For the details about spatial structure and emissions due to mobility, see Cirilli and Veneri (2014).



citizen well-being, through the provision of public services, which can be heavily dependent on place-based actions and policies – both in terms of cost of provision and their quality – which are related to the institutional quality (Ketterer and Rodríguez-Pose, 2015; Iammarino et al., 2017). This aspect is particularly relevant for lagging regions (Rodríguez-Pose and Ketterer, 2019). Therefore, the assessment of this dimension of development should consider both the quality of public services and the local institutions.

Institutional quality may be affected by the relationships of networking and horizontal cooperation between institutional actors, which could be fostered within polycentric regions and resulting in better services. Inter-urban cooperation (e.g. by means of a shared governance by local authorities) could also mitigate the imbalances between centres and peripheries in terms of services, which are particularly relevant when looking at inner and rural areas.

#### 4. Spatial structure and development in Italian Regions: a role for polycentricity?

When investigating the links between spatial structure and development, Italy provides one of the most interesting case studies in Europe. Italian regions show huge heterogeneity in their economic structure and subsequent disparities in social and economic performances. Long run phenomena such as the economic divide between North and South, the rise of the ‘Third Italy’ (i.e. the set of regions of Central and North-Eastern Italy, driven by the “industrial district” organization of activities which, despite their size, succeeded in being internationally competitive) and the noticeable urban development that has characterised the Country has changed dramatically the spatial organization of economic activity, so that regions developed by means of urban growth and territorial coalescence. Consequently, sharp changes in the population distribution occurred towards higher concentration in cities (and the detriment of inner areas) (Figure 2). Nowadays, cities and urban areas are increasingly integrated within their regional context in terms of functions and mutual interactions.

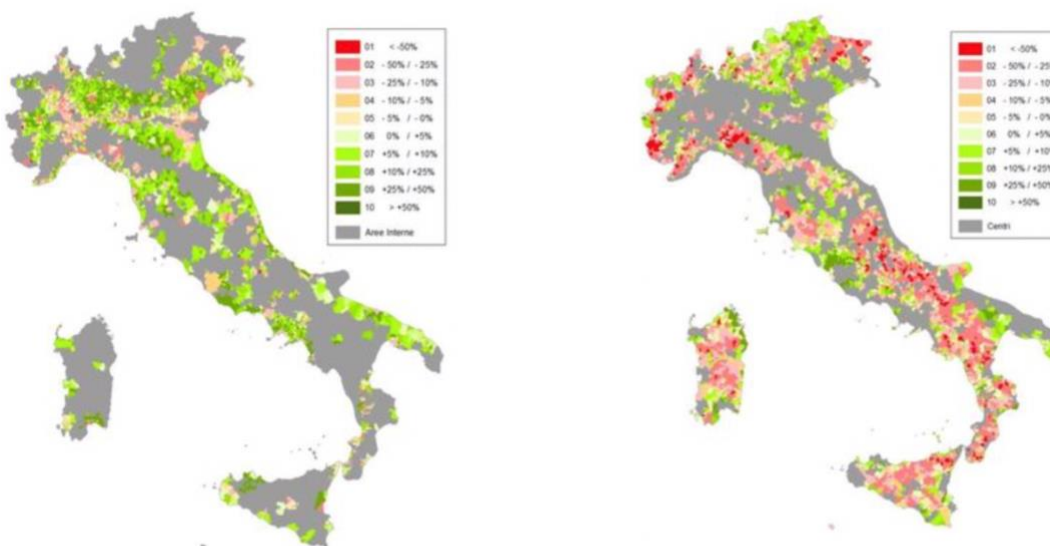


Figure 2: Demographic changes between 1971 and 2011, urban areas (left) and inner areas (right).

Source: own elaboration based on ISTAT data

Focusing on Italian regions is particularly relevant also because they represent both analytical and decisional geographical units, with a relevant power in land planning and development policies. In particular, they are the responsible bodies for strategic territorial planning, including transport planning, and for programming local development policies. Hence, following the classification by Meyer (1963; 22) further elaborated by Parr (2014), this spatial level might combine the aspects of *homogeneity* (of the economic and social structure), *polarization* (around one or more than one or more centres) and *policy orientation* (being spatial units endowed with political power), being both a unit of spatial economic analysis and policy.

#### 4.1 Main features and patterns

From a morphological point of view, rank-size estimates show the differences between regions in terms of hierarchical distribution of people. Some regions, such as Tuscany, Emilia Romagna and Veneto tend to have a more flat hierarchy, while the second group of regions have a primate city of larger size than the others (Figure 3).

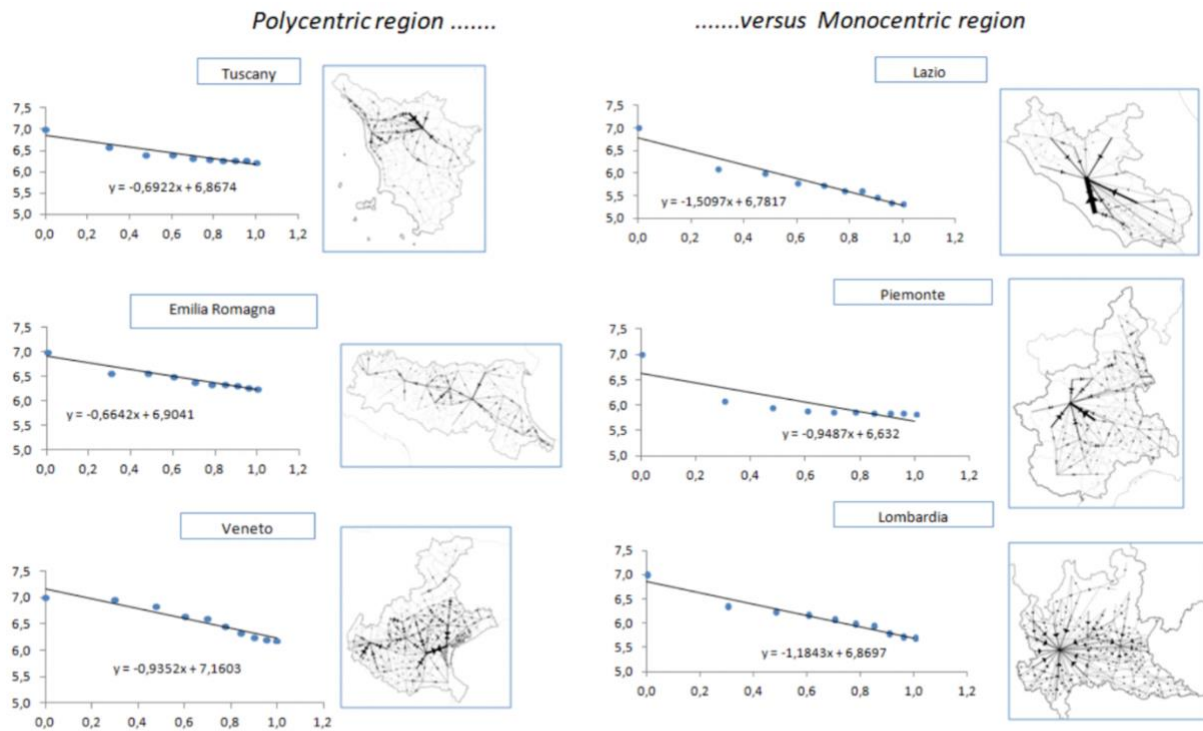


Figure 3: Rank-size estimations and spatial structure in some polycentric and monocentric regions (2011).

Source: own elaboration based on ISTAT Census data

However, the picture becomes more complex when considering both the morphological and the functional dimension of polycentricity. If, in general, there is a positive association between morphological and functional polycentricity (Figure 4), which is also quite stable over time<sup>7</sup>, regional typologies range from fully monocentric (both from a morphological and functional perspective) to fully polycentric. For instance, Lombardia, which can be defined as monocentric from its morphology, shows also a high degree of functional polycentricity (Figure 5).

<sup>7</sup> Pearson correlation coefficients between morphological and functional polycentricity are respectively 0.11 in year 1991, and 0.16 in both year 2001 and 2011.

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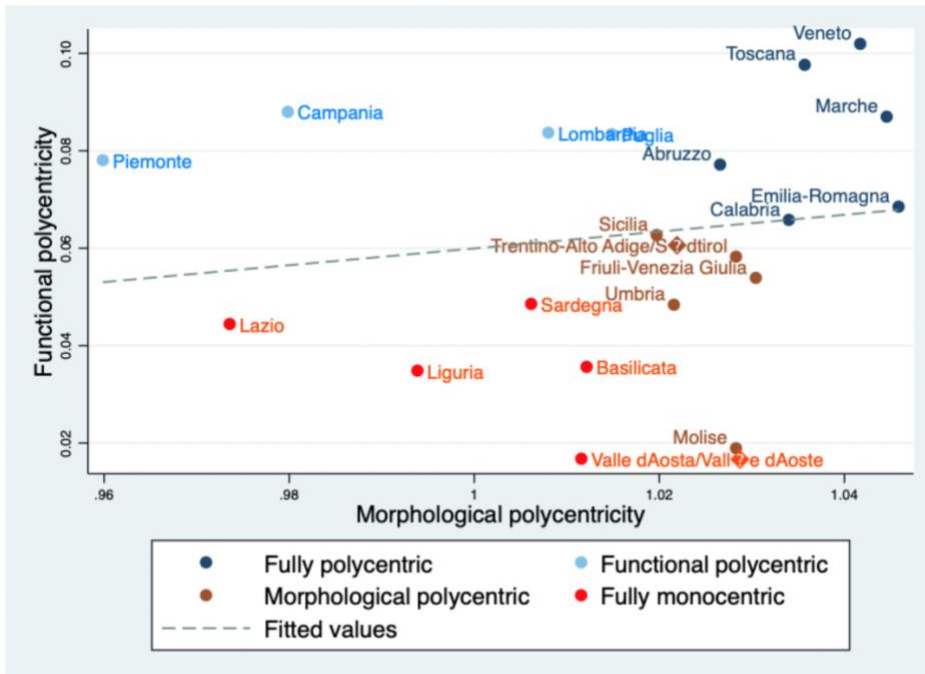


Figure 4: Scatter plot between morphological and functional polycentricity (year 2011)  
Source: own elaboration based on ISTAT Census data

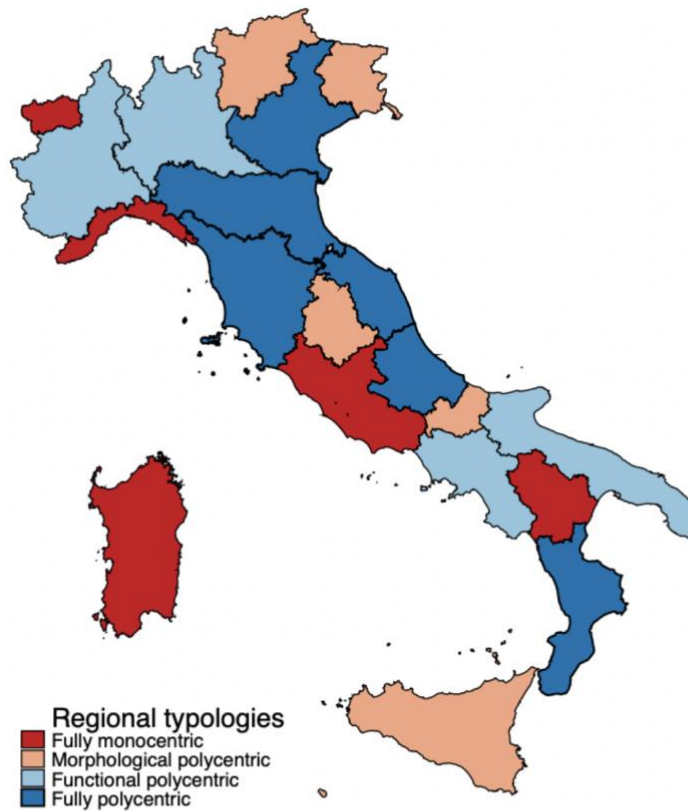


Figure 5: A taxonomy of Italian regions according to their type and level of polycentricity (year 2011)  
Source: own elaboration based on ISTAT Census data

Actually, functional polycentricity is generally positively associated with regional size while morphological polycentricity shows a negative relationship (correlation coefficients are respectively 0.59 and -0.31): this is the case, for instance of the three largest Italian regions - Lombardia, Campania and Lazio - which are characterised by high level of morphological polycentricity.

When looking at the dynamics, we notice a general trend in increase of both morphological and functional polycentricity (as well as in population and urbanised area). However, while morphological polycentricity is more stable over time, both on average and in its distribution, the increase in functional polycentricity is sharper and more complex, with the distribution of the index becoming flatter over time (Figure 6).

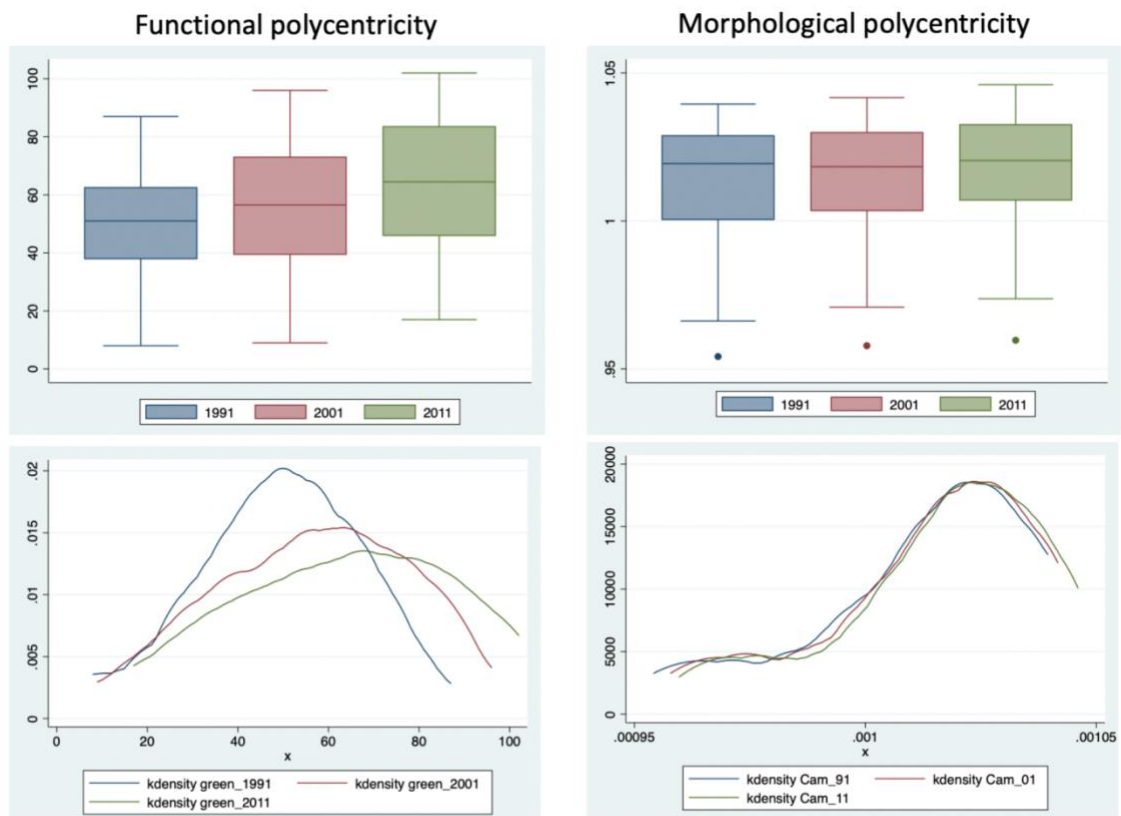


Figure 6: Box plot and distributional graph (kernel density) of the morphological (left side) and functional (right side) polycentricity indicators (years 1991-2001-2011).

Source: own elaboration based on ISTAT Census data

## 4.2 Spatial structure and development

In order to assess the links between the dimensions of spatial structure and the dimensions of development, we performed an analysis of correlation for year 2011. Given the many dimensions of development, data limitations did not allow for an analysis over time, so we were able to set a cross sectional analysis for year 2011.

However, in order to investigate trends over time, we considered also the growth rates for the dimensions of economic competitiveness and cohesion. Table 2 reports the indicators of regional spatial structure and development. The polarity of the indicators is positive: the higher the indicator, the better the aspect of development.

Table 2: dimensions and indicators of regional development

Dimension	Variable name	Conceptual meaning	Description	Source of primary data
<b>Competitiveness</b>	GDP	Economic activity	Gross Domestic Product per capita	ISTAT
	Income	Efficiency in income	Personal income per capita	Ministry of Economy and Finance
	Productivity	Efficiency of manufacturing	Productivity (Value added per worker) in the manufacturing sector	ISTAT
	Innovation	Propensity to adopt technological innovations	Share of firms (with at least 10 employees) that introduced technological innovations (products or processes) in the previous three years of activity	ISTAT
	R&D	Investments in research and development	Share of GDP invested in Research and Development	ISTAT
	KIS	Specialization in advanced sectors	Share of workers in High Tech and Knowledge Intensive Sector (KIS)	ISTAT
<b>Inclusion</b>	Employment	Performance in labour market	Inverse of the unemployment index	ISTAT
	Employment_distr	Spatial distribution of labour market performance	Inverse of Gini index of the employment index computed over municipalities within each region	ISTAT
	Income_spat_distr	Equality in the spatial distribution of personal income	Inverse of the Gini index of income distribution computed over municipalities within each region	ISTAT
	Income_distr	Equality in the regional distribution of personal income	Inverse of the regional Gini index of income distribution	ISTAT
	No poverty	Minimum living standards	Share of people above the relative poverty line	ISTAT
<b>Sustainability</b>	Emissions_pc	Environmental efficiency	Inverse of CO2 emissions per capita	ISPRA
	Emissions_pc_transport	Environmental efficiency in the transport sector	Inverse of CO2 emissions per capita (transport sector)	ISPRA
	Land use	Magnitude of urbanization patterns	Share of regional surface not built-up	ISPRA
<b>Connectivity</b>	Accessibility_population	Access to basic services (education, health, transport)	Share of regional population living in municipalities not classified as peripheral or ultraperipheral according to the National Inner Areas strategy	ISTAT
	Accessibility_logistic_hubs	Access to the main centres for transport	Access to the main centres for transport	ISTAT
	Road_network	Transport infrastructure endowment	Length of road network (in km) divided by regional surface	ISTAT
	ICT_infrastructure	Access to digital services	Share of households with internet broadband connection at home	ISTAT
<b>Public services</b>	Government_quality	Quality in implementing cohesion policies	Cohesion Open Government Index about transparency, participation and cooperation in cohesion policies	Italian Government – cohesion dpt.
	E-government	Provision of E-services by municipalities	Share of municipalities with fully active telematic services	ISTAT
	Free_wi-fi	Provision of E-services by municipalities	Share of municipalities with free wi-fi connection	ISTAT
	Childcare_services	Provision of basic services to children population	Share of municipalities with childcare services (kindergarden or other similar services)	ISTAT
	Municipal_unions	Cooperation within regions	Share of municipalities that have merged into unions (for the provision of public services)	ISTAT

The “smart” dimension was measured by a set of indicators referring to economic efficiency, performance and innovation, by taking into account: GDP per capita, personal income per capita, productivity of the manufacturing sector and a set of indicators about innovation and knowledge economy.

The “social” dimension was measured by indicators referring to the labour market, both considering the aggregate regional performance of employment and its distribution within regional municipalities. We also considered the distribution of income, again both from a place-based and a people-based perspective, and the poverty. “Green” development has been assessed by indicators of greenhouse gas emissions and efficiency in land use. For “Connected” development we considered measures considering both transport (accessibility measures of the regional population, to logistic hubs, the density of the road network) and immaterial infrastructure (density of net connection). Finally, in order to measure the “closer to citizen” dimension, we considered a set of measures taking into account several aspects of local administration and policies, such as the quality of regional government, local services (childcare and free wireless connections), the integration of public administration into unions of municipalities.

Table 3 shows the results of the links between spatial structure and development (Pearson correlation coefficients). With reference to the “smart development” dimension, as expected, agglomeration (size, density and metropolitan functions) is positively associated with efficiency and innovation. It is interesting, in particular, that agglomeration indicators are highly related with innovation, R&D and knowledge intensive sectors: this holds, in particular for the metropolitan indicator, and seems to confirm for Italian Regions the role of metropolitan areas as innovation hubs (European Commission, 2019). Being related with agglomeration, accessibility matters as well. Polycentricity is generally associated with higher economic efficiency. However, morphologically polycentric regions perform lower than functional polycentric regions in indicators related to innovation (R&D activities and KIS workers). Sub-regional polycentricity (at the intra-urban scale) plays a role as well, since the presence of more polycentric local systems is associated with higher performances. However, we notice also a positive role for sub-regional heterogeneity: hence, polycentric regions with a presence of one (or few) large

polycentric urban systems are characterised by higher income, productivity and innovation.

When looking at the “social” dimension, the picture is more complicated. In general larger, denser and metropolitan regions show lower employment rates and a less balanced distribution of the (higher) income produced: this holds both taking into account the (aggregate regional) personal distribution (*income (people) distribution*) and its distribution across each region (*Income (spatial) distribution*). Hence, development in larger regions seems to be more unbalanced. Functional polycentricity does not show strong links, while morphological polycentricity is generally associated with a more inclusive development. Intra-regional polycentricity shows mixed results, while accessibility shows a positive sign.

Hereafter, even if “smart” development is linked with agglomeration, “smart” regions seem to be less “inclusive”, whereas polycentricity could be associated with a more balanced development. However, when looking at the dynamics between 2001 and 2011, we notice that the regions that grew improved the fairness of the income distribution have been those larger and functional polycentric. Both the level (at year 2001) and the growth rate of agglomeration and functional polycentricity are associated with better equality in terms of income distribution (Table 4).



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Table 3: Links between the dimensions regional spatial structure and the dimensions of development (Pearson correlation coefficients, year 2011)

		Agglomeration				Polycentricity			Accessibility
		Size	Density	Metro	Morphological	Functional	Sub-regional polycentricity	Sub-regional heterogeneity	
Competitiveness	GDP	0,11	0,10	0,12	0,09	0,07	0,42	0,24	0,49
	Income	0,15	0,10	0,02	0,22	0,23	0,27	0,18	0,53
	Productivity	0,26	0,27	0,30	-0,05	0,07	0,46	0,25	0,31
	Innovation	0,44	0,32	0,22	0,07	0,54	0,20	0,36	0,42
	R&D	0,48	0,50	0,64	-0,45	0,30	0,23	0,57	0,34
	KIS	0,52	0,63	0,83	-0,62	-0,07	0,16	0,54	0,18
Cohesion	Employment	-0,08	-0,08	-0,08	0,20	0,00	0,33	0,06	0,54
	Employment_distr	0,15	0,08	-0,05	0,26	0,15	-0,46	-0,06	0,22
	Income_spat_distr	-0,40	-0,55	-0,60	0,43	0,00	-0,14	-0,09	0,36
	Income_distr	-0,37	-0,35	-0,49	0,40	0,05	0,41	0,03	0,45
	No poverty	0,33	0,19	0,15	0,11	0,19	0,37	0,09	0,40
Environment	Emissions_pc	-0,20	-0,15	-0,17	-0,05	-0,04	0,11	-0,10	-0,44
	Emissions_pc_transport	0,27	0,15	0,14	-0,12	0,14	-0,18	-0,02	-0,54
	Land use	0,64	0,88	0,86	-0,58	0,30	0,01	0,32	0,06
Connectivity	Accessibility_population	0,40	0,52	0,42	-0,08	0,44	0,00	0,28	0,74
	Accessibility_logistic_hubs	0,29	0,59	0,46	-0,06	0,27	0,19	0,42	0,61
	Road_network	0,20	0,37	0,27	0,07	0,25	-0,28	-0,11	-0,02
	ICT_infrastructure	0,51	0,64	0,77	-0,33	0,22	-0,06	0,11	0,32
Public services	Government_quality	-0,04	0,07	0,07	0,13	0,16	-0,17	0,47	0,38
	E-government	0,46	0,29	0,06	0,34	0,53	0,00	0,09	0,32
	Free_wi-fi	0,19	0,07	0,19	0,13	0,24	-0,26	-0,03	0,39
	Childcare_services	0,05	0,08	-0,14	0,39	0,13	0,23	0,15	0,38
	Municipal_unions	-0,12	-0,21	-0,05	0,03	-0,15	0,03	0,16	0,33

Table 4: Links between spatial structure and average regional income per capita and income distribution (Pearson correlation coefficients, levels at year 2011 and growth 2001-2011)

		Income per capita		Income distribution (equality)		Land use	
		level	growth	level	growth	level	growth
Agglomeration	level	0,87	0,36	-0,55	0,52	-0,83	0,23
	growth	0,57	0,25	0,14	0,36	-0,56	0,25
Morphological polyc	level	-0,08	0,03	0,53	-0,07	0,16	-0,08
	growth	0,49	0,30	-0,20	0,10	-0,39	0,48
Functional polyc	level	0,39	0,24	-0,07	0,41	-0,58	-0,06
	growth	0,09	0,01	0,08	0,42	-0,03	0,04

With reference to the “green” dimension, as expected dimension plays a role in the efficiency of the transport sector, as well as for functional polycentricity, whereas morphological polycentricity is negatively associated. Lower performances are shown by agglomeration when taking into account total emission efficiency. When looking land use, we see that agglomeration, as expected, is characterised by higher net density, hence higher efficiency in terms of land use. The same holds for functional polycentricity, while morphological polycentricity shows a more extensive land use pattern.

With reference to the other two dimensions of development, we notice that the indicators about connectivity show how agglomeration is positively linked with accessibility of population and infrastructures, both physical (road network) and ICT (net connections). Functional polycentricity is positively associated, while there is a negative link between morphological polycentricity and connectivity.

In terms of provision of public services, both morphological and functional polycentricity show positive relationships with this dimension of development. Accessibility show the strongest positive relationships, while the picture is more mixed when looking at agglomeration, even if in general the relationships are positive.

## 5. Concluding remarks

Polycentric spatial structure of cities, urban systems and regions has become a significant concept to be included in policies for territorial competitiveness, cohesion and sustainability. Among others, the concept of polycentricity (and “polycentric

urban region”) has been particularly promoted as a normative and place-based goal in the European context, to address regional development policies. However, notwithstanding the relevance and the increasing amount of research about the pros and cons of polycentricity, the question whether polycentric regions would be more productive, inclusive and sustainable than other regions appears still far from being consolidated. In many cases it appears that the notion of spatial structure, and polycentricity in particular, may be just a ‘one-size-fits-all’ concept and a ‘code word’, i.e. “simple concepts designed to persuade decision-makers” (Baudelle, 2007, 76).

This asymmetry between policy relevance and research gaps is particularly critical, since increasing and novel challenges for regions (such as the rise of inequalities, environmental pressure, social tensions etc.) call for the use of ‘place-sensitive’ and integrated tools and policies at the urban and regional level. So, polycentricity is likely to continue to be a key concept for regional planning and development.

Within this context, we propose a framework to study the linkages between regional polycentricity and development under a multi-dimensional and policy-oriented view of development. Hence, we focused on the definitions and subsequent measures of polycentric regions both from a morphological perspective and from a functional perspective, as well on other relevant dimension of spatial structure. We have also linked spatial structure with regional development, under a multi-dimensional approach based on the framework of the future programming period of EU regional policies.

Focusing on Italian regions, we got some insights on the relationships between the spatial organization of regional urban systems. Notwithstanding the complexity of the notions (and measures) of spatial structures and development, some relevant suggestions emerged, which may spur further analysis. Italian regions appear to be quite heterogeneous in term of spatial structure, however functional polycentricity characterise larger regions. Agglomeration is strongly linked with the “smart” dimension of development, being positively associated with indicators of static (productivity, income) and dynamic (innovation) economic efficiency, while polycentricity seems to be less linked and, in the case of morphological polycentricity, negatively related with innovation indicators. However, the level of development in larger, denser, and metropolitan regions seems to be less inclusive,

both from a 'place-based' and a 'people-based' perspective on cohesion. Hence, polycentricity, at least at a regional level, may play a role not just as a counterpart to "diseconomies of urbanization", but as a tool of territorial cohesion.

Of course, the findings reported in this article suffer from a limitation due to a lack of a complete set of data available over time covering the multiple dimensions of development. We could highlight just correlations between polycentricity and development. However, future data availability might allow for a cause-effect analysis. The framework presented might also be integrated with other dimensions and approaches, such as, for instance the "Regional well-being" provided by OECD. Moreover, further analysis should consider not just the level and growth of general performances, but also their spatial distribution across the regional space, i.e. whether a typology of spatial structure might affect the distribution of the outcomes within the region.

Additionally, the analytical dimension of polycentricity is relevant, as well as the relationships between polycentricity and i) other aspects of the spatial structure ii) the intra-regional and interregional linkages.

After all, given the above-mentioned limitations of this study, as found by previous research on Italian regions (Veneri and Burgalassi, 2012) our findings reinforce the fact that, taken alone, polycentricity could hardly be an effective driver of regional development, and it is likely to continue to be confined to a pseudotechnical meaning. On the contrary, regions should foster integration among polycentricity and other place-based measures, as well as territorial cooperation in the implementation of policies. Regions are called to foster integration inside and outside their borders. This is especially true for those regions belonging to low and medium "clubs" (as many Italian regions are) otherwise they risk to be stuck in an increasingly peaky world dominated by global cities.

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