In Rozenblat C., Pumain D., Velasquez E. (eds.) (**2018**). *International and Transnational Perspectives on Urban Systems*, UN-Habitat / Springer *Series "*Advances in Geographical and Environmental Sciences*", DOI:* 10.1007/978-981-10-7799-9

Chapter 6: Metropolization and polycentrism in the European Urban system

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Abstract:
In the time when Europe needs to strengthen its territorial cohesion and its global competitiveness, this chapter questions the integration and unity of the European urban system inherited from the long-term history as well as from the shortest-term division and re-unification occurring during the second half of the 20th century. First, we recall problems linked with the conceptual definition and delineation of cities and specify the inherited socio-spatial framework. We then detail the significant evolution of the European urban system during the second half of the 20th century and in the beginning of this millennium due to two main processes of social and economic transition. Analyzing the concentration of activities in specialized cities enables to find metropolization processes following two different qualitative modes dividing Europe between Eastern and Western countries. Then, we discuss the question of polycentrism at different scales in connection with European policies.

Keywords: European cities; cities' trajectories; specialization; metropolization; polycentrism

1. Introduction

The European urban system is one of the oldest in the world and still maintains a high density of numerous cities in large parts of the European territory (considered here as including all European Union (EU) countries plus Norway and Switzerland). The current distribution of cities is mostly the amplification of the European urban system that emerged after the Roman Empire during the Middle Age (Pirenne, 1936) and consolidated in the 16th century with the rise of maritime trade with America (De Vries, 1990; Bretagnolle *et al.*, 2000). During the 19th and 20th centuries, the industrial revolution created a few new specialized cities on mineral basins (in the UK, Germany, Belgium and the North of France primarily) and overall, together with colonial trade, generated urban growth that was diffused throughout national territories and reinforced their capital cities with the consolidation of the European nation-states.

However, three major mutations affected all cities during the second half of the 20th century: the formation of the communist bloc, which was maintained for 40 years until its collapse in 1990; the political and economic construction of the European Union, which developed in parallel; and the globalization process, which initiated a new world order in which Europe is no longer dominant.

The first two mutations left diverging traces that were partially obliterated after the collapse of the communist states in 1990. During the next 15 years the consecutive enlargement of European unification created a new impulse in economic growth: Immediately after 1990, Germany enlarged to encompass the East German territories; The European Community became the European Union in 1993 with the Maastricht treaty, which included two main missions: first, reinforcing European integration and institutions, and second, supporting the Eastern post-communist countries' transition into the capitalistic system and their progressive inclusion within the European Union in the 2000s.

Moreover, all European cities are now involved at various levels in multiple international connections that are both reinforcing the continental cohesion between national territories and integrating Europe in the "global system". Among these connections, a few linkages still connect some European countries with their former colonies throughout the world as testimonies of their long-standing relationships. However, since the 1980s, with the acceleration of globalization and the deregulation of the GATT agreements included in the 1990s in the World Trade Organization (WTO), economic actors became more powerful, and their behavior impacted urban evolution. In Europe, "Metropolization" processes increasingly concentrate the functions of the major long-distance networks in the few cities that have managed to integrate economic, social and cultural globalization. As a result, a few dominating cities host most global functions and have become metropolises that are larger and more diversified than other cities. Although a few national path dependencies remain visible in this evolution, the metropolization trend has intensified a general evolutionary process, inducing growing inequalities among cities inside national territories and reinforcing their hierarchical structure over time (Bretagnolle *et al.*, 2000). The largest cities and dense urban regions have developed in a polycentric manner (Hall & Pain, 2006; Cattan, 2007), while other peripheral cities have suffered shrinking processes (Martinez-Fernandez et al., 2012).

To what extent did globalization processes affect cities of different sizes and regions in Europe, and how robust is the system of interdependent cities? These questions are crucial in this time of economic and political crisis, when Europe needs to strengthen its territorial cohesion and its global competitiveness. European cities each concentrate a more or less complete panel of functions while participating in similar world processes of globalization (Hall & Pain, 2006). What are the different levels of specialization among European cities, and to what extent are they complementary?

This chapter aims to answer these questions from the perspective defined throughout this book on international and transnational urban systems by outlining common characteristics of all urban systems in the world and focusing on the European specificities. First, we recall problems linked with the conceptual definition and delineation of cities (section 2) and specify the inherited socio-spatial framework (section 3). We then detail the significant evolution of the European urban system during the second half of the 20th century and in the beginning of this millennium due to two main processes of social and economic transition (section 4). Analyzing the concentration of activities in specialized cities will enable to find metropolization processes (section 5). Then, we shall discuss the question of polycentrism at different scales in connection with European policies (section 6).

2. Urban comparisons in Europe

Comparative studies of the demographic evolution and economic profiles of European cities are difficult because the spatial expansion of cities since the 1970s requires revising the definitions and delineations of urban entities (Van den Berg *et al.*, 1982). All authors mention

at least three major limitations that hamper the quality of statistical comparisons of European cities:

- the lack of a common official definition of what a "city" is in Europe;
- the lack of comparable indicators at the urban level among different countries;
- the difficulty in measuring urban evolution according to a fixed reference.

The first problem is well known, and many efforts have been undertaken recently to overcome the differences among so many national definitions. Although European cities are traditionally compact and dense, the concept of cities in Europe had to evolve to encompass the urban sprawl phenomenon. First, measurements were made according to the spatial expansion of built-up areas, defining and delineating urban agglomerations (Moriconi-Ebrard, 1994), but in a second step, during the 2000s, Functional Urban Areas (FUAs) were defined based on commuters' mobility. Many data are still missing, preventing the implementation of this method in a rigorous and comparative way (Pumain *et al.*, 1992; Rozenblat & Cicille, 2003; ESPON, 2006; Guerois & Pumain, 2008), but rather good proxies for FUAs delineation throughout Europe are now available (Guerois *et al.,* 2012; ESPON FOCI, 2010; BBSR, 2011; Halbert *et al.*, 2012).

Data limitation remains an acute problem. Eastern countries suffer from a large lack of fine-resolution data (ESPON FOCI, 2010), and the enlargement of Europe from 15 to 28 countries further increases this difficulty. There are two opposite ways to build indicators describing FUAs. In one method, FUAs are delineated, and indicators from the municipalities that compose them are aggregated. Sometimes, the non-homogeneity of national nomenclatures data regarding performance are only available at higher territorial levels and must be allocated to the urban areas that may concentrate most of their activities (Pumain & Saint-Julien, 1996; Cattan *et al.*, 1999); often, the NUTS3[1] (are chosen as proxies for the qualifying FUAs included in these regions (ESPON FOCI, 2010; BBSR, 2011; Halbert *et al.*, 2012). Another method consists of collecting information about the precise locations of certain functions that are defined throughout Europe. We utilize this second method for most of the indicators that are used here, although some indicators, that are only likely to be collected at the NUTS level, such as GDP per sector, are included as well (Halbert *et al.*, 2012).

Thus, all the analyses that follow are based on comparable data but within evolving definitions of cities over time. For 1950 to 1990, we consider the population of urban morphological agglomerations (Geopolis database: Moriconi-Ebrard, 1994), while for 2000 and later, cities are defined as FUAs based on commuting flows (ESPON FOCI, 2010; Halbert *et al.*, 2012) and are analyzed using a variety of economic and cultural indicators.

3. A polycentric European system of cities

Taken together, European countries (except those arising from the former USSR) constitute an urban system that, in 1990, comprised 5,200 urban agglomerations with more than 10,000 inhabitants (Moriconi-Ebrard, 1994; Cattan *et al.*, 1999). The spatial organization of this system offers very unequal opportunities for interaction at different levels of geographical influence.

3.1 Three inherited spatial patterns of urban systems

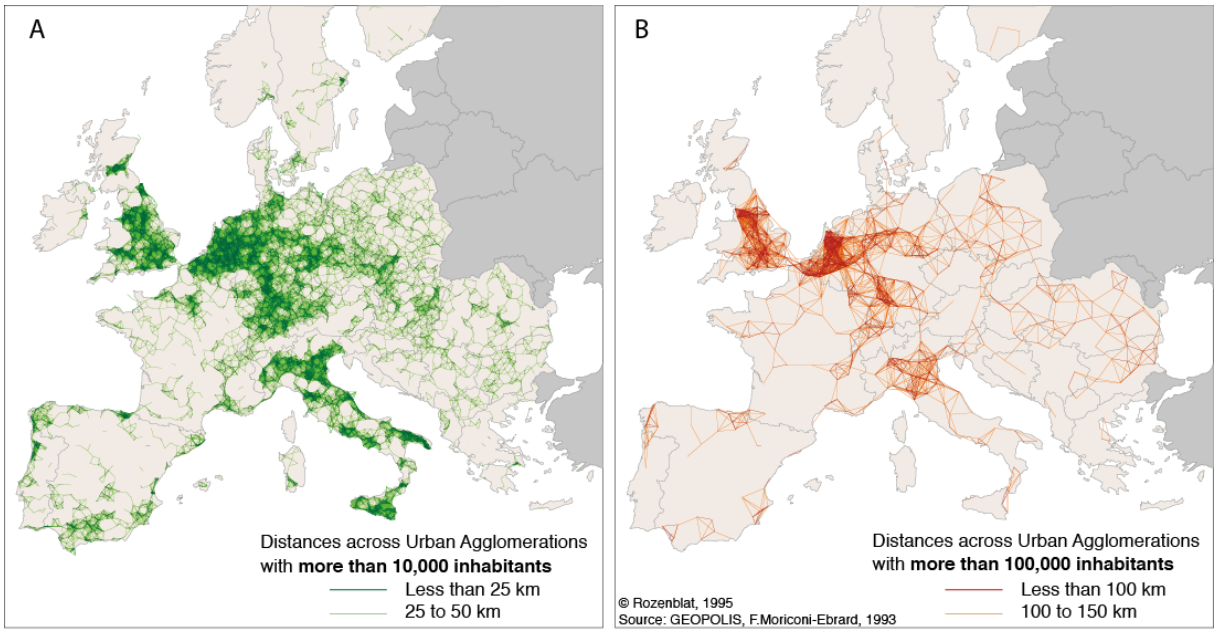
Three types of spatial organizations of urban systems that are coherent through geographical scales are easily visible on the maps in figure 1 A and B, which represent cities with more

[1] Nomenclature of Territorial Units for Statistics (according to Eurostat there are 1,342 regions at NUTS3 level)

than 10,000 inhabitants separated from each other by less than 50 km and cities with more than 100,000 inhabitants separated by less than 150 km, respectively (Rozenblat, 1995; Rozenblat, 2009).

The regions containing high densities of cities are concentrated along the European dorsal axis (Fig.1-A), which stretches from the North of England (the region of Newcastle-upon-Tyne) to Sicily, interrupted only by the English Channel and the Alps. These regions include cities of small political territories that had long been in competition (Germany and Italy unified only in the 19th century), as well as many manufacturing centers that emerged on mineral basins in the 19th century. The margins situated on both sides of this zone of high urban density each have very different aspects (Rozenblat, 2009).

Figure 1: European urban densities in 1990



Rozenblat (1995, 2009) already underlined how far "*in Eastern Europe, a continuous network of regularly spaced towns recalls the rather late and institutionalized colonization of these areas, which intensified only after the 13th century, while to the West, in France and Spain, primarily more distinct regional patterns were inherited from the early centralized kingdoms*" (Rozenblat, 2009, p.1).

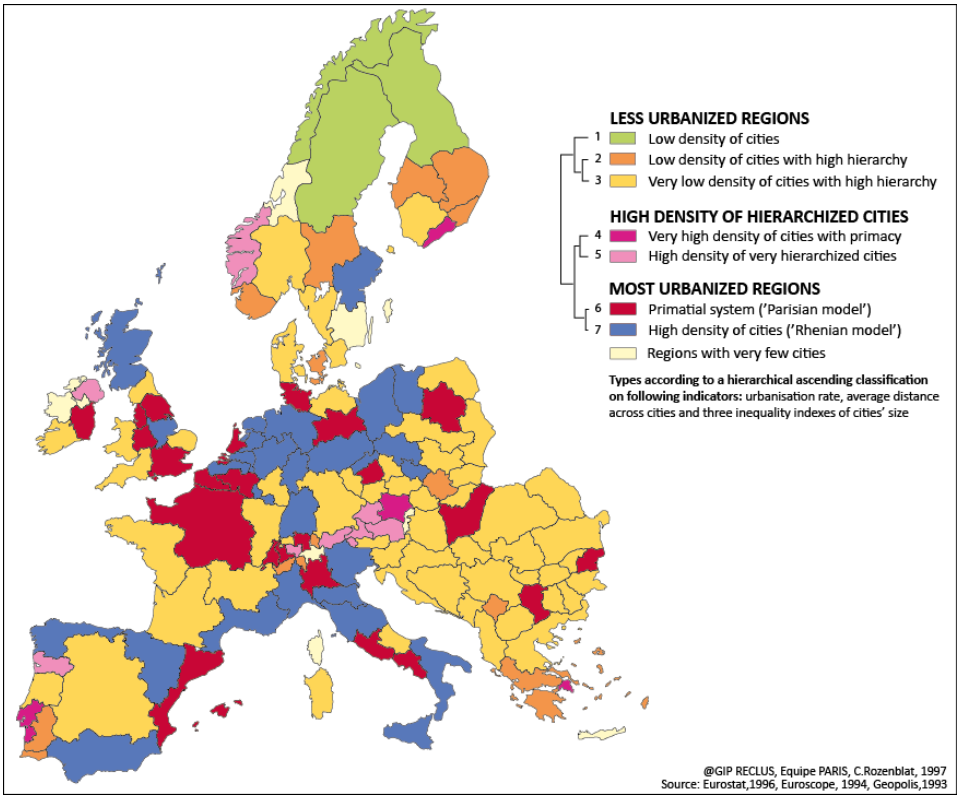
3.2 Regional types of urban hierarchies

The division of Europe into regions — which is the product of political and/or administrative compromises — does not necessarily coincide with the geographical logic of urban networks. Nevertheless, it would seem useful to maintain this division in order to generate within its framework indicators that characterize the structure of urban networks in order to compare them with indicators of economic development. In 1976, Etienne Juillard and Henri Nonn had already postulated a typology of European urban regions based on patterns of medium-range relationships between urban centers and their zones of influence in terms of urban centrality functions (including services to populations and administration of territories). This investigation can be conducted by examining, as we have done, morphological aspects of the urban network, which are the long-term consequences of the effect of territorial and functional competition between urban centers (Pumain *et al.*, 1996).

Regional urban structures have been characterized using a variety of approaches, which all express, in complementary ways, either the intensity of regional urbanization or the inequalities in the sizes of the urban centers belonging to the same region (Pumain &

Rozenblat, 1999; Rozenblat, 2009). A synthetic image of the various forms of urban settlement in Europe has been produced through an ascending hierarchical classification — applied to the 137 regions containing a sufficiently large number of urban centers to enable calculation — that categorizes the regions according to the values of their indicators of urban densities and hierarchies (Rozenblat, 2009) (Fig.2).

Figure 2: Regional typology of Urban hierarchies



Three main types of urban settlements outline vast, relatively homogeneous regions throughout the whole of Europe. Juillard and Nonn (1976) called them "Parisian", "Rhineland" and "peripheral" models of urbanization. The map in figure 2, produced by Rozenblat and Pumain in 1999, simplifies a more complex geographical reality (Rozenblat, 2009).

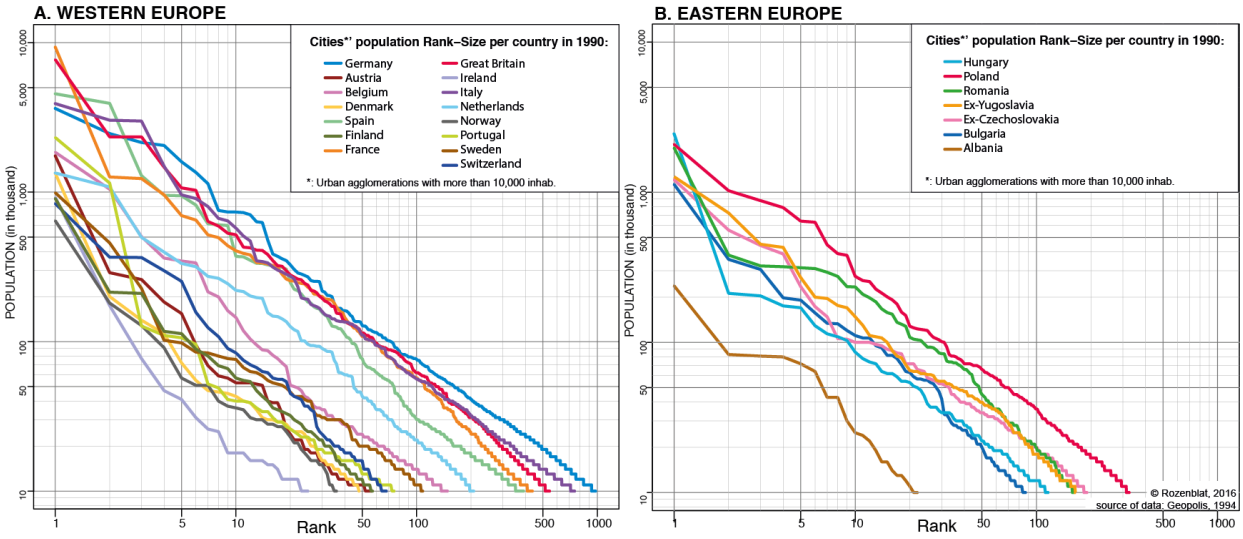
Following Rozenblat (2009), we can wonder if these types of regions correspond to specific development potentials. This assumption supported the reflections developed in the previous years of the *European Spatial Development Perspective* (ESDP) (Faludi, Waterhout, 2002; Faludi, 2004; ESPON 2006). This classification into three principal types of urban regions does not in any way precondition their relative developmental capacity (Rozenblat, 2009). Indeed, Rozenblat pointed out that when these groups are compared based on regional GDP or regional per capita GDP, no significant correlation is observed (Vandermotten, 2003, 2004). According to Vandermotten, conditions are highly variable, and the existence of a dense and only slightly hierarchically differentiated urban network guarantees neither economic development nor territorial equity. Moreover, a given regional urban structure is not easily transferable, as it corresponds to types of functional, institutional and cultural (even familial) links that are not always reproducible inasmuch as they are rooted in specifically local modes of socialization (Vandermotten, 2003).

By contrast, the inherited regional urban frameworks slightly distort the patterns of national urban hierarchies that mostly depend on national institutional organizations (Moriconi-Ebrard, 1993; Rozenblat, 2009). Indeed, Moriconi-Ebrard (1993) proposed that national urban hierarchies reveal two types of oppositions:

- Territorial centralized systems versus federal or regional systems: centralized systems concentrate political and economic functions in a single "primate" city, while federal or regional governments distribute these functions more among several top cities.
- Liberal economic regimes versus planned economic regimes: a liberal regime creates a continuous convex hierarchy under first-level cities, while the planned regime generates a level of second tier cities under the first level.

None of the European countries strictly follows one of the pure models emerging from the four categories crossing these two dichotomies (Fig.3).

Figure 3: European national urban hierarchies in 1990



In the Western liberal part of Europe (Fig.3-A), centralized countries such as France, Great Britain, Austria, Denmark, and Ireland have a single dominating primatial city, while Spain and Portugal have two, and Italy and Germany have three or four.

In the Eastern planned countries (Fig.3-B), despite urban hierarchies being less distinct in general, some national urban systems are more centralized, such as those of Hungary, Romania, Bulgaria and Albania, while at the opposite end, Poland, the former Yugoslavia, and the former Czechoslovakia have more regular curves, revealing the federal systems that managed them for at least forty years. In general, Eastern European countries maintain lower degrees of hierarchy (slope of the curves), thanks to strong territorial redistribution policies.

4. Trajectories of European cities

National institutional structures had a large impact on the form and the speed of urban dynamics, particularly when the former Western and Eastern blocs are compared. Most European countries achieved their urban transition during the decades following World War II. The average urbanization rate in Europe exceeded 50% only in 1950 (United Nations, 2014). However, in 1950, the Western and Northern parts of Europe were the most urbanized, with 64% and 70% urbanized populations, respectively. In contrast, Eastern European countries had lower percentages, with an average of 40%; the Czech Republic (Czechoslovakia) registered a higher percentage (54%), while the Southern Eastern European countries, including Bosnia, Herzegovina and Montenegro (13%), Moldova (18%), Romania (25%), and Albania and Serbia (20%), had not yet begun their urban transition.

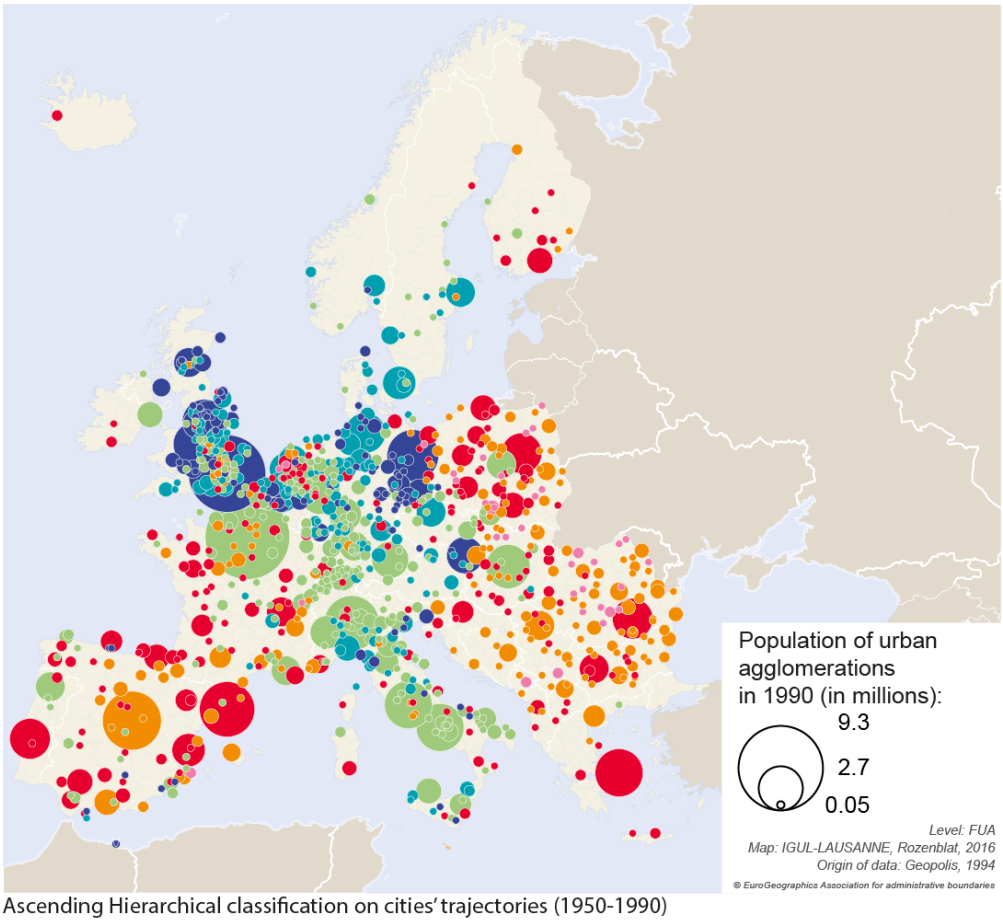
The cities' trajectories (Fig.4) confirm strong national tendencies. Most of the Scandinavian, German, Italian, British, Austrian and Northern French cities did not grow much during the

1950-1990 period. In particular, many British, German, and Austrian cities decreased in absolute size (the two blue classes in figure 4). Large cities such as London, Glasgow, Edinburgh, Belfast, Liverpool, Manchester, Berlin, and Vienna even experienced a declining population weight, mostly due to urban spread outside the boundaries of agglomeration areas.

Some cities remained quite stable in relative weight (green color in figure 4). Among them are capitals such as Paris, Cologne-Bonn, Rome or Budapest and other large cities such as Milan, Turin, Naples, Palermo, Marseilles, Porto, Munich, Essen and Zürich. These cities were at a mature stage and substantially changed their spatial organization and their economic portfolio. Suburbanization expanded beyond the limits of these cities and into peripheral growing centers (edge cities) that are not included in the morphological delineation but are functionally dependent on the historical centers that had been transformed in the process.

Conversely, most Iberian, South-West French and Eastern European cities continued to grow during the 1950-1990 period because of their hosting new rural migrants. They achieved the urban transition that followed the economic transformations of national economic structures entering into transnational markets: agriculture became more mechanized, and industry and services belonged increasingly to the networks of the international division of labor.

Figure 4: Trajectories of European cities, 1950-1990



Ascending Hierarchical classification on cities' trajectories (1950-1990)

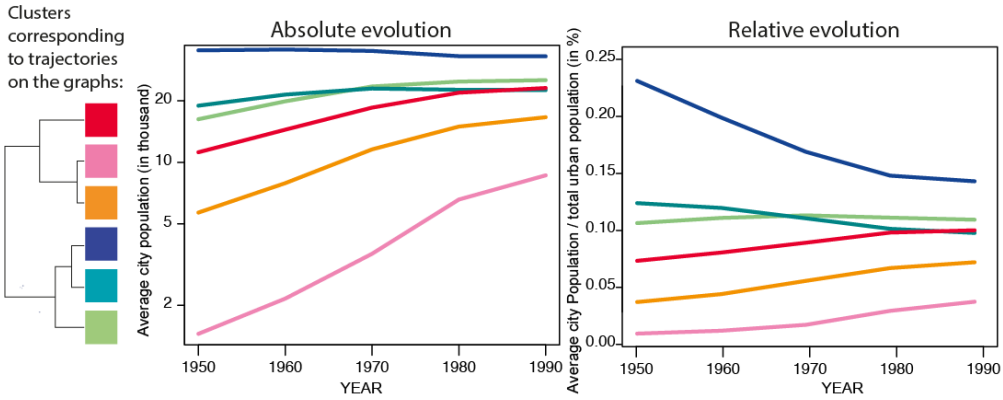
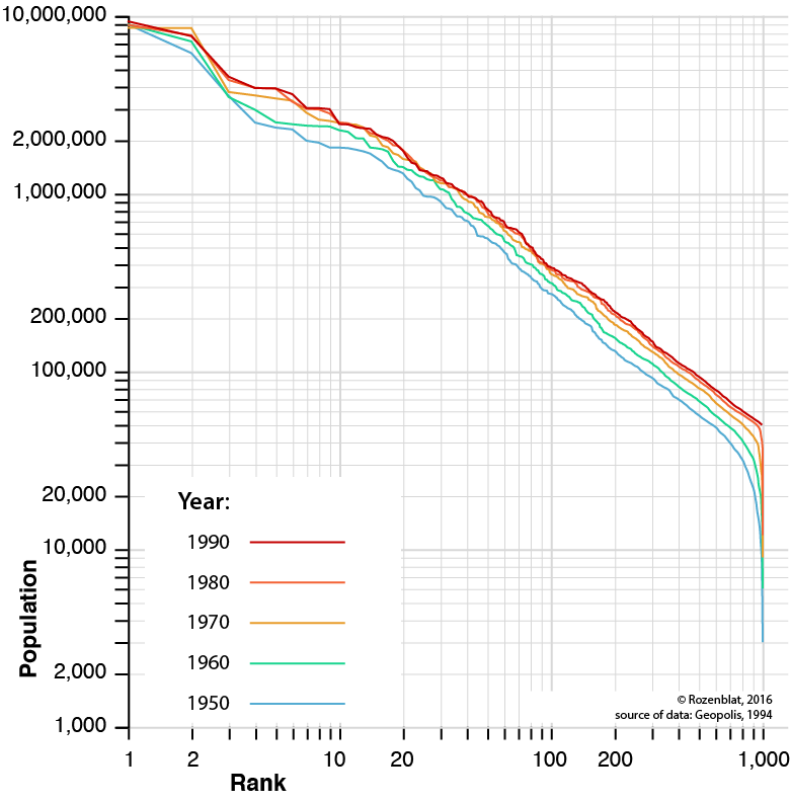


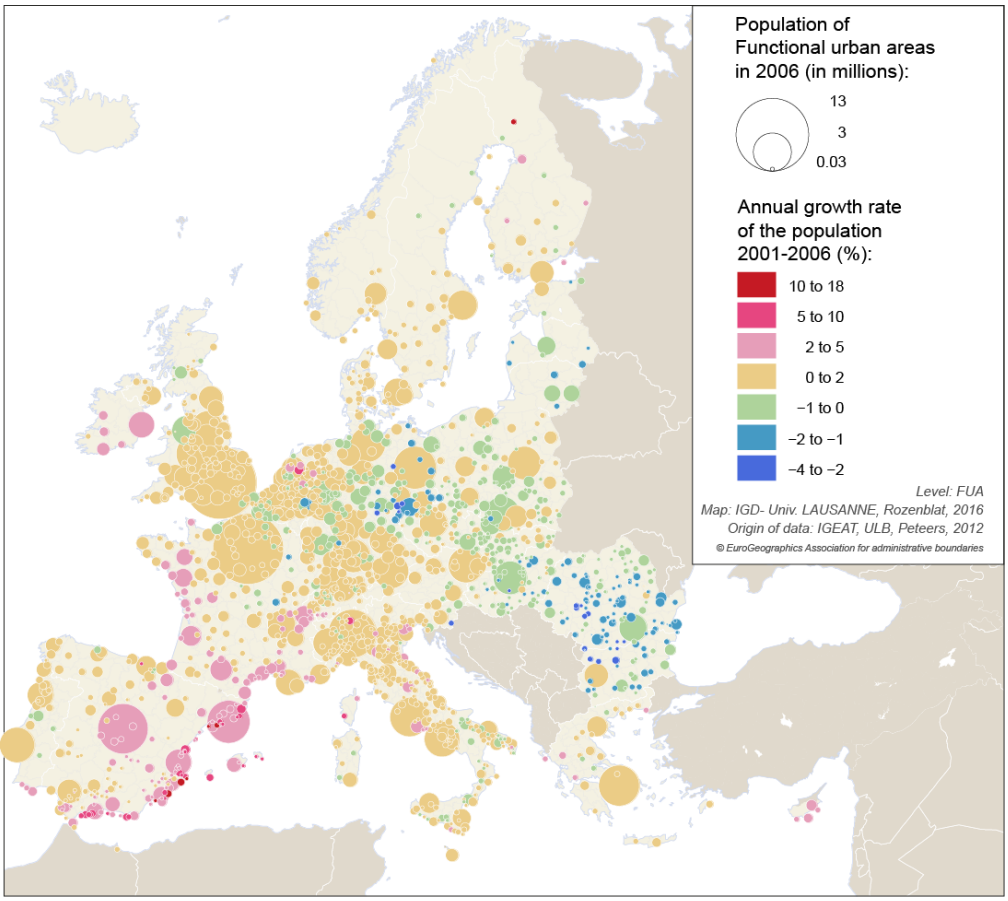
Figure 5: Evolution of the European urban hierarchy, 1950-1990



On the whole, the European urban system evolved according to general absolute growth since 1950, reinforcing two main plateaus of cities at the top of the hierarchy in 1990 (Fig.5). Paris and London form the first plateau in 1990, with 9.3 and 7.8 million inhabitants, respectively; a second plateau comprises cities with populations between 3 and 4.5 inhabitants: Madrid, Barcelona, Milan, Berlin, Athens, Naples and Rome. The other European cities constitute a continuous hierarchy that is a combination of the various national and regional urban systems described above.

The subsequent evolution of European cities after 2000 (Fig.6) stresses a very different pattern than that in the period of 1950-1990. During this time, the Eastern bloc collapsed and faced a long and deep economic crisis of restructuring that affected the growth of cities during the 1990s and lasted even after that. In 2000, only Poland, Slovenia, and the Czech Republic had recovered their production levels, in terms of GDP, to those they had had prior to 1990 (Philipov & Dorbritz, 2004). The crisis of economic transition affected the whole of the Eastern European urban system, where most cities lost a huge part of their obsolete industries (Rozenblat *et al.*, 2009). Numerous Eastern European people migrated, looking for jobs either in other Eastern countries or in Western ones, and these movements were facilitated when their countries officially entered the European Union in 2004 or in 2007. The urban areas most affected by this shrinking trend during this period were located in Eastern Germany and Romania and thus occurred independently of the European political enlargement because Eastern Germany had become integrated in 1990 when the two German countries reunified, and Romania entered the European Union in 2007. In both cases, this pattern means that shrinking cities are long-term processes coupling economic and demographic factors (Turok, 2007).

Figure 6: Evolution of European cities, 2000-2006



The recovery stage in the Eastern countries mainly enhances the relative situation of the capital cities in Poland, Slovenia, and the Czech Republic, where new institutional organizations coupled with the presence of Western audit and business consulting companies attract many new businesses and thus concentrate slow growth.

However, Western capitals also maintained slow growth, while some second-tier or small Spanish, French, Italian and Irish urban areas enjoyed robust growth. The highest demographic growth was observed in small Spanish seaside tourist towns such as Torrevieja, Cambrils-Salou, Benidorm, Torremolinos and Ibiza. Elsewhere, Rovaniemi in Northern Finland benefitted in 2006 from a consolidation of the city with its surrounding rural municipality into a single entity, which explains its spectacular "growth". At the beginning of the millennium, Lugano in the Swiss Ticino undertook a huge project of urban renovation simultaneously with a new *Kulturpol* and a new tunnel linking the city to the highway. Almere in the Netherlands is a planned town that appeared in 1976 on a polder near Amsterdam, and the urban area continues to expand in the 2000s with the support of the Dutch national government.

Thus, as already pointed out by Rozenblat (2009), although the worldwide trend of deregulation has decreased the power of national governments since the 1980s and given cities increased autonomy regarding their own nation-states, cities remain tied to their national urban structure (see Polese, 2005, for a discussion of this idea and *Urban Studies*, 2006, for the debate that followed between Mario Polese and Peter Taylor). As Polese argues, inside a given national urban system, cities have their own trajectories that are based on their ability to capture and diffuse innovation (Pumain, 1982, 2010), but the structures of national systems constrain this capability (Baudet-Michel, 2001, Polese, 2005, 2006; Sassen, 2007).

5. Functional specialization and metropolization in Europe

The delays between demographic and urban transitions between the Northern, Southern and Eastern parts of Europe (Cattan *et al.*, 1999) blurred the measurement of a possible relationship between population growth and economic growth (Hall & Hay, 1980; Champion, 1989; Cheshire *et al.*, 1989). The potential for cities to internationalize the influence of their economic, cultural, or political actors (and thus to attract international functions) relies on their relative position in their national system as well as on the position of their country in international networks (Rozenblat & Pumain, 1993, 2007; Jensen-Butler, 1997). Thus, cities concentrate international functions as a result of both decoupling from the economies of their surrounding regions and supplying their functions. By performing international functions, these cities create "bridges" between their regions and the world. This process may be amplified within Europe, which has a unique open market and many common rules that unify national urban hierarchies into a unique European urban system.

The concentration of rare functions among cities depends on various factors. The first factor is the inherited shape of the urban system; a new activity is usually located according to the existing distribution of other functions. In countries where the state government is strongly concentrated in the capital city, international functions also tend to concentrate in the capital city. This is the main explanation for the high frequency of primatial cities (Jefferson, 1939) in national urban systems in 75% of the countries of the world (Moriconi-Ebrard, 1993). City size is the result of a long history of the accumulation of activities and power through the adoption and adaptation of successive waves of innovation (Pumain, 2006). In turn, this concentration constitutes an attractive framework for urban actors, as noted by Jensen-Butler et al. (1997): "*The structure enables and constrains behavior, but behavior can influence and transform the structure*" (p.17). This structuring amplifies the size of a single large city and is shaped by the distribution of sizes in the entire system in which cities interact, including national, continental, or regional urban systems.

The second factor depends on the speed and scope of the diffusion of innovation waves in this system, which is often of the hierarchical diffusion type (Hägerstrand, 1952; Pred, 1966). During the initial stage of innovation, new functions and activities tend to concentrate in the largest cities to provide proximity and adaptation to the market, as well as to create new technologies and production processes that can reduce the price of the product before its subsequent diffusion to smaller cities and towns. In this respect, many consequences attributed to globalization can be interpreted as products of the current cycle of urban innovation, of which globalization is an important part. As argued by Pumain *et al.* (2006), "*The many contemporary studies on the so-called 'metropolization' rediscover a process which has been for long constitutive of the dynamics of urban systems (Pumain, 1982) at a time when the globalization trends and the general conversion to the 'information society' are designing a new broad cycle of innovations*" (p.5).

The metropolization process is the result of three trends in urban dynamics, in which city size plays a significant role:

- First, the adaptive capacity of cities to create and adopt socio-economic innovations;
- Second, their selective attractiveness for more or less innovative activities that employ more or less skilled people; and
- Third, their cumulative capacity, which allows for greater or fewer sustainable investments, including the diversification of forms of material and symbolic wealth accumulation and know-how.

For a given city, the economic profile of urban activity (or portfolio) can be described in a static way, as a result of choices made by urban actors who share a common interest in

agglomeration economies (Henderson, 1985; Fujita, Krugman and Venables, 1999), or from an evolutionary view, as a product of the successive adoption of different waves of innovation up to variable levels of specialization in the activities developed by each of them (Frenken & Boschma, 2007). More precisely, a city's economic profile may be associated with city size according to a dynamic process in which innovative activities initially concentrate in the largest cities and then relocate through diffusion to less expensive locations. The products or services become commonplace and then retract to a few smaller locations when the activity enters obsolescence (Pumain *et al.*, 2006). This systematic and dynamic process is not fully deterministic; urban specialization may also be explained by the location of specific resources and a few contingent events. Thus, during the globalization process, diversification and specialization occur simultaneously and are not fundamentally contradictory: "*While providing micro-foundations for the link between local diversity and innovation, our model also stresses the advantages of an urban system in which diversified and specialized cities coexist*" (Duranton & Puga, 2001, p.1455). Duranton and Puga demonstrate the "*dynamic advantages [of] urban diversity*" that are useful for individual firms because of higher levels of uncertainty at the initial stages of innovation and "*the static advantage of urban specialization*" that makes it more relevant to relocate when firms' products are mature by enabling economies of location through sharing services and subcontracting. This diffusion process used to occur mainly within national urban systems (Pumain & Saint-Julien, 1996), but it has expanded to the continental and global scales.

The functions that foster urban success and attractiveness and can characterize metropolization change over time. For example, in 1989, Roger Brunet considered call centers an innovative urban function, but these offices relocated rapidly to developing countries during the 1990s. By contrast, some very specialized functions, such as research cooperation networks, were identified as part of the metropolization process but could not be measured (the data did exist but were not available at that time). According to the evolution of urban functions, indicators must be adapted, and strict comparisons over time are not possible. It is also very difficult to compare the relative positions of cities over time because of the change in functions and of their different spatial distributions (Kresl & Singh, 2012).

In 2012, we built a set of 80 indicators of European Functional Urban Areas' economic development and the presence of international functions (Halbert *et al.*, 2012). Many of these indicators were correlated, and we extracted 25 major indicators of economy, stock exchange and financial functions, multinational firm headquarters and subsidiary branches, research and universities, accessibility and transportation, culture, congresses, tourism and political functions.

5.1 Specialization/diversity of European cities according to their international functions

The association of these 25 functions underlines the functional diversity in a few urban profiles by isolating several of the largest European metropolises from the rest of the sample in this projection. The ascending hierarchical classification summarizes these particularities (Fig.7). It clearly identifies Paris and London as a singular class of cities that are much ahead of all others in the metropolization process by scoring maximum values on all related variables (class 1). The city of Brussels also stands out because of its high score on European institutions and lobbies (class 2).

Two other classes of cities have some similarities with these two classes of metropolises, but only a few metropolitan functions are overrepresented there. The first (class 3) includes most of the other country capitals, which are characterized by their financial services, their wealth and their aerial accessibility. They appear in Southern Europe (Athens, Barcelona, Lisbon, Madrid, Rome) but also in Central and Eastern Europe (Berlin, Budapest, Prague, Wien) and

even in Northern Europe (Copenhagen and Helsinki). As most of them are national capitals, they also host the European information centers of their countries. A second sub-class (class 4) distinguishes some cities by their remarkable financial functions, a high GDP/inhab. index and higher air passenger traffic than average. All the secondary economic capitals of Europe belong to this class: Amsterdam, Dublin, Dusseldorf, Frankfurt, Geneva, Glasgow, The Hague, Luxemburg, Milan, Munich, Oslo, Stockholm, Utrecht, and Zurich. All these cities are performing in several very competitive sectors (even if not all of them are in a growth stage of the innovation sector), strengthening European economic networks.

Class 5 specifically includes the university towns of Cambridge and Louvain-la-Neuve.

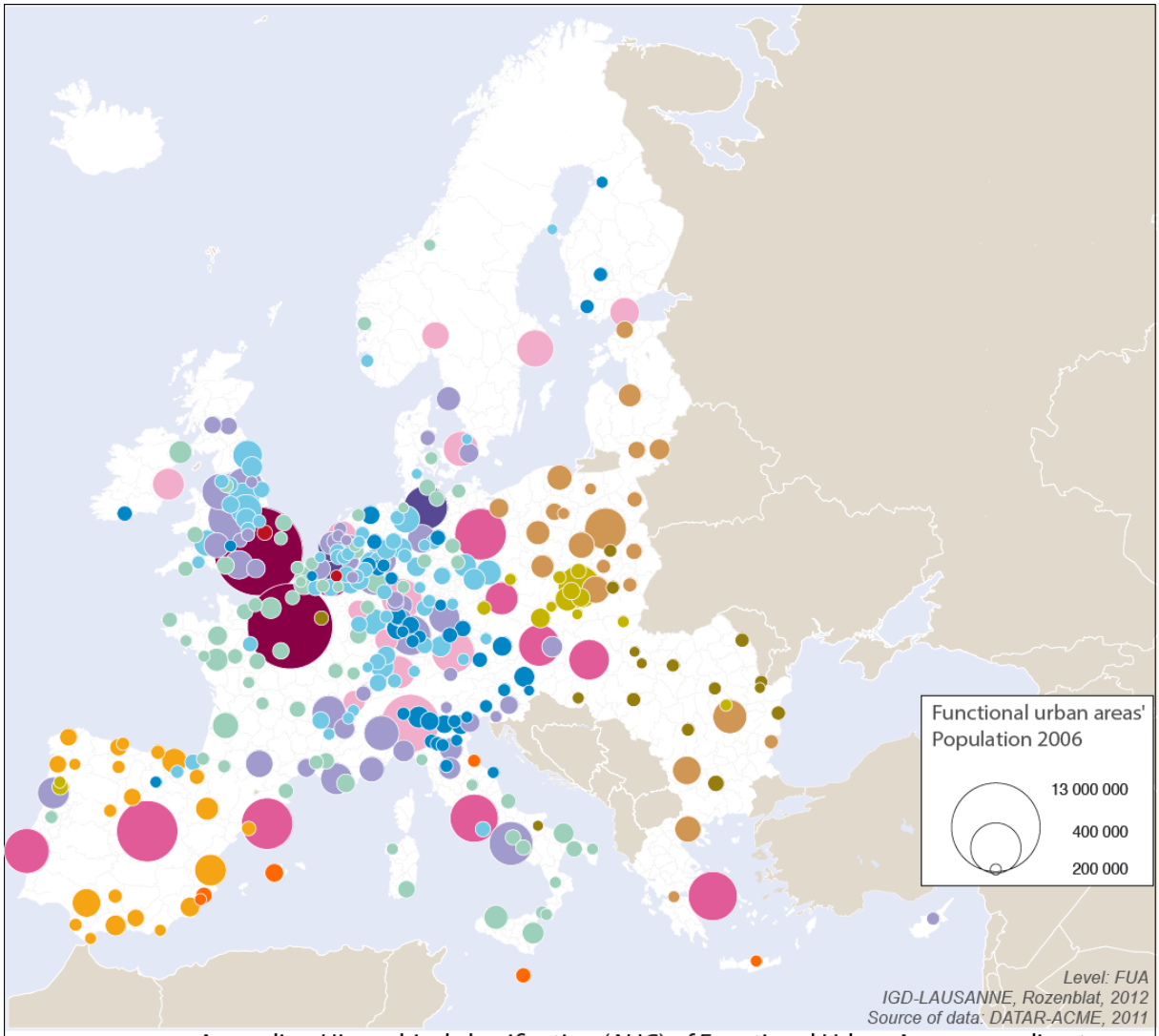
A third group of five classes (6 to 10) encompasses the majority of medium and small European cities that are also representative of a metropolitan profile. Cities of class 6 are located mainly in the central part of Europe and include cities that are developing more advanced services (such as Antwerp, Ljubljana, Marseilles, Porto, Turin or Venice). In the same class, one finds Nicosia, which specializes in finance, and Edinburgh and Glasgow, which specialize in education and trade. Rotterdam and Hamburg (class 7) are separated due to their strong specialization in port functions. Other cities that are highly specialized in manufacturing (class 8) range from Aachen to Zwolle; cities less specialized in manufacturing but lacking trade and students (class 9) range from Ancona to Wuppertal; and regional urban centers specializing in collective services (class 10) range from Avignon to Trondheim.

Cities of class 11 include tourist cities of the Mediterranean area. Cities specializing in the economy of construction (Class 12) are medium sized Spanish cities, which reveal the real estate "bubble" that had developed in Spain since the 1990s and burst during the last economic crisis between 2008 and 2012.

Eastern European cities distinguish themselves with a very different profile, generally characterized by low GDP per inhabitant, which is mostly a national effect (classes 13, 14, 15). Class 13 includes the cities that are the most advanced in advanced services, trade and universities; they are capital cities or are in the most advanced countries undergoing transition, such as Poland or Baltic cities, but they also include Patrai and Thessaloniki in Greece. In Eastern Europe, only Prague and Budapest have caught up to Western European cities in the transformation of their economies. However, the other national cities remain in the Eastern group, specializing in industry (class 15) or in agriculture or the agro-food industry (class 14).

The classification generally confirms the coexistence of diversified and specialized cities at the scale of the European urban system, which has already been demonstrated at the national scale (Duranton & Puga, 2001). The diversity in urban functions that is usually linked with the metropolization trend varies in level and in nature; in particular, the fourth class, including economic capitals with financial functions, high GDP per capita index and high air passenger traffic, represents a very competitive class of cities. However, unfortunately, none of these economic capitals are located in the Eastern part of Europe. These cities constitute a territorial basis that supports the competitiveness of the two main European capitals, London and Paris, and of the more specialized cities. The more specialized cities, such as Cambridge and Louvain-la-Neuve, with their specialization in research, could make their strong specializations an asset (Van Winden *et al*., 2007). However, such cities remain too rare in the European urban system.

Figure 7: Specialization/diversification of economic functions in European cities (2012)



Ascending Hierarchical classification (AHC) of Functional Urban Areas according to 25 economic indicators and international functions

	Specialization index	Over-represented	Under-represented
1	103 867	All international functions	
2	53 442	Lobbyists of EU, intern. and European organizations	
3	5 195	Congresses, cultural places, EU information centers	
4	2 959	Finance, GDP/inhab., air passengers	
5	18 441	European Research, NBIC	
6	321	GDP advanced services, GDP/inhab., owned subsidiaries, accessibility	
7	8 030	Port Traffic	
8	504	GDP industry	GDP trade, GDP collective services
9	220	GDP industry	GDP Trade, EU information centers, students
10	289	GDP collective services	GDP industry
11	4 444	Tourism, trade	
12	999	GDP construction	
13	1 202	GDP trade, Students	GDP/inhab.
14	2 414	GDP agriculture	GDP/inhab., GDP advanced services
15	1 251	GDP industry	GDP/inhab., GDP advanced services, GDP coll. services

In contrast, some Western European cities with more than one million inhabitants lack diversified functions. These relatively specialized cities include Sheffield, Newcastle, Liverpool, Cardiff, Leeds, and Nottingham in Great Britain and Saarbrucken, Bremen, and Stuttgart in Germany. This finding reveals two different national organizations. In Great Britain, most of the international functions are concentrated in London (with the exception of research and higher education, which are also present in small satellites of London). The Scottish cities of Glasgow and Edinburgh have more independent development. In Germany, international functions are concentrated in eleven cities (BBRS, 2011: p.106). Thus, in Germany, the large cities (with the exception of Dusseldorf, Munich, and Frankfurt) have a low relative concentration of international functions.

European "structural foundations" supported the economic restructuring of many Eastern cities, including the support of local or multinational firms such as the developing pharmaceutical industry in Iasi (in Romania, the capital of the Moldavian region); Brno, Czech Republic, which hosts ACER (a Czech industry) and the IBM Global Services Delivery Center, has attracted other foreign investments, such as Honeywell, Carclo Technical Plastic, and Siemens, and in Poland, Poznan, as a traditional industrial center, has attracted many Western companies in the automobile sector (Volkswagen, MAN) and in electronics, IT, design, and finance and accounting (GlaxoSmithKline, Bridgestone, Wrigley, SABMiller, Microsoft, and Roche). Smaller cities have managed to restructure their economies and to integrate internationalization in at least one sector. It concerns Pecs in Hungary (the European capital of culture in 2010), Maribor in Slovenia, and Olsztyn in Poland for their tourist and cultural functions. Other cities have based their industrial development on a previous specialization from the communist era.

5.2 Urban networks and regional development

The mutual influences of network dynamics raise the issue of the geographical scale upon which interrelations between specialized networks develop. This process gives rise to a largely constituent cohesion of the "boundaries" of the city and its influence. Three factors appear to dominate the development of such cohesion:

- Geographical (topographical) proximity, which enables economies of agglomeration in each network;

- Proximity within the network (topological), which encompasses previous processes but can also transcend geographical distance;

- Network diversity, which, at both the local and global scales, enables the strengthening and renewal of networks.

At the local scale, network economies shaped by topological proximity are part of the economies of agglomeration insofar as they are coupled with spatial proximity (topographical). However, they can also transcend this process: intercity exchange networks have long existed in Europe (rare products, cottage industries, technical and social innovation, territorial organization, empires) (Mumford, 1961; Bairoch, 1985).

Today, technological advances, particularly in terms of travel and communication, have bolstered the mutual interdependence of cities. Consequently, the power and the social and economic features of one city are directly faced with those of other cities because of specialized interurban interaction, which transposes codes, technological demands, and "cultures". These networks have accelerated the rate at which innovation, development and crises spread through city systems. Long-range networks also help strengthen each type of movement or activity through new members who contribute, even at a distance, to the visibility and development of urban groups and local activities.

6. Evaluation of polycentrism in urban governance

Very often, territorial policies are implemented at a single given level (intra- or inter-urban, for example) without any real effort to consider their repercussions at other geographical levels. A broad range of policies is applied by every national and regional government (Jönsson *et al.*, 2000; Hague & Kirk, 2002; Allain & Baudelle, 2003; Connelly, 2004; Faludi, 2006). Typologies of the different policies were listed in the ESPON (ESPON 1.1.1 project, annexes B, 2005). From this synthetic qualitative typology, based on scales of application, four categories emerge (Rozenblat, 2009):

- Local polycentrism between centers and satellites;
- Regional polycentrism between second tier cities;
- European and National polycentrism through transport infrastructures;
- European and National polycentrism through specialized clusters.

6.1 Local polycentrism between centers and satellites

At the local scale, city-based policies, as in Berlin and among major cities in Switzerland, Austria, France, Spain and the Netherlands, are implemented to dilute functions and decongest the center. The aim consists of forming multifunctional urban hubs rather than single-function satellites, hoping to maintain the economies of agglomeration generated by urban areas while avoiding the diseconomies of agglomeration with which they tend to be saturated (Rozenblat, 2009). This type of local polycentrism is most commonly implemented in Europe at present under the auspices of Agenda 21 initiatives. While these policies result from awareness of the negative effects of urbanization, they are also the product of power interactions, both among different levels of territorial policies and, within a given level, among local administrations (Jouve & Lefevre, 2002, 2004; Meijers *et al.*, 2003).

Since 2012, new national programs in France, Switzerland, Germany and Italy have encouraged the largest centers to unify with their respective surrounding municipalities into "metropolises", which would transfer most of the local competencies into the largest metropolises' powers, better coordinating, in particular, economic strategy and transportation at every scale, from local to global. Facilitated by the decentralization of competencies from the national to the local levels, the frequent result is a more effective concentration of power, better enabling the coordination of local policies. This type of organization, however, often gives rise to problems of competition between different organs of government. Within strongly centripetal regions, the authority of the largest city is less problematic than is the case in dense and evenly diffused urban zones, where demographic equality hinders the emergence of a clearly identifiable leadership. The decentralization of power away from the national level and toward regional or urban levels very often exacerbates the lack of clarity about governing hierarchies. More particularly, it sometimes tends to restrain collaboration between cities and their outlying areas despite this collaboration being clearly beneficial.

6.2 Regional polycentrism between second tier cities

At the highest regional or even national or international scales, neighboring cities are also encouraged to mutualize facilities and cooperate in economic, administrative and cultural functions because not all facilities can be present in every location (especially airports and rare economic and cultural functions) (Rozenblat, 2009). This is the case in Switzerland, Portugal, Holland and France, which use metropolitan cooperation contracts. This type of cooperation between neighbors is a particularly favorable factor in the development of regions possessing regular spatial frameworks of cities. In addition, it was in this type of region that the first initiatives were undertaken, notably in Western France (Allain & Baudelle, 2003a,

2003b). While it is wholly possible that the same could be implemented in Central Europe, where such regular network structures do exist (as in Silesia, Fig.1), their implementation would appear to be more problematic elsewhere. By the same token, the experiment of sharing — airports, for example — has been very variably appreciated. The establishment of "horizontal" links between cities of similar size should serve not only to improve the infrastructures of all partners but also to connect medium sized urban areas with larger ones, constituting an interface at the international level (Rozenblat, 2009).

The proliferation of links at every scale of geographical scope (as is suggested by Fig.1) may enable reinforcing the diversity of each regional territory and thus encourage a diverse "multi-dependency", which would promote the robustness of regional systems with regard to the diversity of their infrastructural, economic and social vulnerability. Thus, egalitarian networks of this type should not be established in opposition to large metropolises, but rather in collaboration with them, developing strong infrastructural and socio-economic links between larger and smaller urban centers (Rozenblat, 2009).

6.3 European and National polycentrism through transport infrastructures

At the national and European scales, national hubs are strengthened through transport infrastructure developments, primarily in emerging European countries such as Slovenia and Estonia (Rozenblat, 2009). Such national policies are frequently financed through structural aid funding (EU Structural Founds) with the purpose of breaking the vicious circle of depopulation, decreased accessibility and declining local economic activity. It is for this reason that priority is often given to the improvement of transport infrastructure to increase the attractiveness of peripheral regions. By integrating certain regions more effectively into trans-European networks of transport (TEN-T), the increasing transportation supply can, at the same time, facilitate the movement of certain activities toward major urban poles thanks to the economies of agglomeration they thus acquire (Rozenblat, 2009). However, the TEN-T European project, aiming initially to complete these transport infrastructural networks, has been delayed since the 2008 crisis. It was announced that some of these projects were to restart in 2016 under H2020 financial support.

The overall result is that, at the European scale, vectors of change are being concentrated increasingly along a number of principal axes, with the European dorsal axis that stretches from the London basin to Lombardy being the most important among them (Rozenblat, 2009). The extension of the European Union has tended to reinforce the importance of not only the latter axis but also the central axes, which are the obliged long-range routes in Europe. European transport policies thus tend to increase the differentiation of European territory rather than its homogenization, although they do, at the same time, increase its cohesion capability over long geographical distances (Rozenblat, 2009).

6.4 European and National polycentrism through specialized clusters

At the national or even international scale, high-performance business and R&D hubs are set up, as in France, Holland and Switzerland — where "competitive poles" are defined in the spirit of the Lisbon EU Treaty perspective (2007) on the knowledge society (Rozenblat, 2009). Imagined as a mixing of research, industry, education and training, the diversity of networks creates a "synergistic" system in which interaction plays a multiplicative role and serves as a source of renewal (through competition/cooperation) both on a local and a global scale (van den Berg *et al.*, 2001). The model of the 3-Helix, 4-Helix or N-tuple Helices has been developed particularly in Europe, adding governance conditions to industrial, political and research and education actors (Leydesdorff, 2012).

Hubs created by such processes are the distinguishing feature of a simple, highly specialized urban "cluster" (such as "industrial zones"). Such hubs are multidimensional, multiform and multi-scale, developing both inside and between cities.

Inside cities, routine access to resources that are both specialized and diversified generates "security" ("risk insurance": Veltz, 2000) for the development of creativeness for the population and their activities and collective building of sustainability (Yusuf, 2014). Between cities, access to diversified and complementary resources contributes to their complementarity with distant resources, for example, through the effect of spatial division of labor (Aydalot, 1986). Whether within or between cities, it is to be expected that different types of networks interlink, compete with and support each other by improving themselves and each other (Rozenblat, 2009). However, is it right to assume that industrial and education networks or training and research networks might be able to coincide and feed back in a positive way? One can assume that — through the interaction between networks and through the domination of networks in socio-economic or communication structures — a number of networks impose their characteristics on others.

More generally, through the reciprocal adaptation of different networks, levels of scale produce "attractive" infrastructures for newly emerging networks, particularly with communication infrastructures (Rutherford, 2005). Power networks provide mutual reinforcement at the decision-making level and in terms of their specific organization. The importance of achieving a correct balance between the degree of diversity of network levels and the degree of convergence of those levels within unified common networks depends, when functioning inside given urban centers, on the maintenance of a strong capacity for reactivity and renewal, and, when functioning between urban centers, on the local visibility of those networks. The same is also true of national and regional territories, whose institutional networks both "attract" and at the same time are strengthened by economic and social networks through language and identity, with the support and provision of the transport and communication networks that feed the "territory".

7. Conclusion: toward multi-level European governance

The question therefore arises in Europe as to what extent the levels, densities and intersections of countries, regions and cities have a bearing on their openness or insularity and on the ability of combination of policies to diffuse development and encourage cohesion. However, the major European cities are actually more productive in terms of intra-national differentiation, and they bear the lion's share of this national development through their growing of trans-national networks. They nonetheless introduce a complementary and indispensable dimension to European cohesion, predicated as it chiefly is on the linking, openness and diversity of economic and social structures.

Polycentrism is introduced almost exclusively at local or narrow regional levels, concerning second tier urban centers as opposed to metropolises. In this regard, the national scale is considered to be inexistent, whereas we have demonstrated the extent to which it still plays a significant role in regional dynamics. Issues of the relevant territorial levels of decision-making are pertinent at this juncture, given that the local authorities that decide upon the location of poles of competitiveness usually only pay attention to the pole they are planning to accommodate and ignore the networks that are indispensable to their prosperity and value.

The "continentalization" that both globalization and European integration induce – and which may be reinforced according to the negotiations following Britain's withdrawal from the European Union (Brexit) – favors the upper part of the urban hierarchy, but we demonstrated that second-tier cities and regions play a major role in this process — even if that role is only an indirect one — by acting as spatial mediators or staging posts (Rozenblat & Pumain,

2007). Without bringing together all possible functions — as the great political and economic capitals do — specializations develop throughout the fabric of European cities and regions, thus underlining the multi-level complexity of the continental system.

The European Urban Knowledge Network (EUKN) underlined the necessity to formalize better the European multi-level governance (Grisel & van de Waart, 2011; Tasan-Kok & Vranken, 2011). They proposed basic grids summarizing institutional supports from different levels that can be adapted to different contexts. This initiative represents a first step that must include better the complexity of governance which is multi-scales, multi-dimensional and multi-actors. Without a doubt, it is through a complex approach of multi-level governance that the European Union will intervene in a way that is pertinent to each specific regional, urban and national context and so strive toward the achievement of greater equality and cohesion within the European territory.

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