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# Polycentric Metropolitan Development: From Structural Assessment to Processual Dimensions

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**ABSTRACT** *In this paper we aim to enhance the prevailing structural perspective on metropolization by pointing to the mutual relationship between the processes of metropolization and polycentric development. We claim that a processual view is needed to emphasize the temporal dependencies between different layers of polycentricity, and to reveal that European city–regions are situated in different stages of polycentric metropolitan development (PMD). To illustrate this empirically, we first analyse Bratislava and Vienna as two European city–regions that recently decided to jointly approach metropolitan development, while their contextual conditions and development trajectories differ significantly. It is shown upon an indicator-based analysis that the two are in different phases of the metropolization process. Confronting this evidence with stakeholder assessments of the need for strategic intervention in metropolitan development further uncovers the importance of the strategic dimension in metropolitan research. Building upon that, we conduct cluster analysis for a sample of 50 European city–regions by the same indicator set. It is shown that even this large sample of agglomerations can be grouped by different types of metropolizes, reflecting distinct effects of the metropolization process on urban-regional transformation. Hence, we conclude that a processual understanding in strategic approaches to PMD is necessary. Only if the different phases, paces, and effects of the metropolization process are taken into account, we can formulate serious recommendations for the polycentric development of distinct European urban territories. The move from structural to processual understanding is an essential foundation to learning processes for the governance of future PMD. Furthermore, the emphasis on different types of metropolizes should be taken into account in the formulation of future European policies on metropolitan development.*

## 1. Introduction

European cities have encountered diverse transformations within the past quarter century. First, the internationalization of trade, attended by huge economic restructurings, reshaped

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the economic functioning and organization of urban agglomerations across Europe. New patterns of intense migration, mobility of capital, goods and people, and ongoing technological innovation constitute a decisive development condition, namely that of globalization (Dicken, 1998; Held *et al.*, 1999). Second, the permeability of borders is being enhanced by the not yet finished process of European integration, leading to new patterns of urban and regional development in socio-demographic and economic terms (Krätke, 2007; European Commission, 2010a). And third, recurrent economic crises confront European cities and regions with new policy challenges and a break with approved methods of multi-level governance and strategic planning (Herrschel, 2009; Camagni & Capello, 2012).

European urban agglomerations are also increasingly confronted with inter-place competition for metropolitan functions that shape their urban–regional development (Kunzmann, 1996; Friedmann, 2002). Competition under conditions of supranational economic policies and regardless of the physical geographies of distance and national urban hierarchies opened up the once stable European urban system for re-positioning. Thus, European cities actively engage in capitalizing their potentials into assets and providing area-based advantages for the attraction of human and investment capital (Camagni, 2009). Depending on their competitiveness, these cities are hence on their way to becoming metropolizes. Such efforts reach far beyond administrative city boundaries, demanding new modes of metropolitan multi-level governance (Healey, 1997; Parkinson, 1997; Salet *et al.*, 2003). In this regard, the issue of polycentricity is increasingly emphasized for its contribution to integrated metropolitan development (ESPON, 2005). Consequently, European city–regions are assessed on the micro level concerning their integrated inner development, and on a macro level as concerns their embedding in transnational and global networks (ESPON, 2005).

Such assessments though, often analyse solely structural characteristics to depict the degree of polycentricity and metropolization and define recommendations for policy and planning upon that. And the concepts of metropolization and polycentricity are persistently debated as independent analytical variables or normative visions of European urban development. Even more, while academia has for long regarded metropolization as an evolutionary process in analytical terms, i.e. to understand how it evolves and why certain functions of a global economy touch down in distinct places (Sassen, 2001; Hall & Pain, 2006; Castells, 2010), the political processes inherent in strategy-building for metropolitan development and the governance of metropolization are not taken into account with equal emphasis.

Hence, in this paper we highlight the processual dimension of metropolitan development. We claim that for analysing polycentric metropolitan development (henceforth PMD), such a perspective is not only necessary to better understand the links between metropolitan and polycentric features of city–regions and the temporal dependencies between different layers of polycentricity. It also re-emphasizes the fact that despite globalized conditions for territorial development, European city–regions still encounter surrounding transformations differently (Marcuse & van Kempen, 2000; Krätke, 2007), which consequently effectuates their pace of metropolization. Considering this, we suggest intensifying the conflation of analyses of place-based evidence with analyses of distinct local development trajectories, governance processes, and assessments of PMD by relevant stakeholders.

To elucidate this claim, we start with describing PMD in theory upon recent definitions of metropolization, polycentricity, and their presumed interrelations. Next, the argument for adding a processual dimension to the structural assessments of metropolitan regions is substantiated. Empirically, we begin with conducting an analysis of Bratislava and Vienna as two cities that recently launched a common metropolitan governance initiative. With an indicator-based analysis we attempt to uncover that the two city–regions are situated in different phases of the metropolization process. Conflating this approach with a stakeholder assessment at the same time<sup>1</sup>, we attempt to reveal the importance of analysing locally specific stakeholder attitudes, strategic considerations and perceptions of PMD to make serious recommendations for metropolitan planning. In a second step, we try to find whether the assumption of different phases of PMD can be deemed correct on the European level. Therefore, we conduct cluster analysis by the same indicators for a sample of 50 European city–regions. Herewith we plan to show that urban regions can actually be grouped by characteristics of the metropolization process, pointing at different phases of PMD. This urges European territorial policies to further increase the acknowledgement of local specificities and foster research on place-based evidence.

## 2. Understanding PMD

### 2.1. *The Concept of Metropolization*

The process of metropolization, its driving forces, as well as its impacts on urban development have been subject to intense scientific and planning discussions since the 1980s. Facing the increasing globalization of economic activities, improved ICT, and altered modes of production, distribution and consumption, metropolization soon became a dominant debate in several fields of urban studies (Friedmann, 1986; Thornley, 2000; Sassen, 2001). For European cities, the changing geopolitical contexts made this debate even more important for their development considerations. The fall of the Iron Curtain and the process of European integration brought about new opportunities and perspectives for most cities, while shaking the urban hierarchies and position of established cities within them. The newly evolved competitive markets and cooperation possibilities soon altered chances of attracting new activities, but as well increased the challenges of urban-regional governance (Giffinger, 2005; Hamilton *et al.*, 2005; Hall & Pain, 2006).

Meanwhile, the academic discussion has settled on a distinction of two major approaches to metropolization processes, as Castells (2010) elaborates. On the one hand, the primacy of a global knowledge economy is emphasized as the driving force of metropolitan growth, which is limited to a small number of powerful nodes on the global map (Hall & Pain, 2006). As a result, urban centrality in the core still exists, while being enhanced by further functions in new specialized sub-centres in the metropolitan region. And consequently, urban sprawl is increasingly replaced by the emergence of such new sub-centres. On the other hand, Castells (2010, p. 2740) argues that, “[ . . . ] the key spatial feature of the network society is the networked connection between the local and the global”. In this perspective, places are connected upon their contribution to the network’s quality. This contribution, again, depends to a large degree on these places’ respective local networks. Hence, the process of metropolization is driven by the interaction between global and local relations. And it affects the spatial, as well as the socio-demographic development of a city–region. Both networks demand exceptional

ICT standards and transport infrastructures that facilitate global accessibility, as well as face-to-face interaction on a very local level.

From a place-based view, the varying impacts of global networks and European integration are considered as key factors enforcing the competition between cities. Hence, the European urban system experiences two decisive changes. First, not every city is able to meet the new development challenges. Economic restructuring, new economic functions, the increase of knowledge intensive activities, immigration, and the disappearance of labour intensive industries decisively affect the socio-spatial development of metropolitan regions. Herein, some cities and neighborhoods lose, while others reside as winners in economic and social terms (Fainstein *et al.*, 1992; Sassen, 2001; Krätke, 2007). Second, established cities experience particular challenges due to increased competition for their formerly distinct economic, cultural and political functions. Consequently, these functions are relocated to only a few cities globally (Sassen, 2001; Krätke, 2003; Hall & Pain, 2006; Castells, 2010). Accordingly, metropolization is predominantly driven by the allocation of such specialized functions. In order to attract them, cities need to be attractive not as single nodes, but as part of an urban region, so that these functions can be allocated to those places with the highest area-based advantages, herewith supporting the interaction of actors in global and local networks. In line with the points discussed, we can hence define the essential characteristics of the metropolization process as follows:

- Allocation of (new and specialized) economic functions and population as a factor of growth and spatial extension towards a metropolitan region (cf. for instance Friedmann, 1986, 2002; Geyer, 2002; Hall & Pain, 2006)
- Exercise of command and control functions in global networks of material and immaterial flows with excellent connectivity between urban nodes (cf. for instance, Keeling, 1995)
- Technological innovation and economic restructuring towards knowledge intensive economic activities in specialized branches of production or service (cf. for instance, Krätke, 2007; Castells, 2010)
- Socio-spatial processes of segregation or fragmentation through increasing social polarization and the replacement of old urban functions by high-ranked economic functions (cf. for instance Marcuse & van Kempen, 2000; Sassen, 2001)

A specific aspect in conceptualizing metropolization processes is the spatial de-concentration of specialized functions. It is considered important for handling growth and securing both competitiveness and territorial cohesion at once. Hence, the concept of polycentricity is recurrently mentioned as a key element of metropolitan development. A number of studies point at the increasing decentralization of metropolitan functions, identifying that they are being housed in metropolitan sub-centres (Krätke, 1995; Kunzmann, 1996, Friedmann, 2002; ESPON, 2005, 2006, 2012). Yet, as these sub-centres are the outcome of the interplay between global and local networks, metropolitan development must be interpreted as the spatial convergence of urban dimensions of multi-layered global networks. From this perspective, polycentric development is therefore a specific layer in the spatial context of metropolitan development, which replaces the urban-regional model of urban sprawl with that of morphological and functional polycen-

tricity. Its exact definition and importance for metropolization processes are thus elaborated in the following section.

## 2.2. *The Concept of Polycentricity*

The development of metropolitan regions can neither be analytically explained, nor strategically approached without taking into account the obvious specificity of their spatial and functional configuration. As Roca Cladera *et al.* (2009, p. 2842) claim: “The reality of urban development from the 1980s has revealed substantial changes in the structure of metropolitan areas, which cannot be explained by the standard model.” And they go on to elaborate that it is particularly the polycentric structure of these metropolitan territories that deserve our attention, as new sub-centres are increasingly found to be contributing decisively to the economic performance and stability of urban systems with metropolitan character (Rigueulle *et al.*, 2007; Roca Cladera *et al.*, 2009; Camagni *et al.*, 2013).

In its simplest, polycentricity describes the circumstance that the structure and development of a metropolitan territory are determined by multiple instead of a single node (Roca Cladera *et al.*, 2009; ESPON, 2012). Today, polycentricity is debated in a multi-faceted way as both an analytical concept to reveal the level of multi-scalar integration of metropolitan urban regions (ESPO, 2012; Kramar & Kadi, 2014) and as a normative goal to alleviate the problems attending metropolization processes (Council of Ministers, 2011). The final report of ESPON 1.1.3 reveals this duality: “[P]olycentricity can be conceptualized as both an ongoing process and as a normative goal to be achieved and is alleged to help in reducing regional disparities and in increasing competitiveness for integration.” (ESPO, 2006, p. 12). Yet, polycentricity is—notwithstanding its long career as a theoretically discussed and empirically applied concept—critically debated regarding its positive impacts on urban growth, territorial competitiveness and equal spatial development (Vandermotten *et al.*, 2008; Herrschel, 2009; Maier, 2009). Still though, corresponding strategies emphasize the enforcement of polycentric structures in order to enhance competitiveness and alleviate negative side effects of metropolization processes, allowing for cohesion within metropolitan territories. “[T]he polycentricity model [ . . . ] is seen by policymakers as less likely to be exclusive, because it reduces imbalances between dominant cities and ‘the rest’.” (Herrschel, 2009, p. 243). Thus, polycentricity has become a widespread normative goal in metropolitan and European development strategies due to its usability regarding territorial development visions (European Commission, 2010b; Council of Ministers, 2011; ESPON, 2012).

The concept subsumes a number of facets to analytically describe the level of integration of urban agglomerations. In terms of scale, micro-, meso- and macro-levels are usually distinguished to describe the polycentric constitution of a territory. Micro-level polycentricity points at the level of internal integration of metropolitan regions, i.e. a city and its surroundings. Meso-scale polycentricity defines dense national urban networks and the occasional case of intense border-crossing relations (e.g. so-called potential polycentric integration areas, or PIAs). Slovenia’s national urban network is one often-cited case of such well-integrated meso-scale polycentric networks (ESPO, 2012). Macro-scale polycentricity ultimately describes the embedding of metropolitan regions in wider transnational or global networks of metropolizes—the “Pentagon” being an example frequently referred to (ESPO, 2005, 2006).



An equally important distinction concerns the quality of polycentricity. Several accounts of PMD have already formulated a number of conceptualizations that are ever distinct, depending on the focus of analysis and available data for revealing empirical evidence of certain polycentric structures. This paper does not aim at producing a review of the exhaustive literature on theorizing polycentricity, particularly as recent scientific work has already intensely engaged in this effort (Vandermotten *et al.*, 2008; Kramar & Kadi, 2014). Instead, we build upon a differentiation of three basic types of polycentricity by condensing the manifold approaches to a workable definition for this paper and its empirical considerations<sup>2</sup>:

- *Morphological polycentricity*: the delineation of urban hierarchies based upon size; polycentricity as structural characteristic regardless of inter-nodal relations; place-specific city–region definitions and rank-size distribution within the metropolitan territory
- *Functional polycentricity*: the allocation of infrastructural networks, flows and interactions between urban nodes as indicators of inter-urban relations; technical infrastructures, distance, commuting on a daily basis, networking activities in economic, scientific and socio-cultural concerns as indicators
- *Strategic polycentricity*: the identification of political-institutional relations as signified in policy processes and strategic development documents; the cognitive envisioning of PMD as done by relevant stakeholders in strategic urban development processes; inter-urban cooperation, strategic networking between municipalities, planning agreements

Demarcating a regionally integrated metropolis with its polycentric structure is seemingly unproblematic in morphological and functional terms on a micro scale. Yet, delineation is more problematic in strategic or political terms. Diverse imaginations exist of what is to be subsumed spatially, functionally, economically, and politically under a polycentric metropolitan region throughout the range of stakeholders. Also, goal conflicts between a micro-scale delineation of a metropolis as a functionally integrated agglomeration (i.e. welfare- and inclusion-oriented) and the macro-scale imagination of a metropolis as a city in competition (competitiveness-oriented) have been long known (ESPON, 2006; Herrschel, 2009). As both morphological polycentricity and functional linkages can be decisive preconditions in the arrangement of strategic polycentricity, it is necessary that they are perceived by relevant stakeholders. Thus, analyses of recent processes of PMD should attempt to confront evidence with strategy to see how, or if at all, actual development conditions are perceived accurately, and if the respective phase and pace of PMD are taken into account by decision-makers. Hence, it is important to adopt a processual dimension in the conceptualization of PMD, where the different layers of polycentricity are understood as interrelated factors that are temporally and logically dependent on each other.

### 2.3. Adopting a Processual Dimension in Analysing PMD

The above-introduced concepts of metropolization and polycentricity are regarded as mutually related influencing factors of urban development in most scientific discourses (cf. for instance Krätke, 1995; Roca Cladera *et al.*, 2009; Castells, 2010). Yet, as recent research shows, often enough in strategic discussions and urban development practice

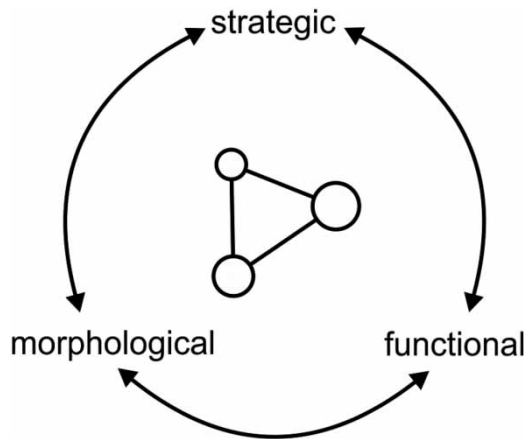


they are rather independently approached. Also, these approaches point to the assessment of PMD from a structural perspective only, and do not sufficiently embed PMD in the individual development contexts of distinct city–regions and the different stages of metropolitanization, in which these city–regions can be situated (ESPON, 2012). This, although we know that urban development, and consequently also metropolitan development, is path-dependent (Moulaert & Jessop, 2013), meaning it leads to ever-specific outcomes. European city–regions have been facing different and changing geo-political and economic preconditions over the last century, hence revealing completely different paths of development based on their experiences and ability to meet new challenges (Krätke, 2007). Also, temporal and logical dependencies between different layers of polycentric development are not analysed, although being of importance as a knowledge base for implementing territorial development strategies. Hence, we suggest enhancing current approaches to PMD with a processual dimension that explicitly points to these interrelations and dependencies. Yet, how can we argue that such a processual dimension is necessary?

First, because one can assume that the metropolitanization process is mutually interrelated with polycentric development on both the micro- and macro-levels—a notion recurrently supported by several scholars (Kunzmann, 1996; Leroy, 2000). At least on the micro-level, metropolitanization processes are by their very nature dependent on the polycentric region for different reasons—for instance the attractiveness of a metropolitan region exceeding the core city, or a well-organized, decentralized region as a potential for future growth. In fact, robust polycentric structures within a metropolitan region are a positive influencing factor of metropolitan growth (Camagni *et al.*, 2013). Consequently, cooperative polycentric strategies are needed that aim at fostering the most relevant assets on the regional level, steering competition between participating cities and municipalities (Giffinger & Hamedinger, 2009). On the macro-level we can see similar dependencies. Metropolitanization needs macro-polycentricity, as the specialization of metropolizes enforces functional relations with other cities and regions. Furthermore, macro-PMD is supported through the embeddedness in global networks of material and immaterial flows or the exercise of command and control functions (Keeling, 1995).

Second, because we need to consider the dependencies between the different qualities of polycentricity. Morphological polycentric features might tell us much about structural preconditions for establishing functional ties and the focus of future territorial cohesion policies. Functional polycentricity is as much a valuable account of a currently well- or scarcely integrated metropolitan region, pointing at the need for adjustment in active spatial development strategies (Geppert, 2009). Yet, we need to consider that polycentric structures in terms of morphology are the material outcome of functionally intense, long-term relations, and that these functional ties are often dependent enough on earlier strategic polycentricity endeavours regulating or facilitating these functional ties (Geppert, 2009).

Thus we argue that the chronology in PMD must as well be considered. In this regard, polycentricity is not just a matter of spatial development, but has an equally important processual dimension that needs to be considered in policy-processes. Analytical and strategic polycentricity thus need to be integrated to support territorially cohesive metropolitan development. Strategic decisions should be made on the basis of broad stakeholder integration, their perception of current polycentric structures, their visions for future PMD,



**Figure 1.** Processual dependencies of the different layers of polycentricity.

and empirical evidence from an analytical standpoint to conjoin all facets of polycentricity at the same time (cf. Figure 1).

Yet, of course, such a processual dimension only makes sense if we are sure that metropolization processes are in fact context-dependent and, hence, differ between European city–regions. Only if we can discover that PMD proceeds at different paces in different city–regions and that, hence, these city–regions are currently in different phases of the metropolization process, it would be helpful to point to the temporal dependencies of metropolization and the layers of polycentricity for the governance of territorial development. Otherwise we could as well turn to undifferentiated territorial policies that neglect place-based evidence and path-dependencies in planning.

Thus, we first analyse Bratislava and Vienna as an often referred-to case of cooperation in metropolitan governance to see whether the assumption of different phases of the metropolization process is correct. And we confront territorial evidence with strategic assessment in this example to show that it is important to empirically analyse the different layers: a strategic or political one vis-à-vis a functional and morphological layer. Second, we take our assumption to the European level to test whether—in the fragmented, path-dependent metropolization processes—similar types of metropolizes can be revealed that might help us to better understand the process of PMD and allow for formulating future European policies for diverse city–regions.

### 3. Phases of PMD: Comparing Bratislava and Vienna

Based on the above discussion it becomes obvious that metropolitan development needs to be interpreted as being deeply linked with the global embedding of metropolizes in wider functional networks, i.e. macro-polycentric development. Metropolitan development and distinct conditions for establishing and steering links with other urban nodes stimulate each other mutually. High-ranked functions and headquarters, congresses or the establishment of knowledge-intensive activities demand excellent accessibility in order to function properly. While this relationship has already been intensely debated (cf. for instance Sassen, 2001; Hall, & Pain 2006; Castells, 2010), it needs to be highlighted with equal

emphasis that metropolitan development as well needs a robust micro-polycentric foundation on the urban-regional level. Urban growth and transformation processes demand polycentric structures on the urban-regional level as, according to Camagni *et al.* (2013), micro-polycentric development supports the reduction of urban costs in metropolitan development.

Hence, we can argue that metropolitan and polycentric development processes are inter-related—their form depending on the ever-specific development paths taken by a particular city–region. Correspondingly, we look at selected European metropolizes in terms of specific morphological and functional features and the strategic layer of PMD. Bratislava and Vienna are analysed in a first step as a case of cooperative metropolitan governance of two nodes in the Central European urban system. Most obviously, the two differ in terms of the preconditions to PMD already at first sight—not only in terms of size, but also as concerns their roles as capitals of Central European countries with distinct political-economic histories (Giffinger & Hamedinger, 2009).

Accordingly, an empirical analysis of the two city–regions is conducted, which groups indicators into components that can be considered characteristic of PMD. First, we regard metropolitan growth as a basic component reflecting size, current urban development process, and an agglomeration’s attractiveness in a competitive context. Second, we define high-ranked functions as a component of PMD, giving recognition to the importance of command and control functions and global accessibility in the metropolization process. Third, economic restructuring is reflected by indicators pointing at a transformed labour market due to a shift to a knowledge-based economy (KBE). Fourth, city–regional integration covers the micro-polycentric constitution of a metropolitan region by reflecting urban-regional structural and functional imbalances. And fifth, transnational embeddedness defines the macro-polycentric integration of a metropolitan territory in wider functional networks. Each of the five components is described by a bundle of indicators (cf. Figure 2).

The basis for our empirical analysis is the classification of city–regions according to the ESPON project 1.1.1 (ESPON, 2005). From 1595 FUAs (Functional Urban Areas) with more than 20,000 inhabitants, 50 city–regions are finally nominated as a representation of European average in terms of PMD.<sup>3</sup> The respective city–region’s figures can then be mirrored with the sample’s average to allow for classifying its individual performance. At the same time, we confront this indicator-based evidence with a qualitative assessment of PMD by relevant city–regional stakeholders in Bratislava and Vienna. This is meant to

PMD Characteristic	Component	Indicators
Population and settlement growth	Metropolitan growth	<ul style="list-style-type: none"> <li>• Annual population growth rate (1990-2007)</li> <li>• Increase rate of built-up areas/capita (2000-2006)</li> </ul>
Command and control functions	High-ranked functions	<ul style="list-style-type: none"> <li>• No. of headquarters of transnational firms (2006)</li> <li>• Accessibility of metropolitan region (2010)</li> </ul>
Global accessibility		
Knowledge-intensive businesses and services	Knowledge-based economy (KBE)	<ul style="list-style-type: none"> <li>• Share of population with tertiary diploma (2005)</li> <li>• Share of scientific and technical employment (2005)</li> </ul>
Micro-polycentricity	City-regional integration	<ul style="list-style-type: none"> <li>• Commuting disparities (2004-2010)</li> <li>• Development disparities (2004)</li> <li>• Population growth difference (2000-2005)</li> </ul>
Macro-polycentricity	Transnational embeddedness	<ul style="list-style-type: none"> <li>• No. of congresses held in region (2009)</li> <li>• No. of air passenger (2006)</li> <li>• Share of Erasmus students (2008-2009)</li> </ul>

Figure 2. Defining components of PMD (see appendix).

elucidate to what degree certain preconditions of PMD are reflected in stakeholder's perceptions, thereby bringing in the strategic dimension of polycentricity, which—as elaborated above—is important to fully comprehend the evolutionary process of metropolitan development that is currently still under-represented in European regional and planning studies.

This first analysis draws upon results from research conducted within POLYCE, a European research project that was run from 2010 to 2012 within the ESPON 2006–2013 Programme (ESPO, 2012). Within POLYCE, metropolization processes and polycentric development of five Central European capital cities, namely Bratislava, Budapest, Ljubljana, Prague and Vienna, were analysed upon European territorial indicators. As another integral step, focused workshops were organized in all five capital cities, with 20–30 relevant stakeholders from the respective metropolitan regions attending. POLYCE created Metropolitan Agendas as development strategies upon stakeholders' opinions, ideas and visions about the future development options for the five Central European metropolitan regions. Participating actors were asked to contribute to the creation of these agendas with their expertise by sharing their perception of recent PMD processes and assessing current development paths of their respective metropolitan region. The qualitative judgment deriving from this strategic discussion was then conflated in a bottom-up manner by the research team and clustered thematically, the result being a Metropolitan Development Agenda for each of the city–regions. Confronting this qualitative assessment with the above introduced indicator-based components reveals in which fields of intervention strategic actors of well- or poorly embedded metropolizes see a need for action, which are less regarded, and to what degree these interpretations converge with the evidence provided above.

Figure 3 shows the results. Territorial evidence, i.e. the components of PMD, and the strategic discussion, i.e. the respective qualitative assessments, were normalized to obtain comparable figures. For territorial evidence, a positive deviation of one PMD component from the European average is interpreted as a low need for strategic intervention, while a negative deviation indicates the opposite. Concerning the results from the strategic stakeholder discussions, the number of mentions of activities relating to a metropolization and/or polycentricity feature is grouped by similar categories. “Low” stands for only few

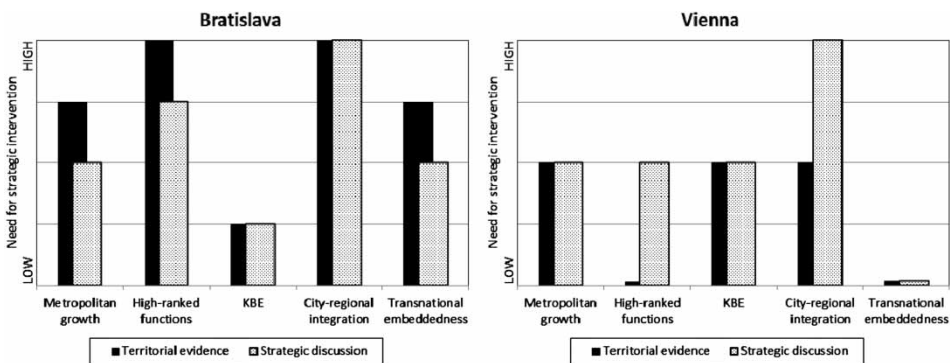


Figure 3. Comparing PMD in Vienna and Bratislava: territorial evidence vis-à-vis strategic assessment.

related activities, while “high” indicates a high number of mentions and, thus, an awareness of the need for strategically intervening in the PMD path of the respective metro-region. Hence, this classification allows for a simple comparison of territorial evidence (i.e. the descriptive analysis of indicators compared to European average) and strategic discussion (i.e. the qualitative assessment of activities mentioned in the Metropolitan Agendas of the Central European metropolitan regions).

Obviously, the two compared city–regions differ decisively as concerns the indicator-based analysis of PMD. Whereas Vienna performs largely above average in most of the defined components, Bratislava’s results vary largely across the five categories. Results particularly hint at Vienna’s role in a wider urban system, where it is obviously well-embedded. Therefore, the strategic debate particularly concentrates on fostering city–regional integration processes instead of further pushing processes of metropolization. Stakeholders seem to accurately interpret the development conditions of the Vienna metropolitan region, while overemphasizing only the equipment with command and control functions and the need for further urban-regional cohesion. Bratislava instead shows a more dispersed picture concerning the degree of convergence between evidence and strategy. Particularly in terms of metropolization features, actors give less regard to activities fostering their metropolitan development than would actually be needed considering indicator analysis. Although tendencies here also point at a convergence between both evidence and strategy, the emphasis on strengthening growth, high-ranked functions and global embedding should be higher in all four fields. As concerns city–regional integration on the other hand, actors already seem to be aware of the high demand for stronger micro-polycentric development efforts. In general, the need to catch up in European terms is by and large acknowledged, although suggested activities cannot cover the whole range of interventions needed.

This initial analysis of two metropolitan regions hence uncovered two things: first, that the structural conditions for PMD differ decisively in the two metropolizes, herewith emphasizing the need for place-based evidence as a foundation of territorial policies; and second, that despite evident structural development conditions, stakeholder perceptions in the strategic debate on PMD are equally important influencing factors of the metropolization process. The latter particularly demands reconsidering analyses of PMD as an evolutionary process depending on the planning-political (or strategic) layer of polycentricity.

#### 4. Identifying types of PMD

Metropolization is regarded as a global process affecting urban development in different dimensions. Hence, it is reasonable to assume that it can be described empirically by a certain set of indicators for any sample of cities. According to the above theory-led discussion and the insights gained from the analysis of Vienna and Bratislava, these components reflect a city’s situation in the process of metropolization in a multi-dimensional way. At the same time, contextual preconditions like the persistence of built urban structures or restricted abilities to govern urban development trends do not have the same impacts on PMD in each and every city (cf. Chapter 2.3, resp. Friedrichs, 1985, or Hamilton *et al.*, 2005). Consequently, we can assume that cities experience the process of PMD differently. They are the result of a specific socio-political context and of a specific pace of development. Based on the above defined components we therefore classify European metropo-

lizes by elaborating comparable features as the path-dependent outcome of recent trends of metropolization. Also, we substantiate the above empirical analysis of Bratislava and Vienna by taking the assumption of PMD as a path-dependent process to the European level. According to the above definition, the empirical classification of metropolizes will concentrate on non-correlating indicators that describe the metropolization process of European urban regions. These are the same that constitute the above defined components (cf. Chapter 3).

The five components describing PMD are standardized and the Ward-method as a hierarchical classification procedure is applied in order to identify homogenous groups of metropolizes. For figuring out the number of clusters with the most homogenous result, a repeated analysis showed that five clusters deliver a satisfying result in statistical terms. Clustering reveals five groups that differ strongly among the five components of PMD. Only two components (“City-regional integration” and “Transnational embeddedness”) show insufficient internal homogeneity in comparison to the total distribution of values. Figure 4 shows the results of cluster analysis, describing the five types compared to European average.

*Cluster 1: Established metropolizes with excellent macro-polycentric performance*

City–regions in this group grow moderately, while clearly lagging behind in terms of the KBE. The latter is expressed by the lowest average among the five clusters. To the contrary, this cluster is characterized by above average “High-ranked functions”, indicating their importance as global political, cultural, and economic centres. Moreover, they are characterized by a moderate decrease in “City-regional integration”—an indication of under-developed micro-polycentricity— as well, while at the same time being excellently embedded on the global scale.

Members of this cluster are: Vienna, Prague, Barcelona, Milano, Roma, La Valletta, and Manchester

		Metropolitan growth (Z-value)	High-ranked functions (Z-value)	Knowledge-based economy (KBE) (Z-value)	City-regional integration (Z-value)	Transnational embeddedness (Z-value)
Cluster 1	<b>Avg.</b>	<b>-0,19</b>	<b>0,36</b>	<b>-0,58</b>	<b>-0,16</b>	<b>1,20</b>
	N°	7	7	7	7	7
	Var.	0,21	0,65	0,31	0,40	0,40
Cluster 2	<b>Avg.</b>	<b>-0,60</b>	<b>-0,80</b>	<b>-0,27</b>	<b>1,28</b>	<b>-0,62</b>
	N°	11	11	11	11	11
	Var.	0,49	0,10	1,16	0,35	0,32
Cluster 3	<b>Avg.</b>	<b>-0,10</b>	<b>1,36</b>	<b>1,26</b>	<b>0,01</b>	<b>0,87</b>
	N°	9	9	9	9	9
	Var.	0,58	0,89	0,42	0,21	0,27
Cluster 4	<b>Avg.</b>	<b>-0,24</b>	<b>-0,25</b>	<b>-0,20</b>	<b>-0,81</b>	<b>-0,78</b>
	N°	17	17	17	17	17
	Var.	0,19	0,40	0,73	0,35	0,15
Cluster 5	<b>Avg.</b>	<b>2,16</b>	<b>-0,28</b>	<b>-0,15</b>	<b>0,11</b>	<b>0,64</b>
	N°	6	6	6	6	6
	Var.	0,36	0,92	0,48	1,28	1,01

**Figure 4.** Clustering metropolizes by components of PMD indicators.<sup>4</sup>

*Cluster 2: Metropolizes with under-developed polycentric features*

City–regions of this group show the weakest performance in “Metropolitan growth” and “High-ranked functions”. Even the performance in terms of KBE is slightly below European average. Hence, these city–regions face clear deficits in the process of metropolization. Besides, they are characterized by weak “City-regional integration”, i.e. mono- instead of polycentric structures, and very poor “Transnational embeddedness”, which reveals their weak preconditions in terms of macro-polycentric development.

Members of this cluster are: Budapest, Bratislava, Ljubljana, Sofia, Tallinn, Vilnius, Riga, Warszawa, Porto, Lisbon and Bucharest

*Cluster 3: Restructured metropolizes with advanced micro- and macro-polycentricity*

This cluster is defined by moderate “Metropolitan growth” and the best performance concerning “High-ranked functions” and KBE, expressing these city–regions’ advanced status in terms of PMD. This is accompanied by a well-balanced “City-regional integration” as an indication of a balanced micro-polycentric development, and excellent “Transnational embeddedness”, which fosters their macro-economic polycentric development.

Members of this cluster are: Brussels, Munich, Berlin, Frankfurt, Copenhagen, Helsinki, Amsterdam, Stockholm and Glasgow

*Cluster 4: Moderately restructured metropolizes with less advanced micro- and macro-polycentricity*

The process of metropolization did not affect these cities with equal intensity. “Metropolitan growth”, “High-ranked functions”, and KBE all reveal a comparably poor performance below European average. At the same time, “City-regional integration” and “Transnational embeddedness” show very strong deviations from European average, indicating a non-balanced micro-polycentric development and poor condition for macro-polycentricity.

Members of this cluster are: Antwerp, Stuttgart, Bremen, Hamburg, Düsseldorf, Köln, Lille, Bordeaux, Lyon, Torino, Bologna, Luxemburg, Rotterdam, Lodz, Krakow, Gdansk and Malmö

*Cluster 5: Fast growing, well-embedded metropolizes with inhomogeneous polycentric features*

City–regions in this cluster are fast-growing, performing moderately in terms of “High-ranked functions” and KBE. The process of metropolization is, in this group, supported by a well-balanced “City-regional integration” in terms of micro-polycentric development and above average “Transnational embeddedness” as an indication of well-developed macro-polycentric features.

Members of this cluster are: Madrid, Valencia, Seville, Toulouse, Athens and Dublin

To sum up, statistical analysis shows that the process of metropolization—in combination with polycentric features—actually allows for the identification of comparable city–regions in five homogenous groups or types of metropolizes. This classification clearly



shows the very specific impact of recent trends of globalization and economic restructuring on PMD under the respective local conditions. Importantly, the above discussed and assumed mutual interrelation between certain features of metropolitan and polycentric development exists in specific bundles of characteristics that together form a characteristic cluster. However, the interrelated development process works differently for specific features and evidently provides different types of metropolizes. Hence, a general trend and interrelation that would be significant across all types of metropolizes could not be detected. This, of course, should have strong impacts on metropolitan policy approaches, which should acknowledge this fact.

## **5. Conclusions: From Structural Assessment to Processual Dimension**

This paper concentrated on the multi-faceted understanding of polycentric development and its significance for European metropolizes. Two different empirical approaches were applied to reveal the preconditions of polycentric development in metropolitan regions. We started with an outline of the concepts of metropolization and polycentricity as our theoretical grounding. It was made clear that metropolization needs to be considered as a multi-dimensional concept that cannot be seriously discussed without taking the specific characteristics of polycentric development processes into account. For polycentricity, we highlighted three conceptual qualities: morphology as an indication of spatial structures, functional relations as the collective name for all kinds of flows and boundary-crossing ties, and strategic interests as the political dimension of PMD.

Building upon this theoretical debate and the so-produced characterization of both concepts, we then attempted to introduce two empirical approaches to identifying different phases and paces of PMD and different types of European metropolizes. We used both a mixed-methods approach and a statistical approach to point at the presumed mutual relation and the strategic dimension of processes of metropolization and polycentric development. In a first step, we concentrated on the specific situation of PMD by comparing Vienna and Bratislava. Analysing the two with a mixed-methods approach that would confront descriptive data analysis and a perceptive-assessing approach, we were not only able to uncover that the two city–regions are situated in different phases of the metropolization process, but that the local conditions for future PMD are also differently perceived among local stakeholders here and there. Obviously strategic actors in already well-integrated city–regions are aware of the importance of micro-polycentricity for PMD, although city–regional relations are perceived differently in each case. The general tendency found is that less-established metropolizes are clearly focusing a competitive behaviour, which puts core cities at centre stage, while established metro-regions have already gone one step further in their efforts to govern the metropolization process by putting more emphasis on embedding an integrated metropolitan region in a wider urban system. Still though, CE metropolizes are obviously aware of the importance of polycentricity in metropolization processes, as two thirds of suggested measures clearly aim at fostering polycentric structures. However, a comprehensive research across all 50 European metropolizes would be necessary in order to clarify further interrelations between place-based evidence and stakeholders' perceptions. Anyhow, we highlighted the importance of the strategic dimension in PMD processes only upon the basic comparative analysis of these two cases.

In a second step, we explored whether specific types of metropolizes could be recognized among a sample of 50 European urban agglomerations. We considered this analysis

as an explorative approach based upon theory-led arguments. Herewith we wanted to point at the need to consider the place-based particularities of different metropolizes in policy processes of European urban development. Statistical analysis found five types of metropolitan agglomerations: first, established metropolizes with excellent macro-polycentric performance, second, metropolizes with under-developed polycentric features, third, restructured metropolizes with advanced micro- and macro-polycentricity, fourth, moderately restructured metropolizes with less advanced micro- and macro-polycentricity, and fifth, fast growing, well-embedded metropolizes with inhomogeneous polycentric features. These types were identified in terms of their specific characteristics of PMD on the micro- and macro-levels. Hence, empirical analysis has also clearly pointed to the interrelation between specific metropolizes and their polycentric structures, while it also made clear that European metropolizes are too different to make any general statements.

Results, therefore, show that actually urban regions are affected by metropolization in ever-specific ways that can still be grouped by homogenous features. Facing this fact, we urge that European territorial policies should further increase the acknowledgement of local specificities and foster research on place-based evidence. Moreover, results demand that future research on PMD take on a processual dimension that recognizes the temporal dependencies of different qualities of territorial development as well as the locally specific development trajectories of European city–regions. In this regard, further comprehensive evidence-based approaches are strongly recommended for analysing metropolitan development processes of European urban agglomerations. Yet, they need to be blended with city-specific approaches that are capable of taking into account place-based specificities of a metropolitan region. As our analysis has shown, suggestions of stakeholders on strategic efforts concerning future PMD do not always converge with deficits or assets of their cities. This divergence between perception and evident status is strongest where metropolization processes are least advanced. Therefore, any concept of European urban policy should emphasize and prioritize place-based research and strategies in order to meet specific local challenges when it comes to fostering metropolization processes and micro-polycentric structures through corresponding cooperative planning efforts.

## Notes

1. Assessments of PMD in Bratislava and Vienna were ascertained in stakeholder workshops in the course of the ESPON project POLYCE (cf. ESPON, 2012).
2. The basic delineation builds upon the following sources: ESPON (2005, 2006, 2012), Geppert (2009), Maier (2009), and Kramar and Kadi (2014).
3. 76 European MEGAs were selected that are covered by Urban Audit for both the Core City and the Larger Urban Zone or approximations of these by NUTS regional level as defined by the ESPON project FOCI (ESPON, 2009). 69 MEGAs remained for data collection after removing huge MEGAs and those agglomerations not included in FOCI from the sample. According to the Urban Audit definitions and database coverage for 1999–2008, Large Urban Zones were used as the primary proxy for the metropolitan regions. In other cases, data were collected from Eurostat or other European research projects, approximating the metropolis by NUTS regional data. The 160 indicators retrieved allowed for a further reduction of the city sample to 50 European MEGAs that were sufficiently covered by data in 123 indicators.
4. The description is based on  $F$ -values defined through the relation of variance between group specific and total value. As all indicators are showing standardized values, the value of information of an indicator is expressed through the indicator's value of variance within a cluster: the lower the value of group specific variance in comparison to total variance of 1.00 is, the stronger an indicator's mean value characterizes the homogeneity of a group of metropolizes in a certain cluster/type.

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## Appendix

Indicator name	Description	Reference year	Spatial reference	Source
Annual population growth rate (LUZ)	Average annual population growth rate of city–regional agglomeration	1990–2007	Larger urban zone	Urban audit
Increase rate of built-up areas/capita (LUZ)	Average increase of built-up areas per inhabitant in the city–regional agglomeration	2000–2006	Larger urban zone	Urban audit

(Continued)

## Appendix. Continued

Indicator name	Description	Reference year	Spatial reference	Source
No. of headquarters of transnational firms	Total number of headquarters of transnational firms of the 2000 biggest world firms located in the city–regional agglomeration	2006	Larger urban zone/NUTS 3	ESPON FOCI project/Forbes
Accessibility of metropolitan region	Number of metropolitan growth areas reachable by rail, air and intermodal return trips	2010	Functional urban area	ESPON FOCI project/OAG
Share of population with tertiary diploma	Proportion of the resident population aged 15 and above qualified at levels 5–6 ISCED in the metropolitan region	2005	Larger urban zone/NUTS 2	ESPON ATTREG project/ESPON DEMIFER project
Share of scientific and technical employment	Share of people employed in scientific and technical jobs from total employment in metropolitan region	2005	Larger urban zone/NUTS 2	Eurostat
Commuting disparities (inbound—outbound commuters)	Absolute difference between inbound commuters (from metro-region to core city) and outbound commuters (from core city to metro-region)	2004–2010	Core city	Urban audit
Development disparities (CC—MR)	Disparities in the GDP-per-capita-level between the metropolitan area and its regional hinterland	2004	Metropolitan growth area	ESPON FOCI project
Population growth difference (CC—MR)	Difference between annual population growth rates of core city and metropolitan region	2000–2005	Core city/larger urban zone	ESPON FOCI project (urban audit)
No. of congresses held in region	Total number of congresses held in the metropolitan region in the reference year	2009	NUTS 2	ESPON ATTREG project/ICCA
No. of air passenger	Total number of air passengers (embarkation and disembarkation) in the reference year	2006	NUTS 2	Eurostat
Share of Erasmus students	Share of Erasmus students per 1000 students enrolled at local universities	2008–2009	NUTS 2	ESPON ATTREG project