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a functional perspective**

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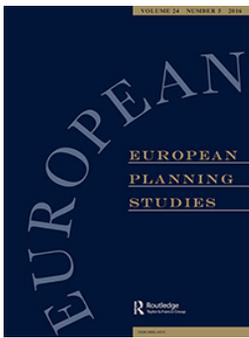
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Contrasts between first-tier and second-tier cities in Europe: a functional perspective

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ABSTRACT

Second-tier cities have been experiencing renewed interest within policy and research contexts, which is reversing a tradition of relative neglect due to the long-standing focus on large cities and capitals. This paper compares European second-tier and first-tier cities with regard to the presence of urban functions and how these are spread over their urban regions. The analysis shows the existence of a substantial ‘first city bonus’: a surplus of urban functions in first-tier cities which cannot be explained by their size or network embeddedness. We also show that second-tier cities are better served with urban functions in the absence of a dominant capital. In first-tier urban regions, the core municipality exploits the critical mass of the urban region to support its own functions, leaving that region functionally underserved. Second-tier cities lack this absorptive capacity, and their urban regions are endowed with more urban functions. These functional differences mean that second-tier cities demand a differentiated research and policy approach, in which city-regional integration becomes an important territorial development strategy. Rather than the dispersion process in first-tier cities leading to a ‘regionalization of the city’, integration in second-tier urban regions may be seen as a process of ‘cification of the region’.

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1. Introduction

Second-tier cities in Europe have been experiencing renewed interest within policy and research contexts, but this has not yet compensated for a tradition of relative neglect when compared with large capitals and first-tier cities which absorb the attention of academics, practitioners and policy-makers. Recent studies and reports clearly show the relevance of paying attention to cities and regions beyond large capitals (Camagni, Capello, & Caragliu, 2015; Dijkstra, 2013; Dijkstra, Garcilazo, & McCann, 2013; OECD, 2012; Parkinson, Meegan, & Karecha, 2015). Other theoretical research argues the specific historical trajectory of second-tier cities, while noticing the lack of scholarship on their particular issues (Connolly, 2008; Hodos, 2011). All of this should come as no surprise if we acknowledge that large, global cities are rare in Europe and that a relatively dense mesh of medium-sized, historically stable urban centres encompasses most of the European

population and is a defining feature of the European urban system (Hohenberg, 2004). Second-tier cities are the top layer of this middle hierarchy—the places lacking the economic weight, political importance and attractive pull of first-tier cities (generally capitals) but still important enough to play a relevant role in national and international contexts.

In a continent characterized by so many cultural, political and historical specificities, it is hardly surprising that the economic performance and living standards of second-tier cities vary significantly, with the economy in some of them growing faster than in large metropolises (Camagni & Capello, 2015; Cox, 2012), while persistent—often institutional—obstacles keep constraining the options of many others and increase the gaps to large capitals, despite their growth potentials (Parkinson et al., 2015). Such gaps are illustrated by imbalances in economic performance (ESPON/SGPTD, 2012), political bias regarding the location of public investment (Crouch & Le Galès, 2012) or different levels of functional performance (BBSR, 2011). The report on the subject that was produced in the ESPON (European Observation Network for Territorial Development and Cohesion) programme (2012) confirms this variation and relates it directly to the different national urban systems: second-tier cities in centralized states where capitals have a high degree of primacy (Portugal, France and the United Kingdom) tend to be politically more neglected and economically less successful than those in more polycentric countries building upon a ‘powerful multi-cylinder economic engine’ (BBSR, 2011, p. 16), such as Germany or the Netherlands.

Alongside policy aspects, second-tier cities also need greater attention and differentiation in research contexts. Many studies see them as incomplete or stunted versions of global cities (Hodos, 2011) with narratives opposing ‘command and control’ urban centres to other cities ‘on the receiving end of development’ (Connolly, 2008, p. 4). Second-tier cities are therefore truly made ‘secondary’: downgraded and less successful versions of their larger counterparts, failing or succeeding according to how fast they move towards that status and perpetuating their position as entries in a ranking measured against a particular standard. As a result, research on second-tier cities has often been made peripheral: questions designed for the largest cities are simply downgraded to test their validity in other contexts, without a critical vision of the fundamental differences between the two types of city. By exploring such differences between first-tier and second-tier cities based on criteria which are particularly relevant for the latter, this paper tries to oppose that common research trend.

1.1. The unexplored features of second-tier cities

Against hierarchical and generic views, some fundamental features that distinguish first-tier and second-tier cities have been made explicit before, with more or less claims of universality. Earlier research has been especially interested in patterns of economic activity (Markusen, Lee, & DiGiovanna, 1999), the presence of agglomeration benefits and costs (Camagni & Capello, 2015; Champion, Coombes, & Gordon, 2014), historical and social trajectories (Hall, 1998; King, 2010), integration in globalization (Hodos, 2011) and relation to political systems at European and national levels (Connolly, 2008; ESPON/SGPTD, 2012). Hodos has analysed the specific strategies used by second-tier cities to affirm themselves as strong alternatives to capitals (2011), referring to a symbolic

path based on large-scale events and cultural individuality and a material path based on massive transport infrastructure investment.

Beyond socio-economic and political aspects, there is not much literature analysing spatial-functional differences that can be linked to a city's role as either first- or second-tier. Such differences may rise especially at the urban-regional scale on which policy and research are increasingly focused. Yet, earlier studies suggest that there may be detectable differences in this respect, which can be particularly well illustrated by the analysis of the presence and distribution of urban functions. The existing literature hints at two major aspects that may reveal clear contrasts between first-tier and second-tier urban regions. The first concerns the overall presence of urban functions as a function of population size, and whether there is an imbalance between both types of city, expressed by a 'first city bonus' versus a relative loss of performance in second-tier cities (BBSR, 2011; Burger, Meijers, Hoogerbrugge, & Masip Tresserra, 2015). The second refers to the spread of urban functions across the urban region, namely the different ways dominant capitals and 'weaker' second-tiers are able to exploit the scale of their hinterland to support their urban functions, and how they manage to centralize important functions in the core city to the detriment of other places versus the ability to create a balanced functional distribution across the urban region (Champion, 2001; ESPON/1.1.1, 2005; Hohenberg, 2004). A focus on urban functions is highly relevant as their presence is an important proxy for economic performance (BBSR, 2011; McCann, 2015) and their intra-regional spatial distribution may either be a major trigger or a major barrier to the spatial, functional and institutional integration of urban regions (Batten, 1995). It may reveal a new and still unexplored set of strategic options for second-tier cities, whose importance and urgency are proportional to the extent to which they are neglected or hampered in their national urban systems.

The aim of this paper is to compare the spatial-functional configuration of first-tier and second-tier cities across Europe. In the next section, we review the existing literature for arguments suggesting these contrasts, culminating in four specific research questions about the overall presence of urban functions and their spread across urban regions. Section 3 presents our research approach, while our empirical results are presented in Section 4. We conclude with a discussion of our findings in Section 5, addressing their meaning not only from an analytical perspective, but also emphasizing the need for different territorial development strategies for first-tier and second-tier cities and their regions.

2. Functional performance and organization of first-tier and second-tier urban regions

2.1. First city bias

While there are certainly limits to the generalization of city types, it is useful to consider some fundamental differences between first-tier and second-tier cities. The most obvious is size. First-tier cities, national capitals or not, are usually larger than second-tiers. City size has been argued in the literature as an explanatory factor for several aspects of the urban economy, not in the least place agglomeration economies. New evidence from the Organisation for Economic Co-operation and Development (OECD) (Ahrend, Farchy, Kaplanis, & Lembcke, 2015) shows not only that larger cities are more productive as a

whole, but also that individual productivity tends to increase with size. Larger cities arguably have a larger labour pool allowing for better matching and greater socio-economic diversity, provide interaction environments allowing for innovation and provide their citizens with more consumption opportunities. In addition, they perform as ‘escalators’ in the sense that career progression is faster in first-tier cities such as London (Champion et al., 2014).

Size is also important for the presence of urban functions and the presence of many and diverse functions has been associated with greater economic productivity and stronger population growth. There are ‘advantages associated with diversified cities which exhibit many different sectors and activities, rather than specialised cities which exhibit a smaller number of specific sectors and activities’ (McCann, 2015, p. 22). In fact, especially when perceived as sites of consumption rather than production, cities tend to be more attractive for residents and firms and grow faster when they are served by a larger and more diverse set of amenities and services (Glaeser, Kolko, & Saiz, 2001; Markusen & Schrock, 2009). Conversely, places that lack this functional diversity and mass will be less attractive and may experience lesser growth and weaker economic prospects. Size is important, as there is a minimum critical mass ‘necessary for high-end metropolitan functions, amenities and places’ (Lambregts, 2006, pp. 119–120). In their study of cultural amenities in north-west Europe, Burger et al. (2015) suggest that size is the single most important factor explaining their presence. The larger an urban system, the more functions it has gathered throughout history and the more new functions it may attract (Hohenberg, 2004).

Therefore, all other things being equal, the size of an urban system and the presence of urban functions should be correlated. But this may not be as linear as it seems. The political and economic bias affecting second-tier cities in Europe, especially in highly centralized countries where a ‘winner-takes-all’ approach tends to favour the cities which are already more successful at the cost of other places (Ades & Glaeser, 1995; Crouch & Le Galès, 2012), may affect this correlation and increase the functional gap between second-tier and first-tier cities beyond differences in size. Throughout Europe, capitals have often profited from centuries of accumulation of public investment, partly rational as return on investments was (perceived to be) higher, but also out of a desire to awe and impress (Dijkstra, 2013). A hint at this phenomenon was provided by the German Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR) study of European metropolitan areas, which showed great discrepancies between the demographic potential and the functional importance of some cities.¹ Functionally ‘underperforming’ cities provide their citizens and firms with fewer functions than their size would suggest: ‘compared with their population potential, the metropolitan importance is rather low [...] A reason may be that these areas either have further development potentials or that their metropolitan importance is historically undermined’ (BBSR, 2011, p. 102). The BBSR map (2011, p. 103) shows that, except for some Eastern European capitals, the cities facing this condition are mostly second-tiers.

Therefore, delving further into the findings of the BBSR study, it is likely that being a first-tier or second-tier city in a given national context affects the linearity of size as an explanatory factor for the presence of urban functions. We propose two research questions to evaluate this: first, to what extent is there an overall ‘first city bonus’ that increases the functional gap between both types of city, making first-tier cities outperform second-tiers beyond what can be rationalized from their different size? And, second, does that bonus

change according to the shape of the national urban system, namely by being larger in monocentric countries with dominant capitals and smaller in more polycentric countries?

2.2. Functional spread and absorptive capacity

While the topic has not yet been empirically explored,² earlier studies on first-tier and second-tier cities suggest that there may be different patterns of distribution of urban functions in both types of city. Hohenberg's long-term view of capitals growing in a 'central place' framework and smaller cities developing in a network model (2004); the distinction between 'spiderweb metropolises' around 'first-order' dominant cities and 'network metropolises' elsewhere by Heynen, Loeckx, and Smets (1991); or the description of hierarchic relations between capital cities and smaller centres around them by Phelps, Parsons, Ballas, and Dowling (2006) should all have visible spatial manifestations. The common feature suggested by these descriptions is that 'first-order' cities tend to play a historically dominant role in their urban regions, which are therefore assumed to evolve from an initially monocentric to a polycentric condition, with new centres emerging from the expansion or relocation of core city activity, in 'a long process of very extended decentralisation from big central cities to adjacent smaller ones, old and new' (Hall & Pain, 2006, p. 3). This is the 'centrifugal' mode of growth in the typology proposed by Champion (2001), in which urban activity is progressively 'squeezed out' to alternative centres as core cities project their political and economic expansion agenda over a relatively 'passive' hinterland.

Two implications follow: first, the functional decentralization process is hierarchic and progressive (core to periphery, large to small), with top-level functions still concentrated in core locations and fewer (and less important) functions elsewhere in the urban region; and second, only cities large enough to first attract or generate a large amount of urban functions were then able to trigger a redistribution process across the territory. This defines Champion's 'centrifugal mode' and means that a dominant city will have the ability to project its expansion agenda over the urban region and influence accordingly the functional organization at that scale (Barry, 2000). Given the core-periphery hierarchy embedded in this process and the tendency of important urban functions to cluster at a few key locations, it is likely that such cities are able to exploit the scale of their urban region as a support base for their own core city-centric urban functions—an ability deemed here as 'absorptive capacity'—but will tend to keep the remaining urban region relatively 'empty' in terms of top-level functions.

Conversely, in smaller and 'weaker' cities, whose development history did not follow the centrifugal mode, core city expansion and decentralization processes played a lesser role. Such places were less subject to core-periphery hierarchies and therefore may have built not only a functionally more fragmented but also a more balanced urban system, with important urban functions emerging at different points of the territory not necessarily through decentralization, thus making the city vs. hinterland contrast less visible here than in the case of first-tier cities. The emerging hypothesis is that, lacking both the attractive pull to aggregate, support and redistribute urban functions and the ability to override divergent local configurations and define a functional hierarchy for the larger region, these core cities will not empty out as much the remaining urban region of important functions, nor will they profit as much from the size of their hinterland for an increased functional performance.

This brings second-tier city development closer to Champion's 'incorporation mode' (2001), in which a large urban centre expands and merges with other expanding centres, which had previously been largely self-sufficient in terms of jobs and services, creating a more polycentric urban region where smaller centres form 'a more powerful catalyst for attracting extra non-residential activities than the centres emerging through the centrifugal mode' (Champion, 2001, p. 664).³ Such centres will be better served by important urban functions than their own size would suggest. However, the second part of the hypothesis means that these individual urban functions draw mostly from local support rather than building upon the increased mass brought by the wider region scale: they may have often emerged *in situ* from a locally autonomous agenda, rather than from the more integrated dynamics of a centrifugal decentralization process. In other words, as far as size and functions correlate, the metropolitan basis for sustaining urban functions is not as fully exploited as in first-tier cities and these functions have potential for growth.

This has important implications for territorial development strategies: with fewer important functions in individual centres and a more spread-out functional arrangement, there is greater need to rely on the urban region scale to achieve the encompassing set of functions, people and activities necessary to enjoy the potential benefits of large-scale agglomeration. As this is fuelled by metropolitan integration that has not naturally occurred (Ahrend et al., 2015; McCann, 2015), it would imply that some urban regions have unfulfilled development potentials, and, in the words of Lambregts (2006), would profit from 'setting free the metropolitan potential and the agglomeration economies that are locked into it' (p. 119). But can this be particularly argued for second-tier cities? If it can, our analysis may uncover another important distinction between both types of city, adding a valuable contribution to the body of research pleading for greater attention to, and specific development strategies for, second-tier cities. We propose two empirical questions to evaluate this: first, are first-tier core cities, more than second-tier core cities, better able to exploit the scale of their urban region to support more urban functions? And second, does their remaining urban region have a smaller share of important functions and is it more reliant on the core city, in contrast to a more balanced functional distribution in second-tier urban regions?

2.3. Agglomeration shadows versus borrowed size

The hypothesis that urban functions are more equitably spread over the urban region of a second-tier city than in the case of a first-tier city engages with recent developments of the agglomeration shadow vs. borrowed size debate (Burger et al., 2015; Meijers & Burger, 2015; Partridge, Rickman, Ali, & Olfert, 2009). The distribution and presence of urban functions in an urban system consisting of a large core city and smaller centres in the surrounding urban region often reflect the presence of 'agglomeration shadows' (Burger et al., 2015). Agglomeration shadows are a prediction of New Economic Geography (NEG; see e.g. Krugman, 1993), building upon central place theory, denoting the negative impact of larger urban centres over the smaller centres in their urban region, mainly affecting the presence of firms, but also used to understand population growth (Partridge et al., 2009) and the presence of urban functions (Burger et al., 2015). A small centre under the 'shadow' of a larger centre nearby would have fewer urban functions than an isolated centre of the same size due to spatial competition effects. The existence of an

encompassing set of functions in a large and easily accessible centre would override the opportunity and need for equivalent functions to emerge in alternative surrounding places. Burger et al. (2015) have looked at the spread of high-end cultural amenities in north-west Europe to conclude that larger cities do cast a shadow on the smaller surrounding centres, as predicted by NEG models. In the case of dominant first-tier cities, this shadow may be cast over increasingly large territories, as it is fuelled by a self-sustaining cycle of new functions gravitating towards existing ones. Such cumulative causation processes are fostered by a variety of economies of scale.

Of course, some studies have also shown the opposite effect. Phelps, Fallon, and Williams (2001) explain how small places near London offer a good environment for particular types of service employment and retail due to the beneficial combination of access to the agglomeration benefits of London and the lower agglomeration costs, mainly in terms of real estate prices. However, this may be confined to particular functions, often leading to monofunctional enclaves rather than actual self-sustaining centres able to co-create and support functional diversity, as argued by Champion for the incorporation mode. If only the 'mass' component of functional distribution is present, and the 'diversity' component is missing, urban centres will not provide the encompassing set of services and amenities argued above as key for urban attractiveness, even if the agglomeration shadow seems less present. With this distinction in mind, Cardoso (2015) has looked at the socio-economic configuration of first-tier and second-tier urban regions in three European countries and showed that the smaller centres around first-tier cities tend to be more dominated by a single socio-economic typology, usually associated with 'suburban' growth modes that override local arrangements, while those in second-tier urban regions seem to have preserved more the socio-economic mix typical of autonomous urban settings and, in some cases, are closer to replicating the configuration of the core city at a smaller scale.

Whereas growth potentials in terms of urban functions are limited in the surrounding areas of large dominant cities, this does not necessarily mean that population growth is equally restricted. In fact, having access to the functions of the first-tier city through connectivity is a main driver of such growth (Partridge et al., 2009). This is a manifestation of one type of 'borrowed size', namely 'borrowed performance'. In its original conceptualization by Alonso (1973, p. 200), borrowed size is about 'a small city or metropolitan area exhibiting some of the characteristics of a larger city if it is near other population concentrations'. However, since these characteristics can either refer to 'performance' (e.g. population growth and per capita income) or to 'functions', it seems more precise to make a distinction between borrowing 'functions' and borrowing 'performance' (Meijers & Burger, 2015).

The relevance of this distinction is that the spatial patterns of borrowed functions and borrowed performance, as well as agglomeration shadows, are likely to be dissimilar for first-tier and second-tier cities. The former are likely to cast a functional agglomeration shadow over their wider urban region, from which they borrow functions, in the sense that they congregate many urban functions in the core whose population support base—essential for sustaining them—draws on the urban region scale. In exchange, having access to these functions may imply that the wider area borrows performance from the central city, which may become manifest in higher population growth or higher incomes, but being in the shadow of a first-tier city also hampers their ability to sustain important functions themselves.

In contrast, second-tier cities which have evolved in the non-centrifugal mode described above may, on the one hand, impose less constraints over the development of nearby centres and, on the other hand, have less ability to congregate a full set of urban functions to the detriment of other places: if second-tier cities tend to be functionally less equipped than their size would justify, as the BBSR study suggests, that ‘encompassing set of functions’ potentially emptying out other places is not only less constrained by core city dominance but also incomplete, opening up all kinds of opportunities for smaller places to create functions missing at the core. As a result, second-tiers cast a smaller or incomplete agglomeration shadow over the wider urban region.

Also, rather than just borrowing functions from the surrounding metropolitan territory, second-tier cities may also borrow performance from this area, as nearby centres will be more than just ‘satellites’ emerging from decentralization, and connectivity will be mutually beneficial rather than just favouring smaller centres. Vice versa, the potential for surrounding areas to borrow performance from the second-tier city is smaller, with likely negative effects on population growth; but the looser functional hierarchies mean that more places beyond the core city will be able to borrow size from the urban region to support their urban functions. Meijers and Burger (2015) show that in urban regions without an overly dominant city, size and function are indeed more disconnected.

3. Research approach

3.1. Defining first-tier and second-tier cities

To define the cities relevant to our research, we use the list of second-tier and first-tier cities as provided by ESPON/SGPTD (2012) with some minor adjustments. ESPON/SGPTD (Secondary Growth Poles and Territorial Development in Europe) uses political and economic-functional criteria to select first-tier and second-tier cities: all capitals are considered first-tier cities; second-tier cities are defined as ‘cities outside the capital whose economic and social performance is sufficiently important to affect the potential performance of the national economy’ (2012, p. 3); in small countries (under 15 million) all cities that qualify as ‘metro regions’ according to the OECD/DG-Regio frameworks are included; in larger countries, only cities adding to the first 66.7% of total metropolitan population (excluding the capital) are included. We adjusted this list by excluding the Swiss capital Bern as a first-tier city, and used Zürich instead, given its demographic and economic importance. We also considered that cities with a larger GDP than their capitals (Munich, Hamburg, Frankfurt and Milan) could not be considered second-tier cities. Like Milan, Barcelona should be considered a kind of ‘pseudo-capital’ from a historical/political perspective, so we decided to not label it a second city either. Finally, we excluded the smaller countries that did not contain a second city at all, as well as Croatia, due to the lack of some necessary data. In the end, our list includes 26 first-tier and 112 second-tier cities (Table 1).

3.2. Data and geographical detail

The database on the location of urban functions was obtained from the German BBSR (2011). It includes, among others, functions in the domains of ‘Business’ (including the

Table 1. First-tier and second-tier cities included in the study.

First-tier cities	Second-tier cities				
Amsterdam	Aalborg	Craiova	La Coruna	Nottingham	Torino
Athens	Aarhus	Daugavpils	Lausanne	Nürnberg	Toulon
Berlin	Antwerp	Debrecen	Leeds	Odense	Toulouse
Bratislava	Arnhem	Dresden	Leicester	Ostrava	Turku
Brussels	Bari	Düsseldorf	Leipzig	Palermo	Valencia
Bucuresti	Basel	Edinburgh	Lens	Pécs	Varna
Budapest	Belfast	Eindhoven	Liège	Plovdiv	Wloclawek
Dublin	Bergen	Enschede	Lille	Plzen	Wroclaw
Helsinki	Bielefeld	Firenze	Linz	Porto	
Kobenhavn	Bilbao	Gdansk	Liverpool	Poznan	
Lisboa	Birmingham	Genève	Lodz	Rennes	
Ljubljana	Bologna	Genova	Lublin	Rotterdam	
London	Bordeaux	Gent	Lyon	Rouen	
Madrid	Bremen	Glasgow	Malaga	Salerno	
Oslo	Brescia	Göteborg	Manchester	Salzburg	
Paris	Bristol	Graz	Mannheim	Seville	
Praha	Brno	Grenoble	Maribor	Sheffield	
Riga	Bydgoszcz	Győr	Marseille	Stavanger	
Roma	Cadiz	Hannover	Metz	Strasbourg	
Sofia	Cardiff	Iasi	Miskolc	Stuttgart	
Stockholm	Catania	Innsbruck	Montpellier	Szczecin	
Tallinn	Charleroi	Katowice	Murcia	Szeged	
Vilnius	Chemnitz	Kielce	Nantes	Tampere	
Warszawa	Cluj-Napoca	Köln	Napoli	Tartu	
Wien	Constanta	Kosice	Newcastle	Thessaloniki	
Zürich	Cork	Krakow	Nice	Timisoara	

presence of top-500 firms, advanced producer services, banks and exhibition fairs); ‘Science’ (including major universities and international research organizations); ‘Culture’ (subdivided into cultural events, including concerts, art fairs and film festivals; and cultural venues, including theatres, opera houses, galleries and museums); and ‘Sports’ (including stadiums, Olympic summer games venues and major sports events). The majority of data corresponds to 2008. In our analyses, we consider indices for these four domains with a primary focus on an aggregate index of all urban functions. See Annex 1 in BBSR (2011) for a complete list of urban functions and sources.

The scores were calculated for a variety of spatial delimitations, starting with Eurostat LAU2 units (generally the municipality) that provide the building blocks for larger delimitations. Most of our analyses employ urban agglomerations as the main geographical unit. These are understood as contiguous built-up areas, or in ESPON terminology ‘Morphological Urban Areas’ (MUAs; ESPON/1.4.3, 2007). Our database contains all 1967 MUAs that have been identified by ESPON in the EU25, Norway and Switzerland, including, but not restricted to, those classified here as first-tier and second-tier cities. For each MUA, the same ESPON project also delimited their labour market, the so-called Functional Urban Area (FUA). However, to proxy the hinterland, we use the ‘polyFUA’ delimitation whenever available. PolyFUAs are constructed when contiguous FUAs are merged based on criteria such as city sizes and distances between them. Finally, in the last part of our analysis, about the distribution of urban functions across these different areas (core city, MUA and FUA/polyFUA), we add the wider metropolitan area—here deemed the ‘urban region’—as provided by the BBSR report (2011). These are constructed from a functional perspective, as spatial clusters of urban functions were identified and joined into metropolitan areas based on 60 minutes accessibility.

3.3. Variables in the models

Our basic approach is to explain the presence of urban functions in cities (or, to be precise, MUAs) using a variety of explanatory factors. Obviously, this includes their size, and also the size of their hinterland, which is measured as the population size of the FUA/polyFUA minus the size of the MUA. Several recent studies show the importance of a city's embeddedness in large-scale networks of all kinds—firms, capital, knowledge, people and goods—for its performance (Neal, 2013; Taylor, 2003), and this can be even more important than local factors (McCann & Acs, 2011) for the presence of urban functions (Meijers, Burger, & Hoogerbrugge, 2015). Therefore, we control for the embeddedness of cities in international networks by including three control variables: tourism, international political networks and flight connections. These data were also provided by the BBSR study and include the Michelin rating of tourist attractiveness and the presence of UNESCO world heritage (tourism), the presence of European institutions and international organizations (international political networks) and a combination of six factors describing the importance and connectivity of airports in terms of cargo and passenger transport (flight connections). While they act as controls in our regression models, we also explore their spatial distribution across different areas (core city, MUA, FUA and urban region) in the last part of our analysis. Finally, we include country dummies to control for institutional and welfare differences between countries. For four small cities, these data were not complete, limiting our data set to 1963 cases.

Turning to our variables of interest, we include a dummy indicating whether a city is first-tier or not, and one that indicates whether a city is a second-tier city. In addition, we constructed a number of interaction variables to explore whether the effects of these two dummy variables are mediated by other variables. One of them is the shape of the national urban system. For this, we employ the classification of national urban systems on a monocentricity–polycentricity axis provided in Meijers and Sandberg (2008), who consider the ‘flatness’ of national urban systems proxied by the slope of the regression line that best fits their rank–size distribution. Another interaction term explores whether the size of the hinterland of cities matters more for first-tier or second-tier cities. Table 2 presents descriptives for these variables.

4. Results

4.1. The performance of first-tier versus second-tier cities

The first hypothesis suggests that first-tier cities outperform second cities in terms of urban functions, in the sense that they host more functions than can be rationalized from their size or international network embeddedness. Table 3 presents various

Table 2. Descriptives.

	Minimum	Maximum	Mean	Std Deviation
Size MUA (*1000)	10	9591	134.56	411.60
Size hinterland (FUA) (*1000)	0	13,699	860.53	2162.03
Polycentricity	−1.89	−0.57	−0.95	0.26
Flight connections	0	75.06	0.39	3.14
International political networks	0	100	0.29	3.33
Tourism networks	0	100	4.97	13.72
Size hinterland 45 minutes (*100k)	0	124.36	19.95	25.23

Table 3. Ordinary least squares (OLS) regression results for presence of urban functions (index).

	Model 1 Urban functions—baseline model	Model 2 Urban functions—first and second city dummy
Constant	−0.085 (0.173)	−0.048 (0.169)
Size MUA (*1000)	0.009 (0.000)**	0.008 (0.000)**
Size hinterland (*1000)	−0.00001 (0.000)	−0.00001 (0.000)
International political networks	0.265 (0.014)**	0.243 (0.014)**
Tourism networks	0.033 (0.003)**	0.027 (0.003)**
Flight connections	0.134 (0.014)**	0.115 (0.013)**
First-tier city (dummy)		4.508 (0.453)**
Second-tier city (dummy)		0.173 (0.181)
Country dummies	Yes	Yes
R	.938	.941
Adjusted R ²	.878	.884
F	415.476**	415.607**
N	1963	1963

Note: Standard errors in parentheses.

* $p < .05$.

** $p < .01$.

models in which the effect of being a first-tier or a second-tier city on the presence of urban functions is explored.

Model 1 presents our baseline regression. The basic variables are able to explain the distribution of urban functions across the European urban system very well (adjusted $R^2 = .878$). Size is a particularly important determinant of the presence of urban functions, and the three network embeddedness controls are also significant. Somewhat counter to our expectations, the size of the hinterland does not seem to influence the presence of urban functions. In model 2, we add our prime variables of interest, namely the first-tier and second-tier city dummy variables. As anticipated, being a first-tier city increases the amount of urban functions quite substantially (+4.5). This corresponds to an increase in population of half a million. Given that the average size of a first city MUA agglomeration is just over two million, this is a surplus in the range of 25%, reserved for first-tier cities only—being a second-tier city does not offer additional benefits (the second city dummy is not

Table 4. OLS regression results for the presence of urban functions in the domains of business, science, culture and sports.

	Model 3 Business	Model 4 Science	Model 5 Culture	Model 6 Sports
Constant	0.319 (0.209)	0.326 (0.188)	−0.311 (0.245)	−0.495 (0.290)
Size MUA (*1000)	0.007 (0.000)**	0.005 (0.000)**	0.008 (0.000)**	0.009 (0.000)**
Size hinterland (*1000)	0.000 (0.000)	−0.000 (0.000)	−0.000 (0.000)	−0.000 (0.000)
International political networks	0.209 (0.017)**	0.505 (0.015)**	0.095 (0.020)**	0.020 (0.024)
Tourism networks	0.011 (0.004)**	0.008 (0.004)*	0.036 (0.005)**	0.036 (0.006)**
Flight connections	0.285 (0.017)**	−0.034 (0.015)*	0.081 (0.020)**	0.062 (0.023)**
First-tier city (dummy)	5.629 (0.562)**	0.087 (0.506)	6.586 (0.660)**	3.061 (0.781)**
Second-tier city (dummy)	0.497 (0.224)*	−0.232 (0.202)	0.076 (0.263)	0.249 (0.311)
Country dummies	Yes	Yes	Yes	Yes
R	.908	.872	.868	.821
Adjusted R ²	.821	.755	.749	.669
F	250.398**	169.354**	163.533**	110.948**
N	1963	1963	1963	1963

Note: Standard errors in parentheses.

* $p < .05$.

** $p < .01$.

significant). This reveals a substantial ‘first city bonus’, a surplus of urban functions that cannot be explained by the size of the city or its network embeddedness.

While model 2 explains a total index of urban functions, models 3–6 in Table 4 provide similar models for the four sub-indexes addressing the presence of functions related to business (model 3), science (model 4), culture (model 5) and sports (model 6).

Table 4 shows that the first city bonus is the highest for cultural functions (+6.6), followed by business (+5.6) and sports (+3.1). There is no first city bonus for scientific functions. This can be explained by the fact that these functions (such as universities and related activities) are not footloose and their spatial distribution is generally inherited from the past. Their strong local embeddedness seems to make them resistant to the attractive pull of large capital cities. By contrast, the high first city bonus for cultural functions is related to a tradition of investment in cultural venues and events, not just to cater to the needs of the local aristocracy, but also to sell a positive image of a country and its capital to the outside world. Many capitals can be considered ‘consumer cities’ *avant la lettre*. Model 3 shows that second-tier cities also enjoy a bonus in business functions, but, in absolute terms, this is over 10 times smaller than that for first-tier cities.

4.2. The first city bonus in different national urban systems

We hypothesized that the first city bonus is not similar for all first-tier cities, but is related to the extent of their dominance within the national urban system. In monocentric systems, with a dominant city at the top, chances for a ‘winner-takes-all’ scenario are higher given the absence of strong competition from other centres (e.g. in the form of political voice influencing policy). In other words, the positive effect of being a first-tier city may be moderated by the shape of the urban system, and is likely to be higher in more hierarchically organized, monocentric contexts. Conversely, chances for second-tier cities to be important players in terms of urban functions are likely to increase when a dominant capital is absent. This can be tested using interaction terms that show how the effect of being a first-tier or second-tier city varies according to the shape of the national urban system, which we measure along the monocentric–polycentric dimension (Meijers & Sandberg, 2008).

Model 7 in Table 5 presents the overall pattern for all urban functions together. Clearly, the first-tier city bonus revealed by model 2 is of the same magnitude (+4.5). Being in a more polycentric national urban system introduces a negative trend (also in models 8–11), albeit not significant. The interaction term ‘First-tier city × Polycentricity’ is also not significant, implying that the first-tier city bonus does not differ in more monocentric or more polycentric countries. So, this does not confirm our hypothesis that this functional bonus varies according to the shape of the national urban system. However, a remarkable difference rests with second-tier cities. The significant interaction term ‘Second-tier city × Polycentricity’ suggests that second-tier cities in more polycentric countries perform substantially better than those in monocentric countries. With first-tier cities keeping their high performance and second cities performing better in polycentric national urban systems, it would seem that such a model is in essence more competitive than a hierarchic monocentric model.

Models 8–11 add some nuance by examining specific functional sectors. Business functions are more present in both second-tier and first-tier cities of the more polycentric

Table 5. OLS regression results for mediating role of the national urban system on the effect of being a first or second city on the presence of urban functions.

	Model 7 Urban functions— interactions	Model 8 Business— interactions	Model 9 Science— interactions	Model 10 Culture— interactions	Model 11 Sports— interactions
Constant	0.262 (0.715)	0.573 (0.514)	0.607 (0.796)	0.346 (1.029)	-0.633 (1.126)
Size MUA (*1000)	0.008 (0.000)**	0.008 (0.000)**	0.005 (0.000)**	0.008 (0.000)**	0.008 (0.000)**
Size hinterland (*1000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
International political networks	0.242 (0.014)**	0.190 (0.017)**	0.514 (0.016)**	0.075 (0.020)**	.044 (0.024)
Tourism networks	0.027 (0.003)**	0.011 (0.004)**	0.008 (0.004)*	0.036 (0.005)**	0.037 (0.006)**
Flight connections	0.114 (0.013)**	0.285 (0.016)**	-0.036 (0.015)*	0.079 (0.019)**	0.061 (0.023)**
First-tier city (dummy)	4.460 (0.454)**	5.622 (0.558)**	0.016 (0.505)	6.515 (0.653)**	3.048 (0.778)**
Second-tier city (dummy)	-0.100 (0.199)	0.077 (0.245)	-0.011 (0.222)	-0.630 (0.287)*	0.223 (0.342)
Polycentricity	-0.929 (1.967)	-0.837 (2.417)	-0.769 (2.188)	-2.038 (2.828)	0.478 (3.371)
First-tier city × Polycentricity	1.244 (0.967)	5.195 (1.188)**	1.126 (1.075)	7.327 (1.390)**	-9.408 (1.657)**
Second-tier city × Polycentricity	1.907 (0.604)**	2.895 (0.742)**	-1.654 (0.672)*	4.884 (0.868)**	0.375 (1.035)
Country dummies	Yes	Yes	Yes	Yes	Yes
R	.942	.909	.873	.872	.825
Adjusted R ²	.884	.824	.758	.756	.674
F	416.036**	254.989**	171.010**	169.128**	113.271**
N	1955	1955	1955	1955	1955

Notes: Standard errors in parentheses. Polycentricity indicator is mean centred. Polycentricity scores for Cyprus, Luxembourg and Malta were not deemed meaningful, given the low number of cities in these countries, which slightly reduces the number of cases.

* $p < .05$.

** $p < .01$.

countries. Cultural functions (model 10) are spread in a similar pattern with second-tier and first-tier cities in more polycentric countries both performing better. Quite in contrast, scientific functions (model 9) seem overall less present the more polycentric a country is, and consequently appear more in second-tier cities in more monocentric countries. Finally, the pattern for sports functions contradicts the overall pattern of model 7. The negative sign of the significant interaction variable 'First-tier city × Polycentricity' suggests that first-tier cities in more monocentric countries have substantially more sports functions than those in polycentric countries. We find more sports venues such as big stadiums and high-level sports events in the more dominant capital cities.

4.3. The absorptive capacity of first-tier and second-tier cities

We hypothesized that an important reason why first cities outperform second cities may be their stronger absorptive capacity (or 'attractive pull'). We explored whether this holds true by examining the extent to which they manage to profit or exploit the size of their hinterland and turn it into a support base for their 'inflated' urban functions. We assume that first-tier cities manage to absorb more of this population potential than second-tiers. Again, this can be measured using interaction terms that state to what extent the population in the hinterland contributes to hosting more functions in a first-tier city ('First-tier city × Hinterland') and a second-tier city ('Second-tier city ×

Table 6. OLS regression results showing the extent to which the population base of the hinterland can be absorbed by first-tier and second-tier cities to sustain a higher level of urban functions.

	Model 12 Absorptive capacity FUA	Model 13 Absorptive capacity wider metropolitan area (45 minutes)
Constant	-0.058 (0.164)	-0.111 (0.211)
Size MUA (*1000)	0.008 (0.000)**	0.008 (0.000)
Size hinterland (FUA) (*1000)	-0.00001 (0.000)	
Size hinterland 45minutes (*100k)		-0.005(0.002)*
International political networks	0.176 (0.015)**	0.186 (0.016)**
Tourism networks	0.027 (0.003)**	0.027 (0.004)**
Flight connections	0.130 (0.013)**	0.112 (0.014)**
First-tier city (dummy)	5.458 (0.455)**	7.202 (0.566)**
Second-tier city (dummy)	0.401 (0.185)*	0.562 (0.197)**
First-tier city × Hinterland (FUA)	0.003 (0.000)**	
Second-tier city × Hinterland (FUA)	0.00014 (0.00018)	
First-tier city × Hinterland 45minutes		0.246 (0.028)**
Second-tier city × Hinterland 45minutes		0.071 (0.009)**
Country dummies	Yes	Yes
R	.944	.946
Adjusted R ²	.889	.893
F	413.878**	350.735**
N	1963	1963

Notes: Standard errors in parentheses. Hinterland indicators are mean centred.

* $p < .05$.

** $p < .01$.

Hinterland'). To check for robustness, we use two different definitions of 'hinterland'. The first refers to the FUA defined by ESPON/1.4.3 (2007), or when applicable, the 'polyFUA' (see Section 3.2). This variable was also used in the preceding models. The second definition is based on the population basin that can be reached within 45 minutes by car from a particular core city, as provided by ESPON/1.1.1 (2005). For both models, we subtracted the population size of the urban agglomeration itself. See the results in Table 6.

In all preceding models, the size of the hinterland did not have a significant effect on the presence of urban functions. In model 12, by including the FUA-based hinterland indicator, we see that one of the reasons was that for some cities the hinterland adds positively to the presence of urban functions, but for others it does not. The interaction variable 'First-tier city × Hinterland' in model 12 shows that the larger the hinterland of a first-tier city, the more it contributes to the presence of urban functions. However, a large hinterland in a second-tier city does not contribute to hosting more of such functions ('Second-tier city × Hinterland' is not significant). In other words, a first-tier city manages to absorb the population mass of its surrounding FUA and turn it into a support base for its urban functions. This ability seems to be absent in second-tier cities.

The results are more or less replicated when using the second definition of the hinterland (model 13). Again, while the coefficient for hinterland is negative and now significant, we see that first-tier cities profit more from a larger hinterland, but second-tier cities equally manage to do that. Their absorptive capacity is nevertheless much less pronounced than in first-tier cities, namely 3.5 times smaller (0.246 versus 0.071). Note that model 12 shows an even larger gap between both coefficients (21 times).

4.4. Agglomeration shadow versus borrowed size

Our final hypothesis addresses the question whether the stronger absorptive capacity of first-tier cities also implies that their hinterlands are emptied out of important functions. We expect that this is much more the case, and that the hinterland of second-tier cities encompasses more urban functions than in first-tier cities. In other words, we expect that first-tier cities cast an agglomeration shadow over their hinterland, whereas second-tier cities have the potential to borrow functions from their wider urban region. We approach this question by examining the spread of urban functions over the urban region. Table 7 presents the spatial distribution of urban functions across (1) the core city, (2) the remaining core urban agglomeration (MUA), (3) the remaining FUA and (4) the remaining wider metropolitan area as defined by the BBSR report in 2011. Recall that this metropolitan area is not defined for all our second-tier cities, meaning that our sample for this analysis is smaller. However, the availability of such a recent and encompassing database whose spatial boundaries are defined precisely by the location of urban functions and which proposes a new spatial scale for policy-making beyond the constraints of FUAs and MUAs justifies the addition of this new spatial scale to the analysis.

The core cities of first-tier urban regions absorb urban functions to a greater extent than in second-tier urban regions, which show a more distributed proportion. Although the distribution of population is also different, the issue here is whether, for the daily life of ‘any’ inhabitant of the urban region, the relevant urban functions tend to be centralized in a core or distributed across the region. The share of top-level functions in first-tier core cities is 72.6% against 49.0% in second-tiers. The MUAs around the core cities host a similarly low share of urban functions, a pattern common to both types of city which illustrates the tendency for monofunctional and homogeneous urban settings in the fringes of first-tier and second-tier cities. The pattern is different at the FUA scale, where second-tier urban regions host a bigger share of urban functions than first-tier urban regions. The contrast is most striking at the larger BBSR metro area scale: 37.8% of the top-level urban functions of second-tier urban regions are here, against only 14.6% in first-tier urban regions. This confirms that, on average, the wider hinterland in second-tier cities is more populated and better served by important urban functions.

Table 7. Distribution of urban functions over different parts of the urban region of first-tier ($N = 26$) and second-tier cities ($N = 75$).

	First-tier cities				Second-tier cities			
	Core city (%)	Rest of MUA (%)	Rest of FUA (%)	Rest of urban region (%)	Core city (%)	Rest of MUA (%)	Rest of FUA (%)	Rest of urban region (%)
Population	39.7	17.2	22.1	21.0	20.0	9.7	25.9	44.4
Metro functions (total)	72.6	5.6	7.2	14.6	49.0	2.8	10.4	37.8
Political-admin.	85.2	5.2	1.2	8.4	57.5	0.0	15.9	26.6
Business	83.1	4.0	4.3	8.5	65.7	2.3	8.1	23.9
Science	78.9	4.9	3.9	12.3	66.3	1.4	8.7	23.6
Culture	84.1	2.1	4.0	9.8	56.9	5.3	9.1	28.7
Sports	75.9	3.5	5.3	15.2	57.8	3.9	8.5	29.8
Tourism	63.7	5.9	9.9	20.4	42.5	1.5	10.3	45.7
Transport	49.2	18.4	16.3	16.1	42.9	7.8	12.4	36.8

Places far outside the core city are able to host functions of metropolitan scope whose existence is justified by the scale of the wider urban region—although the absorptive capacity hypothesis above suggests that the weight of these functions may still grow as it is restricted by the lower capacity of second-tiers to fully exploit their urban region scale. By contrast, first-tier cities project an agglomeration shadow over the surrounding region, and despite relatively high shares of population in the MUA, FUA and wider metropolitan area, these areas are more thinly occupied by top-level functions. The tendency for important urban functions to be attracted by other important functions and congregate in a few selected locations (Hall, 2006; Hohenberg, 2004) is thus shown to be stronger in first-tier cities.

Considering the different functional categories (now including political-administrative, tourism and transport functions, seen in models 3–11 as indicators of network embeddedness, but obviously with a physical location, which is the focus here), we see a consistent pattern. Functions are more concentrated in first-tier than in second-tier core cities in all categories.

5. Discussion and conclusions

Our analysis sustains the more general argument in the literature that second-tier cities should be seen as a specific research and policy category that should be approached in more differentiated and meaningful ways to allow for a more nuanced and elaborated understanding of cities (Connolly, 2008; Hodos, 2011). Here, it was shown that they substantially differ from first-tier cities also in functional terms. This does not only concern the presence of urban functions, but also their spatial distribution over the urban region. Four main conclusions can be drawn from our analysis. First, we established that there is a substantial ‘first city bonus’: a clear surplus of urban functions in first-tier cities which cannot be explained by their size or network embeddedness, but only through their ‘first city’ status in national contexts. Second, this bonus does not differ substantially for first-tier cities in monocentric or more polycentric national urban systems. However, second-tier cities perform better in more polycentric countries, implying that national-level polycentricity seems more competitive. Third, first-tier cities are much more able to exploit the size of their urban region to gather and sustain important functions that build upon this scale, while second-tier cities are not able to draw on the support base of their wider region to boost their functional performance. Fourth, first-tier cities are more hegemonic and centralized, having an overall surplus of urban functions but leaving their urban region relatively underserved, casting a so-called functional agglomeration shadow. By contrast, second-tier cities have a weaker capacity to centralize functions and define the arrangements of the whole urban region: urban functions are spread much more over a wider urban region.

This has important consequences for territorial development strategies. Lacking the ‘first city bonus’ and absorptive capacity of first-tier cities, but having a functionally well-served urban region, provides second-tier cities an opportunity to capture a larger and more diverse array of urban functions through stronger regional integration. This would allow them to compete better with first-tier cities, and provide their firms and households with new opportunities. Given the lack of individual places covering the whole functional range, these spread-out functions may be more complementary than

redundant, creating a greater sense of interdependence and more linkages across the region. For second-tier cities, this potential often goes beyond their current labour market area, proxied by the FUA, suggesting the relevance of integration with their wider metropolitan area, as defined by the BBSR report, as this is where an even larger potential to borrow functions and performance lies. This finding corresponds with early ESPON observations (ESPON/1.1.1, 2005) about the potential gains of 'polycentric integrative policies' in European urban regions. Those gains were also seen to be greater in medium-sized cities than in hegemonic first-tier cities, for which capturing the scale of the surrounding urban region would add little to their already dominant position. This implies that there is a greater incentive for integration in second-tier urban regions, where individual centres are functionally 'weaker' and incomplete and important urban functions are both rarer and more spread out, than in the functionally favoured, all-encompassing first-tier cities, where 'the hyper-centre has created a hyper-periphery' (Domingues, 2009, p. 30).

Such a process of integration in the metropolitan areas of second-tier cities is not as straightforward as it may seem given the potential benefits. While second-tier urban regions are still anchored by a clear 'leading city', smaller centres tend to be more than satellites of the core and complement its functional offer. This is important, as Dieleman and Faludi (1998) have argued that the lack of the unifying power of a leading city in polycentric urban regions may harm effective integration and the formulation of a clear governance vision, due to excessive fragmentation and parochial thinking. On the other hand, a reason why integration is not necessarily easier around first-tier cities is the shared perception in smaller centres of excessive dependence on core city functions and jobs (Phelps et al., 2006). In his overview of metropolitan governance in Europe, Lefèvre (1998) points out how visions dominated by single central cities reduce the willingness of peripheries to engage in a city-regional project. Nelles sees this as an expression of institutional asymmetry which 'may have positive or negative effects on cooperation depending on coercion versus potential for joint gains' (2013, p. 1358). Halfway between dominant core city and polycentric network models, second-tier cities may be in a privileged position to engage in large-scale integration strategies.

Finally, the share of key urban functions in places outside the core city renders the 'city'-'hinterland' contrast particularly obsolete in second-tier urban regions. This addresses the concerns by Sieverts (1997), Brenner (2014) and Harrison and Heley (2015) about how the 'urban' should not be restricted to a set of predefined centres but rather recognized (and planned) at the full scale of the territory. While earlier descriptions of the new territorial scale of cities have referred to a 'regionalization of the city', seen as a city dispersing into a loose urbanized region, second-tier urban regions may be closer to a process of 'citification of the region', in the sense that a previously unconnected set of urban entities consolidates into a larger, more equipped and emergent extensive city.

Notes

1. The BBSR database focuses on a selection of 'top-level' metropolitan functions in five categories: politics, economy, science, transport and culture. See Section 3 for a more detailed description of the data sources.

2. Markusen et al. (1999) write about the specific spatial arrangements of firms in second-tier urban regions, but do not provide a comparison with first-tier cities and do not attempt to typify a contrast.
3. This is still different from Champion's third typology, the 'fusion' mode, in which previously independent centres of similar size merge together as a result of their separate growth and improved linkages. Our perception is that the more mixed and ambiguous incorporation mode, halfway between the centrifugal and fusion types, is often disregarded in face of the polarizing debates between the other two.

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