The geography of contemporary urban systems at various spatial scales

An empirical analysis based on information flows in the advanced producer services sector

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An empirical analysis based on information flows in the advanced producer services sector

De geografie van hedendaagse stedelijke systemen op verschillende schaalniveaus

Een empirische analyse van informatiestromen in de geavanceerde-dienstensector

PROEFSCHRIFT

Proefschrift aangeboden tot het behalen van de graad van Doctor in de Wetenschappen: Geografie

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door

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PREFACE

Although printed immediately after the title page, this Preface actually constitutes the last piece of writing of this dissertation. It is the grand final, where it is finally allowed to leave theories, concepts, methodologies and results behind and to start thinking about the people who have contributed to this research in one way or another.

Firstly, I want to sincerely and truly thank my two supervisors, Professor Frank Witlox and Professor Ben Derudder, for giving me the opportunity to undertake this academic adventure and for guiding me in every step of the way. Without their encouragements, great involvement, sense for detail, and never-ceasing confidence in a good outcome, this research might, or even would, never have been completed. Secondly, I explicitly want to thank all the people who made an active contribution to this dissertation by making some time in their tight agendas to participate in one of my surveys or interviews. Without their help and crucial input, this research would simply not have been possible. Thirdly, I would like to express my deepest gratitude to Helga Vermeulen, not only for her practical support, but also – and particularly – for her true concern and for the many heart-warming and uplifting chats. Finally, my thoughts go to all my colleagues: David, my office/hotel roommate, you are always welcome to visit (the remains of) your childhood meadow; the SEG-girls, including former SEG-girl Nathalie, thanks for the many pleasant moments and also for the moments of shared frustration and the really helpful pep talks (and Katrien, for your attentive care in Seattle!). Kobe, thanks for your enthusiastic presence at (almost) every CBC-activity, and Ruben, for your pleasant company during our three trips to the Ardennes and for the GIS assistance, which saved me at least two years of my life. And of course to all my other colleagues at the Geography Department: thank you for almost eight interesting and enjoyable years at the S8.

Although it has been difficult to imagine this during the many hours I have spent behind my computer the last couple of months, there is of course life outside the university as well. In this regard, I want to thank my family and – though not officially – family-in-law: my parents, Pieter and Mieke, for their support and never-ceasing confidence in their eldest daughter. My grandparents, for their sincere interest in my research, although mostly it took me at least fifteen minutes to explain what it was about again. My sisters, Saskia and Jolien, for all the sister-stuff we did. And Piet, Marleen, Robbe and Liesbet, for the many pleasant and lively table moments and the good care. Secondly, my very special thanks go to the best friends in the world, Julie, Delfien and Marie-Anne, for the many girls' nights, the long conversations and their good advice. Thanks also to Jan, for being one of my 'oldest' friends, and to Veerle, my geography-friend with whom I visited some of the most beautiful places in Europe.

And finally, I would also like to thank Tomas. For asking me every evening with never-ceasing enthusiasm how my day was, although the answer was mostly the same ('good') and loaded with an increasingly large amount of frustration (in which case

'good' obviously meant 'not good'). Thank you for reading between the lines, for retaining your good temper, interest and optimism and especially for making me laugh, particularly during the last months. And thank you for sharing with me the bright future we are looking at: a new job, a new house, and a new small and precious life.

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1 The geography of urban systems

> *"Historically, cities have always existed in environments of linkages, both material flows and information transfers. They have acted as centres from where their hinterlands are serviced and connected to wider realms."*
>
> (Beaverstock et al., 2000, 123)

> *The external relations of cities are not an optional 'add-on' for theorizing the nature of cities. Connections are the very* raison d'être *of cities."*
>
> (Taylor, 2004, 1)

1.1 Research objectives and structure of the introductory part

This dissertation studies the geography of contemporary urban systems through the lens of advanced producer services (APS)[1]. In doing so, it contributes to a specific strand of research in the urban geography literature that examines urban systems from the perspective of the city/services-nexus. Two lines of literature are hereby of particular interest for this dissertation: (i) the literature that has cited/used/criticized the world city network (WCN) model devised by the Globalization and World Cities (GaWC, http://www.lboro.ac.uk/gawc) research group to measure the spatiality of urban networks at a global scale, and (ii) the literature that studies the spatiality of local urban systems from the perspective of polycentric city-regions. In this context, the present dissertation has three research objectives: (i) to study how the geography of globalized service provision has changed during roughly the last decade, (ii) to identify the main service firms and cities for the servicing and articulation of the Belgian economy without making a priori assumptions on relevant firms or cities, and (iii) to study the spatiality of the Belgian urban system based on the geography of APS transaction links.

This introductory part is structured as follows. The remainder of Chapter 1 introduces the conceptual background of my research. It explains why central place thinking has become partly obsolete for studying contemporary urban systems and briefly introduces the two lines of literature referred to above by explaining why they may provide a more appropriate theorization of contemporary urban systems. As these two lines of literature constitute the theoretical focus of this dissertation, they are discussed in more detail in Chapters 2 and 3 of this introductory part. Both chapters are more or less similarly structured. Each starts with a model specification that describes the methodology for measuring urban networks. A second section discusses the empirical elaboration of both models. The chapters conclude by listing the main critiques of the respective lines of literature. In the final Chapter 4 of this introduction, I explain how this dissertation contributes to these two lines of literature. The chapter

[1] Because of this focus on the APS sector, other empirical approaches to measure inter-city relations are outside the scope of this dissertation and are, therefore, not discussed.

begins with a brief overview of the main concepts, methodologies and data that structure the research described in this dissertation. In a second section, it then explains how these data and methodologies have been combined and implemented in practice by giving an overview of the papers that constitute the main body of this dissertation.

1.2 Central place theory in a global age

For many decades, Christaller's (1933) central place theory has arguably been the single most important influence in the field of research that studies urban systems from the perspective of the city/services-nexus. In an attempt to apply spatial modelling in geography, Walter Christaller (ibid) described the spatiality of the German urban system in terms of central places for service provision to households. He posited that for each service, the urban sphere of influence or 'hinterland' of a central place is determined by (i) the threshold of that service, which refers to the minimum demand that is required to bring about its provision, and (ii) a fixed geographical range, which refers to the maximum distance people are willing to travel to procure a service. Based on these two concepts and on a number of simplifying assumptions, his model specifies a nested, seven-level hierarchy of central places with discrete hinterlands and distributed evenly across the region. The relations between these cities are typically one-sided and vertical, meaning that lower ranked central places are strictly dependent on higher ranked central places rather than vice versa (all services provided by lower ranked central places are also present in the higher ranked central places), and that horizontal relations between cites of the same size are redundant and therefore non-existent (Meijers, 2007b, 247).

Despite the many enhancements and adaptations made to Christaller's original model (see Coffey, 1998 for an overview) in more recent years, there seems to have grown a widespread consensus that the assumptions of central place thinking have become problematic for explaining contemporary urban systems (see Davies, 1998; Capello, 2000; Meijers, 2007b; Taylor, 2001a; Taylor et al., 2010a). In a reaction to this, several alternative models have been developed. Overall, this dissertation focuses on two of these lines of literature, which have come to take a rather prominent place in urban geography during the last two decades. The first studies urban networks at a global scale and combines conceptual and empirical writings under the common denominator of 'world city network' (WCN) research. The second studies the changing geography of local urban systems and combines conceptual and empirical writings on so-called polycentric city-regions.

As cities are linked to one-another by multifarious types of flows, it is not surprising that both literatures incorporate a variety of empirical approaches to measure urban networks. Since the empirical focus of this dissertation is on corporate relations in the APS sector – the reasons for this will be discussed in Chapter 4 of this introductory Part – two strands of research are of particular interest here. For the WCN literature, this is the research done in relation to the WCN model devised by the Globalization and World Cities (GaWC, http://www.lboro.ac.uk/gawc) research group (Taylor, 2001a, 2004). For the literature on polycentric city-regions, it is research done in the context

of the POLYNET project (Hall & Pain, 2006a) that is of particular interest for this dissertation.

Although both lines of literature are more or less distinct in their spatial focus, at the least they share the same conceptual rationale, namely that globalization, informationalization and a series of other processes have engendered the need for a "new spatial logic" to structure globalized societies in the current information age (Castells, 1996). Taylor (2004) refers in this context to a metageographical shift, i.e. a shift in "the spatial structures through which people order their knowledge of the world" (Lewis & Wigen, 1997, ix). He argues that the dominant metageography of the post-world war era, described by Castells (ibid) as the "space of places", has been essentially state-centred. This is clearly manifested in the political map of the world, represented by a mosaic of states, and in the way in which existing and new knowledge is collected and structured (e.g. national trade data, gross domestic product, UN's human development index…) (Taylor, 2004). Over the past three decades or so, however, privatization, deregulation, digitization and the increasing integration of the global economy have, if not partially unbundled, then at least altered the relevance of the state as a spatial unit and simultaneously led to the ascendance of other spatial units or scales such as cross-border regions, supra-national entities and – particularly – large-scale metropolitan areas (Sassen, 2001, xviii). It is particularly the large-scale metropolitan areas that are in the process of becoming the main articulators of the capitalist system (Taylor, 2004, 193). To describe a world in which territorial structures are in demise, social scientists have increasingly made use of metaphors like networks or chains. Taylor (ibid) therefore suggests that it is the networked metageography, referred to by Castells (ibid) as the "space of flows", which arguably has the greatest potential to replace the territorial metageography as the new mental spatial framework for the global age.

1.3 World city network formation

At the global scale, globalization and 'informationalization' (Hall & Pain, 2006b, 4) led to the rise of a number of cities whose functional centrality became increasingly disconnected from their broader hinterlands (Sassen, 2001). As Brown et al. (2010) argue, this obviously challenged the traditional way of researching inter-city relations in which non-relational data were used to define an autonomous 'national urban hierarchy' as if the rest of the world did not exist. It was only when the study of these so-called world cities[2] broke free of its national containers that the path was cleared for a more appropriate understanding of their urban dynamics and their functioning in the contemporary global economy. Even then, however, Saey et al. (2005) notice that a Christallerean approach is still observable in this research domain in that world cities are often deemed as a set of central places with a geographical range larger than

[2] As the focus of this dissertation is on business relations in the APS sector, I adopt Sassen's (1991/2001) conceptualization of global cities and leave aside all other approaches (e.g. Cohen, 1981; Friedmann, 1986). With the risk of complicating things, I decided however not to use her term 'global cities', but rather the term 'world cities' as this is more in line with the terminology of the WCN literature.

initially envisioned by Christaller. Hall (2002), for instance, describes world city-formation as a simple addition of two scales atop Christaller's initial central place model (i.e. 'world cities' such as London and Paris, and 'sub-world cities' such as Manchester and Lyon). There are however three interrelated reasons why such a Christallerean approach to world cities is problematic.

A first reason is that, strictly speaking, such an approach conceptualizes cities as central places for service provision to households. This, however, neglects that fact that, due to a recent shift in advanced economies away from manufacturing and goods-handling towards advanced services engaged with information handling (Hall & Pain, 2006b, 4), the 'core business' of many contemporary world cities no longer lies in service provision to households, but rather in the production of advanced producer services (APS) like advertising, financial services, commercial law, insurance and management consultancy… In the course of the twentieth century, these APS firms have displayed a remarkable growth, which took place almost exclusively in large cities, and have acquired a key position in the organization of the contemporary global economy (Sassen, 2001). Moreover, through their global office location strategies, these APS firms have become an important factor contributing to the global reach of world cities.

The latter is linked to the second reason why a Christallerean approach to world cities is problematic, namely the fact that the concept of non-overlapping hinterlands is inadequate for describing the urban spheres of influence of world cities. Although the reach of these cities is of course much larger than originally envisioned by Christaller, it is not the transnational aspect *per se* that is problematic. As Taylor et al. (2010a, 2809) notice in relation to Christaller's (1950) less well-known study on European cities: "Christaller is no respecter of political boundaries". Rather, it is the fact that – precisely because of their global reach – every world city's hinterland overlaps with every other world city's hinterland. In other words, all world cities service one and the same global market, albeit with varying 'intensities' of service provision (Taylor, 2001b).

Finally, the third problematic aspect of central place thinking is that – because of its overall concern for urban hierarchies – it essentially adopts a competitive approach to urban studies in which the competitiveness of a city is primarily dependent on its internal sources. However, in the contemporary global economy where places are increasingly integrated through myriad flows of people, capital, goods and ideas, it has been argued that a city's economic success is increasingly determined by its connectivity to these flows and by the quantity and quality of its connections with other (world) cities. Moreover, alongside the existing forces of competition between cities to acquire a privileged location at the intersection of these flows, cities also cooperate with the specific aim to maintain and strengthen the flows that connect them (Beaverstock et al., 2002). As Taylor (2004) notices: "cities exist in city networks and networks can only exist through collective complementarities".

In light of these issues, Saey et al. (2005) argue that the world city network (WCN) model devised by the GaWC research group provides a good alternative for studying contemporary urban systems at the global scale.

1.4 The growth of polycentric city-regions

With his famous dictum that urban geography research essentially focuses on "cities as systems within systems of cities", Berry (1964) fused internal and external urban relations into one single framework for describing the nature of cities (Taylor, 2004, 2). When exploring the impacts of digitization, globalization, informationalization etc. on cities, the aptness of this formulation becomes remarkably clear. Not only did these processes alter their position in transnational urban systems, they also had a serious impact on their internal structure and on their relations with other cities at the local scale.

The traditional monocentric city model, as described in Burgess' (1925) concentric zone model, can be considered as the ideal-type of an industrial city in the 19th century. It is characterized by a strict city-hinterland separation and constitutes a central business district (CBD) generating demand for labour, surrounded by a residential zone providing the labour supply. In terms of urban relationships this model typically displays centralized commuting patterns following an "up the rent gradient" (Anas et al., 1998, 1444) with people commuting from the residential zone to the CBD, while inter-firm business flows largely remain within or between urban cores (de Goei et al., 2010; van Oort et al., 2010).

From the early 1930s on, however, advancements in transportation technology led to the deconcentration of households and land-consuming economic activities such as industry and retail to cheaper and more accessible locations (Kloosterman & Musterd, 2001). In the 1960s, when advancements in ICT increased the ability to communicate quickly and cheaply across distance, higher-order service functions like accountancy and advertising followed this trend, albeit that this sector typically displayed a higher degree of 'concentrated deconcentration' due to the need for frequent face-to-face contacts (Harrington & Campbell, 1997; Boiteux-Orain & Guillain, 2004; Hall & Pain, 2006a). Over time, these processes resulted in the growth of secondary centres, either growing out of existing towns or emerging as new cities. Some of these secondary centres increasingly became strong alternatives to the traditional CBDs as they combined the advantages of peripheral locations (less congestion, lower office prices…) with those of central locations (infrastructure, urbanization economies..., Anas et al., 1998; Riguelle et al., 2007). As a consequence, the monocentric city model was gradually replaced by a polycentric city model at the scale of the metropolitan area, typically displaying complex patterns of cross-commuting and inter-firm relations (Kloosterman & Musterd, 2001; van Oort et al., 2010).

In a further stage, continuous (sub)urbanization processes resulted in "the coalescence of formerly independent metropolitan areas and the creation of complicated overlapping patterns of interactions" (Davies, 1998, 352). This was particularly the case in Western Europe where these processes took place in the context of a densely populated urban landscape with several smaller cities located in close vicinity (Kloosterman & Musterd, 2001). The clustering of activities in a complex of centres and the ensuing functional division of labour not only allowed these urban regions to achieve major agglomeration economies in the form of enlarged markets, it also induced a situation in which significant functional linkages are formed at increasingly

higher levels of scale than those of the traditional city (de Goei et al., 2010, 1152). Hence, it is argued that the relevant focus for studying the geography and functioning of urban systems nowadays is no longer the polycentric city or metropolitan area, but the polycentric city-region (Kloosterman & Musterd, 2001).

These shifts suggest that central place thinking may no longer provide an appropriate framework for studying contemporary urban systems at the local scale either. Rather than a nested hierarchy of central places providing a 'despecialized' mix of services (Capello, 2000, 1928), many urban systems now consist of a number of relatively similar-sized – or in economic terms equally important – cities with specific specializations. The hinterlands of these cities are no longer non-overlapping and rather than one-sided, vertical relations directed towards the main centre, intercity relations now display criss-cross patterns between cities of different and similar size (Meijers, 2007b; van Oort et al., 2010). Moreover, because of city specializations, the relationships between cities also constitute a different rationale. Rather than subordination to higher-order cities implying intercity competition, the functional and spatial division of labour within contemporary urban systems often results in a situation where relations between cities are based on complementarity rather than competition or dependency (Capello, 2000; Meijers, 2007a). Through this complementarity, cities can benefit from scope economies, knowledge exchange, synergies… and as such become more competitive than they would be in isolation (Meijers, 2007a).

Based on these characteristics, it has been argued that a network model may provide a more appropriate tool for studying the geography and functioning of contemporary local urban systems (Batten, 1995; Capello, 2000; Camagni & Capello, 2004; Meijers, 2007b). Many different terminologies have been coined to describe this new urban form, including 'city networks' (Camagni & Salone, 1993), 'multicore city-regions' (Westin & Östhol, 1994), 'network cities' (Batten, 1995), 'polynucleated metropolitan regions' (Dieleman and Faludi, 1998) and 'polycentric urban regions' (Meijers, 2007c). In this dissertation, I adopt the term 'polycentric city-region'. On the one hand, this is because – contrary to for instance terms like 'polynucleated' or 'multicore' – 'polycentricity' not only refers to the mere existence of multiple centres, but also includes a notion of balance in the importance of these centres. On the other hand, the term 'city-region' clarifies that the spatial focus is not on the intra-urban or city scale, but on the scale of the wider urban region.

2 The world city network

> *"Any world city is the creation of the service firms located there, and its position in the world city network depends upon those firms' particular patterns of offices across other world cities."*
>
> (Taylor et al., 2000, 235)

2.1 Conceptual rationale

The conceptual rationale of GaWC's WCN model is largely based on Sassen's (1995/ 2001) seminal work on place and production in an increasingly globalized economy (Derudder et al., 2010). In her global city hypothesis, Sassen explains how the mounting importance of advanced producer services is a direct consequence of the organizational and spatial structure of the capitalist global economy. The geographical dispersal and simultaneous integration of economic activities have rendered the central corporate functions of MNCs so complex and of such a strategic importance that the headquarters of MNCs increasingly outsource them to highly specialized firms. Thus, Sassen (2001, xx) concludes, "while even ten years ago the key site for the production of these central headquarter functions was the headquarters of a firm, today there is a second key site, the specialized service firms contracted by headquarters to produce some of these central functions or components of them".

Sassen's basic argument in relation to cities then is that, in spite of the fast development of information and communication technologies, specialized service firms cannot just locate anywhere. Due to the complexity of the services they provide, the uncertainty of the markets, and the growing importance of speed of transactions, production of APS can only be successful in 'special places' where concentrations of specialized knowledges intersect with flows of the latest informations (Taylor et al., 2000) enabled by the available high-tech infrastructures. As such, a simultaneous trend of *decentralization* (outsourcing) of central headquarter functions and the *spatial concentration* of (the production of) command and control functions has resulted in the growth of a number of prime centres for the production and consumption of advanced producer services in the organization of global capital (Derudder et al., 2010, 1863). Sassen terms these special places 'global cities' (see, however, footnote 3).
In addition, these APS firms have increasingly become large multinational firms in their own right. To provide a seamless global service to their global clients and to enter new markets, they have pursued various forms of internationalization strategies (Daniels & Moulaert, 1991; Beaverstock et al., 1999b; Aharoni & Nachum, 2000; Harrington & Daniels, 2006) to create world-wide office networks covering major cities. It are the myriad of connections between these service complexes, Sassen (2001, xxi) suggests, that gives way to the "formation of transnational urban systems".

However, although Sassen explicitly links the transnational, city-centred spatial strategies of APS firms to the formation of transnational urban systems, one of the main points of critique of her global city hypothesis – and of the world cities literature in general – is its failure adequately to specify the network itself (Short et al., 1996;

Beaverstock et al., 2000; Taylor, 2001a; see also Derudder, 2006 for an overview of the main commentators). The main reason for this empirical gap is the acute deficit of relational data at the city level (Short & Kim, 1999), which obviously is the result of a 'mismatch' between the traditionally state-centric data collections of the last century and the more recent metageographical shift. It is in the context of this critique that GaWC's contribution to world cities literature should be situated.

2.2 Model specification

To rectify the 'empirical conundrum' (Taylor, 2001a) in world cities literature, GaWC has undertaken a theoretically grounded endeavour of data acquisition for measuring world city *network* formation through the lens of advanced producer services. In line with the empirical rationale discussed above, the WCN has been specified as an interlocking network with three levels (Taylor, 2001a): a network level (i.e. cities connected in a world economy), a nodal level (i.e. the cities), and a sub-nodal level (i.e. the global service firms). It is at the latter level that network *formation* takes place. As projects for international clients require multiple office inputs, APS offices are linked to one-another by intra-firm flows of information, knowledge, plans, directions, advice… Globalized APS firms are thus the prime producers of the WCN, and their multiple office locations can be used as a proxy for inter-city relations (Taylor, 2001a, 2004).

The WCN is defined as the aggregate of the many service firms pursuing a global location strategy. The model can be formally represented by a matrix V defined by *n* cities X *m* firms where v_{ij} is the 'service value' of city *i* to firm *j*. The service value is the importance of a city to a firm's office network. It depends upon the size and functions of an office or offices in a city and ranges between 0 (no office) and 5 (headquarters). The strength of the link between city *a* and any other city *b* in the network, i.e. the *city interlock link* $r_{ab,j}$, can be produced from:

$$r_{ab\,,j} = \sum_j v_{aj} \,.\, v_{bj} \qquad (1.1)$$

For each city *a*, n-1 city interlock links can be calculated. The variations in these measures define a city's hinterworld, which is described as the "relative level of service a city provides in each of the other cities of the WCN" (Taylor, 2001b). The total connectivity of city *a* in the interlocking network, i.e. its *global network connectivity* GNC_a, is then defined as follows:

$$GNC_a = \sum_i r_{ai} \qquad (1.2)$$

Or, when combining equation (1) and (2):

$$GNC_a = \sum_{i,j} v_{aj} \,.\, v_{ij} \text{ (a} \neq \text{i)} \qquad (1.3)$$

The conjecture behind conceiving the product of service values as a surrogate for actual flows of inter-firm information and knowledge between cities is that the more important the office, the more connections there will be with other offices in a firm's

network. Although of course every firm has its own location strategies, this assumption is deemed plausible as long as large data sets are used to iron out idiosyncracies (see however Dicken & Malmberg, 2001; Jones, 2002; and Lambregts, 2008). The limiting case is a city that shares no firms with any other city so that all of its service value products in equation (1) are 0 and it has no connectivity.

2.3 Data collection and empirical analyses

The first large-scale data collection exercise performed by GaWC was in 2000[3] (see Derudder et al., 2003; Taylor et al., 2002a, 2002b; Taylor, 2004) and essentially gathered information on (the importance of) service firms' office locations as mentioned on their corporate websites. The selection of relevant service firms (i.e. service firms pursuing a global strategy) was done in two steps. First, only firms with offices in at least 15 different cities including one or more cities in each of the prime globalization arenas (northern America, Western Europe and Pacific Asia) were included. The second step was more pragmatic. Based on rankings of the top firms in different sectors, firms were selected on the basis of the availability of information on their office network. The result was a list of 100 firms active in five different APS sectors: 18 accountancy firms, 15 advertising firms, 23 banking/finance firms, 11 insurance firms, 16 law firms and 17 management consultancy firms.
The selection of relevant cities was based upon previous experiments and included the capital cities of all but the smallest states plus numerous other cities of economic importance from all continents. This resulted in a set of 316 cities for which information was then gathered on the (importance of) the office locations of the 'GaWC 100' service firms. The end result was a 315 cities X 100 firms matrix of 31 500 service values. Based on this 'master matrix', a number of empirical analyses have been implemented. The examples mentioned hereafter merely constitute an excerpt of the literature to be found at the GaWC website (http://www.lboro.ac.uk/gawc/).

Taylor et al. (2002b) explore the configurations of the WCN. By means of principal components analyses, they produce clusters of cities correlated in terms of similarities in their profiles of service values across firms. Derudder et al. (2003) extend the list to 234 cities to obtain a higher level of geographical detail. By means of a fuzzy clustering algorithm, they produce 22 clusters of cities representing the 'urban arenas' in the world city network. By incorporating the global network connectivity measures in their analyses, the authors are able to reveal not only regional but also hierarchical tendencies within the dataset. Finally, in contrast to the previous three articles, Derudder & Taylor (2005) explore the structure of the WCN by focusing on configurations of the world city *network* rather than on configurations of world cities. To do so, the authors implement a clique analysis which allows disentangling the GNC measures in tangible relations patterns. The results are more or less in line with the results of the former articles, demonstrating that the inter-city links at the global level contain an important regional dimension.

[3] Beaverstock et al. (1999) already made some preliminary explorations into the geography of the world city network by collecting data on the office networks of 74 companies (covering accountancy, advertising, banking/finance and commercial law) in 263 cities.

Apart from these contributions studying the overall structure of the WCN, a second type of analyses focuses on the mapping and comparison of the urban hinterworlds of world cities. Taylor (2001b) for instance maps the hinterworlds of the ten leading world cities based on the results of the first preliminary data gatherings outlined in Beaverstock et al. (1999a). Calculations of hinterworlds based on the results of the more recent data gathering of 2001 are discussed amongst others in Derudder & Taylor (2003) where the focus is on the absolute and relative urban hinterworlds of two Belgian cities Antwerp and Brussels; in Taylor & Walker (2004) who outline the methodology for measuring relative hinterworlds and illustrate it by mapping the hinterworlds of London and Manchester, and in Taylor (2004).

2.4 Critiques of GaWC's world city network model

Although the GaWC approach to understanding the role of world cities in a globalized economy has been widely adopted and implemented, it has also been criticized on different accounts. In this final section, I briefly consider the main critiques. The first critique relates to a gap in the empirical research on the WCN network. So far, most empirical analyses focus on the configurations of the WCN at a given point in time. However, the global economy – and logically also the world city network – is dynamic in nature. Global service firms extend their presence in the new growth-regions of the world economy while in other cities or regions offices may be closed or granted new functions. New alliances are forged or ownership may change in the advent of major acquisitions. As a consequence, static analyses of the configurations of the WCN are destined to reach an expiration date, often sooner than later. Yet, despite this rather obvious observation, until recently, only a few longitudinal analyses of shifting relations at the global scale existed (Taylor et al., 2003; Taylor & Aranya 2008).

A second, more fundamental line of critique of GaWC's WCN model relates to the assumptions underlying the model specification. Nordlund (2004), for instance, argues that the use of internal attribute data (i.e. service values) as an approximation of a network's structural properties (i.e. inter-city relations) can only be meaningful if it is based on a solid theoretical/empirical foundation. On the one hand, this implies that the assumption that APS firms actually use their transnational office networks for the exchange of knowledge needs empirical verification (cf. Lambregts, 2008). On the other hand, the rationality of multiplying service values as a proxy for the degree of connectivity between two cities also needs empirical testing. In this respect, Jones' (2002) qualitative study of agency in transnational investment banks and management consultancy firms for instance suggests that the corporate structure of APS firms does not necessarily correspond to the often assumed highly centralized systems of control. Rather, he argues, these TNCs often display features of a decentralized and more diffuse structure. A similar argument on the rise of heterarchical forms of governance in multinational enterprises has been made by Dicken & Malmberg (2001).

A third critique relates to the continuous discussion on the position and function of secondary cities. While global network connectivities provide a more or less

appropriate tool for studying the global interaction of the world's largest cities in the global economy, they are much less informative about the role of the world/service cities at the WCN's 'fuzzy ends' (Brown et al., 2002). Obviously, the small network connectivities of these cities do not reflect the fact that they are not 'global', nor that these cities are not important as service centres for the articulation of regional/national economies. Rather, they may reflect the failure of the GaWC model to adequately describe the role of these cities as service centres. An important factor in this context is the a priori selection of only the largest APS firms in the world. Moreover, as Parnreiter (2010) argues, the mere presence of local offices of transnational APS firms tells very little about the city's *actual* role in the articulation of the regional/national economy. It is not because a city houses many local offices of transnational APS firms that it is necessarily a centre for global command-and-control functions. In many cases, the services provided by local APS offices merely facilitate a smooth functioning of their clients' production activities.

3 Polycentric city-regions

> *"Global city-regions come to function increasingly as the regional motors of the global economy, that is, as dynamic local networks of economic relationships caught up in more extended worldwide webs of interregional competition and exchange."*
>
> (Scott et al., 2001, 18)

3.1 Morphological and functional polycentricity

Like any other 'fuzzy concept' (Markusen, 2003), the literature on polycentric city-regions is obfuscated by a plethora of different terminologies, conceptualizations, empirical methodologies and data sets (see Kloosterman & Musterd, 2001; Green, 2007; Hoyler et al., 2008; Burger & Meijers, 2010). It is not the objective of this section to provide a comprehensive overview of these concepts and explain the ways in which they differ. Rather, I want to provide a definition of polycentric city-regions that allows to bring some structure to the existing literature and to situate the present dissertation in this wider literature. To do so, I distinguish between a morphological and a functional dimension of polycentricity (Green, 2007; Burger & Meijers, 2010).

The morphological dimension basically addresses the size and distribution of the urban centres across the territory. In this respect, Kloosterman & Musterd (2001) define a polycentric city-region as an urban system consisting of several historically and politically distinct cities amongst which are a small number of relatively similar-sized – or in economic terms equally important – larger cities and a greater number of smaller cities located in more or less close proximity (i.e. commuting distance) from each other and lacking a clear leading city. Empirical studies focusing on this morphological dimension typically use attribute data of centres to measure for instance rank-size distributions of cities (Hall & Hay, 1980; Spiekermann & Wegener, 2004; Hall et al., 2006, 42) and employment- or employment-to-work ratios (Gordon et al., 1986; Redfearn, 2007; Garcia-Lopez & Muniz, 2010).

However, the mere existence of a number of similar-sized cities is a necessary but insufficient condition for polycentricity. There is also functional dimension, which addresses the degree of 'integration' of the constituent centres. As I already explained, this integration results from the fact that the constituent towns or cities not only complement each other in terms of economic specializations[4], but also increasingly cooperate with each other. The result is a "considerable regional cohesion in personal, occupational and corporate relationships of people, organizations and firms that transcends the boundaries of the traditional metropolitan areas" (van Oort et al., 2010). Research that focuses on the functional dimension of polycentricity can be

[4] Kloosterman & Musterd (2001, 627) in fact see two possible outcomes of polycentric development: either the existing functional differentiation may be weakened as the city-region becomes more of a homogeneous economic environment creating one large pool of labour, or the existing functional differentiation may be strengthened as cities specialize in specific urban functions for the whole of the polycentric city-region. The latter scenario has generally been accepted as the most likely outcome.

broadly divided into two lines of inquiry. The first focuses on the underlying assumption of complementarity by measuring the degree and/or the (positive) effects of specialization, complementarity and functional integration of the constituent centres (e.g. Capello, 2000; Kloosterman & Lambregts, 2001; Meijers, 2005, 2007a, 2007b; van Oort et al., 2010). The second and most sizeable line of inquiry focuses on the spatial manifestation of urban integration by studying the multifarious types of flows that run between the urban centres and by exploring to what extent the spatiality of these flows provides evidence for the existence of a polycentric structure (e.g. van der Laan, 1998; Green, 2007; de Goei et al., 2010; Dessemontet et al., 2010 for commuter flows; Limtanakool et al., 2007 for business and leisure trips; Hall & Pain, 2006a; van Oort et al., 2010 for business relations).

3.2 Measuring functional polycentricity through the lens of advanced producer services

Despite the recent growth of the advanced producer services sector (Bryson et al., 2004) and its increasing importance for the contemporary knowledge economy, only few studies have focused on the spatiality of (business relations and/or information flows in) this sector to explore the geography of contemporary city-regions. Examples of such studies include Lambooy (1993), van der Knaap (1994), and – more recently – the POLYNET project, which is arguably the most comprehensive research effort on the subject so far (Hall & Pain, 2006a). For this project, an international group of scholars has joined forces with the aim to analyze and compare the functioning of eight mega-city regions (MCRs) in North West Europe, including South East England, the Randstad, Central Belgium, RhineRuhr, Rhine-Main, the European Metropolitan Region Northern Switzerland, the Paris Region, and Greater Dublin, and to explore the implications of their findings for North West European spatial planning and related policies.

To study the spatial structure and functioning of the eight MCRs and assess their polycentricity, POLYNET has combined a number of both quantitative and qualitative approaches. In a first, exploratory step, the eight MCRs were geographically defined in terms of contiguous functional urban regions (FURs). Based on this initial geographical definition, data on area, population/population change, employment/employment change and commuting were collected and processed to provide a statistical overview of each MCR and to allow for some preliminary measurements of their polycentric structure. The latter was done by means of rank-size indices, measures of self-containment, and degree of daily connectivity. These analyses already revealed a clear difference in internal structure between on the one hand more polycentric MCRs like the Randstad and RhineRuhr and on the other hand more primate MCRs like the Paris Region and Greater Dublin.

In a second step, the aim was to quantitatively measure flows of information within and between the eight MCRs in order to assess their *functional* polycentricity. This was done based on three different approaches. The first approach explored how cities and MCRs are knitted together through business practices of APS firms and how/to what degree the geography of the associated information flows attests to the existence of a

polycentric urban structure. To do so, POLYNET made use of the GaWC model and extended its scope to the local scale. Based on a master matrix containing information on the office locations of 1963 firms, each team calculated the network connectivities of their MCR's constituent FURs and this both at the regional, national, European and global scale. These connectivity measures were then used to quantify the functional polycentricity of the MCRs, which was done by taking the average relative connectivity of the 'non-leading' cities, being the cities with a relative connectivity smaller than 1 (Taylor et al., 2008). Overall, the results showed a clear ordering in the degree of polycentricity, with Rhine-Ruhr being the most polycentric MCR; the Randstad, Central Belgium and EMR Northern Switzerland displaying a duopoly of linkage dominance; and Rhine-Main, Paris Region, Greater Dublin, and South East England displaying features of primate regions where one city strongly dominates the urban system in terms of connectivity to urban networks. In addition to this, the analyses also revealed a consistent pattern of lessening polycentricity and thus increasing primacy with increasing spatial scale.

The second approach to quantitatively measure flows of information (this time only between the 'core' cities of the eight MCRs) was based on business travel movements. Due to the very limited - if not unavailability of data on telecommunications traffic and actual business travel, POLYNET used timetabled flights and trains as a proxy. Based on the number of connections and travel time between two cities, connectivity indices were calculated for air and rail, both separately and in combination. South East England scored best in terms of air connectivity and overall connectivity, while Central Belgium – one of the worst connected MCRs in terms of air connectivity – appeared to be the best connected MCR by rail.

For the third quantitative approach, POLYNET aimed to measure actual rather than potential flows of information within and between firms and organizations in the APS sector. To do so, a web survey was launched amongst all the 1963 firms in the APS dataset. In this survey, senior managers were invited to keep a travel and virtual communications diary for one week. Despite the somewhat disappointing response rate, the survey delivered some interesting insights in the geography of business travel and telecommunications patterns and the associated spatial structure of the individual MCRs. Overall, the individual cases displayed an intensive pattern of local information exchange in the First Cities, combined with well-developed links to other major business cities both in Europe and beyond. Behind this general picture were however again some notable differences. On the one hand, the analyses identified more monocentric MCRs like the Paris Region and Greater Dublin, which display both a highly concentrated pattern of business contacts in the First City FUR and predominantly one-way relationships between other FURs and the core. On the other hand, more polycentric MCRs like South East England were identified, characterized by a more balanced pattern of business contacts including quite extensive and two-way relationships between individual FURs.

As already mentioned, one of the strengths of the POLYNET project is that it combines quantitative methodologies with a qualitative assessment of the geography of information flows and the intersection of the 'space of places' and the 'space of flows'

in the eight MCRs (Pain & Hall, 2006a, 91). Therefore, in a third step, the quantitative analyses were complemented with a relatively small number of in-depth face-to-face interviews with senior executives and managers to tease out information about the pattern, volume and quality of connections and flows. Based on the results of these interviews, three themes were discussed: (i) office locations, clustering and intra- and inter-regional flows of information, (ii) the process of knowledge production, transfer and innovation, and the role of virtual communications and face-to-face contacts, and (iii) the crucial significance of skilled labour and labour markets.

In relation to the first theme, the interviews underlined the strong relationship between intra-regional clustering on the one hand, and sector, market reach and network scope of APS firms on the other hand. In all MCRs, regardless of their more polycentric or monocentric structure, one city (i.e. the First City) stands out as the dominant centre both in terms of overall APS concentration, concentration of firms with a European and/or global scope, and intensity of intra-firm flows and connectivity with other First Cities and with the wider global city network.

Regarding the process of knowledge production and the role of different communication modes, the interviews indicated that, despite the increasing importance of virtual communication modes – particularly of email – face-to-face contacts retain their critical importance. Because of this, key decision-making functions remain concentrated in the CBDs of particularly First Cities. Business contacts within these cities and travel between them continue to be the most important means by which specialized information is transferred within and between cross-border APS networks. Not surprisingly then, worsening transport infrastructure was often mentioned in the POLYNET study as being one of the major stumbling blocks for future APS regional growth.

In relation to the last theme, access to a skilled and specialized labour market was identified as the key determinant of where firms locate within the MCRs, although the scale of recruitment (local vs. global) also depends on the type of skills required. Once again, it are the First Cities that are reported as having the highest (or only) concentration of highly skilled international labour, even to such an extent that a relocation would imply a fatal loss of employees. Overall, locational preferences of firms seemed to have more to with global city processes (i.e. 'soft', social, cultural and economic processes) than with physical infrastructure.

Based on these insights, the two overarching questions that ran through the POLYNET study have been re-evaluated. Firstly, regarding the geographical definition of the MCRs, the overall observation was that, in general, POLYNET's MCR definitions are of little relevance for the functional relations of the firms operating in them. As the Belgian team noted: "Firms do not operate within such a predefined urban network; they recognize actors, not territories" (Aujean et al., 2005, 8). Of much greater importance at the MCR scale, are the policy implications of a number of important issues that emerged throughout the interviews, including spatial concentration, transport, quality of life and inter-urban relations. The fourth and final stage of the POLYNET project therefore combines all the information gathered in the previous

steps and translates them into recommendations for policy regarding sustainable regional management.
The second overarching research question concerns the issue of polycentricity and the extent to which flows within each MCR are associated with polycentric development at the regional scale. At first sight, the tendencies towards the concentration of particularly European and international APS firms in a limited number of centres seem to counter the entire concept of polycentricity. However, as Pain and Hall (2006b, 119) note, functional configurations cannot be directly mapped on to MCR spatial configuration. In the Randstad, the spatially polycentric configuration of urban centres was not reflected in the geography of its intra-regional functional linkages. South East England, on the other hand, revealed just the opposite situation, being a spatially primate regional structure with London as the dominant FUR, but with strong functional linkages between the FURs of the MCR. Based on these observations, probably one of the most interesting conclusions of the POLYNET project is that a high degree of APS concentration and intensive global interactions in the First City might have positive effects on intra-regional functional polycentricity.

3.3 Critical reflections on the literature on polycentric city-regions

To conclude this chapter, I briefly list the main points of critique of the literature on polycentric city-regions. Clearly the most often heard critique relates to the overall lack of conceptual consensus, which has resulted in a multitude of different measures and methodologies[5]. The ensuing fragmented and inconsistent empirical base is not only problematic in academic terms, it has also practical consequences given that, in recent years, polycentricity has gained much attention from policymakers both at the national/regional scale (e.g. van Oort et al., 2006; Albrechts & Lievois, 2004) and at the European scale (e.g. European Union, 1999). At both levels, there is an increasing stress on the active encouragement of polycentricity as a normative planning strategy. On the one hand, polycentric urban development is assumed to have positive implications for regional competitiveness, social cohesion and sustainable development. On the other hand, however, it has also been argued that polycentricity involves increased commuter traffic, environmental degradation, and uneven spatial development (Kloosterman & Musterd, 2001; Halbert et al., 2006; Hall, 2009; Wheeler, 2009). This all raises questions as to what extent and at what spatial scale polycentricity can or should be a desired outcome of future urban development. To answer these questions, obviously, a more coherent and systematic appraisal of the concept is required.

A second critical reflection that is obviously related to the former is that, so far, only little attention has been paid to actually empirically substantiating and validating the assumptions that are made in relation to polycentric city-regions in general, and to

[5] Kloosterman & Musterd (2001) identify three factors that contribute to the "apparent lack of focus in dealing with polycentric urban phenomena": (i) the difference in backgrounds of scholars studying polycentricity (e.g. spatial planners vs. urban geographers), (ii) the inherent complexity of the concept itself, which is as multifaceted as the cities they study, and (iii) the eclectic and pluralistic nature of geographic discipline in the past half-century which makes it susceptible to new concepts.

functional polycentricity in particular (Meijers, 2007a). The latter is partly due to a lack of relational data at the city level. The result is that only few studies have formally tested how well this model actually fits the reality of contemporary urban systems (de Goei et al., 2010, van Oort et al., 2010), and that even fewer studies have quantitatively assessed whether polycentricity indeed involves urban complementarity, economies of scale, and all the other assumed spatial, social and economic outcomes.

A third and final point of critique tackled by de Goei et al. (2010) is that only few studies using flow characteristics measure changes over time. As Bertaud (2004) argues, cities are not 'born' polycentric, but they may evolve in that direction. Hence, longitudinal research based on flow data is needed to allow for a more dynamic assessment of the spatial and functional integration of contemporary urban systems.

4 Overview of the dissertation

Chapters 1, 2 and 3 discussed the theoretical and conceptual background of this dissertation. In this final chapter, I explain how the present research relates to this conceptual framework and how it contributes to the two lines of literature discussed in the previous chapters. This is done in two sections. Section 4.1 gives – at the risk of repetition – a brief overview of the main concepts, objectives methodologies and data that structure the research described in this dissertation. Section 4.2 explains how these data and methodologies have been combined and implemented in practice by giving an overview of the papers that constitute the main body of this dissertation.

4.1 Concepts, objectives, methodology and data

CENTRAL CONCEPTS

The first concept that is central to this dissertation and therefore needs further consideration is that of *advanced producer services*. As Bryson and Daniels (2007, 4) notice, "scholars have always found it extremely difficult to construct a rigorous definition of services". As a consequence, many different definitions and classifications can be found in economic geography literature. It is not the intention of this section to provide a comprehensive overview of existing definitions and classifications. Rather, APS are defined in a more pragmatic way, i.e. by excluding what they are not.

First, the term *producer* distinguishes this group from consumer services in that the former serve 'intermediate' business and public sector demand rather than consumer's final demand. The preposition *advanced* is added to indicate that it concerns a type of producer services of which the production essentially involves a high degree of expertise and knowledge, and where the "transactions involve strategic, technical and professional advice, mainly employing the skills of information gathering, processing, and especially of interpretation" (Wood, 1991, 162). As such, advanced producer services distinguish themselves from producer services like cleaning, catering, transportation and security.

This definition of APS clearly still comprises a wide variety of different types of services. A non-limitative list includes such activities as management consultancy, advertising and marketing, commercial law, real estate management, accountancy, personnel recruitment, supply chain management and financial management[6]. Obviously, this list is too large to include all these service in our analyses. The empirical focus of this dissertation is therefore confined to those APS that are traditionally included in WCN research (i.e. accountancy, advertising, financial services – banking, financial services – insurance, management consultancy and law), including one additional service, namely information and communication technology (ICT).

A second question that requires further explanation is why this dissertation studies the spatiality of contemporary urban systems through the lens of APS and not any of the

[6] The main difference between the term *advanced producer services* and *knowledge-intensive business services* or KIBS, which is another commonly used term in the economic geography literature, is that the latter usually not includes banking and insurance services.

myriad other economic functions present in cities. The answer is twofold. Firstly, APS firms have come to take a prominent place in the contemporary global economy. Particularly in post-industrial countries, where the period after World War II has been characterized by a considerable shift away from manufacturing and goods-handling towards advanced services engaged with information handling (Hall & Pain, 2006b, 4), the APS sector has become increasingly important, both in economic terms (i.e. value added, employment…) and in strategic terms (i.e. command and control functions). The remarkable growth of this sector has to a significant degree been demand-led, although the sector also constitutes a growth potential in its own. On the one hand, intensifying international competition, the concentration of capital in large transnational corporations, and the advances in modern transportation, information and communication technology all together resulted in an increasing complexity of the geographical and organizational corporate structure (Sassen, 2001). To cut unit costs, increase organizational flexibility, or simply because specialized APS firms can deliver higher-quality products and services, manufacturing companies started to outsource many of their administrative, managerial and other knowledge-intensive activities to specialized APS firms (Daniels & Moulaert, 1991; Beyers & Lindahl, 1996; Bryson et al., 2004). Moreover, the increasing complexity of production, transactions and technology also generated a growing demand for new types of services such as integrated IT systems management and all sorts of specialized consultancy services (Wood, 1991). As a result of this outsourcing process, APS firms increasingly acquired a strategic role in the management of and control over transnational flows of capital, goods, and people. On the other hand, the same advancements in ICT and transport technology also allowed the APS firms to broaden the geographical distribution of their service provision (Derudder et al., 2010). To provide a seamless global service to their global clients and to enter new markets, many of these firms have pursued various forms of internationalization strategies (Daniels & Moulaert, 1991; Beaverstock et al., 1999b; Aharoni & Nachum, 2000; Harrington & Daniels, 2006) to create world-wide office networks covering major cities. As a consequence, APS firms have increasingly become large multinational firms in their own right, thus partly generating their own growth potential.

The latter relates to the second reason why this dissertation focuses on APS firms to study the geography of urban systems. Due to the complexity of the services they provide, the uncertainty of the markets they serve, and the growing importance of speed of transactions, production of APS can only be successful in 'special places' where concentrations of specialized knowledge intersect with flows of the latest information enabled by the available high-tech infrastructures (Taylor et al., 2000). APS firms are in other words severely dependent on urbanization economies and therefore display a strong tendency to cluster in (large) cities. Moreover, both through their multi-location strategies and the intensity of their interactions with clients and other APS firms, they can be conceived as important network agents, linking cities to one-another at various spatial scales. Altogether, this makes APS firms particularly

interesting to study the geography of urban systems both at the global scale and at a more local scale[7].

The second key concept in this dissertation is that of *urban networks* and, closely related to that, the concept of *connectivity*. Like any other type of network, an urban network usually consists of two layers: the nodal level (i.e. the cities) and the network level (i.e. the inter-city relations, which have a certain weight or size and display a certain spatial pattern). However, the type of urban network that is central to this dissertation, i.e. the world city network, diverges from the traditional network model. Rather than two layers, it consists of an additional sub-nodal level constituted by APS firms. These APS firms are the key agents in the process of network formation as it is they who interlock the nodes/cities in the network through their everyday practices and as such 'create' the WCN (Taylor, 2001a).
The importance or power of a city in an urban system can be measured in various ways. A typical way to do so, is to measure the power of a city based on its internal sources or 'nodality' (e.g. the number of APS firms in a city). The problem, however, is that power is essentially a relation. As Taylor et al. (2002, 234) explain: "This does not mean that size is not important, obviously such measures indicate the significance of a city within the world economy, but they do not tell us how well the city is globally connected." In other words, from a network approach, the sources for competition are attributed to relational factors (e.g. a city's relative position in terms of connectivity to inter-urban flows of knowledge, human capital…).
In social network analysis, several centrality measures exist to describe the relative position of a node in a network (see, for instance, Alderson & Beckfield, 2004). Depending on whether the flows are directional or not, measures like indegree, outdegree, betweenness and closeness can be calculated. For undirectional data like intra-firm flows of knowledge, the indegree (i.e. the number of links 'arriving' in a city) and outdegree (i.e. the number of links 'departing' from a city) are obviously the same. In the GaWC methodology, these measures are therefore replaced by a 'weighted' centrality measure, i.e. the *global network connectivity*. Contrary then to a ranking of cities based on their importance in terms of nodality, GaWC ranks cities based on their importance in terms connectivity to global flows of knowledge, information, capital…
In relation to the latter, I want to conclude this discussion on urban networks and connectivity by emphasizing what I already explained in section 1.3, namely that the concept of urban networks – and of the world city network in particular – also differs from that of urban hierarchies in that the emphasis is on inter-urban cooperation rather than on urban competitiveness. This is not to say that cities in an urban network, at whatever spatial scale, do not compete with each other (see, e.g. Burger et al., 2008; Hall & Pain, 2006c, 206-208). However, alongside the existing forces of competition to acquire a privileged location at the intersection of these flows, cities, or rather, network articulators like transnational APS firms, who take the time and effort to

[7] It should be noted, however, that the central role of APS firms in MCRs is a predominantly Western phenomenon. Polycentric MCRs have also been identified in areas such as the Pearl River Delta and the Yangtze River Delta regions of China, but there, the polycentric structure primarily related to manufacturing activities (Pain and Hall, 2008, 4).

produce the world city network, also cooperate with the specific aim to maintain and strengthen the flows that connect them (Beaverstock et al., 2002, 112).

The distinction between the nodality and the centrality/connectivity of cities is also relevant in relation to the third concept that is central to this dissertation, which is that of *polycentricity*. As I already briefly explained in Chapter 3, polycentricity refers to the fact that – apart from the obvious existence of multiple centres – there is also a certain balance in the importance of these centres (see Burger & Meijers, 2010). In this regard, a distinction can be made between *morphological polycentricity*, which describes the importance of cities in an urban system in terms of attribute data like employment, population…, and *functional polycentricity*, which makes use of relational data (e.g. commuting, shopping trips). The difference between morphological and functional monocentricity (one dominant centre) and morphological and functional polycentricity (several centres of equal importance) has been nicely visualized by Burger and Meijers (2010, see Figure 4.1).

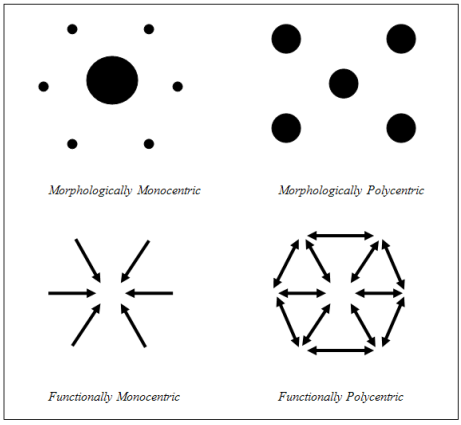

Figure 4.1 Morphological monocentricity/polycentricity vs. functional monocentricity/polycentricity (Source: Burger & Meijers, 2010)

As Hall and Pain (2006b, 15) notice, it is important to emphasize that the concept of polycentricity is both process- and scale-sensitive. The former refers to the fact that the degree of polycentricity in a region obviously depends on the type of data that are used. For instance, in the POLYNET project, the analyses of commuting flows suggested a low degree of regional polycentricity in each of the MCRs, whereas the quantitative analyses of inter-city links based on the GaWC model revealed a potentially high degree of polycentricity for most regions (Hall & Pain, 2006b, 15). Scale-sensitivity on the other hand refers to the fact that polycentricity at one scale might very well imply monocentricity at another scale. For instance, a polycentric structure at the European scale – one of the central policy objectives of the ESDP (Pain & Hall, 2008, 3) – might result in greater monocentricity at the regional/national scale. This is because, particularly in the peripheral regions of the European Union, economic development may lead to a concentration of capital and labour in a few leading cities, as such

creating regional economic imbalances between core and periphery at the level of the individual countries (Hall & Pain, 2006c, 199).

OBJECTIVES, METHODOLOGY, DATA AND GEOGRAPHICAL DELINEATION OF THE STUDY AREA

As I explained in Chapter 1 of this introductory part, the overall aim of this dissertation is to contribute to the urban geography literature that studies the spatiality of contemporary urban systems through the lens of advanced producer services. To do so, this dissertation addresses some of the critiques identified at the end of Chapters 2 and 3. The overall aim of this work can thus be narrowed down into three more specific research objectives:

Objective 1: to measure changes in the world city network in the period 2000-2008

Objective 2: to assess the relevance of GaWC's selection of APS firms and world cities for the articulation of the Belgian economy

Objective 3: to study the spatiality of the Belgian urban system based on transaction link data

To address these research objectives, this dissertation adopts a *multi-method approach*. This means that it combines a quantitative approach for studying urban systems – which allows measuring inter-city relations – with a qualitative approach, which provides more depth to the quantitative findings. Furthermore, the conclusions that are drawn from the latter approach in turn provide an empirical basis for additional quantitative research based on which the preliminary findings of the qualitative research can be generalized. The benefits of such a multi-method approach have been demonstrated in the POLYNET project, where a quantitative appraisal of functional polycentricity was complemented with in-depth qualitative data on actual flows of information.

To *quantify* inter-city relations through the lens of the APS sector, this dissertation uses two types of relational data. The first type constitutes *intra-firm flows* of information between offices of the same APS firm. To measure these intra-firm flows, the GaWC methodology is implemented, which basically uses attribute data on the location of APS firms as a proxy for flow data. As I already explained in Chapter 2, this transformation is based on the assumption that projects for international clients require multiple office inputs, linking APS offices to one-another through intra-firm flows of information, knowledge, plans, directions, advice… A typical feature of this type of relational data is that the link between two office/cities is symmetrical: there is no distinction between the origin and destination of the information flows.
To measure inter-city relations and urban centrality/connectivity based on intra-firm flows of information, and, more particularly, to measure changes in the world city

network (see Objective 1), two datasets are used: the GaWC dataset of 2000, containing information on the importance of office locations of 100 APS firms in 315 cities, and the - up till now still[8] - most recent GaWC dataset on the importance of office locations of 175 APS firms in 526 cities for the year 2008.

The second type of relational data constitutes *inter-firm flows* of information between an APS firm and its client, which we termed *APS transaction links*. There are two important aspects in which this second type of relational data differs from the former. Firstly, measuring urban relations based on transaction link data implies a somewhat different perspective on urban centrality. Rather than measuring it in terms of connectivity to a transnational network of APS firms, it measures urban centrality in terms of service provision to 'customers'. This implies that inter-city relations are no longer symmetrical: there is a clear distinction between the origin of the information flows (i.e. the 'service' city where the APS firm is located and where the service is 'produced') and the destination of the information flows (i.e. the 'user' city where the client firm is located and where the services are 'consumed')[9]. Secondly, and perhaps more importantly, using APS transaction links as relational data allows to measure *actual* rather than assumed/potential information flows, which arguably implies a more concrete measure of inter-city networking.
To measure inter-city relations based on APS transaction links, this dissertation uses a quantitative dataset that contains information on the name and location of the main business partners of some of the largest companies located in Belgium and this for seven different APS sectors (i.e. accountancy, advertising, financial services, insurance, ICT, management consultancy, law). These data have been collected by means of a large-scale email survey sent out to the 300 largest companies located in Belgium between the 7th of June and 22nd of November 2009. The list of the top-300 companies has been obtained from the website of Trends Top (http://trendstop.rnews.be, accessed: 11 May 2009) and is based on corporate turnover figures for the fiscal year 2007. Obviously, our choice to rank firms based on turnover figures is partly arbitrary. Any alternative variable (e.g. number of employees, value added) could have been used as well and any choice would have its advantages and limitations. The main limitation of ranking firms based on turnover figures, for instance, is that compared to e.g. value added, it tells nothing about the cost structure of a company and its 'value' to society. The fact is, however, that we did not intend to select the most important companies for the Belgian economy. We simply wanted to make a list of 'large' companies given that they display a greater tendency to outsource advanced service activities compared to smaller firms (e.g. Martinelli, 1991). In this respect, it is our contention that corporate turnover constitutes an equally valid alternative variable.

[8] At the time this dissertation is written, the most recent data gathering for the year 2009 is being finalized.

[9] On the one hand, however, it should be noted that, in practice, the client is in many cases to a more or lesser extent involved in the 'production' of – particularly complex and customized – advanced producer services. Therefore, although the provision of the service is unidirectional, the flows of information between user city and service city associated with the transaction link are mostly bidirectional.

Based on this ranking of top-300 companies, in a first stage, we tried to collect as much as possible the personal email addresses of the CEO or CFO of the company, or of their personal assistant. In case these email addresses were not mentioned on the corporate website, we tried to obtain them through telephone calls. In a second stage, we sent out a personalized email to each of the 300 companies, appending the questionnaire both in attachment and at the bottom of the email. The cover letter and questionnaire were written in Dutch and in English. In order to optimize the response rate, we designed the questionnaire to be as short and straightforward as possible. Where necessary, a remainder was sent after two weeks. By the end of November, we had received 97 completed surveys which together delivered a dataset containing 358 transaction links. For each link, we had information on (i) the location of the 'user firm', i.e. the 'user' city; (ii) the location of the 'service firm', i.e. the 'service' city; and (iii) the APS sector of the service firm.

Municipalities' postal codes were collected as initial data to locate both user and service firms. However, to avoid an impractical high degree of geographical detail, we aggregated the individual municipalities to a higher geographical level, depending on the nature of analysis:

- For Chapter 8, where we assessed the relevance of GaWC's selection of APS firms and world cities for the articulation of the Belgian economy and where, due to the spatial concentration of APS firms, a relatively limited scale of aggregation was sufficient, municipalities were aggregated to the level of their *urban regions* (see Figure 4.2a). An urban region is a combination of a city's operationalized agglomeration and its urban fringe. It is the spatially enlarged entity within which most of the basic activities of city life are 'displayed' (Luyten & Van Hecke, 2007).
- For Chapter 9, where we studied the spatiality of the Belgian urban system and where, due to the more spatially dispersed pattern of the user firms, the level of the urban region was too small, municipalities were aggregated to the level of their *urban fields* (see Figure 4.2b). An urban field (*stedelijk leefcomplex*, also called Metropolitan Region; Halleux, 2002) consists of an urban region and its commuter area. The latter includes those municipalities in which at least fifteen percent of the active population commutes to the respective agglomeration (Luyten & Van Hecke, 2007).
- For Chapter 11, where we measured the functional polycentricity of the Mega-City Region (MCR) of Central Belgium, municipalities were aggregated to the level of their *functional urban regions* (FURs, see Figure 4.2c). The geographical delineation of these FURs has been defined by the Belgian team of the POLYNET project[10]. Together, these FURs make up the MCR of Central Belgium. As we wanted to compare our results with those of the POLYNET study, we

[10] A FUR comprises an economic core and a ring consisting of those neighbouring municipalities in which at least 10% of the working population commutes to the core on a daily bases. The economic core of a FUR is either a number of neighbouring municipalities with an employment density in excess of 700 jobs per km² and having a total of at least 35 000 jobs; or a municipality with over 35 000 jobs plus its neighbouring municipalities with an employment density exceeding 700 jobs per km².

implemented the same geographical delineation for the FURs. The only difference is that we listed Leuven and Mechelen – two secondary agglomerations in the FUR of Brussels – separately as both agglomerations displayed a relatively high number of links compared to both other secondary agglomerations (e.g. Sint-Niklaas) and other FURs (e.g. Bruges, Charleroi).

For APS firms or user firms located outside the urban regions, urban fields or FURs, the municipality was retained as the spatial unit of analysis.

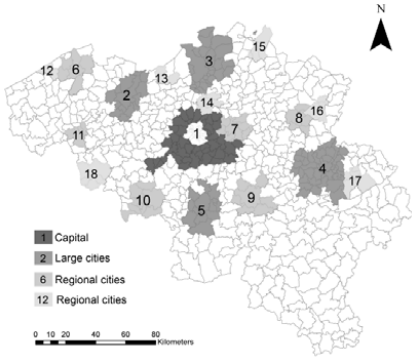

Figure 4.2a Urban Regions

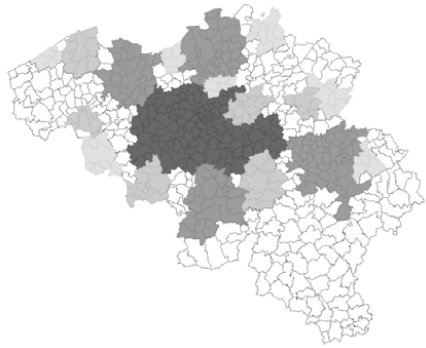

Figure 4.2b Urban Fields

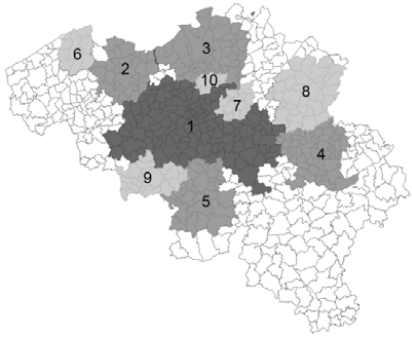

Figure 4.2c Functional urban regions (FURs)

Belgium has eighteen urban regions and hence also eighteen urban fields: Brussels (1), Ghent (2), Antwerp (3), Liège (4), Charleroi (5), Bruges (6), Leuven (7), Hasselt (8), Namur (9), Mons (10), Kortrijk (11), Ostend (12), St-Niklaas (13), Mechelen (14), Turnhout (15), Genk (16), Verviers (17), Tournai (18).

The Belgian FURs: Brussels, including Namur (1), Ghent (2), Antwerp, including Sint-Niklaas (3), Liège (4), Charleroi (5), Bruges (6), Leuven (7), Hasselt-Genk (8), Mons-La Louvière (9), Mechelen (10).

Figure 4.2 Visualization of the three spatial levels of aggregation for Belgian municipalities

The results and conclusions from the quantitative analyses have been complemented with insights obtained from a qualitative appraisal of APS transaction links. The focus was hereby on the factors influencing a firm's selection of APS business partners in general, and on the impact of the intra-firm distribution of decision-making power regarding APS outsourcing on the geography of transaction links in particular.
To collect the necessary data, we conducted a small-scale survey in the Ghent sea port area in the period July – September 2009. The Ghent sea port area is the area delineated by a Regional Spatial Implementation Plan (i.e. het Gewestelijk Ruimtelijke Uitvoeringsplan 'Afbakening Zeehavengebied Gent – Inrichting R4-oost en R4-west') approved by the Flemish government on 15 July 2005. Based on a list of all the firms

located in the Ghent sea port area, thirteen companies active in the manufacturing and distribution of motorized vehicles were contacted[11]. Six of these companies did not want to participate due to corporate policies regarding public or private surveys or lack of time and/or interest. Of the remaining seven companies, two completed and returned our questionnaire. The other five companies agreed to make an appointment for a semi-structured interview based on the questionnaire, which ranged in length from 30 to 45 minutes. Our questionnaire and semi-structured interviews inquired about the procurement of APS in six sectors: accountancy, insurance, financial services, law, management consultancy, and ICT. The questionnaire was divided into six sections so that correspondents could easily skip the sections for those services procured in-house or not procured whatsoever. Each section contained the same set of questions concerning (i) the location of the service partner, (ii) its nationality, (iii) the length of the contract, (iv) where decisions on this contract are made, (v) the factors influencing the selection of the service partner, and (vi) the nature of the services. The data obtained from this small-scale survey constituted the basis for our qualitative analyses.

4.2 Structure of the dissertation: overview of the papers

This section discusses the three research objectives in more detail. It specifies the related research questions and explains how the data and methodologies discussed in section 4.1 have been combined and implemented in practice by giving an overview of the selected papers. The degree of own contribution to these papers is more or less in line with their use of one of the three previously discussed datasets. The two papers constituting Chapters 6 and 7 in Part 2 of this dissertation use GaWC's datasets of 2000 and 2008 to measure changes in the WCN. For these two papers, my contribution has been limited to the empirical part of the research. For the paper in Chapter 6, this means that I have assisted with the implementation of a number of empirical analyses. For the paper in Chapter 7, my involvement has been larger in that I have contributed to the methodology section, performed most of the empirical analyses and discussed the results.

The paper that constitutes Chapter 8 in Part 3 of this dissertation combines GaWC's recent dataset with the second, quantitative dataset to assess the relevance of GaWC's selection of firms and cities for the articulation of the Belgian economy. Chapter 10 in Part 4 is based on the third, qualitative dataset, whereas Chapters 9 and 11 in Part 4 exhaust the possibilities of our quantitative dataset by using it to study the spatiality of urban systems at the local scale. The papers that constitute these last four chapters are almost exclusively my own work. For each of these papers, I have collected the data, formulated the research questions, performed the necessary empirical analyses, and discussed the results and the conclusions. In doing so, I have of course been assisted by my supervisors and, for the statistical analyses in Chapter 11, by Prof. Van Aelst.

[11] The fact that we defined our study area on an administrative rather than a functional basis (i.e. the automobile cluster in and around the Port of Ghent) essentially implies that Volvo Trucks, which is located just outside the Ghent sea port area, was not included in the survey.

MEASURING CHANGES IN THE WORLD CITY NETWORK – PART 2

Until recently (i.e. before the publication of a special issue in Urban Studies, August 2010 on the changing configuration of the world city network), the only existing longitudinal GaWC analyses were those by Taylor et al. (2003) for 2000-01 changes, and Taylor & Aranya (2008) for 2000-04 changes. To study changes in the WCN, both papers take the results of the 2000 data gathering as starting-point and look at how the office networks of the 100 service firms have shifted over time. It soon became clear however that the rigidity of this approach would become increasingly problematic over longer time-periods (Taylor & Aranya, 2008). Firms had to be deleted from the list due to liquidations or mergers, whilst new firms became important players as their global office networks expanded over time. As a consequence, the observed changes were increasingly the result of changes in the dataset rather than changes in urban geographies. Hence, a new, more flexible and consistent approach for data gathering was needed to allow for statistical robustness in future longitudinal analyses.

In light of these problems, GaWC developed a new methodology that was to become the basis of future data gatherings. Central to this methodology is the selection of a pre-defined number of the world's largest firms for each service sector (i.e. top-25 firms for accountancy, advertising, law, and management consultancy and the top-75 firms for financial services, which combines the previously separated sectors insurance and banking/finance). The list of cities was also extended from 315 to 526, adding many new cities from emerging markets. To carry out the new data gathering for 2008, GaWC joined forces with the Global Urban Competitiveness Project (GUCP) at the Chinese Academy of Social Sciences (CASS; Taylor et al., 2009a, 2009b, 2010b). The end-result was a 526 cities x 175 firms matrix of 92.050 service values. This means that there are now two datasets available containing information on the office locations of large APS firms in the years 2000 and 2008.

The first objective of this dissertation is to use both datasets to measure changes in the world city network in the period 2000-2008. This objective can be rephrased into two more specific research questions, each of which is addressed in an individual chapter:

1. *What are the changes in the WCN in general, and in the global network connectivities of cities in particular, in the period 2000-2008?*

2. *Can we observe notable sectoral variations regarding (i) changes in the WCN in general, and (ii) the degree and pattern of changes in city connectivities in particular, in the period 2000-2008?*

Chapter 6: Pathways of change: shifting connectivities in the world city network, 2000-08

The first chapter of Part 2 explores the changes in the global network connectivities of cities in the period 2000-08. As the new methodology for data gathering was only implemented in the latest data collection exercise of 2008, the datasets were not

consistent from the beginning. They included both a different number of cities and a different service mix (i.e. a different number of firms for each sector). A first step in the analyses is therefore to perform the necessary modifications to make both datasets comparable. Once this is done, changes in the WCN can be adequately measured. To do so, the paper first studies the changes in the city-rankings in both years. This preliminary analysis already demonstrates what will be confirmed later, namely the relative decline of US cities in favour of Chinese cities. However, merely considering changes in rankings implicitly entails the adoption of a *competitive approach* for studying urban change, while in the GaWC approach the essence of intercity relations is in *interurban co-operation* (Taylor, 2004). Therefore, rather than exploring changes in city-rankings, the remainder of the paper focuses on changes in network connectivities. This is done both in absolute terms (absolute changes in GNCs) and in relative terms (standardized residuals). The latter approach has been implemented to eliminate the distorting effects of the closed number system and of market saturation. In general, the results of our analyses confirm the observation made above regarding the relative decline of particularly North American cities and the relative connectivity gains of cities in Pacific Asia. These results are then further interpreted and suggestions for explanatory factors are made. The paper concludes by summarizing the main findings and by emphasizing the need for a new data gathering to measure the impact of the global financial crisis – which began shortly after the 2008 data collection was finished – on the world city network.

Chapter 7: The changing geography of globalized service provision, 2000-2008

Chapter 6 describes changes in the *global* network connectivities of cities. The paper in Chapter 7 investigates whether these aggregated connectivity measures conceal important *sectoral* differences. This is done by calculating the sectoral network connectivities (SNC) in 2000 and 2008 for each of the five APS sectors individually. After a short introduction, which situates the paper in the existing world city network literature, we first briefly outline the conceptual rationale and the specification of the GaWC model. In a third section, we discuss the data collections of 2000 and 2008 and elaborate on our methodology to measure both change in the world city network at large, and changes in service provision at the city level. Regarding the latter, a similar approach is adopted as in Chapter 6, i.e. by measuring relative change in terms of standardized residuals. The results of our calculations are discussed in the fourth section of the paper. This is done first at the level of the network, where we combine an appraisal of changes in central tendency measures with an assessment of changes in the shape of the SNC distributions. Secondly, we explore the geography of the standardized residuals of the 132 cities for each sector individually. The results display more or less similar trends across all sectors, namely a relative connectivity decline for North American, Australasian and West-European cities, and relative connectivity gains for Latin American, East European and South-East Asian and Chinese cities. The only exception to this picture is the legal sector, where we observed more intra-regional variety. In a concluding section, we argue that – apart from some general patterns in the shifting positions of cities as globalized service centres – our analyses show that

leading service firms from different sectors have been globalizing along different geographical lines.

ASSESSING THE RELEVANCE OF GAWC'S SELECTION OF APS FIRMS AND WORLD CITIES FOR THE ARTICULATION OF THE BELGIAN ECONOMY – PART 3

The two papers discussed in the previous section contribute to the WCN literature by measuring changes in the geography of globalized service provision. Part 3 of this dissertation also contributes to this literature, but rather than enhancing our understanding of (changes in) the structure of the WCN, it aims to advance this model in a more fundamental way, namely by critically assessing some of the underlying assumptions of the GaWC model.

One of the critiques of GaWC's WCN model is the fact that the a priori selection of APS firms and cities as well as the associated assessment of globalized urban geographies based on the mere location of APS firms in cities may not be relevant for describing cities' role/insertion in the global economy, particularly when the aim is to explore the insertion of 'less obvious' cities and regional city-systems. The second objective of this dissertation is therefore (i) to introduce an alternative method that allows identifying the relevant firms and service centres for the articulation of a national/regional economy without making a priori assumptions on firms and cities, and (ii) to use the results of this method to assess the relevance of GaWC's selection of firms and cities. This is done for a case-study in Belgium for which I use the results of our survey on APS procurement by Belgium's top-300 companies. The research question this chapter tries to answer therefore is:

3. *Is GaWC's selection of APS firms and world cities relevant for the articulation of the Belgian economy?*

Chapter 8: The world city network as articulator of national/regional economies? An exploration of the geographies of producer services procurement in Belgium

Building on the own-collected dataset, this paper discusses APS procurement in Belgium both at the corporate (selection of APS firms) and the city level (selection of service cities) and then systematically compares the results with GaWC's treatise of firms and Belgian cities (i.e. Brussels, Antwerp and Liège) in the WCN for the year 2008. At the corporate level, our analyses show that overall, GaWC's selection of top-25/75 firms accounts for at least half of the transaction links in our dataset, which more or less confirms the relevance of GaWC's selection. This general picture however hides some notable sectoral differences in that the importance of the top-25/75 APS firms is higher for some sectors (e.g. accountancy/audit and financial services) than for others (e.g. advertising and legal services).
At the city level, our analyses more or less confirm GaWC treatise of Belgium's largest cities Brussels and Antwerp. At the lower levels of the Belgian urban hierarchy however, GaWC's selection of cities and our results start to somewhat diverge. In our analyses, it was Ghent and not Liège that showed some evidence for *sufficiency of services*. The importance of Liège as service centre for the Belgian economy appeared

to be very limited, which was also the case for the other Walloon cities. Although this is of course partly a manifestation of the restricted service base in most of the Walloon cities, which are still in a process of transition after the demise of their industrial sector, these results should also be seen in light of the absolute and relative underrepresentation of Walloon user firms in our dataset.

STUDYING THE SPATIALITY OF THE BELGIAN URBAN SYSTEM BASED ON TRANSACTION LINK DATA – PART 4

As I already indicated in section 3.2 of this introductory part, one of the main methodological concerns of the POLYNET project constituted the difficulty of collecting *quantitative* data on *actual* inter-city information flows (Hall & Pain, 2006a; Pain & Hall, 2008). Either information flows were studied quantitatively, but then analyses were based on a *proxy* (i.e. APS office locations and timetabled flights and trains), or actual information flows were considered, but then the available dataset was too limited to allow for meaningful quantitative analyses of geography of the MCRs. The third objective of this dissertation is therefore to (i) introduce an alternative empirical approach that measures actual inter-city links based on APS transaction links, and (ii) to implement this approach to study the spatiality of the Belgian urban system.

This objective can again be rephrased into two more specific research questions.

4. *Given that the relevance of Christaller's central place theory has become partly obsolete for describing the spatiality of contemporary urban systems, what basic principles for alternative theorizations can be derived from a study of the urban geography of APS procurement in Belgium?*

5. *Given the occurrence of criss-cross relations and overlapping hinterlands, to what extent does the urban network paradigm provide a more appropriate model to describe the spatiality of the Belgian urban system? More specifically, to what extent does a formal test of the urban geography of APS procurement in Central Belgium attest to the existence of a functionally polycentric mega-city region?*

The first research question is addressed in Chapters 9 and 10. Chapter 9 builds on the results of the quantitative survey and constitutes an exploratory study into the urban geography of APS procurement in Belgium, whereas Chapter 10 builds on the results of the qualitative survey and explores the geography of transaction links and the underlying location factors in more detail. The second research question is addressed in Chapter 11, which also builds on the results of the quantitative data collection to measure the functional polycentricity of the mega-city region of Central Belgium.

Chapter 9: The urban geography of advanced producer service transaction links in Belgium

The paper presented in this chapter examines how the geographies of APS procurement can inform our understanding of the transformation of contemporary city-systems. Our argument is based on two sets of empirical analyses. First, we describe the urban geography of APS transaction links generated by the largest companies in Belgium. Based on this analysis, we identify three main features: (i) the overall dominance of Brussels as Belgium's most important service city, (ii) the existence of overlapping urban spheres of influence, and (iii) the occurrence of transaction links with cities abroad. Second, we explore some of the driving forces behind the observed geography. To this end, we test the statistical significance of the relationship between the location decision for transaction links on the one hand, and a number of independent variables (i.e. ownership structure, position in corporate hierarchy) on the other hand. In a final section, we make some concluding remarks. We argue that a Christallerean approach to urban centrality is no longer well-suited to understand the urban geography of service provisions to firms in the context of economic globalization. Instead, we argue, alternative theorizations of the spatiality of urban systems should take into consideration three general principles: (i) the impact of world city-formation as described by Sassen (2001) which results in the presence of a sizable APS cluster in only a limited number of cities, (ii) an additional criss-cross pattern of transaction links between larger and smaller cities in both directions as well as between smaller cities, and (iii) the impact of the intra-firm distribution of decision-making power on the geography of APS procurement.

Chapter 10: Managing organizational and geographical complexity: the 'positionality' of advanced producer services in the globalizing economies of metropolitan regions

Chapter 10 of this dissertation focuses on the economic- and urban-geographical dimensions of APS procurement. Based on a critical literature review of how APS impact on metropolitan geographies, it distinguishes between three dimensions of the 'positionality' of APS firms in the globalized production networks of their clients : (i) a functional dimension focusing on APS firms' influence on their clients' managerial and/or operational capabilities; (ii) a governance dimension focusing on APS firms' ability to influence wider geographical patterns; and (iii) a concrete spatial dimension focusing on the geography of APS procurement. The latter dimension constitutes the conceptual focus of the case-study discussed in this paper. Based on the results from a qualitative survey and semi-structured interviews with managers from automobile companies located in the port of Ghent, we describe the spatial patterns of APS procurement and explore the underlying location factors influencing the geography of APS procurement. The paper hereby particularly focuses on the spatial impact of the intra-firm allocation of decision-making power. In this respect, four spatial models/scenarios reappeared throughout our interviews: (i) the centralization scenario, where decisions on APS procurement for one or several subsidiaries are made at the level of the parent company, (ii) the partial centralization scenario, where the subsidiary is serviced by a local branch of the same APS firm that services the parent company, (iii) the partial decentralization scenario, where decisions on APS

procurement for the local subsidiary are made at the level of the subsidiary, albeit in mutual agreement with the parent company, and (iv) the decentralization scenario, where it is the subsidiary who subcontracts its APS partner without the parent company influencing or controlling the decision-making process.

Chapter 11: Assessing the functional polycentricity of the mega-city region of Central Belgium based on advanced producer service transaction links

This paper uses transaction link data to assess the functional polycentricity of the MCR of Central Belgium. In doing so, it distinguish between two necessary conditions for functional polycentricity. The first condition focuses on the nodes/cities and states that there should be a certain balance in their relative importance (i.e. centrality). To test this condition, the paper introduces a sophisticated FPI that is both insensitive to the size of the urban system, and that allows for a straightforward interpretation of the results. The results indicate that the first condition for polycentricity is not met. When it comes to service procurement by large companies in Belgium, the MCR of Central Belgium displays features of a hierarchical urban system with Brussels as main service centre both at the regional and at the national scale.

The second necessary condition for functional polycentricity states that there should be evidence for urban network integration, which is manifested in the existence of criss-cross relations between cities of different size. To assess the extent to which Central Belgium satisfies the second condition, we implement a formal model that tests three more specific requirements for urban network integration. The results indicate that the second condition for functional polycentricity is not met either. The paper therefore concludes that the urban geography of service procurement by large companies does not attest to the existence of a functionally polycentric MCR in Central Belgium. In other words, the urban network model, which has been proposed as the contemporary alternative for central place thinking, is not (yet) suitable for describing the geography of the Belgian urban system.

Following Parts 2, 3 and 4, I conclude this dissertation with a general discussion and conclusion (Part 5). After a brief introduction, Part 5 first briefly summarizes the main results, explains how they correspond to the research objectives and research questions discussed above, and specifies how these results contribute to our knowledge of contemporary urban systems. Chapter 3 of the concluding part identifies the main limitations of this dissertation and – considering these limitations as a starting point rather than a final stage of research – makes some suggestions for future research.

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PART 2 MEASURING CHANGES IN THE WORLD CITY NETWORK

6 Pathways of change: shifting connectivities in the world city network, 2000-08

Derudder, B., Taylor, P.J., Ni, P., De Vos, A., Hoyler, M., Hanssens, H., Bassens, D., Huang, J., Witlox, F. and Yang, X. (2010) Pathways of growth and decline: connectivity changes in the world city network, 2000-2008. Urban Studies, 47 (9), pp. 1861-1877.

6.1 Abstract

This is an empirical paper that measures and interprets changes in intercity relations at the global scale in the period 2000-2008. We draw on the network model devised by the Globalization and World Cities (GaWC) research group to measure global connectivities for 307 cities across the world in 2000 and 2008. The measurements for both years are adjusted so that a coherent set of services/cities is used. A range of statistical techniques is used to explore these changes at the city level and the regional scale. The most notable changes are (i) the general rise of connectivity in the world city network, (ii) the loss of global connectivity of US and Sub-Saharan African cities (Los Angeles, San Francisco and Miami in particular), and (iii) the gain in global connectivity of South Asian, Chinese and Eastern European cities (Shanghai, Beijing and Moscow in particular).

6.2 Introduction

This is an empirical paper that measures and interprets changes in intercity relations at the global scale in the period 2000-2008. To this end, we employ the network model of intercity relations detailed in Taylor (2001). This network model has been the fundamental tool for the quantitative researches of the Globalization and World Cities research network (GaWC, http://www.lboro.ac.uk/gawc), and is based on advanced producer service (APS) firms 'interlocking' cities through their worldwide distributions of offices. The rationale for establishing GaWC was that research on globalized urbanization has long been hampered by data deficiencies. More specifically, in our empirical research, we have focused on one particular criticism of this literature in the 1980s and 90s: a severe empirical deficit as regards intercity relations (e.g. Smith & Timberlake, 1995a,b; Taylor, 1997, 1999; Beaverstock et al., 2000a,b). This evidential crisis has been averted in the last decade through detailed analyses of transnational intercity relations. Two separate and distinctive solutions to this problem have been developed in the literature (Derudder, 2006): (i) analyzing worldwide corporate organization (e.g. Taylor et al., 2002b; Derudder et al., 2003; Alderson & Beckfield, 2004; Wall & van der Knaap, 2009) and (ii) describing the infrastructure that has enabled that organization to go global (e.g., Smith & Timberlake, 2001; Malecki, 2002; Derudder & Witlox, 2008; Devriendt et al., 2008).

A first major application of the GaWC model was the measurement (Taylor et al., 2002a) and subsequent empirical analysis (Taylor et al., 2002b; Derudder et al., 2003) of the world city network (WCN) in the year 2000. In practice, the analyses were based on information on the (importance of the) presence of 100 leading APS firms in 315 cities for the year 2000[1]. Continuing GaWC's decade-long concern for mapping the global economy through the networking practices of APS firms in cities, in 2007 we joined forces with the Global Urban Competitiveness Project (GUCP) at the Chinese Academy of Social Sciences (CASS) to carry out a new large-scale data collection exercise for 2008 (Taylor et al., 2009a,b; 2010). We garnered information on 175 office networks of firms across 525 cities in the first half of 2008. This implies that we have detailed cross-sectional snapshots of the WCN in 2000 and 2008, and the purpose of this paper is to report and interpret the changes that have occurred in this period.

The remainder of the argument is developed in two main sections. First, the paper briefly provides a summary of GaWC's world city network (WCN) model, i.e. its conceptual rationale and data requirements. We also describe the problems involved in comparing the 2000 and 2008 data collection exercises, and detail how we have transformed the data to deal with these issues. The second section discusses the results at the network, the city and the regional level respectively, after which the paper is concluded with an overview of our major findings and some avenues for further research.

[1] This data gathering was repeated in 2001 and 2004 (Taylor et al., 2003; Taylor & Aranya, 2008), but it became increasingly clear that a new way for gathering data was necessary to maintain a consistency in the data structure for fruitful longitudinal analysis.

6.3 Data and methodology

CONCEPTUAL RATIONALE OF THE GAWC MODEL

Drawing on Saskia Sassen's (1995, 2001) work on place and production in an increasingly globalized economy, GaWC has undertaken a theoretically grounded endeavour of data acquisition for measuring WCN-formation. Sassen's research emphasizes the self-accelerative transformation of the economic bases of cities from manufacturing to business services. This conversion can be traced back to the observation that a growing number of manufacturing and service industries, unable to cope with the accelerated pace of structural change and the increasing pressure for product innovation on their own, are becoming more and more dependent on specialized business services, such as financial services, accountancy, management consultancy, advertising, etc. In most, if not all of these advanced producer services (APS) firms, clients purchase customized knowledge, expertise and skills. APS firms have increasingly become multinational firms in their own right as they look for a foreign presence in an international market to service existing clients and find new ones (see Aharoni & Nachum, 2000; Warf, 2001; Harrington & Daniels, 2006). Sassen's (1991, 126) basic argument in relation to cities, now, is that a number of metropolitan centres have secured "a particular component in their economic base" which gives them a "specific role in the current phase of the world economy": they have become prime centres for the production and consumption of business services in the organization of global capital. As locales for service innovations in such areas as multi-jurisdictional law and new financial instruments, these metropolitan centres constitute concentrations of information and knowledge necessary for new service productions by business service firms.

For the purpose of our large-scale empirical analysis, the salient point is that business services are in and of themselves an indispensable production factor that has a growth potential of its own, as opposed to other domains of service sector growth that is the strict result of derived demand in other sectors. The reason for this is that such corporate service firms have benefited immensely from the technological advances in computing and communications that have allowed them to *broaden the geographical distribution of their service provision*: service firms have always clustered in cities to provide such services to their clients, but under conditions of contemporary globalization, multiple offices are required in major cities around the world to provide a seamless service, thereby protecting global brand integrity by keeping all work in-house (see Figure 6.1). Each firm has its own locational strategy – which cities to have offices in, what size and functions those offices will be, and how the offices will be organized. It is the work done in these offices that 'interlock' various cities in projects that require multiple office inputs. Thus the intercity relations in these servicing practices are numerous electronic communications – information, instruction, advice, planning, interpretation, strategy, knowledge, etc., some teleconferencing as required, and probably travel for face-to-face meetings at a minimum for the beginning and end of a given project. These are the working flows that combined across numerous

projects in many firms constitute the world city network (WCN) as specified in the GaWC model (Taylor, 2001, 2004).

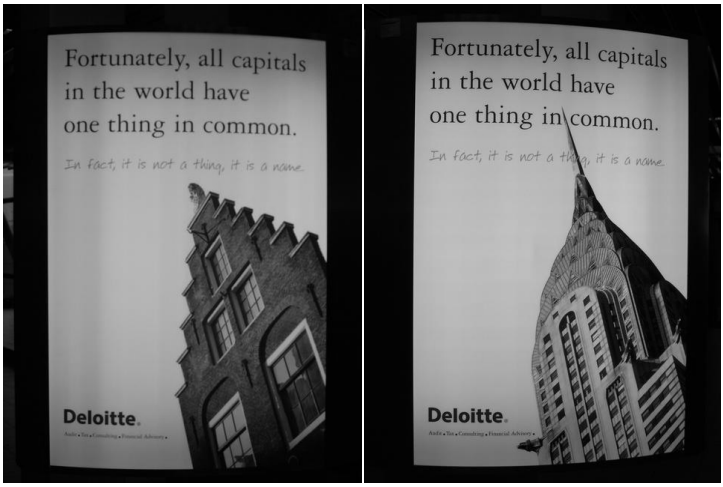

Figure 6.1 Deloitte advertisement at Schiphol Airport

MODEL SPECIFICATION

The GaWC specification of the WCN can be formally represented by a matrix V_{ij} defined by n cities x m firms, where v_{ij} is the 'service value' of city i to firm j. This service value is a standardized measure of the importance of a city to a firm's office network, which depends upon the size and functions of an office or offices in a city. The global network connectivity GNC_a of city a in this interlocking network is defined as follows:

$$GNC_a = \sum_{i,j} v_{aj} \,.\, v_{ij} \quad (a \neq i) \qquad (6.1)$$

The conjecture behind conceiving the product of service values as a surrogate for actual flows of inter-firm information and knowledge between cities is that the more important the office, the more connections there will be with other offices in a firm's network. The limiting case is a city that shares no firms with any other city so that all of its service value products in equation (6.1) are 0 and it has no connectivity. To make GNC measures manageable in our use below (i.e. independent from the number of firms/cities), we express connectivities as proportions of the largest computed connectivity in the data, thus creating a scale from 0 to 1.

DATA GATHERING

Precise specification guides our data collection: data are required on the city office networks of large professional, financial and creative service firms. These exercises in data collection are described in detail in Taylor et al. (2002a) for the year 2000 and in

Taylor et al. (2009b) for the year 2008, and will be summarized here as it is the input to our subsequent analysis.

In 2000, global APS firms were defined as firms with offices in 15 or more different cities, including at least one in each of the prime globalization regions: northern America, Western Europe and Pacific Asia. Firms meeting this criterion were selected from rankings of leading firms in different service sectors. The other key criterion was purely practical - whether adequate information could be found on the firm's website. In the event 100 firms were identified in six sectors: 18 in accountancy, 15 in advertising, 23 in banking/finance, 11 in insurance, 16 in law, and 17 in management consultancy. Selecting cities was much more arbitrary and was based upon previous GaWC experience in researching global office networks. Capital cities of all but the smallest states were included plus many other important cities in larger states. A total of 315 cities were selected. The end result is a *315 cities x 100 firms matrix of 31,500 service values*.

In 2008, we carried out a much larger and complete data collection of APS firms. In order to put the data collection on a sustainable future trajectory, firms were chosen by their ranking in lists of the largest firms in each sector. We combined the banking/finance and insurance categories from 2000 and included the top 75 such firms as ranked in the Forbes composite index, a measure that combines rankings for sales, profits, assets and market value lists. For the other four of the previously studied services – accountancy, advertising, law and management consultancy – we included the top 25 firms: for law the Chambers list of Corporate Law firms was used (www.chambersandpartners.com/global); for advertising agency networks we used Advertising Age's ranking of 'marketing organizations' by revenues (www.adage.com/images/random/lna2007); for accountancy firms' networks we used the ranking by revenues of World Accounting Intelligence (www.worldaccountingintelligence.com); and for management consultancies we used the 2007 edition of the Vault Management & Strategy Consulting Survey, which ranks firms in terms of their 'prestige' based on a large survey of professionals (www.vault.com). In all cases the lists of firms selected are the latest available at the planning of the research project in 2007 and these tended to be based upon 2006 data. There was no way to overcome this two year delay: one year was because planning the project takes time and the second year was because of a one year time lag in reporting such data. For all lists substitute firms were identified (ranked just below 75 and 25) to cover for situations where a firm had disappeared (e.g. been taken over) in the two years before the actual data collection. Overall, the number of firms was increased from 100 to 175. In addition, we carried out a thorough review of cities and added many new cities from emerging markets to create a list of 525[2]. The end result is a 525 cities x 175 firms matrix of 91,875 service values.

[2] In practice, a number of overlapping criteria were used to select cities. All cities with a population of more than 2 million inhabitants were included, which led to the consideration of far more cities located in China, India, Pakistan and Iran. We also included a 'second city' of all but the smallest states plus other important cities in larger states. The latter selection was in part based on a systematic comparison

In both data gatherings, assigning service values to city/firm-pairs focused on two features of a firm's office(s) in a city as shown on their corporate websites: first, the size of office (e.g. number of practitioners), and second, their extra-locational functions (e.g. regional headquarters). Information for every firm was simplified into service values ranging from 0 to 5 as follows. The city housing a firm's headquarters was scored 5, a city with no office of that firm was scored 0. An 'ordinary ' or 'typical' office of the firm resulted in a city scoring 2. With something missing (e.g. no partners in a law office), the score reduced to 1. Particularly large offices were scored 3 and those with important extra-territorial functions (e.g. regional headquarters) scored 4. All such assessments were made firm by firm.

CONSISTENCY IN THE DATA GATHERING EXERCISES

The only longitudinal GaWC analyses to date are by Taylor et al. (2003) for 2000-2001 changes and Taylor & Aranya (2008) for 2000-2004 changes (for an interpretation of the patterns of change documented in the latter paper, see Orozco-Pereira & Derudder, 2010). Both papers take the 2000 data gathering as a starting point, and basically look at how the office networks of the 100 service firms have shifted in 2000-2001 and 2000-2004 respectively. However, particularly in Taylor & Aranya (2008), it became clear that this approach would turn out to be increasingly problematic as the time period becomes longer. The reason for this is that the comparison of city connectivities over time requires a certain consistency in the data structure. However, the dynamic nature of the global economy implies that the relevance of invoking the geography of the office networks of the initial APS firms becomes increasingly problematic as time passes. For instance, in Taylor & Aranya (2008), of the 100 firms used in 2000, 20 had to be deleted because the firms were liquidated, had merged with other firms in the data, or simply because the authors were unsure of the comparability of new data with old data (see also Orozco-Pereira & Derudder, 2010). Since measurement of differences should represent changing urban geographies rather than data collection change, it was clear that this approach was not tenable in the long run: ever-lower number of firms would reduce the robustness of the dataset, while changes in the sectoral composition of the dataset may influence the results. Furthermore, new firms may enter the fray as their global presence/importance rises. The rationale behind the altered data gathering strategy should be understood in light of these problems. The new methodology allows for a more flexible approach: using a predefined number of firms from each sector (e.g. 75 in financial services and 25 in law) selected via independent rankings of their importance as detailed above. This puts the data collection on a new and sounder footing: there will be statistical robustness in future research as the same large number of firms is used for each sector, while we will include the leading firms from each sector.

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with the airline data presented in Derudder & Witlox (2005). For instance, the most connected city in the global airline networks that is not included in our dataset is Nice, one of the major tourist centres and a leading resort on the French Riviera.

However, for the present case, special modifications need to be made to compare the 2000 and 2008 measurements. This requires maintaining as much consistency as possible in the data structure. In terms of cities, consistency is relatively straightforward in that we initially only focused on the 307 cities that feature in both analyses and have a GNC ≠ 0 for both 2000 and 2008 (Baghdad, for instance, had zero connectivity in 2000 and is excluded). Of these 307 cities, we only retained the 132 cities with a GNC of at least one fifth of the most connected city in either year. GNCs were then recomputed based on these 132 so that a coherent set of inter-city relations is being compared. One major consequence of this decision is that the GNC measures and rankings used in the remainder of this paper may be slightly different than those reported in other GaWC publications.

In terms of firms, our main concern was that changes in the sectoral composition of the dataset might influence the results. For instance, in Taylor & Aranya (2008), the number of firms in the accountancy sector was almost reduced by a half between 2000 and 2004. As a consequence, this implies an increased influence of, say, law and management consultancy in dictating network structures. To avoid this situation in the present analysis, the measurements for the year 2000 were adjusted so that the same 'service mix' is used as in 2008 (see Table 6.1). This was especially relevant given the larger number of financial services firms in the 2008 data gathering (75 out of 175), which would – in relative terms – artificially boost the connectivity levels of clear-cut international financial centres such as New York when comparing unadjusted GNC levels in 2000 with GNC levels in 2008. To deal with this potential problem, the connectivity measurements in 2000 were transformed to match the 2008 sectoral distribution (i.e. the last column of Table 6.1). For instance, the connectivity generated in the office networks of the 15 advertising firms in the 2000 data gathering now makes up 25/175 = 14,3% of a city's revised 2000 GNC rather than the initial 15/100 = 15%, while the connectivity generated in the office networks of the 23 + 11 = 34 financial/banking/insurance firms in the 2000 data gathering now makes up 75/175 = 42,9% of a city's revised GNC rather than the initial 34/100 = 34%. Once again, as a consequence of this transformation, the GNC figures in this paper may somewhat differ from those reported in other GaWC publications.

Table 6.1 Sectoral distribution of GaWC data gatherings in 2000 and 2008

Sector	2000	2008	% 2008
Accountancy	18	25	14.3
Advertising	15	25	14.3
Law	16	25	14.3
Management consultancy	17	25	14.3
Finance	34	75	42.9

Figures 6.2 and 6.3 illustrate the WCN in 2000 and 2008 respectively as a pattern of nodes (city codes are given in an Appendix at the end of Part 2). The 132 cities included in both figures have a global network connectivity of at least one fifth of the most connected city in either 2000 (London) or 2008 (New York). Obviously this is an

arbitrary cut off point, it has been chosen because it still provides us with a large number of cities that are distributed across all parts of the settled world. The next section provides a detailed account of the major changes in the WCN between 2000 and 2008.

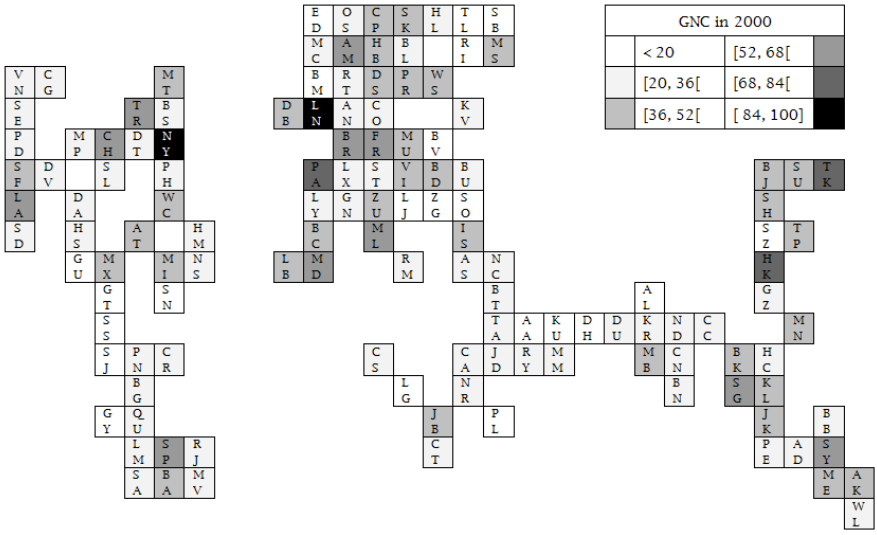

Figure 6.2 GNC for 132 cities in 2000

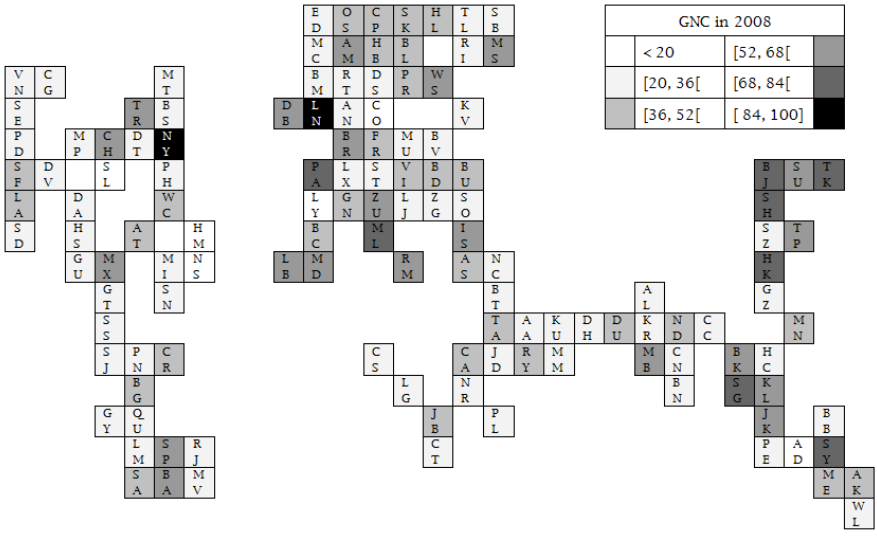

Figure 6.3 GNC for 132 cities in 2008

6.4 Changes in the WCN

PRELIMINARY ANALYSIS: SHIFTING RANKS, RISING CONNECTIVITIES

Table 6.2 presents an overview of the 20 cities with the largest global network connectivity (GNC) in 2000 and 2008, and the major changes in ranks in this time period. Although New York and London change positions, the most notable feature is the stability at the apex of the WCN: London, New York, and Hong Kong remain the most connected cities with NY-LON as the undisputed dominant dyad, and Paris, Singapore and Tokyo follow, albeit with different rankings. Below the top 6, there have been some major changes with 8 cities entering the 14 positions between 6 and 20: cities such as Chicago, Los Angeles and Amsterdam lose out in favour of the likes of Shanghai, Beijing and Seoul in an 'east-west swap'. More specifically, the plummeting of US cities and the concomitant rise of Chinese cities is a more fundamental feature of this analysis. This obviously points to an overarching 'world-regional' trend, as the 20 most connected cities in 2000 included 5 North American cities and 5 Asian cities, whereas in 2008 only 3 North American cities (New York, Toronto, and Chicago) make the top 20 as opposed to 9 Asian cities.

Table 6.2 20 most connected cities in the WCN in 2000 and 2008

2000			2008		
1	London	100.00	1	New York	100.00
2	New York	97.10	2	London	99.32
3	Hong Kong	73.08	3	Hong Kong	83.41
4	Tokyo	70.64	4	Paris	79.68
5	Paris	69.72	5	Singapore	76.15
6	Singapore	66.61	6	Tokyo	73.62
7	Chicago	61.18	7	Sydney	70.93
8	Milan	60.44	8	Shanghai	69.06
9	Madrid	59.23	9	Milan	69.05
10	Los Angeles	58.75	10	Beijing	67.65
11	Sydney	58.06	11	Madrid	65.95
12	Frankfurt	57.53	12	Moscow	64.85
13	Amsterdam	57.10	13	Brussels	63.63
14	Toronto	56.92	14	Seoul	62.74
15	Brussels	56.51	15	Toronto	62.38
16	Sao Paulo	54.26	16	Buenos Aires	60.62
17	San Francisco	50.43	17	Mumbai	59.48
18	Zurich	48.42	18	Kuala Lumpur	58.44
19	Taipei	48.22	19	Chicago	57.57
20	Jakarta	47.92	20	Taipei	56.07
22	Buenos Aires	46.81	21	São Paulo	55.96
23	Mumbai	46.81	22	Zurich	55.51
27	Shanghai	43.95	25	Amsterdam	54.60
28	Kuala Lumpur	43.53	28	Jakarta	53.29
29	Beijing	43.43	31	Frankfurt	51.58
30	Seoul	42.32	40	Los Angeles	45.18
37	Moscow	40.76	46	San Francisco	41.35

It has frequently been suggested that the world-system is in the midst of a major geographical transformation from 'West' to 'East' (e.g. Arrighi, 1994, 2007; Frank, 1998), and these changes – even just before the current financial crisis got underway – suggest that this shift is indeed unfolding in terms of urban connectivity.

Merely considering (notable) changes in ranks is, however, not the best approach when discussing WCN change. An exclusive focus on ranks implicitly entails the adoption of a competitive approach to studying urban change. This approach can, for instance, be observed in Friedmann's (1995, 23) statement that world cities are "driven by relentless competition, struggling to capture ever more command and control functions that comprise their very essence," even to the degree that "[c]ompetitive *angst* is built into world city politics." In the GaWC approach, however, firms not cities are the agents of change and this means that the 'essence' of intercity relations is interurban cooperation within office networks of globalized service firms rather than crude interurban competition for capital, resources, knowledge, etc,… (Beaverstock et al., 2001). This is not to say that there is no competition between cities (see Begg, 1999, 807), but in this paper's argument, the cooperation process is prioritized because it entails the basic reproduction of the intercity relations: *cities exist in city networks and networks can only exist through collective complementarities* (Taylor, 2004). This position is consistent with general organization theory wherein competition and hierarchy are deemed to be different from network and cooperation (Powell, 1990; Thompson, 2003; for an application to cities see Taylor et al., 2010). All this implies that, from our perspective, change is much more than a matter of cities 'rising' or 'falling'. This can be readily observed when looking at Chicago in Table 6.2: in the period under investigation, the city has retained more or less the same overall level of GNC, but it nonetheless loses 12 places in the ranking because other cities have become relatively more connected. In other words: rather than some cities dropping in the 'ranking' per se, the first notable feature of our analysis is the *overall rise of connectivity* in the WCN in the period 2000-2008. This is evident from a number of related indicators: the average connectivity in the WCN has risen from 0.20 to 0.22, while in 2008 the number of cities with a connectivity larger than 20% of the leading city has risen from 110 to 125. Overall, 179 out of 307 cities are more connected to the WCN at large than they were in 2000. This indicates that the globalization of services has been a dynamic and growing economic sector expanding offices in many cities and extending office networks to new cities in the period under investigation. Although the NY-LON dyad still dominates the network, its structure has become more horizontal between 2000 and 2008 indicating a worldwide diffusion of globalization processes. The result has been an increasingly integrated world city network.

CHANGE IN THE WCN

Figure 6.4 shows the geography of global urban connectivity change for the most connected cities in the WCN, with rising connectivities for 97 out of 132 cities. The regional pattern suggested in Table 6.2 is confirmed, with connectivity losses for Western European, Australasian and especially North American cities, and connectivity

gains in other parts of the world in general and specifically in Eastern Europe and Pacific Asia/China.

The degree of change in absolute global network connectivity is useful for observing some of the most notable shifts in the WCN, but it has some severe limitations as a way of understanding change. This is because GNC_a is a closed number system that distorts the measurement of change. However much more connected it becomes, the leading city cannot show additional connectivity through its GNC_a measure of unity. In more general terms, there is a problem of possible underestimation of change at the higher ends of the scale. This problem consists of two components: (i) a measurement problem in that higher ranked cities have less leeway to increase their connectivity because they are nearer the limit of the measurement scale (i.e. a city with a GNC_a of 0.95 can only increase its connectivity with 0.05) and (ii) a conceptual problem in that the markets of higher ranked cities are closer to saturation in that they have less leeway to acquire more/larger/more important offices (i.e. a city where all major service firms have a major office can hardly become more important in the office networks of these firms). We therefore developed an alternative way of measuring change, which takes into account both problems.

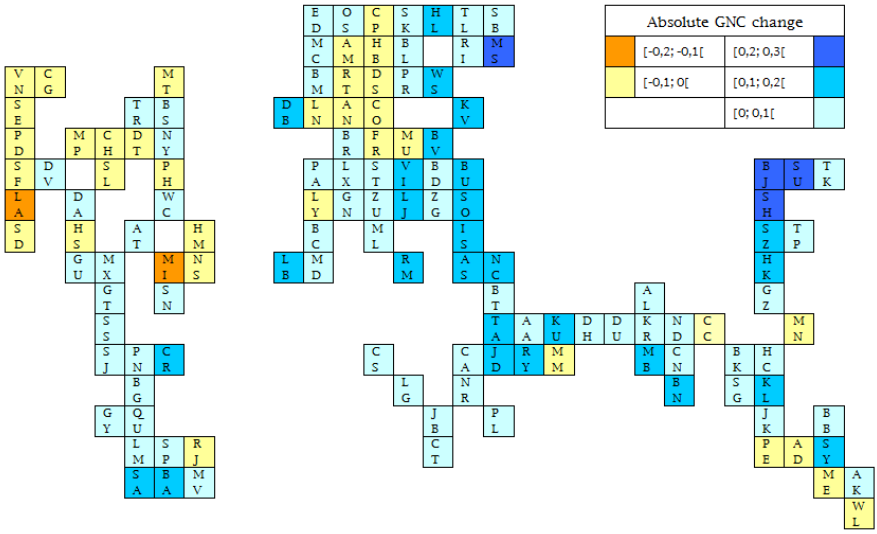

Figure 6.4 Absolute GNC change for 132 cities

The measurement problem is tackled by generating standardized measures of sectoral connectivity change SCC_a.To this end, we first compute standardized global network connectivities $SGNC_a$ for both 2000 and 2008 as follows:

$$SGNC_a = \frac{(GNC_a - GNC_{average})}{\sigma_{GNC}} \qquad (6.2)$$

where $GNC_{average} = \frac{\sum_i GNC_i}{n}$ (6.3)

and $\sigma_{GNC} = \sqrt{\frac{\sum_i (GNC_i - GNC_{average})^2}{n}}$ (6.4)

For both cross-sections, this produces an open number sequence pivoting on zero. Second, change in connectivity is first measured by comparing both standardized global network connectivity $SGNC_a$:

$$CC_a = SGNC_{a(2008)} - SGNC_{a(2000)} \quad (6.5)$$

And, third, for analysis of the distribution of change, CC_a is further standardized to obtain our standardized measure of connectivity change SCC_a, which is defined as:

$$SCC_a = \frac{(CC_a - CC_{average})}{\sigma_{cc}} \quad (6.6)$$

where $CC_{average} = \frac{\sum_i CC_i}{n-1}$ (6.7)

and $\sigma_{GNC} = \sqrt{\frac{\sum_i (CC_i - CC_{average})^2}{n}}$ (6.8)

This leaves us with the conceptual problem of market saturation (see also Orozco-Pereira & Derudder, 2010). Figure 6.5 presents a scatter plot in which the Y axis represents SCC in the period 2000-08 and the X axis GNC in 2000 for each of the 132 cities.

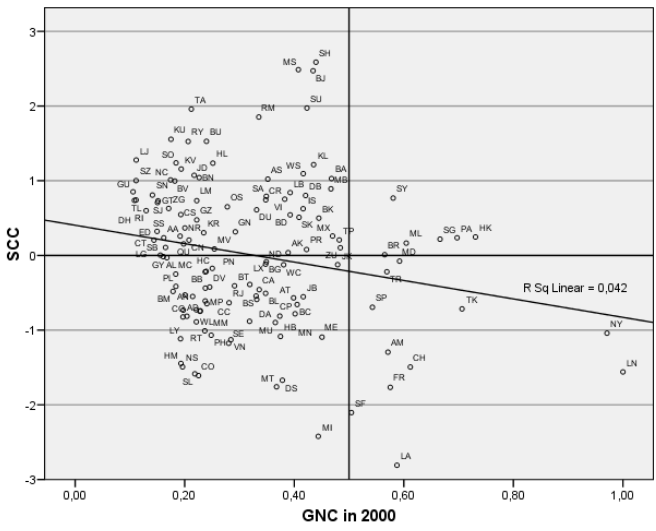

Figure 6.5 GNC in 2000 versus and SCC in 2000-2008 for 132 cities

While the figure provides an immediate and compelling picture of the most upwardly and downwardly mobile cities, it also shows that there is indeed a small but statistically significant negative correlation (r = -0.21) between both indicators. The straightforward solution to the ensuing interpretation problem is to use the standardized residuals from this regression $SRESID_a$ as our actual measures of change. In other words, $SRESID_a$ measures can be understood as the actual level of SCC after accounting for the possible underestimation of change in major service centres because of small but statistically significant processes of market saturation.

This double transformation of GNC_a change into $SRESID_a$ measures produces an open number sequence pivoting on zero. Figure 6.6 plots the distribution of $SRESID_a$, which conforms to a standard normal distribution in that its average is 0, its standard deviation equals 1, while the application of a Kolmogorov-Smirnov test reveals that this distribution can indeed be considered as a normal distribution. As a consequence, $SRESID_a$ can basically be understood as a z-score, which implies that the measures can be interpreted as such (e.g., cities with an absolute value of $SRESID_a \geq 2$ have witnessed exceptional connectivity change). However, it needs to be emphasized that $SRESID_a$ needs to be interpreted as a *relative* measure (i.e. relative vis-à-vis the entire distribution): it is possible that, in the face of an overall rise of connectivity in the WCN, a city that has been gaining in connectivity in recent years has a negative $SRESID_a$ value because other cities in the distribution have – on average – been gaining more connectivity (after taking into account the effect of the initial level of connectivity in 2000). Referring back to the Chicago example, for instance, this implies that the city will have a fairly substantial negative value for $SRESID_a$ despite retaining the same overall level of connectivity.

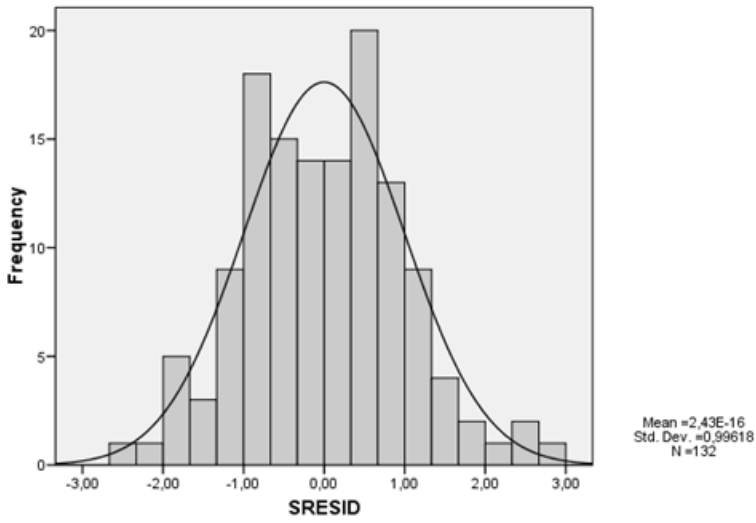

Figure 6.6 SRESID for 132 cities in 2000-2008

Using the transformed measurements for 2000 and 2008 as input to the model allows for straightforward assessments of change in the WCN between 2000 and 2008. Figure 6.7 and Table 6.3 summarize the changing geography of global urban connectivity through this standardized measurement of change. Figure 6.7 plots the $SRESID_a$ of cities in their approximate geographical position, while Table 6.3 features the 10 cities that have witnessed the largest changes (both positive and negative).

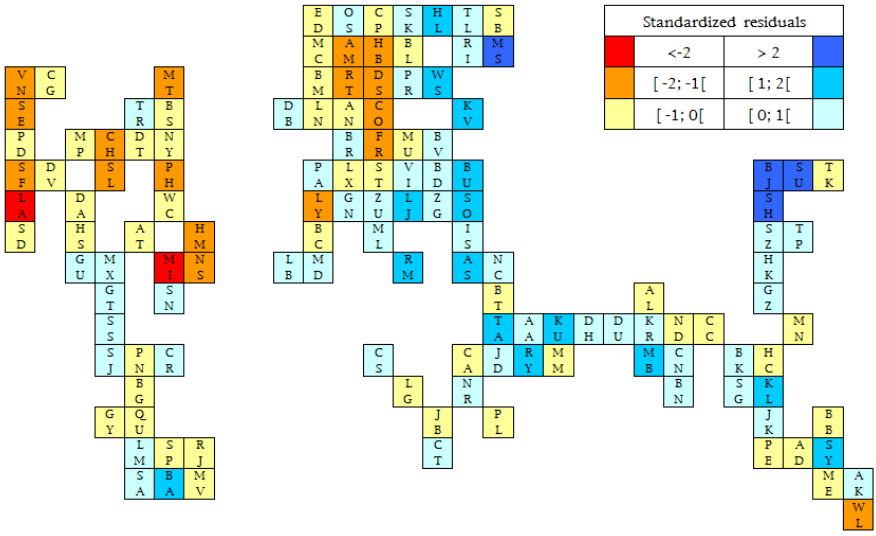

Figure 6.7 Standardized residuals for 132 cities in 2000-2008

Table 6.3 Major positive/negative values of SRESID in 2000-2008

Major negative changes		Major positive changes	
Los Angeles	-2.52	Shanghai	2.76
Miami	-2.31	Beijing	2.64
San Francisco	-1.91	Moscow	2.62
Cologne	-1.76	Seoul	2.12
St Louis	-1.74	Rome	1.89
Montreal	-1.73	Tel Aviv	1.84
Nassau	-1.68	Bucharest	1.44
Hamilton	-1.63	Riyadh	1.39
Düsseldorf	-1.63	Kuwait	1.38
Frankfurt	-1.48	Kuala Lumpur	1.37

With this standardized measurement summarized in Table 6.3 and Figure 6.7, the relative decline of Western European, Australasian and especially North American cities becomes very clear, with not a single city in the latter region keeping up with

change in the rest of the distribution in general and Pacific Asia in particular: the 10 cities with the largest relative connectivity decline are all located in Northern America and Germany (plus Hamilton and Nassau as offshore banking centres). In addition to the substantive interpretation of this pattern being an overall indicator of the 'reOrientation' of the global economy, there is also another – and perhaps less gloomy – possible reading of this trend. That is, it is simply possible that cities with long established service offices in Western Europe and Northern America are declining relatively (= standing still in comparison with the rest of the world) while other parts of world are catching up (see the Chicago example). Moreover, the USA is a special case with its cities already being reported as under-represented in the world city network in 2000 (Taylor & Lang, 2004) and 2004 (Taylor & Aranya, 2008). The 2008 results show a continuation and perhaps even an accentuation of this trend. This may in part be a result of the US home market for advanced producer services being far greater than for any other country, which has two key effects. First, foreign firms find it hard to penetrate the market and tend to represent clients through just a New York office. Second, US service firms have less reason to gamble on global expansion – compare a large Chicago company with a large Seoul company: the former can make better profits through domestic expansion; the latter can only expand through new cross-border work.

Shanghai and Beijing have witnessed the most substantial connectivity gains in the period 2000-2008. Although perhaps not surprising, this is in a way an important finding: although *all* cities in Pacific Asia in general and China in particular have become more connected in the period under investigation, size does seem to matter in that especially the major cities in this region have become the principal gateways for the channelling of transnational flows of capital, goods, knowledge and people (see also the connectivity gains of Moscow in the context of the Former Soviet Union). China's evolution towards capitalism has been fast but in a way also gradual through the continuing imprint of the Party-state, resulting in a state-led transformation of the economy towards a unique variety of capitalism (see Ma, 2002, 1546). Within this context of enduring state-control, these results support the idea that China is now being opened up not only through the well-established gateway of Hong Kong, but also through Beijing and Shanghai. The latter cities are thereby developing along complementary lines, respectively as a political centre and as the mainland's premier business and financial centre (see Lai, 2009).

6.5 Conclusions

This paper has employed a network model of intercity relations based on advanced producer service firms 'interlocking' world cities through their worldwide distributions of offices. Based on data on the location strategies of producer services firms in 2000 and 2008, we have highlighted the major changes that have been taking place in the WCN during this time period. A little thought might lead to the idea that these findings are not actually very surprising: what makes New York and London so important in the world economy is their distinctiveness as massive global service centres, while the rising connectivities of Shanghai and Beijing are in line with commonsensical

expectations. But such reasoning remains conjecture, to be convincing such a notion needs empirical verification in a broad comparative study. The value of the measurement exercise described here is that it can make such verification possible. In conclusion, we have tried to enhance insight into globalization through the depiction of the changing geography of the world city network. Very much in the spirit of a number of other papers in this special issue (e.g. Alderson et al., 2010; Matthiessen et al., 2010; Mahutga et al., 2010; Pirie, 2010), we have not restricted 'globalization forces' to just a limited set of 'world cities' but have incorporated a very large number of cities into a single global urban analysis. Contemporary globalization is not an end-product in itself but an on-going bundle of processes. We cannot know what future scenario will come to pass but we do know that we will not be able to assess such changes unless we have a good empirical understanding of the contemporary world city network.

When garnering the data for 2008, we obviously could not fully realize that this research was generating *instant history*. Given the usual lag time of about one year from preparing and carrying out data collection to the beginning of analyses, it seemed a reasonable assumption that we would have the latest, up-to-date results on the shape of the world city network. But much has happened since the new GaWC data were collected in the first half of 2008: place-based public finance has had to come to the rescue of network-based private finance. The nationalization (part, full or implicit) of financial services firms has brought territories and their boundaries back to the centre stage of the world economy at the expense of networks and their flows. Put another way, the relations between cities and states have seemingly been readjusted in the latter's favour. Neo-liberal globalization may be collapsing but firms operating through global spaces of flows have not been eliminated; we cannot now know what form this emerging globalization will take. So what we have been presenting here are the latest but not up-to-date results on the world city network. This can be interpreted as measurement of the world city network *prior to the effects of the current geoeconomic transition being realized*: it is the ‘before' position to be compared to subsequent research on the ‘after' position in, say, 2010 (Taylor et al., 2009a).

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7 The changing geography of globalized service provision, 2000-2008

Hanssens, H., Derudder, B., Taylor, P.J., Hoyler, M., Ni, P., Huang, J., Yang, X. and Witlox, F. (2011) The changing geography of globalized service provision, 2000-2008. The Service Industries Journal 31 (14), in press.

7.1 Abstract

This is an empirical paper mapping changes in the global geography of advanced producer service provision across major cities in the period 2000-8. The analyses are based on a systematic assessment of geographical shifts in the office networks of leading firms in finance, management consultancy, accountancy, advertising and law using measures of inter-city connectivity. It has been previously shown that there has been a general shift of these services from 'West to East'. In this paper variations in the degree and pattern of this global shift among the different sectors are described and interpreted. The results point to an inherent complexity in economic globalization that is sometimes overlooked in general descriptions of the meta-process.

7.2 Introduction

This is an empirical paper that draws on the network model devised by the Globalization and World Cities research group (GaWC, http://www.lboro.ac.uk/gawc) to map changes in the urban geography of globalized service provision in the period 2000-8. In GaWC research, cities are not simply deemed to be service centres because they 'contain' a lot of service firms. Rather, starting from the observation that service provision is now transnationally organized through myriad interactions within the organization structure of major service firms, the position of cities is assessed through a model that provides a systematic appraisal of *intra-firm flows in globalized producer services firms*.

A first major application of the GaWC model was the measurement and subsequent empirical analysis of network formation amongst service centres in the year 2000 (Derudder et al., 2003; Taylor et al., 2002a, 2002b, 2004). These analyses were based on information on the (importance of the) presence of 100 leading advanced producer services (APS) firms in 315 cities for the year 2000. In 2007, GaWC joined forces with the Global Urban Competitiveness Project (GUCP) at the Chinese Academy of Social Sciences (CASS) to carry out a new large-scale data collection exercise for 2008 (Taylor et al., 2009a, 2009b). In the first half of 2008, GaWC/GUCP garnered information on 175 office networks of APS firms across 526 cities. This means that we have comparable cross-sectional snapshots of the organization of globalized service firms in 2000 and 2008.

By assessing the shifting position of cities in this time period, Derudder et al. (2010) provide a preliminary insight in the changing geographies of globalized service provision. The authors point to the relative decline of Western European, Australasian and especially North American cities, and the relative rise of South Asian, Chinese and Eastern European cities (Shanghai, Beijing, Seoul and Moscow in particular). However, in that paper cities were approached as general service centres in that information on different service sectors was aggregated. As a consequence, it remains unclear if and how different sectors have globalized along different geographical lines. In this paper, we systematically examine geographical shifts in the office networks of major service firms at the sectoral level (management consultancy, finance, advertising, accountancy, law), which allows us to obtain a more nuanced understanding of the ongoing globalization of service provision through major cities.

The remainder of this paper is organized in three main sections. First, the paper provides a brief summary of the GaWC model, i.e. its conceptual rationale, specification and data requirements. Second, we briefly describe the data collections in 2000 and in 2008, followed by an overview of the way in which these data were transformed in order to coherently measure changes in service provision. Third, we discuss change for each of the sectors in the data at the network and the city level respectively. The paper is concluded with an overview of our major findings and some avenues for further research.

7.3 Specification of the GaWC Model

CONCEPTUAL RATIONALE

Drawing on Saskia Sassen's (1995, 2001) work on place and production in an increasingly globalized economy, GaWC has undertaken a theoretically grounded endeavour of data acquisition for measuring WCN-formation. Sassen's research emphasizes the self-accelerative transformation of the economic bases of cities from manufacturing to business services. Unable to cope with the accelerated pace of structural change and the increasing pressure for product innovation on their own, both manufacturing and service industries are becoming more and more dependent on the customized knowledge, expertise and skills provided by specialized business services such as financial services, accountancy, management consultancy, advertising, etc.

It is now well established that many of these business service firms have increasingly become large multinational firms as they have been looking for a presence in an international market to service existing clients and find new ones (see Daniels & Moulaert, 1991; Aharoni, 1993; Edvardsson et al., 1993; Leslie, 1995; Roberts, 1999; Aharoni & Nachum, 2000; Warf, 2001; Harrington & Daniels, 2006; Daniels, 2007). Business service firms have always clustered in cities to provide such services to their clients (see, however, Harrington & Campell, 1997), but under conditions of contemporary globalization, multiple offices are required in major cities around the world to provide a seamless service.

Obviously, each firm has its own location strategy – which cities to have offices in, what size and functions those offices will have, and how the offices will be organized. It is the work done in these offices that 'interlocks' various cities in projects that require multiple office inputs. Thus the inter-city relations in these servicing practices are numerous electronic communications – information, instruction, advice, planning, interpretation, strategy, knowledge, etc., some teleconferencing as required, and probably travel for face-to-face meetings at a minimum for the beginning and end of a given project. These are the working flows that combined across numerous projects in many firms to constitute the relations between globalized service centres specified as an interlocking city network in GaWC research (Taylor, 2001, 2004).

MODEL SPECIFICATION

The GaWC specification of the network of globalized service centres can be formally represented by a matrix V_{ij} defined by n cities x m firms, where v_{ij} is the 'service value' of city i to firm j. This service value is a standardized measure of the importance of a city to a firm's office network, which depends upon the size and functions of an office or offices in a city. The global network connectivity GNC_a of city a in this interlocking network is defined as follows:

$$GNC_a = \sum_{i,j} v_{aj} \cdot v_{ij} \text{ (a} \neq \text{i)} \qquad (7.1)^1$$

The conjecture behind conceiving the product of service values as a surrogate for actual flows of inter-firm information and knowledge between cities is that the more important the office, the more connections there will be with other offices in a firm's network[2]. The limiting case is a city that shares no firms with any other city so that all of its service value products in equation (7.1) are 0 and it has no connectivity.

In previous GaWC research, GNC measures were based on an aggregation of the connectivities of firms from different sectors (see, however, Hoyler et al., 2008, for a sectoral mapping of connectivities for one city-region). In this paper, connectivity in the office networks of service firms will be measured at the sectoral level. Thus a city's overall GNC_a will be disaggregated into 'sectoral network connectivities' $SNC_{a,sector}$. For instance, $SNC_{London,accountancy}$ represents London's connectivity in the office networks of leading accountancy firms.

7.4 Data and methodology

DATA COLLECTIONS IN 2000 AND 2008

Precise specification guides the data collection: data are required on the city office networks of large professional, financial and creative service firms. These exercises in data collection are described in detail in Taylor et al. (2002a) for the year 2000 and in Taylor et al. (2009b) for the year 2008, and will be summarized here as they are the inputs to our subsequent analysis.

In 2000, global APS firms were defined as firms with offices in 15 or more different cities, including at least one in each of the prime globalization regions: northern America, Western Europe and Pacific Asia. Firms meeting this criterion were selected from rankings of leading firms in different service sectors. In the event 100 firms were identified in six sectors: 18 in accountancy, 15 in advertising, 23 in banking/finance, 11 in insurance, 16 in law, and 17 in management consultancy. Selecting cities was much

[1] Our approach implies that any given city's connectivity can change because of two reasons: (i) directly because an APS firm's presence in this city in and by itself changes (e.g., a firm moving into the city or upgrading the status of its office(s) will boost a city's connectivity because it now has more or more important connections across the world); but also (ii) indirectly because an APS firm's presence in other cities has changed (e.g., a larger number of offices of a given firm in other cities will increase a city's connectivity if the firm is present there because it now has more connections across the world).

[2] This rather tentative basic assumption in WCN research has been repeatedly criticized as it tends to oversimplify the complex and diverse nature of the organizational architectures of international APS firms (see for instance Dicken & Malmberg, 2001; Jones, 2002; Lambregts, 2008). Although it is probably fair to assume that the GaWC methodology is adequate enough to capture the large patterns of change in the geography of global service provision as the use of large data sets will somewhat iron out such idiosyncrasies, the results should nevertheless be interpreted with the necessary caution. Moreover, as one of the referees aptly pointed out, the WCN approach would surely benefit from parallel primary research testing this basic assumption, even if this research only involves a small sample of the entire set of leading APS firms.

more arbitrary and was based upon previous GaWC experience in researching global office networks. Capital cities of all but the smallest states were included plus many other important cities in larger states, which resulted in a list of 315 cities.

In 2008, we carried out a much larger and complete data collection. To allow for future comparisons of city connectivities over time, a certain consistency in the data structure is required. The dynamic nature of the global economy, however, implies that the relevance of invoking the geography of the office networks of the initial GaWC 100 APS firms becomes increasingly problematic as time passes. Firms get liquidated, merge with other firms, are replaced by new firms whose global presence/importance rises, etc. Since measurement of differences should represent changing urban geographies rather than data collection change, APS firms were now chosen strictly by their ranking in lists of the largest firms in each sector. Overall, the number of firms was increased from 100 to 175. We combined the banking/finance and insurance categories from 2000 and included the top 75 such firms as ranked in the Forbes composite index, a measure that combines rankings for sales, profits, assets and market value lists. For the other four of the previously studied services – accountancy, advertising, law and management consultancy – we included the top 25 firms: for law the Chambers list of Corporate Law firms was used (www.chambersandpartners.com/global); for advertising agency networks we used Advertising Age's ranking of 'marketing organizations' by revenues (www.adage.com/images/random/lna2007); for accountancy firms' networks we used the ranking by revenues of World Accounting Intelligence (www.worldaccountingintelligence.com); and for management consultancies we used the 2007 edition of the Vault Management & Strategy Consulting Survey, which ranks firms in terms of their 'prestige' based on a large survey of professionals (www.vault.com). In all cases the lists of firms selected are the latest available at the planning of the research project in 2007 and these tended to be based upon 2006 rankings[3]. For all lists substitute firms were identified (ranked just below 75 and 25) to cover for situations where a firm had disappeared (e.g. been taken over) in the two years before the actual data collection in 2008. In addition, we carried out a thorough review of cities and added many new cities from emerging markets to create a list of 526.

In both data gatherings, assigning service values to city/firm-pairs focused on two features of a firm's office(s) in a city as shown on their corporate websites: first, the size of the office (e.g. number of practitioners), and second, their extra-locational functions (e.g. regional headquarters). Information for every firm was simplified into service values v_{ij} ranging from 0 to 5 as follows. The city housing a firm's headquarters was scored 5, a city with no office of that firm was scored 0. An 'ordinary' or 'typical' office of the firm resulted in a city scoring 2. With something missing (e.g. no partners in a law office), the score reduced to 1. Particularly large offices were scored 3 and

[3] There was no way to overcome this two year delay: one year was because planning the project takes time and the second year was because of a one year time lag in reporting such data. Thus although the actual data gathering took places in 2008, the selection of firms is based on 2006 rankings.

those with important extra-territorial functions (e.g. regional headquarters) scored 4. All such assessments were made firm by firm.

To measure the changing position of cities in the office networks of service firms, we computed sectoral network connectivities (SNC) for each of the five sectors in 2000 and 2008. From the 307 cities that feature in both datasets, we only retained the 132 cities that have a GNC of at least one fifth of the most connected city in either 2000 (London) or 2008 (New York) – see Derudder et al. (2010). Obviously this is an arbitrary cut off point, but it allows for a large number of cities that are distributed across all parts of the settled world while at the same time excluding idiosyncratic results (i.e. city connectivities based on the presence of a limited number of firms). To allow for consistency in the interpretation of change in SNC, we (i) computed cities' SNC's vis-à-vis the other 131 cities only and (ii) express connectivities as proportions of the largest computed connectivity in each sector to iron out the effect of the larger number of firms in 2008 (thus creating a scale from 0 to 1 for each of the SNC measures). These SNC measures for 2000 and 2008 are the input to our analyses of change at the network and the city level.

MEASURING CHANGE

First, we measure change in the network at large. Because no single measure can unambiguously capture the direction, degree and form of change in the network, we combine two sets of indicators:
The most straightforward assessment of change at the network level is based on an appraisal of *changes in the central tendency of the SNC distributions* through changes in the average value of the distributions, and this in combination with the percentage of cities that have become more connected to the network (rising averages and percentages >50% point to rising levels of connectivity).

To assess the *changing shape of the SNC distributions*, we compute changes in two basic indicators regarding the form of the distribution, i.e. standard deviation (declining values point to increasing convergence around the mean and) and skewness (all distributions are positively skewed, and rising values point to a more 'asymmetrical' distribution).

A comprehensive appraisal of change at the network level needs to combine both sets of indicators *and* the different measurements within both groups. For instance, rising average values can in principle be associated with fewer than 50% cities with rising connectivities if a limited number of nodes experience large connectivity gains in the face of slightly declining connectivity in the rest of the network. Furthermore, rising averages can result in very different evolutions in the shape of the distributions (e.g. the distribution can become either more or less 'spread out' or 'asymmetrical' as a result), while declining levels of skewness may be associated with either convergence around the mean or spreading out of connectivity over the distribution, etc. Obviously, other indicators are possible (e.g. median value and kurtosis), but when considered

together these indicators allow for a fair appraisal of some of the overarching changes in the office networks of leading service firms for the different sectors.

Second, we computed a measure of change that allows for a straightforward interpretation of changing service provision at the city level. This measure of SNC change at the city level is based on a two-step transformation of the data. Such a double transformation was deemed necessary because neither changes in rank nor absolute change in SNC are well-suited for this purpose: the different SNC distributions are essentially closed number systems that distort the measurement of change. For instance, however much more connected it becomes, the leading city cannot show additional connectivity through its SNC measure of unity. In more general terms, there is a problem of possible underestimation of change at the higher ends of the scale. This problem consists of two components: (i) a measurement problem in that higher ranked cities have less leeway to increase their sectoral connectivity because they are nearer the limit of the measurement scale (i.e. a city with a SNC of 0.95 can only increase its connectivity with 0.05) and (ii) a conceptual problem in that the markets of higher ranked cities are closer to saturation in that they have less leeway to acquire more/larger/more important offices (i.e. a city where all major service firms have a major office can hardly become more important in the office networks of these firms). Therefore, an alternative way of measuring change is required.

The measurement problem is tackled by generating standardized measures of sectoral connectivity change SSCC (see Taylor & Aranya, 2008). These SSCC measures are computed by (i) standardizing connectivities in 2000 and 2008 (through z-scores), followed by a (ii) standardization of the 2008-2000 difference (again through z-scores). This produces an open number sequence pivoting on 0 with a standard deviation of 1.

This leaves us with the conceptual problem, which can be read from the fact that for each of the sectors there is a small but significant negative correlation between SNC in 2000 and SSCC in the period 2000-08 (see Orozca-Pereira & Derudder, 2010). As an example, Figure 7.1 shows the small but statistically significant relation between both indicators for the management consultancy sector. The negative trend ($r = -0.23$), pointing to saturation processes, is clearly visible[4]. The straightforward solution to this second problem is to use the standardized residuals from the regression SRESID as our actual measures of change. These figures can be understood as the actual level of SSCC after accounting for the possible underestimation of change in major service centres because of small but statistically significant processes of market saturation. Once again, and as can be seen in Figure 7.2, the standardized residuals have a standard normal distribution (average = 0, standard deviation = 1, Kolmogorov-Smirnov-test points to a normal distribution), which implies that the change measures at the city level can be interpreted as z-scores (e.g. change > +2 or < -2 means 'exceptional change' in statistical terms).

[4] This effect is present in all sectors, with correlations ranging between -0.41 for the sector accountancy and -0.17 for the law sector. Each of the correlations is significant at the 0.01 level, except for the financial services sector and the law sector, where the correlation is significant at the 0.05 level.

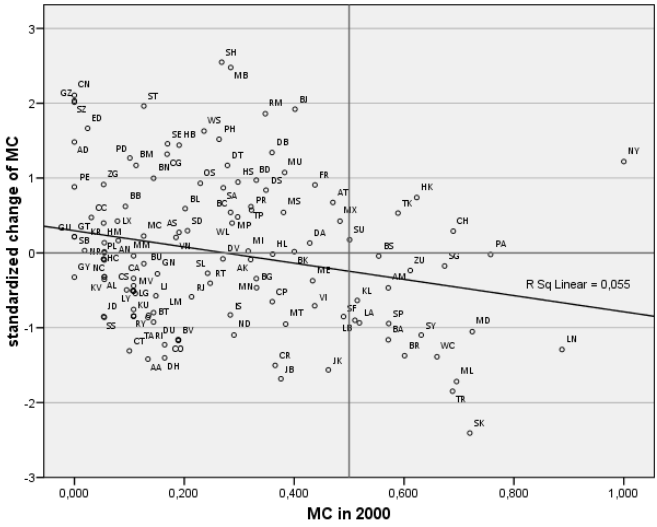

Figure 7.1 Negative correlation between the SNC in 2000 and the SSCC 2000-08 for the management consultancy sector

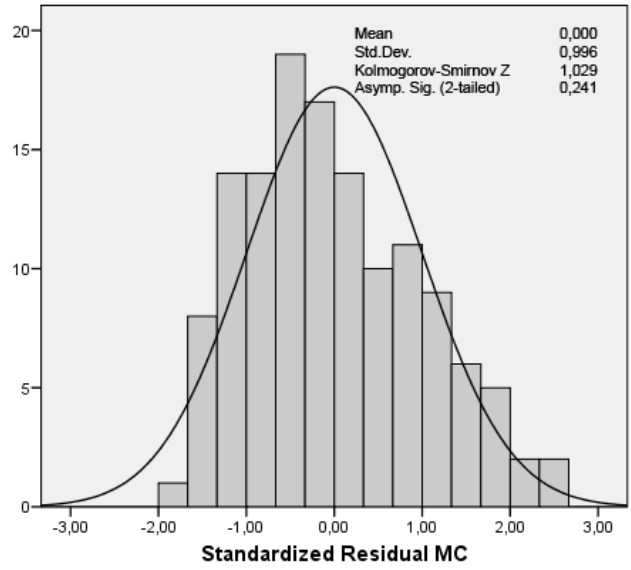

Figure 7.2 Standard normal distribution of the standardized residuals for the management consultancy sector

7.5 Results: changes in globalization service provision

CHANGES AT THE NETWORK LEVEL

Table 7.1 summarizes the results of the different (sets of) indicators for measuring connectivity change at the network level. The first two measures summarize changes in the central tendency of the distribution; the following two indicators show changes in the shape of the distribution.

According to our analysis, the office networks of leading firms in the financial services, accountancy and advertising sectors have been characterized by clear-cut expansion in the period 2000-8[5]. This increased connectivity is especially discernible in the advertising sector. The office networks of management consultancy firms, in turn, have on average lost connectivity in the period 2000-8, while law firms show a mixed pattern in that the rising average connectivity is matched by more cities exhibiting declining than increasing connectivities. As we will see below, this mixed pattern can in part be attributed to the fact that a limited set of cities (i.e. Shanghai, Beijing, Dubai, Madrid, Paris and Antwerp) have witnessed sizable connectivity gains in the office networks of law firms in the face of overall stagnation in the geographical expansion of these networks.

The connectivity distributions of the different sectors have changed along quite different lines. For law and accountancy, standard deviations have remained largely unchanged, while those of the advertising and financial services sectors have increased. The latter implies that the overall distribution has become more 'stretched out' as more cities have become either less or more connected than the average value. Connectivities for the management consultancy sector, in turn, have converged around the mean value. When considered alongside the declining skewness of the distribution (and the stagnation of the connectivity of most cities through the office networks of leading management consultancy firms), this clearly points to a levelling out or, given the central tendency results, a stalling of the globalization of this sector. And finally, the skewness of the financial services and law sector has remained largely unchanged, while the advertising and accountancy distributions have become significantly less skewed. This shows that whereas the former services have largely remained active in a given set of cities, in advertising and accountancy the importance of these services have spread to rather more cities in 2008.

[5] A non-longitudinal, cross-sectoral comparison unsurprisingly shows that the law sector and the accountancy sector are characterized by the least and most integrated office networks, respectively. Thus while the office networks of leading accountancy firms cover most leading cities in the world, the networks of law firms are far more concentrated in a limited number of cities.

Table 7.1 Changes at the network level per sector (132 cities)

		ACC	ADV	FS	LAW	MC
Central tendency	Average of SNC	2000: 0.403 2008: 0.428 Diff: 0.025 = 6%	2000: 0.295 2008: 0.351 Diff: 0.056 = 19%	2000: 0.301 2008: 0.316 Diff: 0.015 = 5%	2000: 0.130 2008: 0.132 Diff: 0.002 = 1.7%	2000: 0.274 2008: 0.265 *Diff: -0.009* *= -3.1%*
	Percentage of cities more connected to the network in 2008	58%	70%	52%	*36%*	*44%*
Changing shape	Standard deviation of SNC	2000: 0.131 2008: 0.139 Diff: 0.008	2000: 0.163 2008: 0.206 Diff: 0.043	2000: 0.197 2008: 0.235 Diff: 0.039	2000: 0.191 2008: 0.183 *Diff: -0.008*	2000: 0.217 2008: 0.188 *Diff: -0.029*
	Skewness of SNC	2000: 0.974 2008: 0.628 *Diff: -0.346*	2000: 0.676 2008: 0.233 *Diff: -0.442*	2000: 0.992 2008: 0.972 Diff: *-0.020*	2000: 2.150 2008: 2.160 Diff: 0.010	2000: 0.894 2008: 0.707 *Diff: -0.187*

CHANGES AT THE CITY LEVEL

Figures 7.3-7.7 illustrate the geography of the standardized residuals SRESID of the 132 cities for each of the service sectors. Each of the figures is a cartogram that places cities in their approximate geographical locations, whereby cities are indicated through a meaningful two letter code (e.g. NY is New York). These visualizations are complemented by Table 7.2 which lists the top and bottom ten cities ranked by standardised residuals for each sector. These lists provide specific details of where city connectivities are growing strongly and where they are relatively in severe decline.

Table 7.2 Major positive and major negative standardized residuals per sector

Accountancy		Advertising		Financial services	
Beijing	2.40	Moscow	2.37	Moscow	2.81
Shanghai	1.95	Bangkok	1.85	Seoul	2.39
Tel Aviv	1.87	Shanghai	1.81	Shanghai	2.33
Seoul	1.74	Riyadh	1.81	Dubai	1.98
Kuala Lumpur	1.67	Paris	1.73	Beijing	1.96
Kuwait	1.66	Stockholm	1.64	Sydney	1.92
Hong Kong	1.65	Dubai	1.59	Doha	1.91
Singapore	1.63	Dublin	1.48	Stockholm	1.82
Sydney	1.60	Warsaw	1.47	Lima	1.68
Bucharest	1.49	Jeddah	1.46	Tel Aviv	1.54
Munich	-1.40	Houston	-1.38	St Louis	-1.30
Miami	-1.50	Philadelphia	-1.51	Miami	-1.43
Nassau	-1.52	Vancouver	-1.54	Philadelphia	-1.49
Birmingham	-1.52	Detroit	-1.72	Seattle	-1.53
Minneapolis	-1.53	Melbourne	-1.72	Barcelona	-1.81
Hamilton	-1.89	Calcutta	-1.92	Los Angeles	-1.82
Los Angeles	-1.90	Frankfurt	-1.95	San Francisco	-2.00
St Louis	-1.93	Calgary	-2.18	Berlin	-2.03
Lyon	-1.95	Montreal	-2.89	Hamburg	-2.37
Cologne	-2.06	Miami	-2.89	Düsseldorf	-2.73

Law		Management Consultancy	
Shanghai	3.27	Shanghai	2.59
Madrid	3.09	Mumbai	2.54
Beijing	2.95	Beijing	2.10
Paris	2.93	New York	2.05
Dubai	2.14	Rome	1.98
Antwerp	2.11	Chennai	1.85
Moscow	1.63	Stuttgart	1.84
Vienna	1.62	Shenzhen	1.77
Milan	1.54	Guangzhou	1.75
London	1.33	Warsaw	1.62
Rotterdam	-1.26	Bratislava	-1.29
Manama	-1.34	Riga	-1.37
Johannesburg	-1.51	Jakarta	-1.39
Denver	-1.52	Toronto	-1.43
Hong Kong	-1.59	Caracas	-1.43
Kiev	-1.60	Cape Town	-1.53
Almaty	-1.63	Doha	-1.55
Ho Chi Minh City	-1.88	Amman	-1.60
Singapore	-2.43	Johannesburg	-1.60
Berlin	-2.85	Stockholm	-1.96

Figure 7.3 depicts the geographical distribution of the standardized residuals for the accountancy sector. It clearly shows a relative connectivity decline for nearly all North American and most of the Australasian and Western European cities, with Cologne experiencing the largest decrease. New York and – even to a larger extent – London and Brussels are notable exceptions to this overall trend. Because these measures are controlled for possible effects of market saturation, this suggests that these massive service centres still have considerable leeway for connectivity growth despite already being well-connected. Latin American and South and East European cities have evidently increased their connectivity. The same holds for the South-East Asian and Chinese cities, with Beijing having experienced the largest connectivity gain (Table 7.2).

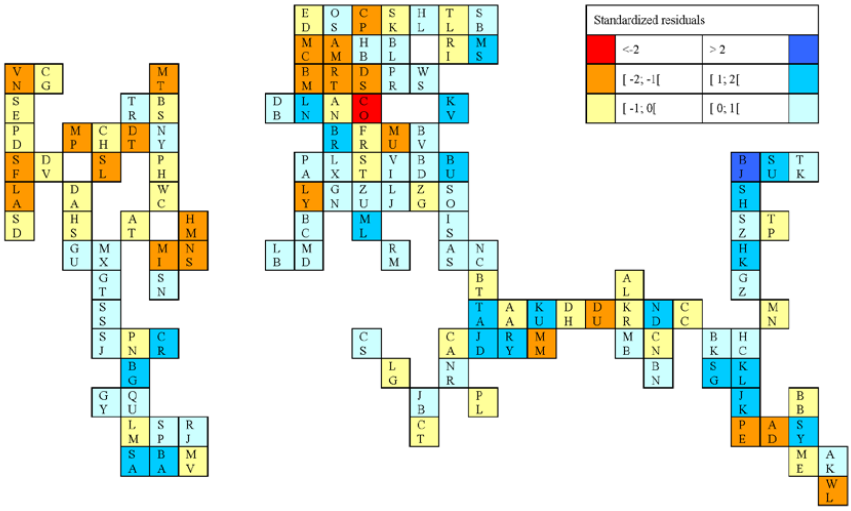

Figure 7.3 Standardized residuals for 132 cities for the sector accountancy

Figure 7.4 summarizes the geographical distribution of the standardized residuals for the advertising sector. In general terms, the patterns discernible for the accountancy sector re-emerge: declining connectivities for North American, Australasian and (some) West European cities, and increasing connectivities for South-East Asian and particularly for East European cities, with Moscow sporting the largest connectivity growth (Table 7.2). For this sector, the connectivity change of Latin American cities is less clear-cut, and this in contrast to the service centres in the Middle-East where Riyadh, Dubai, and Jeddah are amongst the cities with the largest connectivity growth. Miami, Montreal, and Calgary, all North American cities, have declined most in this sector, while New York and especially London and Frankfurt have also experienced connectivity losses.

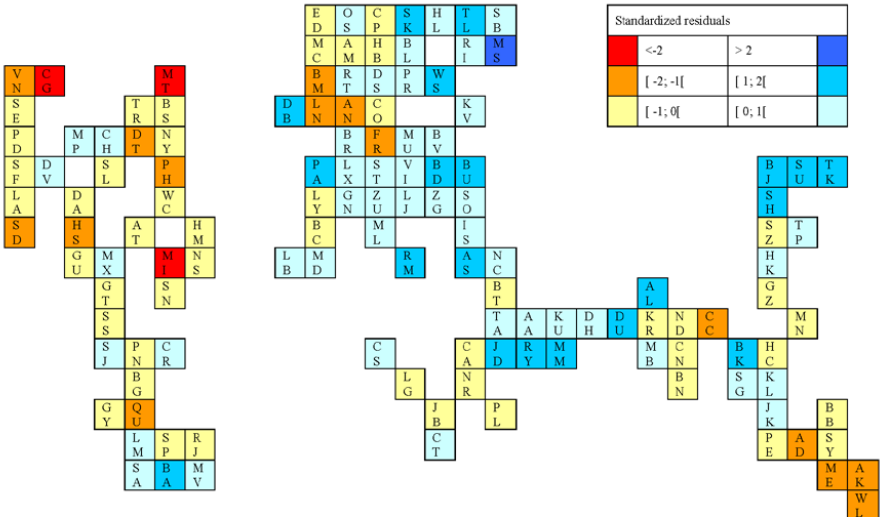

Figure 7.4 Standardized residuals for 132 cities for the sector advertising

The geographical distribution of the standardized residuals for the financial services sector is depicted in Figure 7.5. Dusseldorf, Hamburg, and Berlin are amongst the worst performing cities in the financial services network, and a majority of North American cities such as San Francisco follow this negative trend. With the exception of Budapest, most East European cities have experienced positive connectivity changes as leading banks have extended their office networks to these cities. Moscow is again the city with the largest connectivity growth, in addition to fast growing East Asian cities such as Seoul, Shanghai, and Beijing. Sydney, which seems to benefit from its strong ties to these East Asian cities, has experienced the sixth largest connectivity gain overall (Table 7.2).

Compared to the previous three sectors, the geographical distribution of the standardized residuals for the law sector shows a rather different picture featuring more intra-regional variety (Figure 7.6). The relative connectivity decline of North American cities is less obvious here. San Diego and Boston have been doing relatively well, and this in contrast to Los Angeles, Denver and Montreal. The same mixed pattern can be found in Western Europe, albeit that a majority of cities has experienced increasing network connectivities. Madrid, Paris, Antwerp, Milan, and London are even amongst the ten cities with the largest connectivity growth (Table 7.2). East European cities, and particularly Saint Petersburg, Kiev and Budapest on the other hand, have experienced connectivity declines, and this in contrast to Bucharest, Sofia, and Zagreb. Similarly, the connectivity changes for Chinese and East Asian cities are also far less homogeneous than in previous sectors, with Shanghai and Beijing being amongst the stronger growers and Hong Kong amongst the strongest declining cities in the office networks of leading legal services firms. The measures for Latin American, Middle Eastern, and South Asian cities are rather more straightforward: all

three regions generally experience declining connectivities, with Dubai as the major exception.

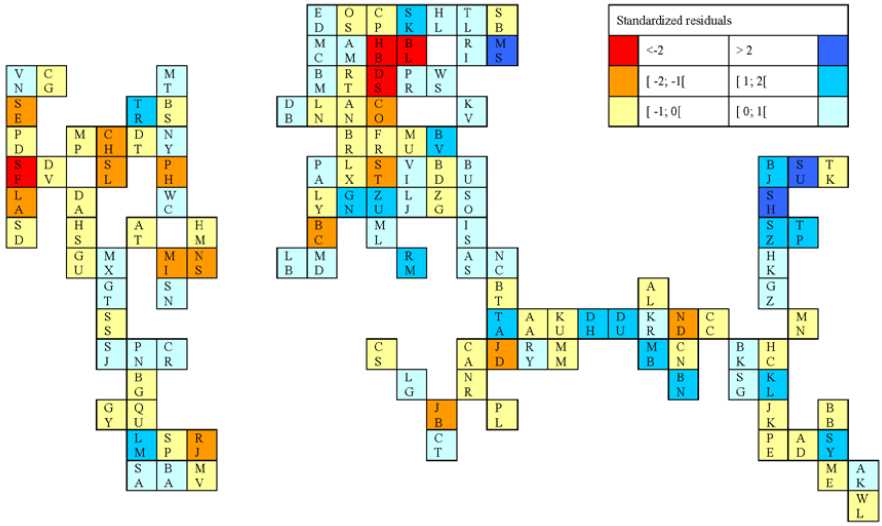

Figure 7.5 Standardized residuals for 132 cities for the sector financial services

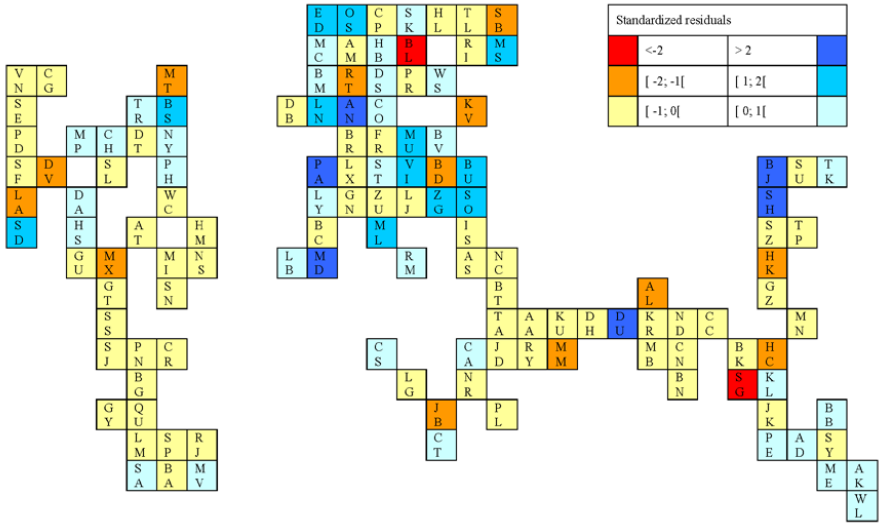

Figure 7.6 Standardized residuals for 132 cities for the sector law

And finally, Figure 7.7 depicts the geographical distribution of standardized residuals for the management consultancy sector. Not unlike the previous sector, cities in Latin America and especially in the Middle East have experienced declining network

connectivities. The obverse is true for East Asian, Chinese and Indian cities. For North America and Eastern and Western Europe, the general tendency is less clear-cut. Indeed, in general, North American cities appear to score relatively well, with New York even belonging to the top five cities with the largest connectivity growth (Table 7.2). The latter may in part be reflective of the fact that the ranking of leading firms in this sector is – more so than the other sectors – dominated by US firms that have gone global, but still retain a strong focus on the US market. In Western Europe, German and English cities also did relatively well (except for London and Cologne). Apart from Warsaw and Budapest, East European cities generally experienced a relative connectivity decline in the management consultancy network.

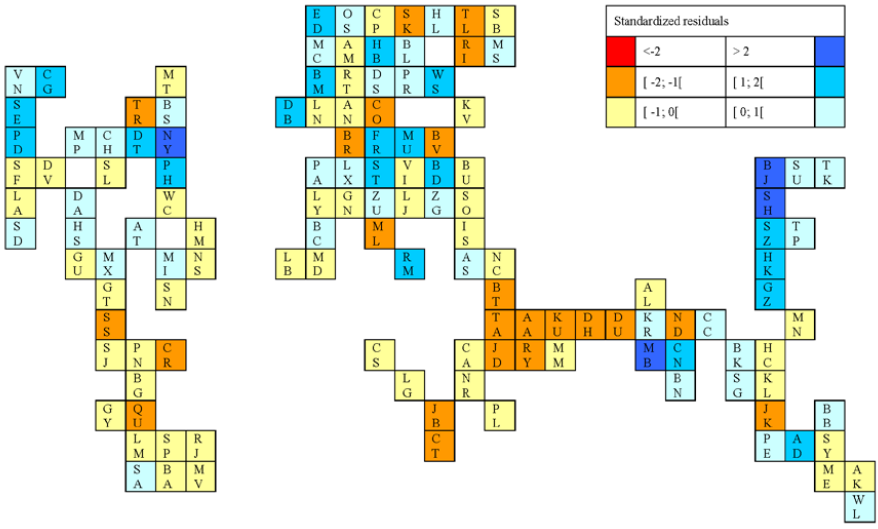

Figure 7.7 Standardized residuals for 132 cities for the sector management consultancy

7.6 Conclusions

This paper has implemented the GaWC network model to measure urban connectivity change for different service sectors in the period 2000-2008. Using information on the location strategies of APS firms gathered in 2000 and 2008 we applied a series of statistical and mapping tools to compute and visualize the connectivity changes for a set of 132 cities in the office networks of accountancy, advertising, financial services, law, and management consultancy firms.

We have shown that there are a number of converging patterns, such as the rising connectivities of Chinese cities in general and of Moscow, Seoul, Beijing and Shanghai in particular, and this alongside the relative decline of the connectivities of North American and West European cities. At the same time, it is also clear that these general tendencies also have a more specific sectoral dimension. For instance, while North American cities have – in relative terms – become less connected in the office networks of leading financial services, some of these cities have managed to increase their connectivity in the office networks of management consultancy firms. In other

words, despite some general patterns in the shifting positions of cities as globalized service centres, we have shown that leading service firms from different sectors have been globalizing along different geographical lines.

Contemporary globalization is obviously not an end-product in itself but an on-going bundle of processes. This important point is especially relevant in the light of the recent financial/economic crisis: when garnering the data before the crisis in early 2008, we obviously could not fully realize that this research was generating 'instant history'. Given the usual lag time of about one year from preparing and carrying out data collection to the beginning of analyses, it seemed a reasonable assumption that we would have the latest, up-to-date results on the shape of the office networks of leading service firms. But much has happened since these data were collected in the first half of 2008, and we cannot know now what form the impact of the financial/economic crisis will have on the office networks of leading service firms. What we have provided in this paper, therefore, is a base line of global service provision on the eve of the crisis. This will be an essential tool for future study of the geographical impact of current ongoing transformations in economic globalization.

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Appendix: List of abbreviations for Figures 6.2-6.5, 6.7 and 7.3-7.7

AA	Amman	DB	Dublin	LN	London	RT	Rotterdam
AD	Adelaide	DH	Doha	LX	Luxembourg	RY	Riyadh
AK	Auckland	DS	Düsseldorf	LY	Lyon	SA	Santiago
AL	Almaty	DT	Detroit	MB	Mumbai	SB	St Petersburg
AM	Amsterdam	DU	Dubai	MC	Manchester	SD	San Diego
AN	Antwerp	DV	Denver	MD	Madrid	SE	Seattle
AS	Athens	ED	Edinburgh	ME	Melbourne	SF	San Francisco
AT	Atlanta	FR	Frankfurt am	MI	Miami	SG	Singapore
BA	Buenos Aires		Main	ML	Milan	SH	Shanghai
BB	Brisbane	GN	Geneva	MM	Manama	SJ	San José
BC	Barcelona	GT	Guatemala City	MN	Manila	SK	Stockholm
BD	Budapest	GU	Guadalajara	MP	Minneapolis	SL	Saint Louis
							Santo
BG	Bogota	GY	Guayaquil	MS	Moscow	SN	Domingo
BJ	Beijing	GZ	Guangzhou	MT	Montreal	SO	Sofia
BK	Bangkok	HC	Ho Chi Minh	MU	Munich	SP	São Paulo
BL	Berlin		City	MV	Montevideo	SS	San Salvador
BM	Birmingham	HK	Hong Kong	MX	Mexico City	ST	Stuttgart
BN	Bangalore	HL	Helsinki	NC	Nicosia	SU	Seoul
BR	Brussels	HB	Hamburg	ND	New Delhi	SY	Sydney
BS	Boston	HM	Hamilton	NR	Nairobi	SZ	Shenzhen
BT	Beirut	HS	Houston	NS	Nassau	TA	Tel Aviv
BU	Bucharest	IS	Istanbul	NY	New York	TK	Tokyo
BV	Bratislava	JB	Johannesburg	OS	Oslo	TL	Tallinn
CA	Cairo	JD	Jeddah	PA	Paris	TP	Taipei
CC	Calcutta	JK	Jakarta	PD	Portland	TR	Toronto
CG	Calgary	KL	Kuala Lumpur	PE	Perth	VI	Vienna
CH	Chicago	KR	Karachi	PH	Philadelphia	VN	Vancouver
CN	Chennai	KU	Kuwait	PL	Port Louis	WC	Washington
CO	Cologne	KV	Kiev	PN	Panama City		D.C.
CP	Copenhagen	LA	Los Angeles	PR	Prague	WL	Wellington
CR	Caracas	LB	Lisbon	QU	Quito	WS	Warsaw
CS	Casablanca	LG	Lagos	RI	Riga	ZG	Zagreb
CT	Cape Town	LJ	Ljubljana	RJ	Rio de Janeiro	ZU	Zurich
DA	Dallas	LM	Lima	RM	Rome		

PART 3 ASSESSING THE RELEVANCE OF GAWC'S SELECTION OF APS FIRMS AND WORLD CITIES FOR THE ARTICULATION OF THE BELGIAN ECONOMY

8 The world city network as articulator of national/regional economies? An exploration of the geographies of producer services procurement in Belgium

Hanssens, H., Derudder, B., and Witlox, F. (2011) The world city network as articulator of national/regional economies? An exploration of the geographies of producer services procurement in Belgium. Geoforum, submitted.

8.1 Abstract

This paper introduces a methodology that allows identifying the relevant actors and urban service centres for the urban articulation of national/regional economies into the global economy without making a priori assumptions on 'relevant' firms or cities. The methodology is based on an exploration of the geographies of producer services procurement in the Belgian space economy, whereby these urban geographies are compared to GaWC's ranking of Belgian cities as service centres in the context of the world city network. Our results indicate that, taken together, the GaWC approach for gauging the urban articulation of a regional/national economy into the global economy is a good proxy: the urban geographies of service procurement largely reproduce GaWC's urban rankings, while GaWC's selection of firms accounts for more than half of the procured services. However, at the same time, our analysis indicates that this appraisal is subject to sectoral differences, which may be used in future research to adjust the systematic analysis of the cities/services-nexus at the global scale.

8.2 Introduction

It has been nearly eighty years since Walter Christaller (1933) introduced central place theory to describe the spatiality of urban systems based on the urban centrality of service provision. In recent years, the world city network approach, primarily devised by the Globalization and World Cities research network (GaWC, http://www.lboro.ac.uk/gawc) under the directorship of Peter Taylor, has arguably become one of the most frequently used frameworks for assessing the spatiality of urban systems based on the urban centrality of globalized service provision (Taylor, 2001a, 2004). The straightforward parallels between Christaller's central-place system and GaWC's world city network have led Hall (2002) to describe the latter research project as 'Christaller for a global age'. Hall thus describes world city-formation as a simple addition of two scales atop Christaller's initial central place model, i.e. 'world cities' such as London and Paris and 'sub-world cities' such as Manchester and Lyon.

A closer reading of the GaWC approach to the cities/services-nexus, however, reveals that it diverges from classical central place thinking on at least two crucial accounts. First, the primary focus is no longer on the urban centrality of service provision to households, but rather on the urban centrality of service provision with the explicit purpose of ensuring the speeding-up of capital circulation and accumulation (i.e. *producer* services provision). Second, the dominant geographical principle of the overall system is no longer sought in a nested hierarchy of cities with non-overlapping hinterlands, but rather in the overall degree of connectivity in inter-urban flows. In Taylor's (2001a) specification of the world city network (WCN), cities are inter-linked through the multi-office location strategies of globalized advanced producer services (APS) firms, reflecting these firms' aspiration to offer a seamless global service to their clients. To describe the geographical outline of the WCN, Taylor (2001b) thus introduces the concept of overlapping '*hinterworlds*', defined as cities' capacity and distribution of service connections.

A major application of the GaWC model was the measurement (Taylor et al., 2002a) and subsequent empirical analysis (Taylor et al., 2002b; Derudder et al., 2003) of the world city network in the year 2000. To this end, data was gathered on the (importance of the) office locations of 100 leading APS firms in 315 cities. In 2007, GaWC joined forces with the Global Urban Competitiveness Project (GUCP) at the Chinese Academy of Social Sciences (CASS) to carry out a new large-scale data collection exercise for 2008 (Taylor et al., 2009a,b, 2010). The list of cities was extended from 315 to 526, and the list of APS firms from 100 to 175, including leading firms for accountancy, advertising, law, and management consultancy, and financial services. The availability of comparable datasets for two points in time allowed the GaWC researchers to assess the changes in the urban geographies of globalized service provision for the period 2000-2008, both for the WCN as a whole (Derudder et al., 2010) and for the constituent APS sectors separately (Hanssens et al., *in press*).

GaWC's empirical efforts to outline the geographies of the WCN beyond a limited number of well-connected cities have proven to be a major contribution to the contemporary urban geography literature. Apart from the empirical studies referred to above, the GaWC model has also been implemented to analyze regional urban networks (Hall & Pain, 2006; Hoyler et al., 2008, Taylor et al., 2008) and to study how regions are integrated in the global economy through the WCN (e.g. Taylor, 2001c; Brown et al., 2002; van der Merwe, 2004). The present paper seeks to extend the latter two lines of research by focusing on the 'regional' urban geographies of producer services *procurement*. One key advantage of this approach is that it allows researchers to assess how in a 'regional' economy APS firms are used to enable other firms' functioning in the global space economy. The empirical focus of this paper is on Belgium, which has a very open and globally integrated economy, thus providing a good test case for outlining how and to what degree APS firms can be consider key networking agents in globalizing urban geographies. To this end, we organized an e-mail survey in which we asked respondents to provide information on the procured services in different APS sectors (i.e. transaction links between service provider and service consumer). Based on this survey, we examine the day-to-day urban-economic geographies of APS firms, after which we can systematically compare our results to GaWC's treatise of the integration of Belgium's cities in the WCN.

The remainder of this paper is organized as follows. The first section situates this paper in the literature on urban/APS geographies. We then describe our data and methodology in a second section, after which the results section provides an overview of the geographies of APS procurement in Belgium and systematically compares it to GaWC's assessment of Belgian cities in the WCN. In the fourth and final section, we present a critical overview of our main findings and outline some avenues for future research.

8.3 Literature review: APS geographies and urban networks

GaWC's WCN approach draws on Sassen's (1991/2001) observations on how global economic integration seems to have gone hand in hand with the spatial concentration of APS firms - key enabling agents of this global economic integration - in key cities across the globe. To map the uneven connectivity of cities in the office networks created by APS firms, Taylor et al. (2010) preselect a set of cities/firms for further scrutiny.

In terms of firms, selection criteria varied from sector to sector, but for each sector firms were chosen by their ranking in lists of the largest firms in each sector. For instance, for finance the top 75 firms as ranked in the Forbes composite index were chosen, a measure that combines rankings for sales, profits, assets and market value lists. For the other four services – accountancy, advertising, law and management consultancy – GaWC included the top 25 firms: for law the Chambers list of Corporate Law firms was used (www.chambersandpartners.com/global); for advertising agency networks we used Advertising Age's ranking of 'marketing organizations' by revenues (www.adage.com/images/random/lna2007); for accountancy firms' networks we used the ranking by revenues of World Accounting Intelligence

(www.worldaccountingintelligence.com); and for management consultancies we used the 2007 edition of the Vault Management & Strategy Consulting Survey, which ranks firms in terms of their 'prestige' based on a large survey of professionals (www.vault.com).
In terms of cities, a number of overlapping criteria were used to select cities. In addition to all cities studied in previous analyses, all cities with a population of more than 2 million inhabitants were included, which led to the consideration of far more cities located in China, India, Pakistan and Iran. Furthermore, Taylor et al. (2010) also included a 'second city' of all but the smallest states plus other important cities in larger states, whereby the latter selection was in part based on a systematic comparison with airline data.

Based on GaWC's reading of the cities/services-nexus under contemporary globalization, Belgium's urban geographies in terms of APS provision can be summarized as follows (Table 8.1)[1]: only 3 Belgian cities are considered for further analysis (Brussels, Antwerp and Liège), whereby Brussels is by far the dominant city for each of the different sectors (and, as a corollary, in the WCN as a whole). Liège is only connected in the APS firm networks of accountancy and management consultancy firms, while Antwerp is – compared to its overall connectivity – well-connected in the office networks of law and accountancy firms. In *Global Urban Analysis* (Taylor et al., 2010), GaWC's summary of 10 years of empirical WCN research, this geography is straightforwardly described as the result of Brussels' role as *de facto* EU capital, the presence of port-related services in Antwerp, and Liège's difficult transition to a service economy from its industrial past rooted in coal and steel. Echoing Vandermotten et al. (2006), the dominance of Brussels is further sought in the small size and well-developed infrastructure of Belgium as this implies that firms have no difficulty in servicing the whole of the national market from their Brussels base.

Table 8.1 Global and sectoral network connectivities for Brussels, Antwerp and Liège

	Brussels	Antwerp	Liège
GNC	0.63	0.02	0.08
ACC	0.59	0.37	0.15
ADV	0.62	0.05	0.00
FS	0.57	0.15	0.01
LAW	0.54	0.23	0.00
MC	0.43	0.11	0.09

Although this GaWC approach to understanding the role of urban centres in a globalized economy has been widely cited/used/invoked, its assessment of globalized urbanization through the lens of 'leading APS firms' has been criticized on different accounts. For the purposes of this paper, two lines of critique are especially relevant.

[1] The scores in this table are based on a 526 cities X 175 firms matrix and are therefore somewhat different from the scores reported in Derudder et al. (2010) and Hanssens et al. (*in press*), which were based on a 132 cities X 175 firms matrix.

A first line of critique is that GaWC's WCN rankings –perhaps unwillingly– result in a metanarrative in which cities/processes outside 'the Western realm' are not on the conceptual/empirical map of globalized urbanization (Robinson, 2002). In terms of cities, McCann (2004) for instance makes the case that the WCN approach tends to undermine research into the relationship between urbanization and globalization beyond a predefined set of 'major' cities. Based on an analysis of Lexington (Kentucky) in the global economy, he calls for a more complex and process-based view of contemporary urbanism that would allow the globalization/urbanization-nexus to be studied in and through a diverse range of cities (see also McCann & Ward, 2010). In terms of processes, in turn, Bassens et al. (2010) challenge the utility of the WCN approach for understanding the transnational connectivity of major Gulf cities. They point out that in GaWC's WCN rankings Arab Gulf cities are essentially analyzed from a 'Western' vantage point as the crucial actors in WCN-formation are deemed to be (mainly US and European) APS firms. Bassens et al. (2010) thus develop an alternative approach to understanding the relationalities of major Gulf cities within capital circuits by exploring the roles and geographies of Shari'a scholars standing at the crossroads of financial and religious authority in Islamic financial services firms.
A second line of critique relates to the GaWC model specification in and by itself. Nordlund (2004), for instance, finds fault with the network model at the basis of the GaWC approach on conceptual grounds, while Lambregts (2008) argues that GaWC researchers have paid insufficient attention to the assumptions underlying their model. One example would be what Jones (2002) – in line with the rise of heterarchical forms of governance in multinational enterprises (Dicken & Malmberg, 2001) – has called 'the myth of global management in transnational service firms'. Put differently: the GaWC model assumes the presence of inter-city relations based on possible interactions between service firms rather than providing actual proof of the networking abilities and geographies of these service firms. Moreover, although the mere presence of an office of major APS firms of course indicates that a city is deemed important in the location strategy of these firms, it tells very little about the city's actual role for the articulation of the regional/national economy (see Parnreiter, 2010).

Both lines of critique can succinctly be summarized as follows: the a priori selection of APS firms and cities as well as the associated assessment of globalized urban geographies based on the mere location of APS firms in cities may not be relevant for describing cities' role/insertion in the global economy, particularly when the aim is to explore the insertion of 'less obvious' cities and regional city-systems. The formative aim of this paper, therefore, is to introduce an alternative method for analysing the urban geographies of APS provision that addresses these issues. To do so, in this paper we explore the geographies and functionalities of the *actual* links between large companies and their main APS business partners. The results can/will be cross-referenced with GaWC's treatise of the APS-based urban geographies of Belgium's cities as a sort of robustness test (in the non-statistical sense) of the GaWC approach.
This empirical focus on (the geography of) business transaction links between APS firms and their clients is obviously not new. It has been a topic of much research in the

broader literature on advanced producer services[2] (see amongst others Daniels & Moulaert, 1991; Daniels et al., 1992; Rusten, 2000; Bryson et al., 2004; Aslesen & Isaksen, 2007; Eraydin & Köroglu, 2007). However, despite a recent call by both urban and economic geographers to explore the potential benefits of a conceptual integration of the APS-based WCN model and research on global commodity chains integrating the global economy (*Global Networks*, 2010) through APS transaction links, a systematic inquiry into the geography of transaction links between APS firms and their clients has not been used in the context of WCN research. The only exceptions to our knowledge are a contribution by Rossi et al. (2007), in which the authors map the geography of transaction links between Brazil's leading cities and their main business partners for several APS; and a contribution by Lüthi et al. (2010) who explore the spatial patterns of service procurement by high-tech firms located in the greater Munich area. Here we expand the remit of these analyses by adding a sector-specific dimension to the analysis and a systematic analysis of the implications for analyses of globalized urbanization through APS.

8.4 Collecting transaction link data

To identify the key actors and main service centres for APS provision in the Belgian economy, we focus on APS procurement by the 300 largest companies located in Belgium[3]. Nearly two thirds of these companies are foreign owned, which obviously is a result of the open character of the Belgian economy. Another ten percent are publically owned companies of Belgian origin, including some of the country's most successful global enterprises like Bekaert (drawn steel wire), Inbev (beer), Dredging International (dredging and land reclamation) and Delhaize Group (retail). The remaining companies are Belgian-owned private companies and autonomous government companies like the NMBS (the national railway company), VRT (the Flemish public broadcasting company), and B-post (the national postal service).

Between 7 June and 22 November 2009, a questionnaire was sent out these companies in which they were asked to identify and locate the main business partner for those APS outsourced during the last year of operation. In line with Taylor et al. (2010), the list of APS included (i) accountancy-audit; (ii) advertising; (iii) financial services-creditor bank; (iv) financial services-insurance; (v) legal services; and (vi) management consultancy. Of the 300 companies, we received 118 responses. 21 of these companies indicated that they would not participate as the required information was considered too confidential. The remaining 97 responses included a completed survey. These answers were then compiled to form a list of 327 transaction (i.e. outsourced) links. For each link, information was added on (i) the name and location of

[2] In this line of research, knowledge-intensive business services (KIBS) is a more commonly used phrase to refer to this type of producer services.

[3] Belgium's top 300 firms as listed on the website of Trends Top (http://trendstop.rnews.be, Accessed: 11 May 2009). This ranking is based on corporate turnover figures for fiscal year 2007.

the user firm (postal code); (ii) the name (if given) and location of the service firm; and (iii) the APS sector of the service firm.

Table 8.2 lists the distribution of the population (300 companies) and the sample (97 companies) by administrative region and economic sector. It shows how half of Belgium's top-300 companies are located in the Brussels Capital Region (BCR). The large majority of the remaining companies are located in the Flemish Region, while the Walloon Region only houses 28 companies. The last column compares the relative distribution of the sample with the relative distribution of the population. Table 8.2 reveals that Walloon companies are quite underrepresented in the sample, whereas companies in the BCR are somewhat overrepresented. Obviously, this will have to be taken in consideration when discussing the results. The relative distribution of Flemish companies on the other hand remains more or less the same.

Similar observations can be made for the sectoral distribution of the companies. As Table 8.2 shows, over two thirds of Belgium's largest firms are active in manufacturing (NACE section C) and wholesale & retail trade (NACE section G). The sample displays a comparable sectoral distribution. Only NACE sections D and E are slightly underrepresented, while information & communication firms (NACE section J) are somewhat overrepresented. Overall however, the scores in Table 8.2 indicate that the sample of 97 companies is more or less representative for the population of the top-300 companies in Belgium.

Table 8.2 Distribution of firm population (300 companies) and sample (97 companies) by location and economic sector

	Pop.	% Pop	Sample	% Sam.	RATIO
Flanders	122	40.67	39	40.21	0.99
Brussels Capital Region	150	50.00	54	55.67	1.11
Wallonia	28	9.33	4	4.12	0.44
C: Manufacturing	108	36.00	39	40.21	1.12
D: Electricity, gas, steam and air conditioning supply	15	5.00	3	3.09	0.62
E: Water supply, sewerage, waste management…	4	1.33	1	1.03	0.77
F: Construction	5	1.67	2	2.06	1.24
G: Wholesale and retail trade…	109	36.33	33	34.02	0.94
H: Transporting and storage	16	5.33	5	5.15	0.97
J: Information and communication	12	4.00	5	5.15	1.29
K: Financial and Insurance activities	12	4.00	4	4.12	1.03
L Real estate activities	1	0.33	0	0.00	0.00
M: Professional, scientific and technical activities	4	1.33	0	0.00	0.00
N: Administrative and support service activities	11	3.67	4	4.12	1.12
P: Education	1	0.33	1	1.03	3.09
Q: Human health and social work activities	1	0.33	0	0.00	0.00
R: Arts, entertainment and recreation	1	0.33	0	0.00	0.00

8.5 Articulators of the Belgian economy

Based on the survey results, in this section we investigate to what types of APS firms Belgium's largest companies outsource their services, and explore from which cities these transaction links are predominantly procured. The results are thereby cross-referenced with GaWC's selection of APS firms and cities deemed to be relevant for the Belgian case, i.e. we assess to what degree APS articulators of the Belgian economy are listed/used and to what degree the assumed connectivity of cities is reflected in our results. The results of our analyses are discussed for each APS sector separately and are based on Tables 8.3 and 8.4 and Figures 8.1b-h.

Table 8.3 distinguishes between the total number of observed transaction links for each APS sector and the number of transaction links for which the name of the APS partner was mentioned in the survey For the 'Identified' links, the column *%GaWC* lists the share of the number of links with the top-25 APS firms (top-75 for financial services) as specified in the GaWC data collection exercise of 2008 (Derudder et al., 2010). The column *%Large,* in turn, lists the relative number of links with non-GaWC-listed international APS firms (defined as firms with offices in at least three countries). And finally, column *%Local* lists the number of links with local APS firms, which are Belgian APS firms with one or several offices in Belgium.

Table 8.3 Corporate distribution of transaction links

	Total	Known	GawC	% GaWC	Large	% Large	Local	% Local
ACC	91	90	88	97.8	1	1.1	1	1.1
ADV	33	31	15	48.4	5	16.1	11	35.5
FS	61	54	53	98.1	1	1.9	0	0.0
INS	41	30	17	56.7	6	20.0	7	23.3
LAW	45	41	21	51.2	5	12.2	15	36.6
MC	31	26	13	50.0	9	34.6	4	15.4

Figures 8.1b-h map the geography of transaction links for each APS sector separately. It is important to bear in mind that one dot on this map represents one transaction link, not one APS firm. An APS firm can thus be represented by several dots. The grey areas on the map represent the eighteen urban regions[4] in Belgium, which are the spatial units of analysis in this paper. This means that an APS firm located in, say, Zaventem will be listed as located in the service city of Brussels. The white area in the service city of Brussels is the Brussels Capital Region. For APS firms located outside an urban region, the municipality was retained as the spatial unit of analysis.

[4] An urban region is a combination of the operationalized agglomeration and its urban fringe. It is the spatially enlarged entity within which most of the basic activities of city life are 'displayed' (Luyten & Van Hecke, 2007).

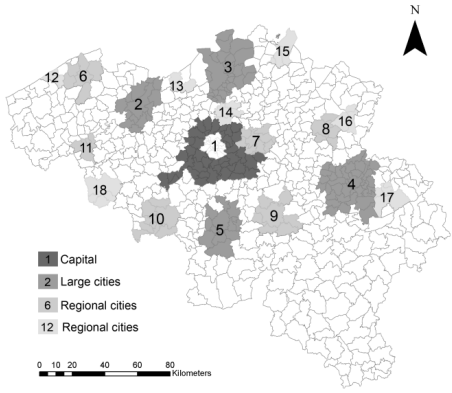

Figure 8.1a Urban regions in Belgium

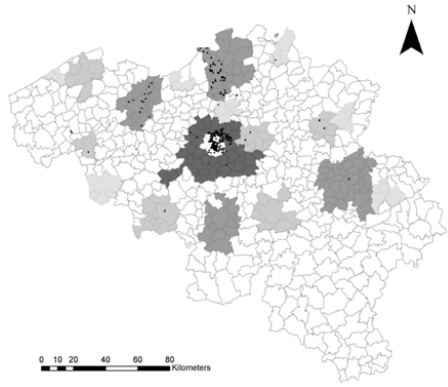

Figure 8.1b All sectors

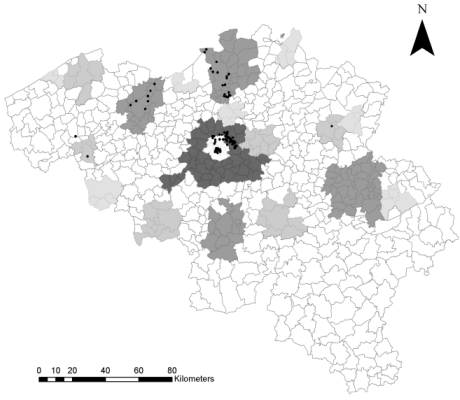

Figure 8.1c Accountancy and audit

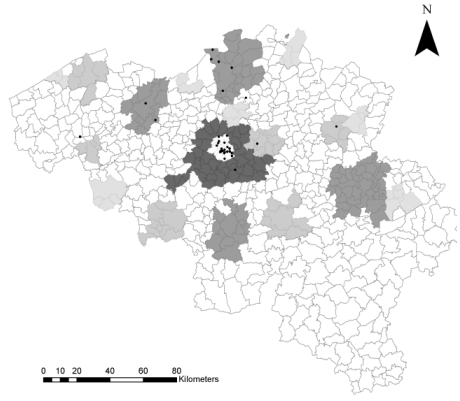

Figure 8.1d Advertising

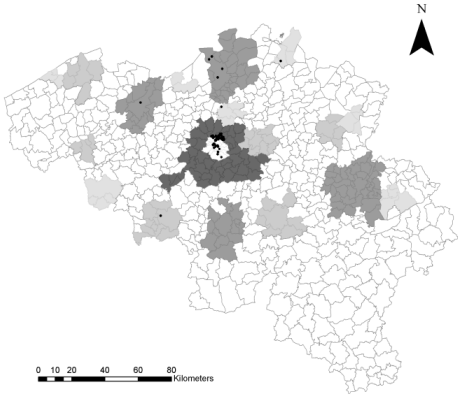

Figure 8.1e Financial services

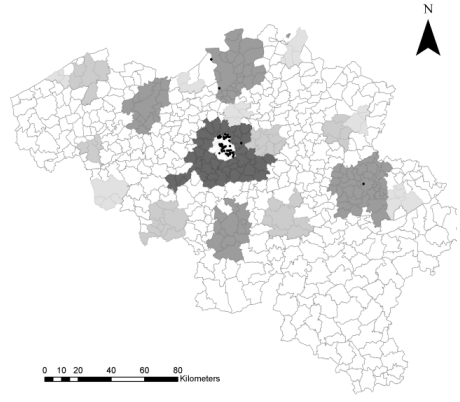

Figure 8.1f Insurance

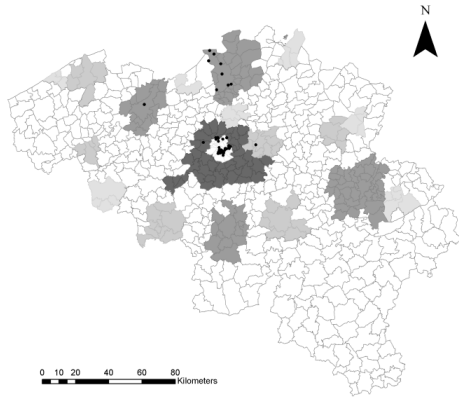

Figure 8.1g Law

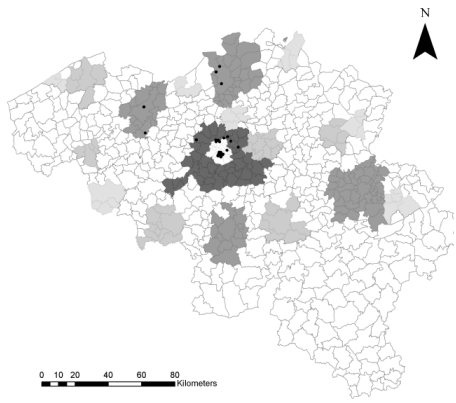

Figure 8.1h Management consultancy

Figure 8.1 Geography of APS procurement in Belgium

Urban regions: Brussels (1), Ghent (2), Antwerp (3), Liège (4), Charleroi (5), Bruges (6), Leuven (7), Hasselt (8), Namur (9), Mons (10), Kortrijk (11), Ostend (12), St-Niklaas (13), Mechelen (14), Turnhout (15), Genk (16), Verviers (17), Tournai (18). (Source: Luyten & Van Hecke, 2007)

Table 8.4 complements these figures by quantifying the spatial concentration of APS transaction links. It lists the share of each service city (Brussels, Antwerp, Liège, and Ghent, which – although not in the GaWC selection of cities – was listed separately as the analyses revealed a relatively high number of links for this city) or service city category ('Other', including all other Belgian service cities; and 'Foreign', including all foreign service cities) in the total number of transactions.

Table 8.4 Spatial distribution of transaction links

		Brussels		Antwerp		Liège		Ghent		Other		Foreign	
	Total	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
ACC	91	56	61.5	23	25.3	0	0.0	7	7.7	3	3.3	2	2.2
ADV	33	18	54.5	5	15.2	0	0.0	2	6.1	4	12.1	4	12.1
FS	61	49	80.3	4	6.6	1	1.6	1	1.6	2	3.3	4	6.6
INS	41	33	80.5	2	4.9	0	0.0	0	0.0	1	2.4	5	12.2
LAW	45	34	75.6	8	17.8	0	0.0	1	2.2	1	2.2	1	2.2
MC	31	20	64.5	3	9.7	0	0.0	2	6.5	0	0.0	6	19.4

ACCOUNTANCY AND AUDIT

Table 8.3 shows how 88 of the 90 identified transaction links (98%) for accountancy and audit are with one of the top-25 accountancy firms. Not less than 85 of these 88 links are with the Big Four accounting firms (Ernst & Young, Deloitte Touche Tohmatsu, KPMG International, and PricewaterhouseCoopers), which dominate international accounting. This finding concurs with similar research in other countries, including Selim & Yiannakas (2000) for internal audit outsourcing by large companies in the

public and private sector in the UK, Van Peursem & Jiang (2008) for internal audit outsourcing by SMEs in New Zealand, and Barac & Moubatse (2009) for internal audit outsourcing by 30 large listed South-African companies. Selim & Yiannakas (2000, 221) ascribe the success of the Big Four to the aggressive promotion of their services to existing customers as well as new ones, and to their size and experience in the audit field. In the context of the present paper, their widespread office networks (Daniels et al., 1989; Taylor et al., 2002c) can be included as an additional factor explaining their global domination. The other GaWC-listed APS firms in our dataset are BDO, Grant Thornton and RSM International, each accounting for one link. Of the two remaining links, one is with an international APS firm and one with a Belgian auditor, both located in Antwerp.

Table 8.4 and Figure 8.1c show how the majority (62%) of transaction links for accountancy is concentrated in only three municipalities in the urban region of Brussels: the city of Brussels (KPMG), Machelen (E&Y and Deloitte), and Zaventem, (BDO and PwC). With less than half the number of links, Antwerp constitutes the second largest cluster. Apart from Antwerp, Ghent is the only other large city housing the main business partner of some of Belgium's top-300 companies, of which most are located in Ghent or in the proximity of Ghent. The remaining three national transaction links are with smaller, regional cities in Flanders (i.e. Kortrijk, Roeselare and Hasselt). Here too, services are procured from local offices of the Big Four, which gives a nice illustration of their widespread office networks. The latter is also reflected in Table 8.1, which shows that the smallest city, Liège, is best connected to the world city network through its accountancy sector. However, when it comes to actual service provision to large companies, the importance of Liège as a service city appears to be very limited, even for accountancy. Finally, two of the 91 transaction links are with service cities abroad (i.e. Luxemburg and New York). In both cases, these links can be traced back to the headquarter location of the user firm's parent company (see Hanssens & Derudder, 2011).

ADVERTISING

Compared to accountancy and audit, the advertising sector displays a rather different picture. As Table 8.3 shows, only half of the identified links are with local offices or subsidiaries of GaWC's 25 advertising firms. Examples found in our dataset include local offices of DDB Worldwide, BBDO Worldwide, TBWA Worldwide, and Publicis; and local subsidiaries such as, for instance, Duval Guillaume, which was Belgium's largest independent advertising company until it was acquired by Publicis in 2006 (see Horsky, 2006 for quantitative results on the share of advertising conglomerates in the total number of transaction links by American advertisers). The other half of the advertising companies consists for one third of international companies with offices in at least three countries, and for two thirds of privately owned Belgian companies. An interesting finding is that amongst the clients of the latter are Belgian offices of large multinational companies such as BMW group and BP. Ikea Belgium for instance subcontracted the Leuven-based communication agency Kunstmaan to develop and implement a communication strategy for the Belgian market to increase its number of

visitors (www.kunstmaan.be/work). At this point, it is not entirely clear how these findings should be interpreted in light of the often-made assumption that MNOs apply to multinational advertising agencies firms because the latter's global networks "*are the most effective way to service clients which have globalised product development but still sell locally, and therefore need local advertising*" (Daniels, 1995, 283). To do so, more information is needed on the global advertising strategy of for instance Ikea and on its business model, which prescribes at what corporate levels decisions on such topics are made.

In large contrast to the office networks of the Big Four, all of the top-25 advertising companies occurring in our dataset are serving the Belgian market from one single office located either in the city of Brussels or in one of the other eighteen municipalities constituting the Brussels Capital Region. As a consequence, about half of the advertising transaction links in our dataset are with Brussels (see Figure 8.1d and Table 8.4). In other words, for user firms wanting to do business with one of the top-25 advertising companies, Brussels is clearly the one and – in contrast to the Big Four – the only place to be (see also Table 8.1). The opposite is true however for links with the non-top international, and particularly with the local advertising companies in our dataset. These are predominantly located either in Antwerp, in Ghent or in one of the smaller regional cities Leuven, or Hasselt. Possibly, smaller advertising companies tend to less locate in Brussels due to the high office rental prices in the capital city. The role of Liège as a service city for advertising is again limited, both in terms of the location of top-25 firms (Table 8.1) and in terms of the actual provision of advertising services to large companies (Table 8.4). Finally, despite the fact that in most of these cases the advertising company in question also has a Belgian-based office, four advertising transaction links are with service cities abroad (i.e. London (DDB), Paris (Publicis), Eindhoven (Hunterskill Howard) and Vienna (unknown).

FINANCIAL SERVICES: BANKING AND INSURANCE

In our survey, the main business partner for banking services (creditor bank) and insurance was listed separately. In the GaWC data collection exercise of 2008 however, both sectors were combined under the denominator 'financial services' and information was collected about the office locations of the top-75 financial institutions rather than the top-25 banks and the top-25 insurance company separately. This section therefore first discusses the results for banking and insurance seperately, and then makes some concluding remarks for the financial services sector as a whole.

At the firm level, the financial services-creditor bank sector displays a somewhat similar picture as for accountancy-audit. All but one of the identified business partners belong the top-75 financial institutions (see Table 8.3). Of these top-75 companies, BNP Paribas Fortis[5], ING, and KBC alone account for 80% of the identified transaction links. The other creditor banks include Citibank, ABN Amro, Deutsche Bank, Dexia and

[5] In the top-75 financial institutions in 2008, BNP Paribas and Fortis are ranked separately. However, by the time we launched our survey (Juni-November 2009), Fortis was already acquired by BNP Paribas.

HSBC. Bank of Tokyo is the only bank mentioned in our survey that is not listed in GaWC's top-75 financial institutions.
Although the Belgian office networks of most financial institutions in our dataset are many times larger than those of the Big Four, corporate banking activities (i.e. financial services for large enterprises) in most cases take place at the bank's national headquarters. As a consequence, and perhaps somewhat counterintuitively, the banking sector is the most spatially concentrated sector in our survey: 80% of all transaction links are located in the Brussels Capital Region (see Table 8.4 and Figure 8.1e). The few remaining links are with banking offices located in Antwerp and Ghent, and in a number of smaller cities including Mechelen, Turnhout and Mons. Finally, four links are with service cities abroad, including Amsterdam (ING), Luxemburg (ING), Lille (HSBC), and New York (Citibank).

For insurance, nearly half of the user firms identified insurance brokers rather than insurance companies as their main business partner. This is somewhat problematic as the list of top-75 financial institutions did not include insurance brokers. As a consequence, we can only include part of the transaction links for insurance in our analyses. It is however worth mentioning that the large majority of these companies (72%) are local agents of Marsh and AON, two of the world's leading insurance brokers and risk advisors. Another notable observation is that, although these companies have offices in Brussels, Antwerp, Liège and at least one other Flemish city, the main share (12 out of 18) of the transaction links is again located in Brussels. Antwerp and Ghent are the only other service cities displaying links with global insurance brokers. Transaction links with Belgian insurance brokers on the other hand have a more local character and include mainly small service cities like Leuven, Bruges, and Mons.

When exploring the links with the insurance companies, a first notable observation is that – in comparison to the banking sector – the share of GaWC's 75 financial institutions in our dataset is less absolute. Moreover, also in contrast to the banking sector where only three banks accounted for about 80% of all transaction links, the list of insurance companies is much more varied. Top-75 financial institutions include Allianz, AXA, and Chartis, which is a subsidiary of American International Group (AIG); large, non-top insurance companies in our dataset include Royal & Sun Alliance, HDI-Gerling, and Vanbreda.
In spatial terms, the results are more similar to the banking sector in that there is a larger degree of spatial concentration (see Table 8.4 and Figure 8.1f): 81% of all transaction links are located in Brussels. Antwerp and Liège, where the headquarters of Ethias, one of Belgium's largest insurance companies, are located, are the only other Belgian service cities but their role in providing insurance services is very limited. The remaining links are with foreign cities, including New York, London, Paris, Utrecht and Deurne.

In general, we can conclude that the financial services sector is the most spatially concentrated sector in our database: about 80 percent of all transaction links are located in Brussels. Antwerp is the second service city, whereas the role of Ghent and

particularly of Liège for financial services provision is restricted. The relative importance of Belgian service cities in terms of actual service provision is thus more or less in line with the patterns in sectoral network connectivity (Table 8.1). At the firm level, there is less consistency between banking and insurance. GaWC's selection of financial services is clearly more relevant for banking than for insurance, where non-top financial institutions constitute about half of the transaction links.

LAW

Table 8.3 shows how about half of the identified law transaction links are with one of GaWC's 25 law firms. These include local offices of the British law firms Allen & Overy, Linklaters, Freshfields, and Stibbe, which became a member of the Herbert Smith Alliance in 2001. Baker & Mckenzie, DLA Piper and Cleary Gottlieb Steen & Hamilton are the remaining, American top-25 law firms in our dataset (see Beaverstock et al., 1999a for more information on the globalization strategies of UK law firms; and Beaverstock et al., 2000 and Warf, 2001 for more information on the globalization strategies of US law firms). Amongst the international, non-top law firms are local offices of Hunton & Williams, Loyens & Loeff, and also of the Big Four accountancy firms. The latter illustrates the competition law firms experience from the Big Four, whose aim is to become "*all-in-one global professional one-stop-shop service firms servicing international clients for everything from accountancy to management consultancy and legal advice*" (Beaverstock et al., 1999a). About one third of the identified links are with Belgian law firms. Similar to the case of advertising, many of their clients include Belgian offices of multinational companies like BMW Group Belux, Ikea Belgium and Toyota Motor Europe. Although here too, further research on the nature of APS provided is needed, it can be assumed that these Belgian law firms are mainly subcontracted for local legal matters such as labour law.

All of GaWC's law firms in our dataset have an office in Brussels, and – unlike the 25 advertising companies – most of them have an additional office in Antwerp (see also Table 8.1). Belgian law firms that operate from more than one office in many cases have at least one office in Brussels and mostly also an office in Antwerp. Brussels and Antwerp might thus be considered the two main service centres for legal services. However, despite the location of Antwerp in most corporate networks, Table 8.4 and Figure 8.1g show how the large majority of transaction links is once again concentrated in and around the city of Brussels. The only other Belgian service cities in our dataset are Ghent and Leuven. The importance of Liège as a service centre for legal matters is not only limited in terms of the office location strategies of the top-25 law firms (Table 8.1), but also once more in terms of service provision to large companies in Belgium. Finally, there is one additional foreign link with a law firm in Vienna.

MANAGEMENT CONSULTANCY

The last APS sector in our survey is management consultancy for which we have geographical information on 31 links, and corporate information on 26 transaction links. About half is of these 26 identified transaction links are with one of the top-25 management consultancy companies, of which only three global management

consultancy firms account for the total number of links, namely Accenture, Deloitte Consulting – one of the seven service groups of Deloitte Touche Tohmatsu (cf. the above quote from Beaverstock et al., 1999a), and McKinsey & Company. One third of the identified links are with international non-top management consultancy firms like Arthur D. Little, Celerant and KPMG, and only a few links are with local management consultancy firms whose clients are mainly privately owned, Belgian companies.

Table 8.4 and Figure 8.1h show that Brussels is once again the main service node. All transaction links with one of the three top-25 management consultancy companies, and all but one of the transaction links with non-top companies are located in Brussels although here too, many companies have an additional Belgian office in Antwerp (as also indicated in Table 8.1). Only transaction links with local companies are not necessarily directed towards the capital, but rather to Antwerp and Ghent. Although two of the top-25 management consultancy firms have local offices in Liège, none of Belgium's largest companies seems to procure services from this city. Finally, our database also contains six foreign transaction links with management consultancy companies abroad: Frankfurt (McKinsey), Vienna (McKinsey), London (PCM Consulting), Paris (Lazard), and Zug (Kaizen Institute).

8.6 Discussion and conclusion

To what degree are assessments of the globalization of regional city-systems through the lens of the location of 'major' APS firms in 'major' cities relevant? In the last decade or so, this question has been looked at from very different perspectives, but in this paper we have presented a new take on this issue. We introduced a method that allows identifying the relevant firms and service centres for the articulation of a national/regional economy without making a priori assumptions on 'relevant' firms or cities. To this end, we explored the geographies of APS outsourcing in Belgium.
Obviously, given the simplicity of our survey on the one hand and the complexity of corporate outsourcing on the other hand, our results provide indicative rather than conclusive evidence for the geographical features of APS provision to the Belgian economy. Our research design obviously implies that – in contrast to some other assessments of GaWC research – we concede that APS-based geographies may be relevant in analyses of globalized urbanization: we suggest other methodological ways of approaching the cities/services-nexus in a post-Christaller urban world rather than arguing that this nexus is not very relevant at all. Only time will tell whether this assumption is acceptable. One further critique that may be raised against our empirical approach is that our focus on the APS outsourcing of the 300 largest firms reproduces the a priori assumption that 'major' firms are the key drivers of urban economies – similar research focusing on small and medium-sized enterprises may therefore be a welcome complement to the results summarizes in this paper. Nonetheless, we believe our results can be used as a relevant robustness test of GaWC-like approaches, especially in the context of the very open and globalized nature of the Belgian economy.

Viewed from this perspective, some interesting conclusions can be drawn. For instance, our survey underlines the dominance of Brussels as main service centre (see Figure 8.1b) and shows that for each APS sector, GaWC's selection if APS firms accounts for at least half of the transaction links. At the same time, this general picture hides some important sectoral differences. In corporate terms, accountancy-audit is the most concentrated sector with the Big Four representing 94% of the total number of identified links. For financial services-creditor bank, where three companies represent 85% of all identified links, a similar situation can be observed. For these two sectors, GaWC's selection of APS firms is thus certainly relevant. For the other four sectors, the domination of top-25 (top-75) APS firms is much less absolute. In the case of advertising and legal services, local APS firms represent about one third of the remaining transaction links, whereas for management consultancy, international non-top APS firms make out the second largest group.
In geographical terms, the financial services sector (banking and insurance) turned out to be the most concentrated sector with 80 percent of all transaction links located in Brussels. The law sector displays similar patterns. Accountancy and advertising constitute the sectors where service procurement is least concentrated in Brussels. For the former, this is presumably because of the widespread office networks of the Big Four, although this is in turn also partly a result of their dominance in this market. For the latter, the limited significance of Brussels as a service city compared to the other sectors is probably due to the fact that over half of the transaction links are procured from non-top international or local APS firms which appear to be predominantly located outside Brussels.

To what extent then do these geographical patterns endorse or contradict GaWC's selection of potential 'world cities' in Belgium? In GaWC's classification of world cities, Brussels is listed as 'alpha world city'. As Derudder & Taylor (2003) argue, the presence of European institutions articulating the production of policy and legislation provided a firm basis for designating Brussels as a European-shaped world city. At the same time, our analyses also demonstrated that Brussels is by far the main centre for APS provision to the Belgian economy (or at least, to Belgium's largest companies). Similar to Gordon's (2004) argument for London, we therefore conclude that Brussels – as many other cities – functions as a service centre at various urban scales (Cf. Hill & Fujita's (2003) notion of 'nested city systems').
Listed as a 'gamma world city', Antwerp has been described by GaWC *as an important world city whose major global capacity is not in advanced producer service provision but rather in its function as port city.* Our analyses more or less confirm this description. Despite the fact that most APS firms have an additional Belgian office located in Antwerp, its importance as a centre for APS provision to large companies is rather restricted (although it was the second largest cluster of APS transaction links in our dataset). Although the concentration of user firms in and around the urban region of Brussels partly accounts for the domination of the capital city, further research is needed to explore whether other factors might also play a role (e.g. the expertise of offices in Antwerp vs. Brussels, the impact of the 'image' of APS firms located in Brussels…).

For the two cities at the top of the Belgian hierarchy, our analyses contain few surprises. Below the apex however, GaWC's selection of cities and our results start to somewhat diverge. Apart from Brussels and Antwerp, it was Ghent and not Liège that showed some evidence for *sufficiency of services*, suggesting that the former might be by only partly reliant on 'world cities' like Brussels for the procurement of advanced producer services. As for Liège, GaWC's selection of this city as the 'Walloon' service centre seems somewhat unfounded, although at this point, it is not entirely clear what the alternative might be. In terms of population, Liège is slightly smaller than Charleroi and slightly larger than Namur, but it is Namur which is the administrative capital of Wallonia and of the Walloon Region. Given the limited number of transaction links with Walloon cities, our analyses contribute little to this question. On the one hand, the restricted importance of Walloon cities in our dataset – particularly in comparison to Flemish cities – should be seen in light of the uneven spatial distribution of companies in our survey. On the other hand however, there is also a more structural factor at play here in that Wallonia's largest cities are still in a process of transition after the demise of their industrial sector. A more detailed and longitudinal account of the service base of Walloon cities is needed to allow for a better understanding of their role as articulators of the Belgian/Walloon economy.

To conclude, as was also noticed when discussing the results – two additional questions that require more attention in future research are the *nature* of the services provided to large companies (cf. Parnreiter, 2010) and – relating to this – the way in which the 'local' APS firms should be interpreted in the context of MNO's global outsourcing strategies. These pertinent questions cannot be answered in this research, and require other, qualitative research methods.

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PART 4 STUDYING THE SPATIALITY OF THE BELGIAN URBAN SYSTEM BASED ON TRANSACTION LINK DATA

9 The urban geography of advanced producer service transaction links in Belgium

Hanssens, H. and Derudder, B. (2011) The urban geography of advanced producer service transaction links in Belgium. Belgeo, in press.

9.1 Abstract

This paper aims to contribute to the literature on the geography of external relations of cities. Our overall purpose thereby is to tease out some of the basic principles of alternative approaches to the study of the spatiality of urban systems in the context of economic globalization. To this end, we present an empirical analysis of the urban geography of producer service procurement by the 300 largest companies in Belgium. The main features of this urban geography of service procurement include (i) the dominance of Brussels as a service city; (ii) the existence of overlapping urban spheres of influence; and (iii) the presence of transaction links with foreign cities. The results of our analysis also suggest that, in addition to space- and quality-related decision factors, the intra-firm distribution of decision-making power in multinational firms equally influences the spatiality of transaction links. The relevance of these results is discussed in the context of theorizations of urban systems.

9.2 Introduction

For many decades, Christaller's (1933) central place theory has perhaps been the single most important influence in conceptual and empirical research on the spatiality of urban systems. Although there seems to be a widespread consensus that the relevance of this theory for understanding contemporary city systems is disappearing, it can be noted that its implicit line of thinking still pervades the urban geography literature. One obvious example is the research on the rise of so-called 'world cities', which *inter alia* serve as key territorial platforms in the (re)production of the global economy. According to Saey et al. (2005), a Christallerean approach is still observable in this research domain in that world cities are often deemed to be the (logical) outcome of a new scale of economic integration (in turn enabled by technological advances), resulting in a set of central places with a geographical range larger than initially envisioned by Christaller. Hall (2002), for instance, describes world city-formation as a simple addition of two scales atop Christaller's initial central place model (i.e. 'world cities' such as London and Paris, and 'sub-world cities' such as Manchester and Lyon).

Saey et al. (2005), however, refute Hall-like (2002) theorizations, and suggest that Taylor's (2004) research on the 'world city network' (WCN) may provide the conceptual and empirical raw material to provide a better alternative in this context. Taylor's approach diverges from classical central place thinking on two crucial accounts. First, the primary focus is no longer on the urban centrality of service provision to households, but rather on the urban centrality of service provision with the explicit purpose of ensuring speeding-up capital circulation and accumulation (i.e. advanced producer services (APS) offered to firms). This is relevant as it brings the analysis of city-systems closer to a (more appropriate) conceptualization of cities as critical nodes in a globalizing *capitalist* economy rather than a market economy. Second, the dominant geographical principle of the overall system is no longer sought in a nested hierarchy of cities with non-overlapping hinterlands, but rather in the overall degree of connectivity in inter-urban flows. In Taylor's specification of the WCN, cities are inter-linked through the multi-office location strategies of globalized APS firms, which reflects their aspiration to offer a seamless global service to their clients. To describe the geographical outline of the WCN, Taylor thus introduces the concept of overlapping '*hinterworlds*', defined as cities' capacity and distribution of service connections.

In the spirit of Saey et al.'s (2005) appreciation of Taylor's (2004) work, in this paper we examine how the geographies of APS provision can inform our understanding of the transformation of city-systems. However, our approach is somewhat different from that of Taylor (2004) in that (i) we will concentrate on the implications for *urban systems at different scales* rather than making a straightforward scalar jump to 'world cities' (which arguably avoids some of the reification involved in the pre-factum identification of 'world cities'); (ii) our approach makes use of data on inter-firm rather than intra-firm links to measure inter-city relations; and (iii) rather than *assuming* that cities are connected based on the mere co-presence of APS firms, we focus on the

actual transaction links between APS firms and their clients (which arguably implies a more concrete measure of inter-city networking).

Our argument will be based on two juxtaposed sets of empirical analyses. First, we describe the urban geography of APS transaction links generated by the largest companies located in Belgium. Second, we present an explanatory analysis of this urban geography, whereby we mainly explore where in the corporate hierarchy decisions on outsourcing are being made. Based on our results, the paper is concluded with an overview of some of the implications for the study of urban systems in the context of economic globalization. Before turning to the discussion of our results, however, we first present a brief outline of our data collection.

9.3 Data collection

Between 7 June and 22 November 2009, we sent out a questionnaire to the top-300 companies in Belgium[1], asking them to identify and locate their main business partner for those APS that were outsourced during the last year of operation. The list of APS included (i) accountancy-audit; (ii) financial services-creditor bank; (iii) insurance; (iv) legal services; (v) management consultancy; (vi) advertising; and (vii) information and communication technologies (ICT). Of the 300 companies, we received 118 responses. Of these 118 responses, 97 included a completed questionnaire; the remaining 21 companies indicated that they would not participate as the required information was considered too confidential.

Table 9.1 lists the distribution of the population (300 companies) and the sample (97 companies) by administrative region and economic sector[2]. It shows how half of Belgium's top-300 companies are located in the Brussels Capital Region (BCR). The large majority of the remaining companies are located in the Flemish Region, while the Walloon Region only accommodates 28 companies. The last column compares the relative distribution of the sample with the relative distribution of the population. It shows that Walloon companies are quite underrepresented in the sample, whereas companies in the BCR are somewhat overrepresented. Obviously, this will have consequences for the geography of APS procurement in general, and for the occurrence of Walloon service cities in our dataset in particular. The relative distribution of Flemish companies on the other hand is more or less the same.

Similar observations can be made for the sectoral distribution of the companies. As Table 9.1 shows, over two thirds of Belgium's largest firms are active in manufacturing (NACE section C) and wholesale & retail trade (NACE section G). The sample displays a comparable sectoral distribution. Only NACE sections D and E are slightly

[1] Belgium's top 300 firms as listed on the website of Trends Top (http://trendstop.rnews.be, Accessed: 11 May 2009). This ranking is based on corporate turnover figures for the fiscal year 2007.

[2] Information on the location (address) and economic sector (NACE-code) of the user firm was also obtained from the website of Trends Top (http://trendstop.rnews.be, Accessed: 11 May 2009).

underrepresented, while information & communication firms (NACE section J) are somewhat overrepresented.

The result of our survey was a list of 358 transaction links, indicating for each link (i) the location of the 'user firm' (we term this the 'user' city, as this is where the service is 'consumed'); (ii) the location of the 'service firm' (i.e. the 'service' city, as this is where the service is 'produced'); and (iii) the APS sector of the service firm. Municipalities' postal codes were collected as the initial data to locate both user and service firms. However, to avoid an impractical high degree of geographical detail, we aggregated the individual municipalities to the level of their urban fields[3] and used these urban fields to identify the respective user and service cities. Municipalities that do not belong to an urban field were listed individually.
In addition to this survey, we also scanned the user firms' websites to collect additional corporate information on (i) their ownership structure (distinguishing between Belgian private ownership, foreign private ownership, mixed Belgian/foreign ownership, and autonomous government companies); and (ii) their position in the corporate hierarchy (distinguishing between global headquarters, regional/divisional headquarters, and subsidiaries).

Table 9.1 Distribution of firm population (300 companies) and sample (97 companies) by location and economic sector

	Pop.	% Pop.	Sample	% Samp.	RATIO
Flanders	122	40.67	39	40.21	0.99
Brussels Capital Region	150	50.00	54	55.67	1.11
Wallonia	28	9.33	4	4.12	0.44
C: Manufacturing	108	36.00	39	40.21	1.12
D: Electricity, gas, steam and air conditioning supply	15	5.00	3	3.09	0.62
E: Water supply, sewerage, waste management…	4	1.33	1	1.03	0.77
F: Construction	5	1.67	2	2.06	1.24
G: Wholesale and retail trade…	109	36.33	33	34.02	0.94
H: Transporting and storage	16	5.33	5	5.15	0.97
J: Information and communication	12	4.00	5	5.15	1.29
K: Financial and Insurance activities	12	4.00	4	4.12	1.03
L Real estate activities	1	0.33	0	0.00	0.00
M: Professional, scientific and technical activities	4	1.33	0	0.00	0.00
N: Administrative and support service activities	11	3.67	4	4.12	1.12
P: Education	1	0.33	1	1.03	3.09
Q: Human health and social work activities	1	0.33	0	0.00	0.00
R: Arts, entertainment and recreation	1	0.33	0	0.00	0.00

[3] In Belgium, an urban field (*stedelijk leefcomplex*, also called Metropolitan Region; Halleux, 2002) consists of an urban region and its commuter area. The former is a combination of a city's operational agglomeration and the urban fringe. The latter includes those municipalities in which at least fifteen percent of the active population commutes to the respective agglomeration. Belgium has eighteen urban regions (and hence also eighteen urban fields). All urban fields together represent 51 % of the Belgian territory and 75 % of its total population (Luyten & Van Hecke, 2007).

9.4 Results

THE GEOGRAPHY OF APS PROCUREMENT BY LARGE COMPANIES IN BELGIUM

To explore the spatiality of APS procurement by large companies in Belgium, we computed a matrix that lists the number of transaction links between each of the 21 user cities and each of the 32 service cities in our sample (Table 9.2). The table provides information on the size and direction of the individual city-to-city relations. It shows, for instance, how all but 3 of the 21 user cities share at least one link with Brussels and how 14 of them (Brussels included) even rely on this city for a majority of their transaction links. Geel, where the European division of Hyundai Heavy Industries is located, is the only city that procures a majority of its links in Antwerp.
The scores in the last column represent the total APS supply for each service city. Once again, Brussels stands out: out of 358 transaction links, 245 (64%) are purchased from APS firms located in the capital, while Antwerp merely accommodates 53 (14%) service provisions and Ghent only 14 (4%). The few remaining transaction links are procured from a limited number of urban fields and individual – both Belgian and foreign – municipalities. Most of the foreign service cities are located in the neighbouring countries, i.e. the Netherlands, the UK, France, and Germany. The only two service cities located outside Europe are Tokyo and New York.

Because Brussels, Antwerp and Ghent are the only user and service cities with a more or less significant economic role (i.e. the starting point or destination of more than 10 transaction links), the relative share of the remaining cities in either service demand or service supply is very small. This implies that it becomes difficult to formulate meaningful statements about the geography of the remaining transaction links, and we therefore aggregated our data in two steps.
In a first step, we grouped all Belgian cities with 10 or less links in a single 'residual' category (e.g. Bruges, Liège, Ostend…) and all foreign cities in a single 'international' category (e.g. Amsterdam, Copenhagen, Deurne…). Table 9.3 represents the aggregated version of the basic matrix shown in Table 9.2. The table shows, for instance, that cities of the residual category procure 14 APS in other cities of the residual category, of which 6 APS are procured from within the same city.

Table 9.2 Service city to user city transaction link matrix

Service cities \ User cities	Antwerp	Brussels	Ghent	Beringen	Bornem	Bruges	Charleroi	Estaimpuis	Geel	Genk	Hasselt	Herentals	Izegem	Kortrijk	Leuven	Liège	Mechelen	Mons	Ostend	Roeselare	Wielsbeke	Total
Antwerp	*30*	15	1		1				3						1		1					53
Brussels	31	*165*	9	1	3	2	1	3		1	2	1	5	8	1	3	2	1	3		4	245
Ghent	2	1	*4*					1					2	2			1		1			14
Bornem					*1*																	1
Bruges																				1		1
Geel				1					*1*													1
Hasselt	1										*2*											3
Kortrijk																				1		1
Leuven		1													*1*		1					3
Liège		1																				1
Mechelen	1																					2
Mons								1										*1*				2
Roeselare	1					1																2
Sint-Niklaas																	1					1
Turnhout									1													1
Westerlo	1																					1
Amsterdam		1																				1
Copenhagen				1																		1
Deurne	1																					1
Eindhoven		1																				1
Frankfurt																		1				1
Lille																		1				1
London		2																			1	3
Luxemburg		2																				2
Maarssen	1																					1
New York		4																				4
Paris	2	1																				3
Rotterdam		1																				1
Tokyo		1																				1
Utrecht		1																				1
Vienna				3																		3
Zug			1																			1
Total	71	197	15	6	5	3	1	5	5	1	4	1	7	10	3	3	6	4	4	2	5	358

Table 9.3 Aggregated service city to user city transaction link matrix

Service cities \ User cities	Antwerp	Brussels	Ghent	Residual	Total
Antwerp	*30*	15	1	7	53
Brussels	31	*165*	9	40	245
Ghent	2	1	*4*	7	14
Residual	4	2	0	14(6)	20
International	4	14	1	7	26
Total	71	197	15	75	358

In a second step, we aggregated the transaction links into three new location categories, being intra-city, national inter-city and international inter-city transaction links. The pie chart in Figure 9.1 visualizes the result of these aggregations. The chart is divided by means of a dual classification. The first level classifies all transaction links in terms of intra-city, national inter-city and international inter-city links. The second level subdivides each of these three categories individually in terms of the share of each service city. Only the international inter-city category is subdivided in terms of user cities rather than service cities. In this way, Figure 9.1 specifies for instance how many of the intra-city links are procured in Antwerp (i.e. 30); how many of the national inter-city transaction links are supplied by APS firms located in Antwerp to user firms located elsewhere in the country (i.e. 23); and how many of the international inter-city links are procured by user firms located in Antwerp (i.e. 3).

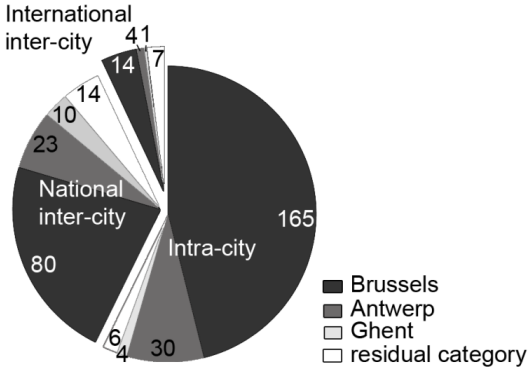


Figure 9.1 Classification of transaction links by location category

When combining Figure 9.1 and Table 9.3, we can derive three main features of the geography of APS procurement by large companies in Belgium. First, the pie chart shows how the majority of transaction links are procured within the own city. The dominance of intra-city links in our dataset is however mainly due to the large share of

intra-city links in Brussels, which is in turn partly explained by the fact that 54 of the 97 user firms in our sample are located in the capital city. However, the distribution of transaction links for the national inter-city category shows that Brussels is not only acting as a service city for user firms located in the city itself, but also for user firms located elsewhere in the country. The overall dominance of Brussels as a service city is thus a first feature of the geography of APS procurement by Belgium's largest companies.

A second feature is that, when looking beyond links with Brussels, the remaining national transaction links display a criss-cross pattern of (i) services procured by user firms located in the smaller cities of the residual category from APS firms located in the larger cities Antwerp and Ghent; (ii) transaction links going in the opposite direction, namely procured by user firms in Antwerp or Ghent from APS firms in the cities of the residual category; and (iii) transaction links between the cities of the residual category themselves. In other words, when it comes to APS provision to large companies, the urban spheres of influence of both large and smaller service cities in Belgium clearly overlap.

Finally, a third feature of the urban geography of service procurement in Belgium is the occurrence of 26 transaction links with service cities abroad. This demonstrates how the urban spheres of influence of service cities are not restricted by national borders.

EXPLORING SOME DRIVING FORCES BEHIND THE OBSERVED GEOGRAPHY

Now that we have described the geography of APS procurement by Belgium's largest companies, a second step is to explore some of the driving forces behind the observed geography. In general, most of the intra-city and national inter-city transaction links in our dataset can be explained as being the result of (a combination of) space-related and/or quality-related decision factors. The dominance of Brussels as service city for instance can be mainly ascribed to (i) its overall relative proximity as the city is centrally located in a small country with a well-established infrastructure; (ii) its function as both state capital and capital of the European Union; and – closely related to this – (iii) its world city status in the sense that globalizing APS firms have set up shop in Brussels in the context of their globalized office networks (Taylor, 2004; Aujean et al., 2007; Derudder et al., 2010). Moreover, as Vandermotten et al. (2006, 148) argue: "Many MNCs setting up in Belgium opt for a location in Brussels or its periphery, without trying to establish subsidiaries in other Belgian cities. […] Due to the small size of the country, these firms have no difficulty in servicing the whole of the national market from their Brussels base."

It is however less obvious whether the transaction link between, say, Brussels and Vienna was primarily based on (i) the choice of the APS firm's location in Vienna (which is rather unlikely as Vienna is neither ranked prominently in APS-based world city rankings nor a prime service centre for a particular APS sector); (ii) the characteristics of that firm regardless of it being located in Vienna; or (iii) even no 'choice' at all in the sense that the APS firm could have been imposed on the Belgian firm by its (presumably Austrian) parent company. As we have shown in an earlier paper on this topic (Hanssens et al., 2010), the geography of transaction links entails more than

spatiality s.s.: it also refers to where in the overarching MNC structure the decision(s) regarding these transaction links are made. In our survey, we implicitly assumed a heterarchical form of organization in which the choice for a particular APS is left at the discretion of the local management. However, although research on such heterarchical forms of organization in MNCs does indeed emphasize that corporate power is far more decentralized and diffuse than often presumed (Dicken & Malmberg, 2001; Jones, 2002), it can be argued that a strict heterarchical organization represents just one end of a continuous spectrum of organizational structures. The other end is represented by more hierarchical forms of corporate organization where the choice for a particular APS is imposed by a corporate hierarchy. For firms whose organizational structure displays a tendency towards the latter, decisions on outsourcing are made elsewhere, which has of course important implications for the geography of transaction links.

As our questionnaire did not inquire on the process behind APS outsourcing, we cannot directly identify those cases. There is, however, an indirect way to address this question. As already mentioned in the overview of our data collection exercise, our dataset also contains information on the ownership structure of the user firms (distinguishing between Belgian private ownership, foreign private ownership, mixed Belgian/foreign ownership, and autonomous government companies) and their position in the corporate hierarchy (distinguishing between global headquarters, regional/divisional headquarters, and subsidiaries). By means of a Pearson Chi-square test of independence, we assessed the statistical significance of the relationship between both these variables and the location decision for transaction links in terms of intra-city, national inter-city and international inter-city relations. The results of these measurements are listed in Table 9.4. The table shows that, because for each pair of variables the calculated Chi-square statistic (column 2) is larger than the critical measure (column 4) at the 1% significance level, there is indeed a statistically significant relationship between both sets of variables. However, as Pearson Chi-square provides no information on the strength of this relationship, we also computed the Cramer's V for each pair of variables. Cramer's V is a measure of association based on Chi-square and ranges between 0 and 1, with 0 indicating no association between both variables, and values close to 1 indicating a high degree of association. The results are listed in the last column of Table 9.4. They display relatively low scores. Taken together, we can thus conclude that there is a weak but statistically significant relationship between ownership structure and location choice on the one hand, and position in the corporate hierarchy and location choice on the other hand.

Table 9.4 Results of Pearson Chi-square test of independence and Cramer's V

	Pearson Chi-square	df	Threshold of probability (0.001)	Cramer's V
Ownership – location choice	37.015	6	22.46	0.227
Position – location choice	30.109	4	18.47	0.205
Ownership – position	209.380	6	22.46	0.541

Figures 9.2 and 9.3 explore this relationship in greater detail. The pie charts in Figure 9.2 visualize the distribution of transaction links for each ownership category individually. Especially the distribution of the foreign transaction links is of particular interest here. The pie charts show that – except for one foreign transaction link by a Belgian company – only user firms with a (partial) foreign ownership buy APS abroad.

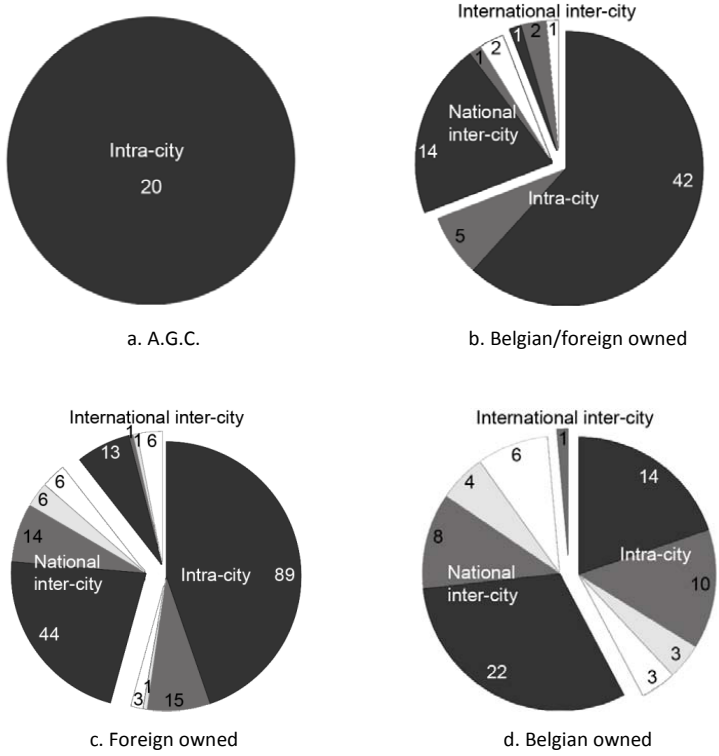
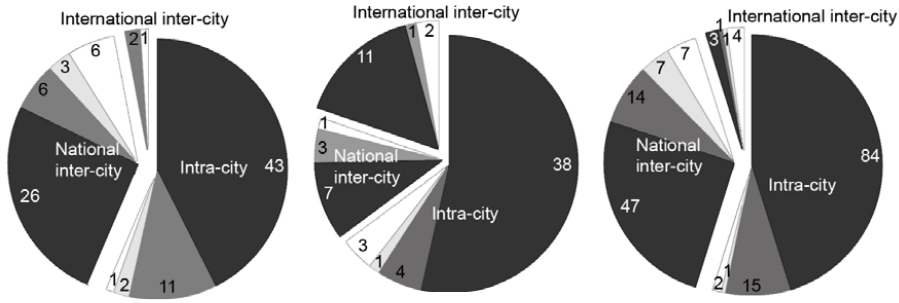


Figure 9.2 Disaggregation of transaction links by firm ownership

Pie charts a-c in Figure 9.3 disaggregate the distribution of transaction links in terms of a user firm's position in the corporate hierarchy. The most remarkable feature here is the large number of international inter-city links for regional/divisional headquarters. The majority of these links originates in Brussels. Subsidiaries also procure APS abroad, albeit to a much lesser degree. Global headquarters located in Belgium only display three international inter-city links.



a. Global headquarters

b. Regional/divisional headquarters

c. Subsidiary

Figure 9.3 Disaggregation of transaction links by position in corporate hierarchy

The last row in Table 9.4 provides a partial explanation for these observations. The figures show a relatively strong relationship between the ownership structure of the user firms and their position in the corporate hierarchy. In specific terms this means that – to a certain extent – global headquarters display relatively few foreign transaction links because the majority of these companies are Belgian owned (51.5%) or autonomous government companies (10.9%), whereas regional/divisional headquarters, which generate the majority of foreign transaction links, are generally foreign owned (56.3%) or mixed Belgian/foreign owned (28.2%) companies. For subsidiaries this relationship is less straightforward. Although more than 90% of all subsidiaries are foreign owned (85.5%) or mixed Belgian/foreign owned (5.4%), they only represent 6 international APS links.

The fact that on the one hand only companies with a (partial) foreign ownership, and on the other hand mainly regional/divisional headquarters and subsidiaries display international inter-city links can be considered as a first indication of the involvement of the parent company in outsourcing decisions. To further explore this assumption, we compared the location of the user firm's parent company or holding to the location of the foreign transaction choices. In 12 of the 26 links, we found a match. For instance, a manufacturing company located in Brussels with headquarters in New York indicated that it receives several of its services (i.e. accountancy/audit, financial services, insurance, and management consultancy) from APS firms located in New York. Although this is of course an indirect approach, it is a strong indication that for these transaction links, the actual *decision* making on outsourcing does not happen in Belgium.

9.5 Discussion and conclusions

It can be said that the results of the different empirical analyses contain few surprises: the observations that (i) Brussels is the major centre for APS procurement of major companies located in Belgium and that (ii) the mounting importance of MNCs goes hand in hand with the internationalization of service procurement may not come as a

surprise. However, the key point here is that these observations – more so than Taylor's (2004) analysis of WCNs – clearly show that a Christallerean approach to urban centrality is not well-suited to understand the urban geography of service provision to firms in the context of economic globalization. As a consequence, Hall's (2002) formulation of a revamped city-system by simply including new layers of service provision to Christaller's initial scheme fails to recognize the nature and geography of service provision under conditions of contemporary economic globalization.

In this paper, we have tried to tease out some of the basic principles of alternative theorizations of the spatiality of central place systems. In our reading, the empirical description of centrality in APS provision to large companies in Belgium leads to three general principles that need to be taken into account in these theorizations: (i) world city-formation as described by Sassen (2001) does seem to have an impact in that the presence of sizable APS clusters in a limited number of urban centres reproduces a spatial focus on a single central city; (ii) however, the pattern is far more complex in that, contrary to Christaller's notion of discrete hinterlands, over and beyond this focus on a single dominant node there are also criss-cross patterns of transaction links between larger and smaller cities in both directions as well as between smaller cities[1]; furthermore (iii) this complex overlap of urban spheres of influence supersedes national borders in general and Euclidean space particularly, i.e. the indication that the geography of APS procurement depends on the insertion of firms in MNC hierarchies. Regarding the latter, more in-depth qualitative research is definitely needed to tease out the impact of the intra-firm distribution of decision-making power – be it in terms of hierarchical relations or functional relations – on the geography of APS procurement.

The results of our case study – and the dominance of Brussels in particular – should however also be partly nuanced in this context. The design of our case-study entails three potential biases favouring Brussels as a service city. First, we only focused on a restricted number of APS. Logistics or transportation, for instance, which are typical APS for port cities such as Antwerp or Ghent, were left out. Second, our questionnaire only inquired about the *main* business partner, and did therefore not distinguish between domestic and foreign business of the user firms. And finally, the case study explored the geography of transaction links by Belgium's top-300 companies. Apart from the fact that these large companies may use other decision criteria for selecting APS firms than small- and medium-sized enterprises (SMEs), they also appeared to be predominantly located in Brussels, which might partly explain the disproportionate share of intra-city links in the capital city. One future avenue for further research will therefore *inter alia* focus on some of these issues.

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[1] These results are largely in line with similar research on the external relations of cities based on corporate relations in other urban systems (see, amongst others, van Oort et al., 2006; Rossi et al., 2007; Hall & Pain, 2006; Pain, 2008a, 2008b).

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10 Managing organizational and geographical complexity: the 'positionality' of advanced producer services in the globalizing economies of metropolitan regions

Hanssens, H. Derudder, B. and Witlox, F. (2011) Managing organizational and geographical complexity: the 'positionality' of advanced producer services in the globalizing economies of metropolitan regions. Erdkunde, submitted.

10.1 Abstract

The purpose of this paper is to tease out some of the basic principles of alternative approaches to the study of the spatiality of urban systems in the context of economic globalization. To this end, we analyze the economic- and urban-geographical dimensions of advanced producer service (APS) procurement based on a survey and semi-structured interviews with managers from automobile companies located in the port of Ghent (Belgium). Our analysis focuses on three dimensions: (i) a functional dimension focusing on APS firms' influence on managerial and/or operational capabilities; (ii) a governance dimension focusing on APS firms' ability to influence wider geographical patterns; and (iii) a concrete spatial dimension focusing on the geography of APS procurement. Our analysis suggests that the intra-firm allocation of decision-making power as regards service procurement is a key variable when accounting for the urban APS geographies. The relevance of this and other findings are discussed on the cities/APS-nexus in the study of globalizing (systems of) metropolitan regions.

10.2 Introduction

In the last decade or so, 'world city network' (WCN) research has emerged as one of the fastest-growing literatures in urban geography at large (Taylor, 2004). Above all, WCN research can be seen as one of the urban-geographical answers to the wider social-scientific plea to acknowledge the (mounting) importance of trans-state processes. In this context, 'world cities' are generally defined as those metropolitan areas that function as organizing centres for the (re)production of the global economy. Because of its unambiguous focus on a seemingly more appropriate scale of economic and social activity ('transnational' rather than 'national' urban systems), world cities research entailed the intrinsic promise to break free from the iron grip of territorial states on the metageographical imagination in the social sciences in general and in urban geography research in particular.

One major strand of 'WCN research' relates to the role of advanced producer services (APS) firms in sustaining the interdependent skein of material, financial, and cultural flows that together sustain contemporary globalization. For instance, some of the exercises to map out the spatialities of the WCNs are in practice large-scale empirical analyses of APS firms' location strategies (Derudder et al., 2010), while qualitative appraisals of metropolitan regions' insertion in the global economy are often based on an in-depth analysis of the networking abilities of APS firms (e.g. Lüthi et al., 2010; Parnreiter, 2010). This APS dimension of research on globalizing urban systems has, however, also emerged in research on regional urban networks under contemporary globalization. Thus Hall & Pain (2006) and Hoyler et al. (2008) apply some of the methodologies developed to understand the WCN for analyzing the polycentric development of regional urban systems such as Île de France and Southeast England in the context of economic globalization (see also, Growe, 2011).

Set against the backdrop of this APS/urban systems-nexus, this paper has two related purposes. Our first purpose is conceptual in that we seek to analyze the potential reification involved in the a priori choice of a relevant scale for analyzing the APS dimension of cities and city-systems under contemporary globalization. That is, in this paper we seek to analyze the implications of globalizing APS geographies for *urban systems at different scales* rather than making an a priori scalar choice between 'world cities' or 'regional urban networks'. Our second purpose is methodological in that, rather than *assuming* that urban geographies of APS can be gleaned from the mere presence of such firms, we focus on the *actual position and function of APS firms* for their clients. To this end, in this paper we focus on the urban geographies of *APS procurement*. One key advantage of this approach is that it allows researchers to assess how in a 'globalizing region' APS firms are used to enable other firms' functioning in the global space economy.

Our empirical focus in this paper is on Belgium, which has a very open and globally integrated economy, thus providing a good test case for outlining how and to what degree APS firms can be considered key networking agents in globalizing urban geographies. More specifically, the empirical material in this paper is based on a survey

and semi-structured interviews conducted at several automobile companies in the Port of Ghent. The purpose of these surveys/interviews was to tease out some of the key elements of the 'positionality' of APS firms in the globalized production networks of their clients. 'Positionality' hereby refers to the geographical interpretation of this term as elaborated by Sheppard (2002), who uses this concept to describe how different entities are positioned with respect to one another in space/time. In our framework, we analyze three dimensions of the positionality of APS:

(i) A functional dimension examining what services APS firms provide to their clients and how this input affects their clients' managerial and/or operational activities in a globalizing space economy;
(ii) A governance dimension examining whether/how this input influences their clients' strategic decisions and, therefore, the geographical distribution of value and value creation;
(iii) A spatial dimension examining the geographical location of APS firms in absolute and relative (i.e. vis-à-vis their clients) terms.

The remainder of this paper is organized as follows. In the first section, we provide a closer consideration of the three 'positionality' dimensions through a literature review of how APS impact metropolitan geographies. The second section presents the results of the fieldwork conducted in the Port of Ghent, which are *inter alia* used to provide an overview of the different aspects of the spatial dimensions of APS provision. The paper concludes with an overview of possible avenues for future research with regards to the framework developed in this paper.

10.3 APS in city economies: 'overcoming global differences'

At a very general level, it can be said that the role of APS firms in 'economic globalization' boils down to the observation that they help overcoming "differences between parts of the world in terms of technology, product specification, language, culture, politics, legal institutions, infrastructure and forms of regulation" (Bryson et al., 2004, 61). These differences may impede the development of an integrated, global economy, and what is thus required is a complex institutional infrastructure that overcomes some of these differences.

The APS dimension of this 'complex institutional infrastructure' for overcoming 'global differences' is related to the production of services that enable clients to compete in the global economy. Put differently: confronted with the increasing spatial and organizational complexity of their production and distribution networks, firms have become ever more dependent on the expertise of law firms, accountancy and consultancy firms, insurers, etc. to successfully run their business. Although 'APS' may thus seem like a chaotic conception in that they produce sometimes very different types of services, their myriad functions may be thought of as comparable in that they reduce the relative distance between places. This 'relative distance' has both a geographical and a socio-cultural dimension.

APS reduce geographical distance between places through the mobilization of assets. Banks and financial institutions, for example, enable and manage transnational flows of financial capital (Daniels, 1993; Parnreiter et al., 2004); ICT firms facilitate instant

exchange of information and data between geographically remote places (Bryson et al., 2004); and transportation and logistics companies fulfil the often immensely complex task of just-in-time distribution of goods (Hesse & Rodrigue, 2006; Hesse, 2007).
The socio-cultural distance between places, in turn, is reduced by APS firms through the acquisition, assimilation, and strategic implementation of knowledge of local cultures, languages and legal frameworks. Advertising firms, for example, set up advertising campaigns meticulously adapted to the specificities of different consumer segments all over the world. By creating and manipulating consumers' tastes and their emotional or material needs, they open up new markets for companies to sell their products or services. As such, advertising companies have become key actors in the reproduction of contemporary consumer capitalism (Taylor, 2006; Hudson, 2008). Law firms, in turn, not only provide their clients with detailed explicit knowledge on both international legal frameworks and local law systems concerning corporate, commercial and financial law, they also master indispensable tacit knowledge on political and cultural sensitivities (Beaverstock et al., 1999).

The overarching rationale for the analytical connection between emerging APS geographies and globalizing urban systems rests on two key observations. The first observation is that, to keep ahead in their business, APS firms require access to a skilled labour pool, information-rich and prestigious environs, and superior office, transport and telecommunications infrastructures, all of which are predominantly found in leading cities across the globe (see, however, Harrington & Campbell, 1997). The second observation is that APS firms have increasingly become multinational firms in their own right as they look for a foreign presence in an international market to service existing clients and find new ones (Aharoni & Nachum, 2000; Warf, 2001; Harrington & Daniels, 2006). As a result, we have seen the emergence of multinational APS firms with branches in cities all over the world, thus generating a seamless global service provision through a transnational web of global service centres also known as the WCN. Combining both insights, a central argument in WCN research is that a number of metropolitan centres have secured a particular component in their economic base that gives them a specific role in the current phase of the world economy (Sassen, 2001): they have become prime centres for the production and consumption of APS in the organization of global networks of capital. As locales for service innovations in areas such as multi-jurisdictional law and new financial instruments, these metropolitan centres constitute concentrations of information and knowledge necessary for new service productions by APS firms.

The above line of reasoning is, of course, the implicit line of reasoning in the research on the WCN/APS-nexus. But closer scrutiny reveals that some of the generalizing assumptions in this line of reasoning are not without their problems. The work of Hamburg-based geographer Christof Parnreiter is very instructive in this respect. In a paper on world city-formation processes in Santiago de Chile and Mexico City, for instance, Parnreiter (2003) notes that although the increased integration of Mexico/Chile in transnational commodity flows on the one hand and the mounting presence of internationalized APS firms in Mexico City/Santiago on the other hand run

parallel, no-one has ever provided qualified evidence about how both these processes of global economic integration are interrelated. Put differently: although the functional and spatial linkages between the presence of globalized APS clusters and 'economic globalization' seem straightforward if not commonsensical, these have not yet been explicitly broached by geographers. The main reason for this, Parnreiter (2003) argues, is that there is a systematic lack of information on the spatial and functional relations between APS firms and their clients. In his later work, Parnreiter et al. (2004, 2005) therefore tries revealing some of these missing links for *inter alia* the financial services sector by investigating how internationalized APS firms act as key network makers in the global economic integration of both countries through, for instance, the facilitation of transnational stock market transactions.
In his most recent contribution on the topic, Parnreiter (2010) additionally explores the linkages between auditors, law firms and real estate firms located in Mexico City, and their manufacturing, wholesale and retail clients. In the process, Parnreiter (2010) also addresses the issue of governance by examining to what degree the outsourcing of service activities simultaneously involves the outsourcing of strategic decisions. His main conclusion is that there is a wide variety of options, ranging from mere facilitative servicing to allow for transnational interactions (e.g. a logistics firm) to decision-making servicing that actually shapes the organization and spatiality of global economic integration (e.g. a bank). Apart from the type of APS, this governance dimension also depends on other factors. For instance, the particular position of the 'service user' will have an impact: it is unlikely (but not impossible) that small executive branches will be able to make decisions with global implications, so that APS firms servicing these branches have less leeway to influence the distribution of value in production networks.

When scrutinizing the different aspects of the 'positionality' of APS in the unfolding globalization of economies apparent in Parnreiter's research, we can identify the three dimensions that may be the focus for future research on this topic:

(i) The question of how e.g. financial firms and law firms facilitate the integration of the Mexican economy in the global economy is a clear example of the functional dimension[1];
(ii) The difference between e.g. a Guadalajara-based ICT firm as a mere facilitator versus a Mexico City-based bank as a decision-maker illustrates the different degrees of governance;
(iii) The observation that globalized APS firms tend to concentrate in Mexico City evidently relates to the spatial dimension of the positionality of APS firms.

In the remainder of this paper, we further elaborate on the 'spatial dimension', i.e. the geographical dimensions of APS procurement in the context of the globalization of (systems of) urban economies. Not only has this third dimension been the least

[1] Within the broader literature on APS or KIBS (knowledge-intensive business services), there exists a specific strand of research that implicitly deals with this first dimension (see, amongst others, Daniels, 1991 for the accountancy sector, Moulaert et al., 1991 for the IT consultancy sector, Bryson et al., 2004 for management consultancy, and Vanchan, 2007 for the industrial design sector).

researched topic, it is perhaps also the most crucial dimension from a geographer's point of view. In recent years, a limited number of publications has dealt with the way in which the location of APS firms relates to their clients' position in space. In addition to Parnreiter's work on this topic, Jacobs et al. (2010) have discussed the co-location and interaction between corporate control and APS capacity in port cities, while Lüthi et al. (2010) have assessed spatial patterns of service procurement by high-tech firms located in the greater Munich area.

The most systematic assessment of the linkages between APS and their business partners to date is the work by Rossi et al. (2007). Drawing on a survey amongst Brazil's leading firms on the outsourcing of APS in different service sectors, the authors are able to map the urban geographies of the transaction links between 'decision cities' (i.e. cities where MNEs are headquartered) and 'service cities' (i.e. the cities where the APS are bought). The most innovative element of this study is that the authors not only investigate the geography of transaction links, but also some of the functional factors influencing this geography. The latter is achieved through a statistical analysis of the associations between the characteristics of the MNEs (ownership, sector, and scale of business) and the location of their service firms.

In the next section, we aim to deepen the insights of these analyses by developing a heuristic scheme for assessing the spatial dimension of APS provision in the context of economic globalization. This is achieved through an analysis of the different geographical dimensions of APS provision to firms in the automobile cluster in the Port of Ghent (Belgium).

10.4 Spatial patterns in the provision of APS

THE AUTOMOBILE INDUSTRY IN THE PORT OF GHENT

According to the annual report on the economic importance of the Belgian ports published by the National Bank of Belgium (Mathys, 2009), the Port of Ghent is the country's third largest sea port, both in terms of maritime freight conveyance and employment. It is preceded by the ports of Antwerp and Bruges-Zeebrugge, and followed by the ports of Brussels and Ostend. In terms of value added, the port of Ghent is the second largest port after the Port of Antwerp. In 2007 the Port of Ghent directly accounted for 0.7% of the total employment in Belgium and for 1.2% of its GDP. Apart from the maritime and trade cluster, the port of Ghent accommodates several important industrial clusters of which the automobile industry is the third largest in terms of employment and value added - only the metal industry and the chemical industry are larger in both respects. The main part of the automobile cluster is comprised of Just-In-Time suppliers concentrated around Volvo Cars Gent, the Belgian subsidiary of the Swedish car manufacturer Volvo Cars.

In our survey, we concentrated on this automobile cluster to assess the spatial dimension of APS provision in greater detail. Based on a list of all the firms located in the Ghent sea port area (www.portofghent.be/Business), thirteen companies active in the manufacturing and distribution of motorized vehicles were contacted. Six of them did not want to participate due to corporate policies regarding public or private

surveys or lack of time and/or interest. Of the remaining seven companies, two completed and returned our questionnaire. The other five companies agreed to make an appointment for a semi-structured interview based on the questionnaire, which ranged in length from 30 to 45 minutes (for an anonymized list of the corporate positions of the interviewees, see Appendix). The results of this survey provide the empirical basis of our framework.

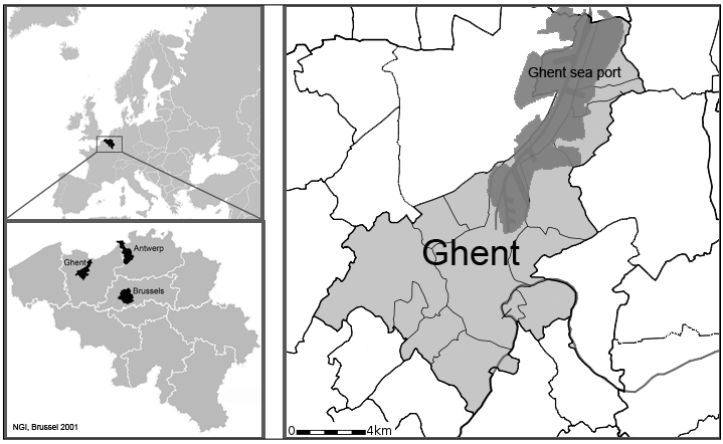

Figure 10.1 Location of Ghent and the Ghent sea port area

Our questionnaire and semi-structured interviews inquired about the procurement of APS in six sectors: accountancy, insurance, financial services, law, management consultancy, and ICT[2]. The questionnaire was divided into six sections so that correspondents could easily skip the sections for those services procured in-house or not procured whatsoever. Each section contained the same set of questions concerning (i) the location of the service partner, (ii) its nationality, (iii) the length of the contract, (iv) where decisions on this contract are made, (v) the factors influencing the selection of the service partner, and (vi) the nature of the services.

THE GEOGRAPHY OF TRANSACTION LINKS AND ITS UNDERLYING LOCATION FACTORS

Table 10.1 summarizes the geography of transaction links by automobile companies located in the port of Ghent in terms of intra-city and inter-city relations. It clearly shows the dominant position of Ghent and Brussels as service cities, in particular for accountancy and insurance & financial services respectively. The only other Belgian service cities are Antwerp (two links) and Courtray (one link), whereas five transaction links are with cities abroad.

[2] We did not include advertising in our survey since most of the firms are manufacturers for whom the marketing of a product is less relevant.

Table 10.1 Geography of transaction links

	Intra-city	National inter-city	International inter-city	Total
Accountancy (audit)	5	Brussels 1 Courtray 1		7
Insurance		Brussels 4 Antwerp 1	USA 1 Karlsruhe 1	7
Financial services	1	Brussels 4	Karlsruhe 1	6
Law	3	Brussels 2 Antwerp 1		6
Management consultancy	1			1
ICT	2		Gothenburg 1 Oderzo 1	4
Total	12	Brussels 11 Antwerp 2 Courtray 1	5	31

A first aspect of the spatial dimension of APS involvement relates to the geography of APS procurement in the strict sense. Recent research on APS geographies has focused on the locational prerequisites that seem to be abundantly present in key metropolitan areas aka 'world cities'. Table 10.1, however, suggests a more variegated picture. Although companies in the Port of Ghent do indeed acquire quite some services in Belgium's premier world city (Brussels), other patterns of spatial involvement emerge. First, 'spatial proximity' matters in that respondents indicated that in some cases the choice for a particular APS firm was influenced by the fact that it was 'conveniently' located (i.e. in Ghent itself, see Lüthi et al., 2010). For other firms/services space did not matter that much in that sometimes APS firms were primarily selected based on their 'reputation' and 'expertise' more than spatial proximity per se. The latter is of course related to the fact that in a small country such as Belgium, the notion of 'spatial proximity' is quite relative: all national inter-city links are with cities located at less than 60 kilometres from the Ghent sea port area.

Second, although the automobile sector in the Port of Ghent is a key example of a 'cluster' embedded in a transnational 'value chain', the 'global presence' of APS firms was only mentioned a couple of times as an important selection criterion. In other words, for this particular case, quality–related criteria were deemed more important than 'global presence', and no analytical connection between both was made on behalf of the respondents.

Third, beyond the 'spatial proximity' versus 'world city' dichotomy, there are a number of – at first sight 'unexpected' – international transaction links with cities such as Karlsruhe, Oderzo, and Gothenburg, showing the messy character of the spatial involvement of APS. It is however obvious that the transaction link between, say, Ghent and Gothenburg is in reality not that 'unexpected' as it can readily be explained by the fact that the ICT service provider has been 'imposed' by the parent automobile company in Sweden.

This last example leads us to the consideration of a second aspect of the spatial dimension of APS involvement, i.e. the different types of decision making regarding *where* in the value chain power is ultimately wielded with respect to the choice of an APS firm. In the above overview of transaction links, we implicitly assumed a complete decentralization of corporate decision-making power, which is in practice not tenable. For instance, while company G did explain that its parent company grants a relative large degree of independence to its divisions in order to avoid bureaucratic rigidity (thus allowing the local branch to make its own decisions regarding, say, ICT), company B is part of a corporation that maintains rather tight structures and centralizes most power at the top levels (thus imposing APS firms).
Based on the different types of organizational architecture outlined below, we can further refine Rossi's (2007) singular notion of transaction links between decision cities and service cities: based on the results of our survey/interviews, a more detailed distinction can be made between (i) first order decision cities where the corporate headquarters of a firm are located, serviced by (ii) first order service cities; (iii) second or lower order decision cities where local subsidiaries are located, serviced by (iv) second or lower order service cities, and finally (v) production or commercial nodes with little or no decision-making power. Although the configurations of the functional and spatial linkages between these different nodes can theoretically result in many different patterns, only four variations reappeared throughout our interviews (see Figure 10.2)[3].

(1) In the case of centralization, decision-making power is concentrated at the level of the parent company (PC). The flows between the first order decision city and the first order service city include strategic knowledge, contractual arrangements, capital transfers, etc. while the production or commercial nodes and the first order service city merely exchange information, ideas, products, services, etc. This was for instance the case for company F whose production activities were audited by a management consultancy firm subcontracted by its PC. Generally, such contracts are temporary and designed for one assignment at a single company. The selection of the APS firm therefore mainly depends on the specificities of the assignment and the expertise of the consultancy firm. This requires a thorough knowledge of the management and production processes of the client. Hence, although the parent company is formally in charge, outsourcing decisions are often made in consultation with the subsidiary.
Apart from the centralization of services for a single subsidiary, services for several or even all subsidiaries can also be centralized, for instance in the case of financial services (loans) or insurance products. As our correspondent at company G explained, economies of scale are often an important factor. Combining financial or insurance products for several subsidiaries in one contract reduces costs and grants the client a stronger negotiating position. Company A explained how its financial services, together with those of the other European subsidiaries and one subsidiary in South Africa are all handled at the level of its PC through a contract with a single bank in Brussels.

[3] Although our survey focuses on the automobile industry, we believe that these spatial models depict more general patterns that are also applicable to other sectors.

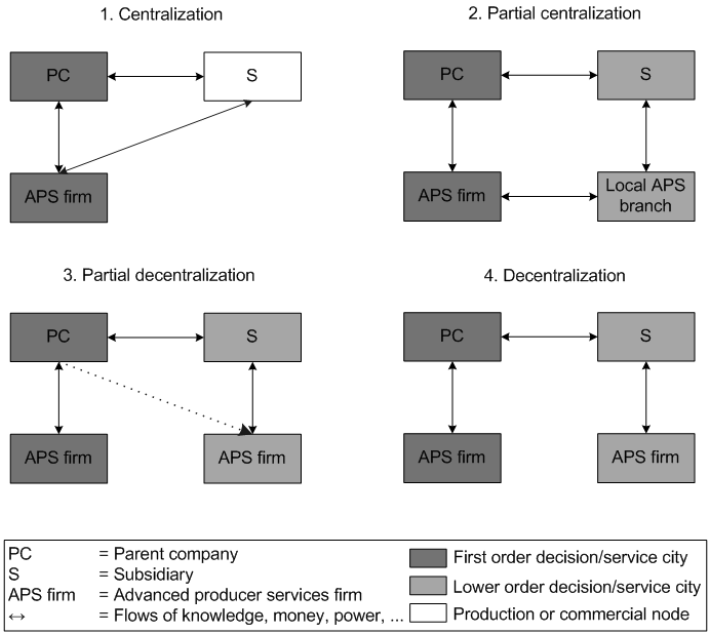

Figure 10.2 Four spatial models of APS transaction links

(2) For accountancy, all but one of the seven companies in our case-study indicated that their business partner is a local branch of their PC's accountancy firm. This is not very surprising as accountancy firms are amongst the most globalized companies in the world (Daniels et al., 1989). Since the PC selects the APS firm and sets out the broad lines of the contract, decision-making power is concentrated in the first order decision city, which has a strong relation with the first order service city. The specificities of the local contracts, however, are the responsibility of the subsidiaries, located in the second or lower order decision cities, and serviced by second or lower order service cities. Hence, accountancy is a typical example of partial centralization. Another example of this spatial model, although not applicable to our case-study, is that of global advertising. A PC contacts a multi-locational advertising firm to promote a product in all countries where it is sold. The use of a single agency ensures that the advertising campaign contains a coherent message, while the local branches adapt the campaign to the specificities of the local markets (Bryson et al., 2004).

(3) In spatial terms, the third and the fourth model are identical. In both cases the PC and its subsidiary are serviced by different APS firms, so that we are dealing with decentralised decision making. The two models differ as regards the flows between the first order decision city and the second order service city. In the case of partial decentralization, the subsidiary selects the APS firms, but the PC still has a say in the outsourcing process. Company F for instance, indicated that it can set its own contracts

with local banks and ICT firms albeit by mutual agreement with its PC. Company G, on the other hand, illustrates how this model can be the result of an acquisition in which the PC allows the new subsidiary to maintain its former contracts with its law firm.

(4) In the case of complete decentralization, a subsidiary subcontracts a local APS firm without the PC influencing or controlling the decision-making process. Companies C, D and E indicate that this is the case for their legal issues. Company C mainly consults its law firm for issues relating to labour law. The fact that this a local matter explains why the parent company is not involved in the decision-making process and a 'global presence' is not important at all. A similar argument is made by our correspondent at company G, who explains that the involvement of the parent company depends on the nature of the legal issue. Job disputes are local concerns, while the acquisition of a subsidiary will be coordinated from the PC. Company C exemplifies how this can also be the case for insurance: while labour insurance is serviced by a local insurance company, other insurance products such as property insurance or casualty insurance are procured at the level of the PC.

10.5 Discussion and conclusions

In this paper, we have tried to provide some new insights into the 'black box' of the positionality of APS in the globalizing economies of metropolitan regions. First, based on a critical literature review, we identified three dimensions to the relevance of considering the positionality of APS. The first dimension explores the functional relations between companies and their service partners. It identifies relevant APS firms, investigates what services they provide to their clients, and how these services affect their clients' managerial and/or operational activities. The second dimension studies the positionality of APS in terms of their clients' network governance by focusing on the question which service firms influence their clients' strategic decision-making process and hence the distribution of value (creation). The third dimension describes and explains the spatial configurations of the transaction links between 'service cities' and 'decision cities'.
Second, drawing on qualitative research on the location of APS firms servicing the automobile cluster in the Port of Ghent, we have tried to enhance our understanding of the complexity of the spatial dimension. Our main finding relates to the complexity of the transaction links, which shows that the spatial link between globalizing APS geographies and globalizing urban geographies can neither be summarized as a matter of 'spatial proximity' nor as matter of APS clusters in 'world cities'. Furthermore, this finding relates both to the location of APS firms in the absolute sense and the relative sense (i.e. the location where decisions regarding which APS firms to use is wielded). In the process, we identified four recurring spatial models of decision-making which underline the validity of Jones' (2002) qualitative research on heterarchical arrangements in the organization of multinational firms.

Taken together, our findings corroborate and further spell out Parnreiter's (2010) call for a more comprehensive appraisal of the interrelations between globalizing tendencies in APS geographies on the one hand and metropolitan economies and city-

systems on the other hand. Having said this, there is obviously a large scope for further specification and testing of our findings. One obvious example is that Figure 10.2 does not do justice to the incredibly complex economic and urban geographies under conditions of contemporary globalization. For instance, the heuristic model employed here assumes a simple division between parent company and subsidiary, which is often unrealistic. Furthermore, the practical value of the different models summarized in Figure 10.2 needs further scrutiny because of the limited scope of this case-study: other empirical settings – both in terms of economic sector and regional background – would provide us with the necessary comparative material to solidify and/or alter and/or complement the heuristic model outlined in Figure 10.2.

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10.7 Appendix. List of corporate positions of the interviewees

Company A: Plant Manager*
Company B: Employees of financial and legal departments*
Company C: Plant Manager*
Company D: CFO
Company E: Logistics & IT/IS Manager
Company F: Business Process Manager*
Company G: Plant Manager*

For companies with a *, the questionnaire was supplemented with a semi-structured interview.
Companies without a * emailed the completed questionnaire.

11 Assessing the functional polycentricity of the mega-city region of Central Belgium based on advanced producer service transaction links

Hanssens, H., Derudder, B., Van Aelst, S., and Witlox, F. (2011) Assessing the functional polycentricity of the mega-city region of Central Belgium based on advanced producer service transaction links. Regional Studies, submitted.

11.1 Abstract

The formative aim of this paper is to contribute to the urban geography literature that studies the spatiality of contemporary MCRs through the lens of APS. In doing so, it essentially complements the research that has been done in the POLYNET project on three accounts: (i) it introduces an alternative method based on inter-firm transaction links to *quantitatively* measure *actual* flows of information in the APS sector, (ii) it develops and implements a more sophisticated method to calculate the functional polycentricity index (FPI), and (iii) it broadens the conceptualization of functional polycentricity by introducing a formal model to test the degree of urban network integration in the MCR. These alternative methods are implemented to a specific case-study that assesses the functional polycentricity of the MCR of Central Belgium based on APS procurement by Belgium's top-300 companies. The results suggest that, when it comes to service procurement by large companies in Belgium, Central Belgium displays more features of a hierarchical urban system with Brussels as dominant service city than of a functionally polycentric urban system.

11.2 Introduction

One of the many spatial structures associated with the nexus between globalization processes and urban change has been the development of a new type of urban form, formally known under a wide range of labels such as multi-core metropolis (Hall, 1999); global city-regions (Scott, 2001); polycentric urban regions (Kloosterman & Musterd, 2001); and – as applied in the present paper – mega-city regions (MCR; Hall & Pain, 2006). Although the various terminologies differ in specific meaning and regional scope, they do share some core features of what constitutes this new type of urban form (Hoyler et al., 2008): it is spread out over a large area, contains a number of physically separate but functionally networked cities and towns that are more or less at commuting distance and clustered around one or several larger central cities, and is/is increasingly becoming to some degree *polycentric* in that (i) there is no dominant city and (ii) there is considerable regional cohesion in personal occupational, and corporate relationships of people, organizations, and firms (Kloosterman & Musterd, 2001; Hall & Pain, 2006, 3; Hoyler et al., 2008; de Goei et al., 2010).

In the urban geography literature, a variety of empirical approaches exist to study the spatial structure of contemporary city-regions (e.g. commuter flows, leisure trips, corporate relations…). The present paper contributes to a specific line of research that explores the geography of inter-city relations through the lens of advanced producer services (APS)[1]. Despite the recent growth of the APS sector (Wood, 1991; Bryson et al., 2004) and the increasing importance of APS firms in the contemporary knowledge economy, until recently, only few studies have focused on the spatiality of (business relations and/or information flows in) this sector to explore the geography of contemporary city-regions (see, for instance, Lambooy, 1993; van der Knaap, 1994). In more recent years, however, the European Commission – through the INTERREG IIIB project – has invested in what has probably been the most comprehensive and elaborate research effort on the subject so far, namely the POLYNET project. Building theoretically on (i) Sassen's (2001) global city theory; (ii) the world city network (WCN) model devised by the Globalization and World Cities (GaWC, http://www.lboro.ac.uk/gawc) research group (Derudder *et al.*, 2003; Taylor 2001, 2004; Taylor & Aranya, 2008); (iii) the literature on global city regions (Scott, 2001); and (iv) Castells' (1996) space of flows, the POLYNET project has studied flows of information, people, knowledge… in the advanced producer services (APS) sector to quantitatively and qualitatively measure inter-city relations both within eight North West European MCRs[2] and beyond their boundaries (Hall & Pain, 2006).

[1] For the remainder of this paper, we employ the term advanced producer services (APS) rather than knowledge-intensive business services (KIBS). There are two reasons for this: (i) this paper to some extent conceptually builds on the literature on global cities and the world city network in which APS is more commonly used than KIBS; and (ii) apart from the usual KIBS such as management consultancy, law, advertising… our analysis also includes financial services and insurance.

[2] The eight MCRs are South East England, the Randstad, Central Belgium, RhineRuhr, Rhine-Main, the European Metropolitan Region Northern Switzerland, the Paris Region, and Greater Dublin.

The formative aim of this paper is to contribute to the urban geography literature that studies the spatiality of contemporary MCRs through the lens of APS. In doing so, it essentially complements the research that has been done in the POLYNET project on three accounts: (i) it introduces an alternative method based on inter-firm transaction links to *quantitatively* measure *actual* flows of information in the APS sector, (ii) it develops and implements a more sophisticated method to calculate the functional polycentricity index (FPI), and (iii) it broadens the conceptualization of functional polycentricity by introducing a formal model to test the degree of urban network integration in the MCR. These alternative methods are implemented to a specific case-study that assesses the functional polycentricity of the MCR of Central Belgium based on APS procurement by Belgium's top-300 companies.

The remainder of the paper is structured as follows. Section 11.3 starts with a brief definition of functional polycentricity and discusses how the functional polycentricity of the eight North West European MCRs is *quantitatively* measured in the POLYNET project. The second part of section 11.3 provides a more detailed discussion of the three accounts on which this paper complements the POLYNET research. These are then discussed and implemented to our case-study in sections 11.4, 11.5 and 11.6 of this paper. Section 11.4 describes our methodology for collecting transaction link data, section 11.5 develops and implements an alternative method to calculate the FPI, and section 11.6 introduces a formal model to test the degree of urban network formation. In the conclusions, we present a critical overview of our main findings and outline some avenues for future research.

11.3 Measuring functional polycentricity through the lens of the APS sector

THE POLYNET PROJECT: METHODOLOGIES AND DATA

To define the concept of functional polycentricity, Burger & Meijers (2010) initially distinguish between *multicentricity* and *polycentricity* in that the latter concept – apart from the obvious existence of multiple centres – also involves *a certain balance in importance of these centres*. A fundamental difference of opinion in the existing literature relates to how this 'importance' can and should be measured. In general, polycentricity is analyzed either in terms of absolute importance (i.e. *nodality*) of centres or in terms of relative importance (i.e. *centrality*) of centres. The former approach, referred to as *morphological* or *spatial polycentricity*, makes use of static attributes (e.g. employment, population) to quantify the importance of a city. The latter approach, referred to as *functional polycentricity*, makes use of relational data (e.g. commuting, shopping trips, or – in the case of POLYNET – flows of knowledge). Based on these definitions, it follows that a functionally polycentric MCR is one in which there is *a certain balance in the relative importance or centrality of the constituent centres*. Assessing the functional polycentricity of a MCR thus constitutes two steps: (i) quantifying the centrality of each centre; and (ii) combining these measures into one single index to compute the degree of balance.

To explore the structure and dynamics of the eight European MCRs and assess their functional polycentricity, POLYNET explores the geography of information flows in the APS sector. It hereby combines both quantitative and qualitative approaches and uses a number of different datasets. Although each of these approaches contributes in its own specific way to the overall picture that is gradually drawn for each of the eight MCRs, this section focuses on one of them because it is, from a methodological perspective, the approach that shares most resemblances to the one adopted in this paper.

The approach in question constitutes an implementation of the GaWC methodology, which was originally devised by the Globalization and World Cities (GaWC) research network to measure the world city network (WCN), of which the scope has been extended to the regional scale (Taylor et al., 2006, 2008). The WCN is specified as an interlocking network with three levels (Taylor, 2001): a network level (i.e. cities connected in world economy), a nodal level (i.e. the cities), and a sub-nodal level (i.e. the firms providing APS). It is at the latter level that *network formation* takes place. Through their attempts to provide a seamless service to their clients across the world, and given their dependency on urbanization economies, APS firms have created global networks of offices in cities around the world. One of the basic assumptions of the WCN model is that these offices are linked to one-another by intra-firm flows of information and knowledge as projects for international clients require multiple office inputs. Globalized APS firms are thus the prime producers of the WCN, and their multiple office locations can be used as a proxy for inter-city flows of information.
The WCN is then defined as the inter-urban flows generated within the context of the global location decisions of service firms. The model can be formally represented by a matrix V defined by *n* cities X *m* firms where v_{ij} is the 'service value' of city *i* to firm *j*. The service value is the importance of a city to a firm's office network and depends upon the size and functions of an office or offices in a city. The global network connectivity GNC_a of city *a* in this interlocking network is defined as follows:

$$GNC_a = \sum_{i,j} v_{aj} \, . \, v_{ij} \text{ (a} \neq \text{i)} \qquad (11.1)$$

The conjecture behind conceiving the product of service values as a surrogate for actual flows of inter-firm information and knowledge between cities is that the more important the office, the more connections there will be with other offices in a firm's network (see however Dicken & Malmberg, 2001; Jones, 2002; and Lambregts, 2008 for a critical appraisal of the assumptions underlying GaWC's WCN model). The limiting case is a city that shares no firms with any other city so that all of its service value products in equation (1) are 0 and it has no connectivity.

As already mentioned, POLYNET extends the scope of the GaWC model to the local scale. In practice, this means that – rather than merely looking at apex of cities and APS firms in the world economy and measuring an urban network at the global scale – POLYNET includes cities and APS firms with a national or regional scope (for more

information, see Hall & Pain, 2006; Taylor et al., 2006, 2008). The measurement methodology (equation 11.1) however remains the same. Network connectivity and centrality can thus be considered as synonyms, and are commonly expressed in relative terms, which is a city's network connectivity divided by the network connectivity of the most connected city.

Once the network connectivities are calculated, the second step is to combine these scores into a single functional polycentricity index (FPI) to quantify the degree of balance. In the POLYNET project, this is done by taking the average relative connectivity of the non-leading cities, which are the cities with a relative connectivity smaller than 1 (Taylor et al., 2006).

SUGGESTIONS FOR ALTERNATIVES

As already explained in the introduction, this paper aims to contribute the literature that studies the spatiality of contemporary MCRs through the lens of advanced producer services by complementing the POLYNET research on three accounts. The first relates to the measurement of actual flows of information in the APS sector. One of the main methodological concerns of the POLYNET project constituted the difficulty of collecting *quantitative* data on *actual* information flows (Hall & Pain, 2006; Pain & Hall, 2008). Either information flows were studied quantitatively, but then analyses were based on a *proxy* (i.e. APS office locations and timetabled flights and trains), or actual information flows were considered, but then the available dataset was too limited to allow for meaningful quantitative analyses.
This paper introduces an alternative approach to study actual information flows in the APS sector, namely one that quantitatively measures the information flows associated with the provision of advanced services to clients. We call this type of information flows 'transaction links'. It is generally accepted – particularly in management studies – that clients play a key role in the co-production of advanced knowledge and services (Bettencourt et al., 2002; Auh et al., 2007, Möller et al., 2008; Trippl et al., 2009). It thus seems reasonable to assume that transaction links involve at least some degree of high-end information and knowledge exchange. Therefore, rather than measuring functional inter-city relations in terms of assumed intra-firm linkages, this paper measures functional inter-city relations in terms of service provision to clients, which arguably implies a more concrete measure of inter-city networking[3] (see Rossi et al., 2007; van Oort et al., 2010; and Lüthi et al., 2010 for similar research). In section 11.4 of this paper, we explain how such transaction link data were collected and processed.

The second account on which this paper complements the POLYNET research relates to the way in which the functional polycentricity index (FPI) is calculated. As we explained in the previous section, this was done by taking the average relative connectivity of the non-leading cities. The problem with this methodology, however, is

[3] A similar argument has been made in studies that measure inter-city relations based on ownership links in multinational companies (cf. Alderson & Beckfield, 2004; Rozenblat & Pumain, 2007; Wall & van der Knaap, 2010).

that the outcome is not only determined by the centrality scores of the constituent centres, but also by the number of centres. As a consequence, the FPIs of urban systems with a different number of constituent centres cannot be compared. Section 11.5 of this paper therefore develops a more sophisticated index that is both insensitive to the size of the urban system, and that allows for a straightforward interpretation of the results.

The third and final way in which this paper complements the POLYNET research is that it broadens the conceptualization of functional polycentricity by introducing a formal model to assess the degree of urban network integration in the MCR. To quantitatively measure the functional polycentricity of the MCRs, POLYNET has calculated the centrality (connectivity) of the constituent FURs. In doing so, it implicitly assumed a conceptualization of functional polycentricity which can be described as a situation where there is *a certain balance in the relative importance (centrality) of the constituent centres*. However, although this is a necessary condition for a functionally polycentric MCR, it is not a sufficient one. Another necessary condition relates to the *spatial distribution* of these inter-city relations in general, and to the existence of a certain degree of urban network integration in particular. This means that the constituent cities and towns (FURs) are to a more or lesser extent functionally networked, which involves a *considerable regional cohesion in personal, occupational and corporate relationships* (de Goei et al., 2010; van Oort et al., 2010). In other words, a functionally integrated MCR not only displays hierarchical core-periphery relations, but also criss-cross relations between cores or between cities in the periphery. Assessing the degree of urban network integration could be easily done by simply visualizing/studying the inter-city relations, which was also done in the POLYNET project and in section 11.5 of this paper. However, as we will explain in more detail in section 11.6, a simple visual analysis is not sufficient. It is best to complement it with what de Goei et al. (2010, 1156) call "a formal model to test the structure in spatial interaction patterns". How this is done will also be discussed section 11.6.

11.4 Case-study: collecting transaction link data

THE STUDY AREA

The MCR of Central Belgium – as defined by the Belgian team of the POLYNET project (Hall et al., 2006) – comprises a densely populated area straddling the linguistic and administrative borders between the Dutch-speaking Flemish Region, the French-speaking Walloon Region, and the bilingual Brussels-Capital Region. Its economic core consists of an area known as the *Flemish Diamond*, which is bounded by the agglomerations of Antwerp, Leuven, Brussels and Ghent, and originated as a policy instrument for spatial planning by the Flemish government. The MCR of Central Belgium is dominated by the city of Brussels, which is the capital of both the federal state of Belgium and the European Union, and is also the economic decision-making centre of the country, hosting many financial and corporate headquarters that grant it its world city status (Elmhorn, 1998, 2001; Derudder & Taylor, 2003; Derudder et al., 2010). Antwerp, the second largest city, accommodates one of Europe's largest ports

and is also the country's first industrial region. Apart from Brussels and Antwerp, the MCR of Central Belgium also consists of a number of regional cities such as Ghent and Hasselt/Genk in the Dutch-speaking part, and a belt of old industrial towns in the French-speaking Region south of Brussels, including Mons-La Louvière, Charleroi and Liège (Aujean et al., 2005; Hall et al., 2006; Vandermotten et al., 2006).

DATA COLLECTION AND PROCESSING

To measure the functional polycentricity of Central Belgium based on transaction links, we collected information on APS procurement by the 300 largest companies located in Belgium[4]. Between the 7th of June and 22nd of November 2009, we sent out a questionnaire asking these companies to identify and locate their main business partner for accountancy, advertising, banking/finance, insurance, law, management consultancy and ICT. Of the 300 companies we received 97 completed surveys. 21 companies indicated that they would not participate in our survey for reasons of confidentiality.

To locate both user and service firms, municipalities' postal codes were collected as initial data. However, to allow for a meaningful comparison with the results of the POLYNET study, we aggregated the municipalities to the level of the functional urban regions (FURs) as defined by the Belgian team[5] (Aujean et al., 2005; Hall et al., 2006). The only difference is that we listed Leuven and Mechelen – two secondary agglomerations in the FUR of Brussels – separately as both agglomerations displayed a relatively high number of links compared to both other secondary agglomerations (e.g. St-Niklaas) and other FURs (e.g. Bruges, Charleroi). For companies located outside the MCR, we retained the municipality as spatial unit as POLYNET did not define FURs outside the MCR.

Table 11.1 lists the distribution of the population (300 companies) and the sample (97 companies) by location, administrative region and sector. The last column provides information on the representativeness of the sample by comparing the relative distribution of the sample with the relative distribution of the population. It shows that Walloon companies are somewhat underrepresented in the sample, whereas companies in the Brussels-Capital Region are slightly overrepresented[6]. Regarding the

[4] Belgium's top 300 firms as listed on the website of Trends Top (http://trendstop.rnews.be, Accessed: 11 May 2009). This ranking is based on corporate turnover figures for fiscal year 2007.

[5] A FUR comprises an economic core and a ring consisting of those neighbouring municipalities in which at least 10% of the working population commutes to the core on a daily bases. The economic core of a FUR is either a number of neighbouring municipalities with an employment density in excess of 700 jobs per km² and having a total of at least 35 000 jobs; or a municipality with over 35 000 jobs plus its neighbouring municipalities with an employment density exceeding 700 jobs per km². In the Belgian case, eight contiguous FURs make up the MCR. For more details on the geographical definition of the MCR of Central Belgium, see Aujean et al. (2005).

[6] As our questionnaire was written in Dutch and English but not in French, it has been suggested that the underrepresentation of Walloon firms might be the result of a language bias. There are two reasons why

sectoral distribution, only NACE sections D and E are slightly underrepresented, while information and communication firms (NACE section J) are somewhat overrepresented. Overall however, the scores in Table 11.1 allow us to conclude that the sample of 97 companies is more or less representative for the population of the top-300 companies in Belgium.

Table 11.1 Geographical and sectoral distribution of firm population (300 companies) and sample (97 companies)

	Pop.	% Pop	Sample	% Sam	RATIO
Flanders	122	40.67	39	40.21	0.99
Brussels Capital Region	150	50.00	54	55.67	1.11
Wallonia	28	9.33	4	4.12	0.44
C: Manufacturing	108	36.00	39	40.21	1.12
D: Electricity, gas, steam & air conditioning supply	15	5.00	3	3.09	0.62
E: Water supply, sewerage, waste management…	4	1.33	1	1.03	0.77
F: Construction	5	1.67	2	2.06	1.24
G: Wholesale and retail trade…	109	36.33	33	34.02	0.94
H: Transporting and storage	16	5.33	5	5.15	0.97
J: Information and communication	12	4.00	5	5.15	1.29
K: Financial and Insurance activities	12	4.00	4	4.12	1.03
L Real estate activities	1	0.33	0	0.00	0.00
M: Professional, scientific and technical activities	4	1.33	0	0.00	0.00
N: Administrative and support service activities	11	3.67	4	4.12	1.12
P: Education	1	0.33	1	1.03	3.09
Q: Human health and social work activities	1	0.33	0	0.00	0.00
R: Arts, entertainment and recreation	1	0.33	0	0.00	0.00

The result of our survey was a dataset containing 332 national transaction links[7] which we then converted into an asymmetric, directional matrix listing the number of transaction links between each of the 17 user cities (FURs or municipalities where the user firms are located) and each of the 15 Belgian service cities (FURs or municipalities where the service firms are located). This matrix is the empirical basis for all further calculations (see Table 11.2).

we think this might be the case only to some extent. First of all, the bilingual (though in practice predominantly French speaking) Brussels Capital Region is overrepresented in our sample. Second, instead of considering the location of the companies to test the assumption of a language bias, it might be more useful to take into account the (native) language of the CEO/CFO or personal assistant who initially received and dealt with our survey.

[7] It should be noted that, on top of the 332 national links, our dataset also included 26 international links with service cities abroad.

Table 11.2 Service city-to-user city matrix

User cities / Service cities	Antwerp	Bruges	Brussels	Charleroi	Ghent	Hasselt-Genk	Leuven	Liège	Mechelen	Mons-La L.	Estaimpuis	Geel	Izegem	Kortrijk	Oostende	Roeselare	Wielsbeke	Regional centrality	National centrality
Antwerp	32		15		1	1	1		2			3						52	55
Bruges																1		0	1
Brussels	35	2	165	1	9	3	1	3	2	1	3		5	8	3		4	222	245
Charleroi																		0	0
Ghent	2		1		4				1		1		2	2	1			8	14
Hasselt/Genk	1					2												3	3
Leuven			1				1		1									3	3
Liège			1															1	1
Mechelen	1					1												2	2
Mons-La L.										1	1							1	2
Geel												1				1			1
Kortrijk																1			1
Roeselare	1	1																	2
Turnhout												1							1
Westerlo	1																		1
Total																		292	332

11.5 An alternative approach for calculating the FPI

When looking at the list of user and service cities in Table 11.2, it becomes clear that the geography of transaction links is not restricted to the MCR. Seven of the 17 user cities and five of the 15 service cities are located outside the MCR. Hence, the functional polycentricity of Central Belgium can be measured at two scales: the regional scale, i.e. by considering only the intra-MCR transaction links (white matrix in Table 11.2), and the national scale, i.e. by extending the white matrix in Table 11.2 with the user and service cities outside the MCR (grey area). In the first part of this section, we will discuss the methodology for measuring functional polycentricity at the regional scale. A similar procedure is then implemented for the national scale. The results are discussed in the second part of this section.

DEVELOPING AN ALTERNATIVE FPI

As was explained in section 11.3, measuring the functional polycentricity of a MCR entails two subsequent steps: (i) measuring the centrality of each city/FUR; and (ii) combining these centrality scores into a single index to quantify the degree of balance. For the first step, we focus on the white matrix in Table 11.2. The rows in this matrix list the total number of services supplied by each FUR to the other FURs in the MCR. A FUR's centrality can be easily computed by taking the sum of the row scores, which equals the total number of transaction links supplied by a FUR (see column 'Regional centrality' in Table 11.2). Absolute figures are standardized by dividing them by the largest centrality score, which is that of Brussels. These relative centrality scores are listed in the second column of Table 11.3.

Table 11.3 Relative centrality scores and functional polycentricity index for each scale

	Regional	National
Antwerp	0.23	0.22
Bruges	0.00	0.004
Brussels	1.00	1.00
Charleroi	0.00	0.00
Ghent	0.04	0.06
Hasselt-Genk	0.01	0.01
Leuven	0.01	0.01
Liège	0.005	0.004
Mechelen	0.01	0.01
Mons-La Louvière	0.005	0.01
Geel		0.004
Kortrijk		0.004
Roeselare		0.01
Turnhout		0.004
Westerlo		0.004
FPI	0.074	0.078

The second step is to combine the relative centrality scores into one single FPI. To do so, we implement an alternative index that is both insensitive to the size of the MCR and that allows for a straightforward interpretation of individual values. The specification of this functional polycentricity index (FPI) is a variation on the specification of the indices developed in Van Nuffel et al. (2010). The FPI is calculated in three steps.

First, we compute for each FUR *i* the ratio between its *relative centrality* (RC_i) and the average relative centrality of the other FURs. We call this measure the *dominance index* (DI_i) of city *i* as it measures the extent to which FUR *i* is more or less important compared to the average importance of the other FURs:

$$DI_i = \frac{RC_i}{\sum_{j=1}^{J} \frac{RC_j}{J}} \qquad (11.2)$$

In a second step, we quantify the overall degree of variance in the DI's by calculating the *standard deviation* (SD)[8]. The more balanced the importance of the FURs (i.e. the more polycentric the MCR) the smaller the SD. The larger the dominance of one or a few cities, the larger the SD. The SD is however still sensitive to the number of constituent FURs in a MCR. Van Nuffel et al. (2010) demonstrate this by calculating the SD for a rank size distribution with an equal number of FURs/cities. In this rank size

[8] The reason why we calculate the SD of the DI's instead of the SD of the RC's is that – as will become clear in the third step of our measurement methodology – we need the SD to become infinite in the limiting case of absolute dominance.

distribution, the relative centrality of FUR i (RC'_i) is 1/i of the relative centrality score of the largest FUR, which is 1. In other words:

$$RC'_i = \frac{1}{i} \tag{11.3}$$

If the SD was insensitive to the number of FUR, then adding a FUR k with a RC' of 1/k would have no impact on the SD. As this is not the case, the third step is to normalize the SD in such a way that eliminates its sensitivity for the number of FURs, and that statements about individual values can be easily substantiated. The normalization formula is (Van Nuffel et al., 2010):

$$FPI = \frac{2-\frac{SD}{SD_{RS}}}{2} \text{When } SD \leq SD_{RS} \tag{11.4}$$

$$FPI = \frac{\frac{SD_{RS}}{SD}}{2} \text{ When } SD \geq SD_{RS} \tag{11.5}$$

The outcome is an FPI that, indifferent of the number of FURs in the MCR, results in a value between 0 and 1, where 0 indicates absolute dominance, 1 points to perfect polycentricity, and 0.5 reflects the rank size distribution.

EVIDENCE FOR A BALANCE IN URBAN CENTRALITY IN THE MCR OF CENTRAL BELGIUM

This section discusses the results of the functional polycentricity calculations in Table 11.3, and studies the geography of city-to-city relations using the cartogram in Figure 11.1. In the cartogram, the area of the MCR is marked by the frame. Intra-MCR transaction links are represented by black arrows, while the grey arrows represent transaction links with or between Belgian cities outside the MCR. The linguistic border between the Flemish Region and the Walloon Region is also indicated on the cartogram. The orientation of the arrows corresponds to the direction of the service supply (from service city to user city), the borders around the city names correspond to the intra-city links. Cities without intra-city links have no borders. The weight of the arrows and borders is a function of the relative city-to-city service score, which is the absolute city-to-city service score as listed in Table 11.2, divided by the largest city-to-city score (in this case 165).

Urban centrality at the regional scale

When comparing the two highest scores in the second column of Table 11.3, the figures unmistakably point to the dominance of Brussels. Apparently, large companies located in the MCR of Central Belgium apply to APS firms located in Brussels over four times more than to APS firms located in the second city (Antwerp). The relative centrality of the remaining eight FURs is almost negligible. Ghent appears to be the most 'wanted' regional city for APS procurement, followed first by Hasselt/Genk, Leuven and Mechelen, and then by the Walloon FURs of Liège and Mons-La Louvière, which display an even smaller centrality. Bruges and Charleroi supply no APS, resulting in a relative centrality of 0.

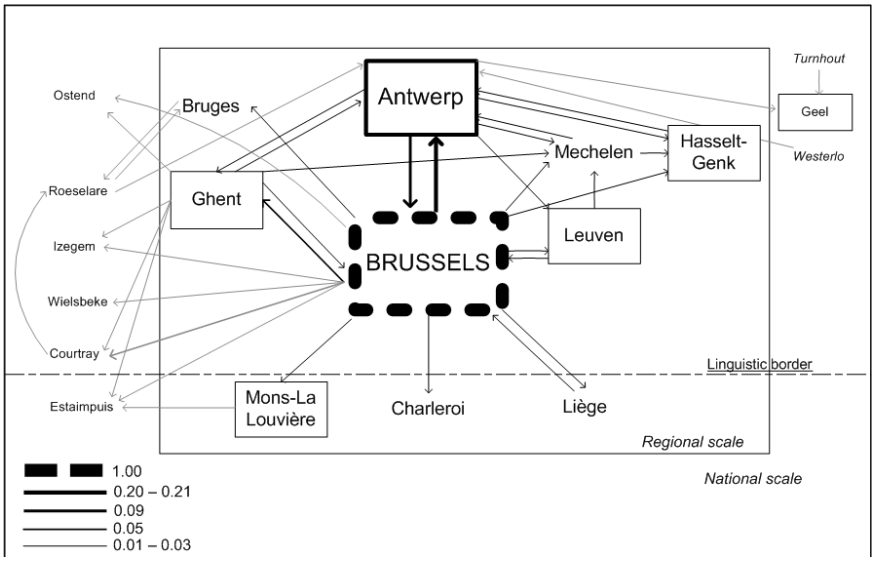

Figure 11.1 Geography of transaction links at the regional and national scale

When we take a look at the geography of the individual inter-FUR relations in Figure 11.1, the most striking feature is probably the weight of the border around Brussels: 57% of all regional transaction links are procured within this FUR. Since 54 of the 97 companies in our sample are located here (see Table 11.1), this is however not that much of a surprise. Another notable feature are the arrows between Brussels and Antwerp, indicating the relatively strong link between both FURs. Moreover, Antwerp also displays a relatively high number of intra-city links itself. The only other inter-city relation of some importance is the one between Brussels and Ghent. When looking at the spatial distribution of the remaining service links, we find that Brussels is the only city that is appealed to by each of the other FURs in the MCR. Moreover, apart from one intra-FUR link in Mons-La Louvière, it is also the only service city for all three Walloon FURs. Except for Bruges, Flemish FURs by contrast feature a more regionally intertwined pattern of APS procurement. Interestingly, there are no cross-border links between Flemish and Walloon FURs in either direction[9].

Taken together, these observations suggest that – as for APS provision to large companies at the regional scale – Central Belgium displays features of a hierarchical urban system with Brussels standing out as dominant service city both in terms of absolute number of links (centrality) and in terms of the spatiality of these links. The latter refers to the fact that Brussels is the only city that provides APS to all other cities

[9] Although Brussels is situated north of the linguistic border, it officially constitutes a bilingual region. Therefore, the transaction links between Brussels and either Walloon or Flemish FURs or are not considered as cross-border linkages.

in the MCR and that there are no other major links bypassing the city. This is also confirmed when looking at the FPI (see last row in Table 11.3).

Urban centrality at the national scale

To measure the functional polycentricity of Central Belgium at the national scale, the regional, white matrix in Table 11.2 is extended with the grey area. This allows answering the following two questions: (i) are there notable changes in the relative importance of the FURs when transaction links to cities outside the MCR are considered; and (ii) can we identify important service cities outside the MCR?

As Table 11.3 shows, the answer to the first question is clearly negative. Brussels remains the prime service city at the national scale. Its lead on the second city Antwerp even grows as the latter displays a small decrease in relative importance. In fact, Ghent is the only service city who's relative centrality significantly increases at the national scale. The reason for this somewhat remarkable difference between Antwerp and Ghent has however more to do with the demarcation of the MCR – a key issue in spatial analysis known as the Modifiable Area Unit Problem (MAUP) – than with their relative importance as service cities at the national scale. As defined by POLYNET, the MCR of Central Belgium excludes a relatively important region in economic terms in the vicinity of Ghent, consisting of cities as Kortrijk, Roeselare and Izegem. Extending the MCR to include these cities would result in a slightly larger relative centrality for Ghent (0.05 instead of 0.04) and a slightly smaller relative centrality for Antwerp (0.022 instead of 0.023) at the regional scale.
This is also visible in Figure 11.1 where the national transaction links clearly display an intertwined pattern in the western part of the country with Ghent and Brussels as the main service cities. A remarkable link in this spatial pattern is the one between Ghent and Estaimpuis since it is the only transaction link in our dataset crossing the linguistic border[10]. Table 11.3 learns that the FPI at the national scale is only slightly larger than at the regional scale. The MCR of Central Belgium in other words more or less retains it hierarchical structure at the national scale.

To answer the second question regarding the existence of important service cities outside the MCR, we need to look at the relative centrality scores of the five extra-MCR service cities in Table 11.3. It becomes immediately clear that these are all cities of little significance and that there are no remarkable inter-city links bypassing the MCR. Hence, when it comes to APS procurement by Belgium's largest companies, Brussels is not only the prime service city in the MCR, but also the prime service city at the national scale.

[10] In her study of the impact of the Belgian linguistic border on the spatial configurations of inter-firm networks of small- and medium-sized enterprises located in the Flemish-Walloon border region, Strihan (2008) reported similar observations. She noted that corporate networks do have ties crossing the border, but that these are few and – in her study – predominantly develop along family-based or ethnic axes of solidarity.

11.6 A formal model for testing urban network integration

THE GRAVITY MODEL

As already explained in section 11.3, the existence of a number of cities of more or less equal importance is a necessary but not sufficient condition for functional polycentricity. The spatial distribution of these inter-city relations should also be taken into consideration. In this context, de Goei et al. (2010) and van Oort et al. (2010) argue that the most extreme form of functional polycentricity can be conceived of as "a fully integrated, larger-scale urban network in which there is no effect of the spatial-functional context on inter-firm networks other than the economic mass of sending and receiving localities" (the larger their economic mass, the larger the probability of inter-city relations) "and the physical distance between them" (the larger the distance, the smaller the probability). The obvious reason why a simple visualization of urban relations is not sufficient to assess the degree of urban network integration, is that it "does not allow for differences in the absolute sizes of municipalities and the distance between them" (de Goei et al., 2010, 1156). It might for instance be the case that there is a *relatively* large degree of interaction between Leuven and Mechelen, but that this interaction somewhat 'disappears' because of the - in absolute terms - small size of both cities and because of their close proximity to Brussels.

To formally test the structure in the spatiality of transaction links, we introduce an interaction model that is well-known in spatial analysis and regional science: a geographical application of Newton's gravity model:

$$I_{ij} = K \frac{M_i^{ß1} M_j^{ß2}}{d_{ij}^{ß3}} \qquad (11.6)$$

The dependent variable I_{ij} is the interaction intensity between FURs *i* and *j* expressed as the number of transaction links provided by service FUR *j* to user FUR *i*. *K* is a proportionality constant, M_i is the mass of the user FUR defined as the total number of transaction links 'demanded' by the FUR and M_j is the mass of the service FUR defined as the total number of transaction links 'provided' by the FUR. Finally, d_{ij} is the physical distance between two FURs. For inter-FUR relations, this is calculated as the shortest distance by road between the centres of the core cities of the FURs (e.g. centre of Antwerp to centre of Brussels). This is a good approximation since most of the large companies and APS firms in our survey are located in or in the near proximity of a FUR's core municipality. For intra-FUR relations, d_{ij} is calculated by taking two-thirds of the radius of the circle equalling the area A_i of the FUR (see Bröcker, 1989; and Frost & Spence, 1995 for further details):

$$d_{ii} = \frac{2}{3}\sqrt{\frac{A_i}{\pi}} \qquad (11.7)$$

ß1, ß2 and ß3 are parameters to be estimated. ß1 reflects the potential of a FUR to generate demand for transaction links, ß2 reflects the potential of a FUR to provide

APS services, and ß3 is an impedance factor reflecting the rate of increase of the friction of physical distance.

To estimate these parameters, several regression models have been implemented in the literature. The most simple and therefore most commonly used model is multiple linear regression, often referred to as the log-normal model because of its use of natural logarithms. More advanced models include Poisson regression (Flowerdew & Aitkin, 1982) and zero-inflated negative binomial (ZNB) regression (Burger et al., 2009; de Goei et al., 2010; and van Oort et al., 2010). Contrary to the log-normal model, where the interaction variables are assumed to be normally distributed around the estimate, the Poisson and ZNB model are count models, which treat the interaction variable as the outcome of a discrete probability process. The main difference between Poisson regression and ZNB regression is that the latter allows for heteroscedasticity and overdispersion (when the conditional variance is larger than the conditional mean), and also deals with excessive numbers of zero counts (when the incidence of zero counts is greater than would be expected by the negative binomial regression model). Given the problems related to the use of the log-normal model (see Flowerdew & Aitkin, 1982 for an overview) this paper only considers the count models.
To select the best fitting regression model (Poisson or negative binomial, zero-inflated or non zero-inflated), we test for overdispersion and zero-inflation (cf. van Oort et al., 2010). The former is done by means of a likelihood ratio test of overdispersion α (Cameron & Trivedi, 1986), the latter by means of a Vuong statistic (Vuong, 1989). The results are summarized in Table 11.4. Overall, the values suggest that the negative binomial fit is not significantly better than the Poisson fit (i.e. the log likelihood of the negative binomial model equals that of the Poisson model, so there is no indication for overdispersion), and that the zero-inflated Poisson model is not significantly better than the Poisson model (i.e. there is no indication of zero inflation)[11]. This paper therefore implements the Poisson model to estimate the parameters of the gravity model.

Poisson regression is estimated by means of maximum likelihood estimation techniques. The observed interaction intensity between two cities has a Poisson distribution with a conditional mean μ_{ij} that is a function of the independent variables (van Oort et al., 2010, 736):

$$\Pr\left[I_{ij}\right] = \frac{\exp(-\mu_{ij})\mu_{ij}^{I_{ij}}}{I_{ij}!} \qquad (11.8)$$

$$\text{With } \mu_{ij} = \exp[K + \beta_1 \ln(M_i) + \beta_2 \ln(M_j) + \beta_3 \ln(d_{ij})] \qquad (11.9)$$

[11] The only exception is model 2, where the Vuong statistic indicates that the zero-inflated Poisson fit is better. However, as the expected number of zero's in both regression models is the same (i.e. 75 compared to 71 observed zero's), this difference in model fit cannot be explained by a better fit for zero-inflation. Hence, also for model 2, a Poisson regression appeared to be the most appropriate model.

Table 11.4 Results of the Poisson regression

	Model 1	Model 2	Model 3	Model 4
Intercept	0.01 (0.02)	-1.17 (1.55)	-1.18 (1.16)	-0.01 (0.02)
Mass Mi (ln)	0.82 (15.06)***	0.71 (11.65)***	0.83 (6.322)***	0.81 (15.01)***
Mass Mj (ln)	0.95 (16.27)***	0.86 (14.05)***	1.03 (9.61)***	0.94 (16.11)***
Distance dij (ln)	-1.32 (8.22)***	-0.62 (2.59)***	-1.15 (6.68)***	-1.29 (8.01)***
Intra-FUR		•		
Inter-FUR (D1)		-0.86 (3.48)***		
Periphery-core			•	
Inter-core (D2)			0.12 (0.21)	
Core-periphery (D3)			-0.09 (0.12)	
Inter-periphery (D4)			1.33 (2.04)**	
Within linguistic region				•
Cross-border (D5)				-16.49 (0.01)
Overdispersion (α)	0.00	0.00	0.00	0.00
Vuong-statistic	1.17	2.76***	0.77	0.52
Log likelihood	-67.74	-61.65	-63.21	-66.85
McFadden's adjusted R^2	0.92	0.93	0.92	0.92
AIC	143.49	133.30	140.42	143.70

***p<0.01, **p<0.05, *p<0.10. Figures between brackets are the absolute z-values. • = benchmark

This model estimates the gravity model in its most basic form. To test the assumption of urban network integration, it can be extended by including other variables (de Goei et al., 2010; van Oort et al., 2010). Previously, we argued that, if Central Belgium can be characterized as an integrated urban network, then inter-city relations are solely determined by the economic mass of cities and the physical distance between them, and not by the spatial-functional context. In other words, there should be no difference in the relative strength of different types of spatial relations (regimes, see de Goei et al., 2010; van Oort et al., 2010). For the case of Central Belgium, we can distinguish six regimes:

(i) Transaction relations within FURs,
(ii) Transaction relations between FURs,
    a. Inter-core relations (transaction links between Antwerp and Brussels),
    b. Core-periphery relations (APS provision by Antwerp or Brussels to the other FURs),
    c. Periphery-core relations (APS provision by peripheral FURs to Antwerp or Brussels),
    d. Periphery-periphery relations (transaction links between peripheral FURs).
(iii) Transaction links crossing the linguistic border (transaction links between strictly Flemish FURs and strictly Walloon FURs, see Figure 11.1).

By analogy with van Oort et al. (2010), we can then rephrase the overall condition for urban network integration into three formally testable conditions:

(i) Intra-FUR interdependency should not be stronger than interdependencies between FURs in the MCR of Central Belgium. This is tested by introducing a dummy variable D1 for inter-FUR transaction links,

(ii) There should be no observable hierarchy in the different types of inter-FUR interdependencies. This is tested by introducing dummy variables D2 for inter-core transaction links, D3 for core-periphery transaction links, and D4 for inter-periphery transaction links,
(iii) There should be no effect of the linguistic border on the interdependencies between Flemish and Walloon FURs. This is tested by introducing dummy variable D5 for cross-border transaction links.

EVIDENCE FOR URBAN NETWORK INTEGRATION IN THE MCR OF CENTRAL BELGIUM

Model 1 in Table 11.4 represents the basic gravity model. It only considers the economic mass of the user FUR and the service FUR, and the distance between both FURs to estimate the regression parameters. As was to be expected, the results first of all show that there is a marked direct correlation between the economic mass of both the user FUR (M_i) and the service FUR (M_j) on the one hand, and the flow frequency I_{ij} between both FURs on the other hand. As indicated by the estimates, which can be interpreted as elasticities (van Oort et al., 2010), the impact of M_j on the flow frequency is hereby larger than the impact of M_i: when the economic mass of the user city M_i increases with one percent, then the flow frequency between both cities is predicted to increase with 0.82 percent, whereas a similar increase in the mass of the service city M_j would result in an increase of the flow frequency between both cities with 0.95 percent. Second, as was also to be expected, there is a marked inverse correlation between the distance d_{ij} between both FURs on the one hand and the flow frequency I_{ij} on the other hand: when d_{ij} increases with one percent, then I_{ij} decreases with 1.32 percent.

Model 2 tests the first condition for spatial integration, which asserts that the intra-FUR interdependency should not be stronger than the inter-FUR interdependency. This condition was tested by introducing a dummy variable D1, which equals 0 in the case of intra-FUR relations and 1 in the case of inter-FUR relations. The estimate for D1 shows that this first condition is not met. When controlling for economic mass and distance, the flow frequency decreases significantly when the interaction is between two FURs instead of within the same FUR. More specifically, the predicted flow intensity *within* the same FUR is over 136 percent larger compared to the predicted flow intensity between two FURs. This can be calculated by taking the natural exponent of the estimate of the dummy variable. The log likelihood, McFadden's Adjusted R^2, and AIC in Table 11.4 indicate that model 2 better estimates the data than model 1.

The second condition states that there should be no observable hierarchy in the different types of inter-FUR interdependencies. This condition is tested in model 3. In analogy to van Oort et al. (2010), we take periphery-core relations as the reference category, as it is conceptually the weakest type of urban interdependency. By computing the estimates for the three dummy variables D2 (equals 1 in the case of inter-core relations), D3 (equals 1 in the case of core-periphery relations), and D4 (equals 1 in the case of inter-periphery relations), we can compare the relative

strength of the different types of inter-FUR interdependencies. A Wald test is implemented to formally test this assumption (cf. van Oort et al., 2010). The results of the Wald test and the scores in Table 11.4 indicate that this condition is also not met, although the results are rather counterintuitive and not entirely statistically significant. The only estimate that is statistically significant is the one for inter-periphery relations (D4). According to Table 11.4, the number of predicted flows for inter-periphery relations is over 277 percent higher than the number of predicted flows for periphery-core relations, whereas for inter-core relations, the number of predicted flows is only 13 percent higher. For core-periphery relations, the results are even more counterintuitive as the number of predicted flows for core-periphery relations is nearly 9 percent lower than for periphery-core relations. The latter two estimates are however not statistically significant, suggesting that more data are needed to allow for a better statistically grounded assessment of this second condition.

Finally, model 4 tests the third condition for spatial integration, which states that there should be no impact of the linguistic border on the interdependencies between FURs. The estimate for D5 seems to suggest that there is a marked, inverse correlation between this variable and I_{ij}, indicating that – when controlling for economic mass and distance – the expected flow intensity decreases in the case of cross-border transaction links. However, as the p-value of the estimate shows, the impact of D5 on the interaction intensity is not statistically significant. The reason why this foreseeable impact is not confirmed by our model is probably because of the lack of information that is needed to allow for a more precise estimation of this parameter.

Overall, this formal test adds to our previous finding that Central Belgium does not (yet) function as a functionally polycentric MCR. Despite the relative good model fit, the interpretation of the results is however not always straightforward. This is probably due to the limited number of city-to-city relations in our database (i.e. 100 of which 71 zero's), the relatively high share of intra-FUR relations in Brussels (over 56 percent of all transaction links), and the small number of transaction links for smaller FURs. A more elaborate data collection is therefore needed to allow for more a more robust formal test.

11.7 Conclusion and discussion

This paper has introduced an alternative approach to measure functional polycentricity through the lens of advanced producer services and has implemented it to the case of Central Belgium. In doing so, it distinguished between two necessary conditions for functional polycentricity. The first condition focused on the nodes/cities and stated that there should be a certain balance in their relative importance (i.e. centrality). This has been tested by calculating the proposed alternative FPI. The results indicated that the first condition for polycentricity was not met. When it comes to service procurement by large companies in Belgium, the MCR of Central Belgium displays features of a hierarchical urban system with Brussels as main service centre both at the regional and at the national scale.

Merely calculating the FPI does however not account for the spatiality of the inter-city relations. The second necessary condition for functional polycentricity therefore states that there should be evidence for urban network integration, which is manifested in the existence of criss-cross relations between cities of different size. To assess the extent to which Central Belgium satisfies the second condition for functional polycentricity, we implemented a formal model that tests three more specific requirements for urban network integration. None of these requirements, however, were met: (i) intra-FUR interdependencies appeared to be stronger than inter-FUR interdependencies, (ii) we observed a hierarchy in the different types of inter-FUR relations, and (iii) we also found a rather strict spatial division in service procurement between the Flemish and Walloon Region.

Overall, these results suggest that the urban geography of service procurement by large companies does not attest to the existence of a functionally polycentric MCR in Central Belgium. Our analyses hereby more or less endorse the findings of the POLYNET project in general, and of the Belgian case in particular. While POLYNET's quantitative analysis of polycentricity based on APS office locations describes Central Belgium as a duopoly of linkage dominance with Antwerp rivalling Brussels (Hall & Pain, 2006, Chapter 3), its qualitative appraisal of actual information flows in the APS sector indicated that APS firms in general, and APS firms with a European or global scope in particular, show a strong tendency to concentrate in the First City, rendering this city a key role as global knowledge 'gateway' for the regional and national economy. Given that the large majority of transaction links in our dataset are procured from such European or global APS firms (see Hanssens et al., 2011), it is not surprising that Brussels – apart from being the MCR's global knowledge gateway – also turned out to be by far Belgium's most important service centre, both at the regional and the national scale. On the other hand, although Brussels is also the most important service centre for transaction links with local APS firms, the share of smaller FURs for this type of transaction links is clearly more significant. This too is largely in line with the observations described in the POLYNET project, where it is noted that APS firms with a regional or national scope tend to locate in the smaller regional centres in order to be close to their important customers (see Pain & Hall, 2006, 96).

Based on these observations, we can conclude that the functional polycentricity (also coined urban network) concept, which has been proposed as the contemporary alternative for central place thinking (Batten, 1995; Capello, 2000; Camagni & Capello, 2004; Meijers, 2007), is not (yet) suitable for describing the geography of the Belgian urban system. On the other hand, however, it is clear that a traditional Christallerean approach is also no longer appropriate. This is particularly true for the Flemish Region, where we observed a more regionally intertwined pattern of transaction links. The two main paradigms in urban geography – the Christallerean hierarchy and the concept of urban networks – are thus neither completely fit for describing the geography of the Belgian urban system, at least not for the case of urban centrality in APS provision. Rather, both paradigms seem to make an 'uneasy reunion' (Hall & Pain, 2006, 12). On the one hand, Central Belgium displays criss-cross relations resulting in overlapping

urban spheres of influence which at times even supersede national borders. On the other hand, there is also a recognizable urban hierarchy with Brussels as the 'First City', whose urban influence stretches across the national economy and beyond.

Although these conclusions are rather straightforward, it is nevertheless important to interpret them in light of the limited scope of our case-study. First of all, as we already suggested in the previous section, a more elaborate data collection is needed to capture the urban geography of service procurement in more detail and to allow for a more robust analysis of the geography of the Belgian urban system. Second, this paper assessed the urban structure of Central Belgium at one point in time. However, as de Goei et al. (2010) notice, although cities are not 'born' polycentric, they may be evolving in that direction. A longitudinal study is therefore needed to explore whether this might also be the case for Central Belgium. Third, contrary to the POLYNET project, our survey did not include the logistics sector, which almost certainly has implications for the relative importance of Antwerp as a service centre. As the Belgian team of the POLYNET project indicated, there is indeed some degree of sectoral specialization in Central Belgium, with Brussels being the main 'all-round' APS centre and Antwerp being more specialized in logistics services due to its harbour and good highway network (Pain & Hall, 2006, 95). Because of this sectoral specialization, Antwerp and Brussels have complementary service functions and it is precisely this urban complementarity – not captured in the present paper – that is argued to promote/induce urban network integration. Moreover, apart from sectoral specialization, complementarity between cities can also be derived from their functional specialization, which – as explained above – results from the fact that international scope APS firms predominantly cluster in just one city. In relation then to this 'functional specialization', POLYNET also observed a distinction in the 'quality' of knowledge generation and service functions in the different cities. Whereas concentrations of international APS firms were associated with high-complexity, high-skill global functions, the regional and local network scale appeared to be "generally associated with less complex, lower value business functions" (Pain & Hall, 2008, 8). The fact that this case study focused only on service procurement by large companies might imply a bias favouring the First City (i.e. Brussels) as service centre since it can be expected that large companies generally require more high-complexity, high-skill services than small- and medium-sized enterprises (SMEs). In other words, a case study of the geography of service procurement by SMEs might have revealed a more functionally polycentric situation, where services are to a larger extent procured from regional or national scope APS firms located in the secondary cities of the MCR.

11.8 References

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PART 5 GENERAL DISCUSSION AND CONCLUSION

12 Introduction

Cities have always existed as central places for the provision of services to their urban hinterlands. Amongst the frameworks that describe the spatiality of urban systems from this city/service-nexus perspective, Christaller's (1933) central place theory has for many decades been the single most important theory in urban geography. In recent years, however, it has been argued that this model has become partly obsolete to study contemporary urban systems. On the one hand, this is because globalization and informationalization have led to the rise of a number of cities whose functional centrality has become increasingly disconnected from their broader hinterlands. These so-called world cities "have secured a particular component in their economic base which gives them a specific role in the current phase of the world economy: through the spatial concentration of APS firms, these cities have become prime centres for the production of APS in the organization of global capital" (Derudder et al., 2010b, 1862). Moreover, to provide a seamless global service to their clients, APS firms have become transnational companies in their own right. As such, they have been conceptualized as the prime producers of a transnational network of world cities of which the urban spheres of influence can no longer be described in terms of discrete hinterlands, but rather in terms of overlapping hinterworlds (Taylor, 2001b). In light of these changes, Saey et al. (2005) have argued that the WCN model devised by the GaWC research network may provide the conceptual and empirical raw material for a more appropriate approach to study contemporary urban systems at the global scale.

On the other hand, globalization, informationalization and advancements in transportation and communication technologies have also severely altered the structure of urban systems at the local scale. From the 1930's onwards, (sub)urbanization and the 'concentrated deconcentration' of employment and households has led to the rise of secondary centres, some of which are increasingly becoming strong alternatives to the traditional CBD. Moreover, particularly in densely populated areas like western Europe, continuous processes of (sub)urbanization resulted in the coalescence of formerly independent metropolitan areas (Kloosterman & Musterd, 2001). The spatial outcome has been the rise of so-called polycentric city-regions for which the Randstad often serves as a school example. This new type of urban form typically exists of a number of similar-sized cities characterized by specific specializations. Because of these urban specializations, relationships between cities in the polycentric city-region are assumed to be progressively more based on complementarity, and inter-urban relations typically display criss-cross patterns between cities of similar and of different size. In light of these shifts, urban geographers have suggested that a network model may provide a more appropriate alternative to central place thinking for studying the spatiality of contemporary urban systems at the local scale (Batten, 1995; Capello, 2000; Camagni & Capello, 2004; Meijers, 2007b).

Taking these two frameworks as the conceptual starting point, the overall contribution of this PhD dissertation to the literature on the geography of urban systems can be summarized in terms of three dimensions:

1. The *dynamics* of contemporary urban systems and the implications for their spatial configurations;

2. The *assumptions* underlying the conceptual framework for studying urban systems;

3. The many ways in which cities are part of 'nested city systems' at various *spatial scales*.

This final, concluding part has a twofold purpose. On the one hand, it summarizes the main research findings, explains how they correspond to the research objectives and research questions specified in the introductory part of this dissertation, and specifies how these results contribute to our knowledge of contemporary urban systems. On the other hand, this final part also identifies the main limitations of this work and – considering these limitations as a starting point rather than a final stage of research – suggests some avenues for future research.

13 Overview of the main results

13.1 Dynamics: measuring changes in the WCN

In the course of the last two decades, the urban geography literature has witnessed a considerable upsurge of research aiming to measure world city *network* formation from a broad range of empirical approaches. In this sense, it can be argued that GaWC's initial objective, i.e. to address the "empirical conundrum" in world cities literature (Taylor, 2001a), has been successfully met. However, notwithstanding the valuable contribution of these studies, many questions remain unanswered. One of these questions relates to the dynamics of the WCN. Until recently, very few studies have measured the changing configurations of the WCN. Obviously, this lack of longitudinal research is one of the after-effects of the acute deficit of relational data at the city level, which has long hampered this field of research. To address this empirical gap in WCN research, in 2007, GaWC joined forces with the Global Urban Competitiveness Project (GUCP) at the Chinese Academy of Social Sciences (CASS; Taylor et al., 2009a, 2009b, 2010) to perform a new large-scale data collection exercise for the year 2008. The first objective of this dissertation was to use this new dataset to explore how the spatial configurations of the world city network have changed in the period 2000-2008. This objective has been specified into two research questions:

1. *What are the changes in the WCN in general, and in the global network connectivities of cities in particular, in the period 2000-2008?*

This research question has been the subject of Chapter 6 of this dissertation. A first notable feature of the observed changes in the period 2000-2008 was the overall rise in connectivity in the WCN, which indicated that the global APS sector has been growing in the period under investigation both by expanding its offices in many cities and by extending its office networks to new cities. At the city level, our analyses first of all revealed a plummeting of particularly US cities in the world city ranking, and a concomitant rise in ranking of cities in Pacific Asia and particularly in China. Apart from these changes in rankings, the results also showed both absolute and relative (i.e in terms of standardized residuals) connectivity losses for West-European, Australasian and – again especially – North American cities, and absolute and relative connectivity gains for cities in Pacific Asia and, particularly, Chinese cities. On the one hand, these results seem to endorse Frank's (1998) 'reOrient' thesis, which asserts that the centre of gravity in the world-system is in the midst of a geographical transformation – or rather, a shifting back – from 'West' to 'East'. On the other hand, the relative connectivity declines of cities in the 'West' might also be interpreted as being a manifestation of the fact that, due to the already long established APS sector, these cities are simply 'standing still' while other parts of the world are 'catching up'.

2. *Can we observe notable sectoral variations regarding (i) changes in the WCN in general, and (ii) the degree and pattern of changes in city connectivities in particular, in the period 2000-2008?*

To examine how and to what extent different APS sectors have globalized along different geographical lines, Chapter 7 systematically explored geographical shifts in the office networks of major service firms at the sectoral level. Similar to Chapter 6, we first measured change at the level of the network. For the accountancy sector, the increase in the average sectoral network connectivity (SNC) pointed to an expansion of the office networks of leading accountancy firms, while the decreasing skewness of the distribution suggested that the importance of these services has spread to more cities in 2008. The office networks of leading firms in the advertising sector have also notably expanded in the period 2000-2008, whereby more cities have become either less or more connected than the average value (increasing standard deviation of the distribution) and, similar to the accountancy sector, the importance of these services has spread to more cities in 2008. Also for the financial services sector, the period 2000-2008 has witnessed an expansion of the office networks of leading firms with more cities having become either less or more connected than the average value. Contrary to the advertising sector however, leading firms in the financial sector have largely remained active in a given set of cities. The final two sectors showed a somewhat different picture. For the law sector, only a limited set of cities has witnessed sizable connectivity gains and services have largely remained active in a given set of cities. Finally, office networks in the management consultancy sector have on average lost connectivity. At the same time, however, connectivities have converged around the mean value as the importance of these services has spread to rather more cities. These trends suggested an overall stalling of the globalization of this sector.

At the city level, changes in the sectors accountancy, advertising and financial services were more or less in line with the overall patterns described in Chapter 6, featuring overall relative connectivity declines for North American and most of the Australasian and Western European cities, and overall relative connectivity gains for most South-East Asia, Chinese, East European cities. The sectors law and management consultancy, on the other hand, displayed more intra-regional variety. For the law sector, the relative connectivity declines of North American and western European cities and the relative connectivity gains for Chinese and East Asian cities were less homogeneous, whereas Latin American, Middle Eastern, and South Asian cities experienced more straightforward declining connectivities. A more or less similar situation was found for the management consultancy sector, only here, the connectivity gains of East Asian, Chinese and Indian cities were more clear-cut.

In brief, despite some general patterns in the shifting positions of cities as globalized service centres, this chapter has shown that leading service firms from different sectors have been globalizing along different geographical lines.

To conclude, the chapters in Part 2 of this dissertation have contributed to the literature on contemporary urban systems at the global scale in two ways: (i) they have

made a methodological contribution to the literature by introducing a sophisticated approach for measuring changes in the world city network, one that addresses the problem of possible underestimation of change at the higher ends of the scale, and (ii) they have contributed to the literature in an empirical way by studying how the geography of globalized service provision has changed in the period 2000-2008 both in general terms (i.e. global network connectivity) and for each sector individually.

13.2 Assumptions: assessing the relevance of GaWC's selection of leading APS firms and Belgian cities for the articulation of the Belgian economy

GaWC's model measures world city network formation based on office location data of leading APS firms. It hereby starts from the (implicit) assumption that the mere presence of leading APS firms is not only a relevant, but also a key factor in the globalized urbanization of regional city-systems. This dissertation also studies urban systems through the lens of the APS sector. As such, and in contrast to some other appraisals of GaWC's research, it endorses the assumed role of the APS sector in contemporary urbanization. What this dissertation does question, however, is the usefulness/relevance of GaWC's focus on the location strategies of a limited and a priori selected number of APS firms in an a priori selected number of cities, particularly when the aim is to explore the insertion of 'less obvious' cities and regional city-systems in the WCN. There are two elements to this critical reflection: (i) is the mere presence of local offices of leading APS firms a sufficient condition for 'world city-ness'? (cf. Parnreiter, 2010), and (ii) are the a priori selected APS firms and world cities necessarily (the only) relevant firms and cities for the integration of a regional/national economy in the global economy?

This dissertation has focused on the second question. One of the main propositions hereby was that a focus on APS transaction links provides an interesting methodology to address these (and other) critiques of GaWC's WCN model. This has been demonstrated in Chapter 8. In this chapter, the results of the survey on APS procurement amongst Belgium's top-300 companies were compared with GaWC's selection of APS firms and cities for the year 2008 to address the following research question:

3. *Is GaWC's selection of APS firms and world cities relevant for the articulation of the Belgian economy?*

In terms of APS firms, the results showed that GaWC's selection of leading APS firms indeed generally accounts for over half of the procured services. At the same time, however, this general picture also hid some important sectoral differences. The relevance of leading APS firms for the servicing of the Belgian economy – or, at least, of Belgium's largest companies – appeared to be remarkably more evident for accountancy-audit (cf. the domination of the Big Four) and for financial services-creditor bank than for the other sectors. For the latter, local advertising companies and law firms, and international non-leading management consultancy firms constituted at least one third of the remaining transaction links.

In terms of cities, the urban geographies of service procurement in Belgium largely reproduced GaWC's urban rankings, at least up to a given point. Brussels clearly appeared to be the main service centre and this for all service sectors. Antwerp followed on a second place, featuring a distinct role as service centre for the provision of accountancy and legal services, which was also largely in line with the city's sectoral network connectivities (SNC's) computed by GaWC. Below the apex of Belgian service centres – i.e. for the 'less obvious' cities – GaWC's selection of cities and our results started however to somewhat diverge. Rather than Liège (the third Belgian city in the GaWC list), it was Ghent that appeared to be the third most important service centre and this particularly for accountancy, advertising and management consultancy.

To conclude, Part 3 of this dissertation has contributed to the WCN literature by demonstrating how APS transaction link data can be used, on the one hand, to assess the relevance of leading/obvious APS firms and world cities for the articulation of regional/national economies, and, on the other hand, to identify potentially relevant secondary cities and non-leading APS firms. The results of these analyses can be used in future research to adjust the systematic analysis of the cities/services-nexus at the global scale and to explore the 'fuzzy ends' of the world city network based on actual/revealed service provision.

13.3 Scale: studying the spatiality of the Belgium urban system based on transaction link data

During the last half century, globalization, informationalization and advancements in transportation and communication technologies did not only have an impact on the spatiality of inter-city relations at a global scale and the position of cities in transnational urban networks, but also on the internal structure of cities (cf. the rise of polycentricity at the city-scale) and on their relations with other cities in urban systems at a local scale. In this context, it has been argued that, rather than a nested hierarchy of central places with discrete hinterlands, many local urban systems nowadays increasingly display features of what has been termed a 'polycentric city-region'.
In the last two decades, the literature on polycentric city-regions has generated a wide variety of empirical studies trying to quantify inter-city relations and measure polycentricity, and this from a whole range of different perspectives. Very few studies, however, have explored the spatiality of assumed polycentric city-regions from the perspective of advanced producer services. In fact, to our knowledge, the only existing research that has been done in this context is the POLYNET project, where the functional polycentricity of eight North West European MCRs has been explored by means of both quantitative and qualitative analyses.
One of the main methodological concerns of the POLYNET project constituted the difficulty of collecting *quantitative* data on *actual* information flows in the APS sector. Either information flows were studied quantitatively, but then analyses were based on a *proxy* (i.e. APS office locations and timetabled flights and trains), or actual information flows were considered, but then the available dataset was too limited to allow for meaningful quantitative analyses (Hall & Pain, 2006a; Pain & Hall, 2008). The third objective of this dissertation, therefore, was to introduce an alternative

methodology that allows measuring actual inter-city links in the APS sector, and to implement this methodology to study the spatiality of the Belgian urban system. More specifically, this dissertation has tried to answer the following two research questions:

4. *Given that the relevance of Christaller's central place theory has become partly obsolete for describing the spatiality of contemporary urban systems, what basic principles for alternative theorizations can be derived from a study of the urban geography of APS procurement in Belgium?*

Chapter 9 used the results of the quantitative survey on APS procurement by Belgium's largest companies to perform an exploratory study of the spatiality of the Belgian urban system. The analyses revealed that the spatiality of the Belgian urban system displays three main features: (i) the overall dominance of Brussels as Belgium's most important service city, (ii) the existence of overlapping urban spheres of influence, and (iii) the occurrence of transaction links with cities abroad. Based on these spatial features, three basic principles for alternative theorizations of contemporary urban systems were identified: (i) the impact of world city-formation as described by Sassen (2001) – and as empirically observed in the POLYNET study (Pain & Hall, 2006b, 116) – which results in the presence of a sizable APS cluster in only a limited number of cities (in this case, Brussels), (ii) an additional criss-cross pattern of transaction links between larger and smaller cities in both directions as well as between smaller cities, and (iii) the impact of the intra-firm distribution of decision-making power on the geography of APS procurement. The latter implies that outsourcing decisions are not necessarily made where the services are 'consumed', which might explain the occurrence of transaction links with 'unexpected' service cities abroad.

Based on the results of the qualitative survey on APS procurement by automobile companies in the Port of Ghent, Chapter 10 of this dissertation scrutinized the spatial dimension of the 'positionality' of APS firms in the globalized production networks of their clients. It described the observed geographical patterns and explored the underlying location factors influencing/explaining the geography of APS transaction links in more detail. The focus was hereby particularly on the – in Chapter 9 indirectly observed and therefore assumed – impact of intra-firm distribution of decision-making power. Based on our analyses, we could identify two aspects of the spatial dimension of APS involvement. The first related to the geography of APS procurement in a strict sense, and included location factors like world city-formation, spatial proximity, and quality-related factors. The second aspect related to the different types of decision making regarding where in the value chain power is ultimately wielded with respect to the choice of an APS firm. In this respect, four spatial models/scenarios reappeared throughout our interviews: (i) the centralization scenario, where decisions on APS procurement for one or several subsidiaries are made at the level of the parent company, (ii) the partial centralization scenario, where the subsidiary is serviced by a local branch of the same APS firm that services the parent company, (iii) the partial decentralization scenario, where decisions on APS procurement for the local subsidiary

are made at the level of the subsidiary, albeit in mutual agreement with the parent company, and (iv) the decentralization scenario, where it is the subsidiary who subcontracts its APS partner without the parent company influencing or controlling the decision-making process.

5. *Given the occurrence of criss-cross relations and overlapping hinterlands, to what extent does the urban network paradigm provide a more appropriate model to describe the spatiality of the Belgian urban system? More specifically, to what extent does a formal test of the urban geography of APS procurement in Central Belgium attest to the existence of a functionally polycentric mega-city region?*

To assess the functional polycentricity of the MCR of Central Belgium through the lens of APS transaction links, Chapter 11 of this dissertation has formally tested two necessary conditions for functional polycentricity: (i) the degree of balance in the relative importance/centrality of the constituent centres, and (ii) the degree of urban network integration manifested in the existence of criss-cross relations between cities of different size. Regarding the former, the results of the FPI calculations indicate that the first condition is not met. Both at the regional and at the national scale, Central Belgium displays features of a hierarchical urban system with Brussels as main service centre. Regarding the latter, the results of the estimations of the gravity model indicate that the second condition is also not met. The degree of interaction between two cities is not only determined by the mass of both cities and the distance between them, but also by the spatial-functional context of the interactions. For instance, when controlling for economic mass and distance, the flow frequency increases significantly when the interaction is within the same FUR instead of between two FUR's.

To conclude, Part 4 of this dissertation has contributed to the literature on the geography of local urban systems in three ways. From a methodological perspective, it is – to our knowledge – the first empirical study that explores/measures the spatiality of a city-region based on APS transaction link data. This empirical approach has the advantage that it allows to measure actual inter-city relations and this without making an a priori choice regarding the relevant scale of research: transaction links are both local, national and transnational in reach. From a conceptual perspective, this dissertation has demonstrated how, at least for the case of APS transaction links in Belgium, neither Christaller's central place theory, nor the polycentric city-region concept seem to provide an entirely appropriate framework for studying the spatiality of the Belgian urban system. Rather, both paradigms seem to make an 'uneasy reunion' (Hall & Pain, 2006b, 12), resulting in a situation that seems to contain a bit of both worlds: criss-cross relations and overlapping urban spheres of influence on the one hand, and a 'traditional' national urban hierarchy with Brussels as the main service city for the entire Belgian territory on the other hand. And, finally, from an empirical perspective, this dissertation has identified three basic principles for alternative theorizations of contemporary urban systems.

14 Critical reflections and avenues for future research

As with all research, new insights invoke further research questions. This final chapter therefore discusses some of the main critical reflections regarding the research presented in this dissertation and, based on these critical reflections, makes some suggestions for future research. Similarly to the previous chapter, this is done in terms of the three conceptual dimensions identified in Chapter 13.1, i.e. dynamics, assumptions and scale. At the end, I also add one overarching dimension, namely data.

14.1 Dynamics: the changing geography of contemporary urban systems

At the global scale, this dissertation has measured change in the WCN for the period 2000-2008. However, as Taylor et al. (2009b) notice, a lot has happened since the GaWC data were collected in the first half of 2008. The global financial and economic crisis has had a severe impact on the economies of particularly western countries, leading – amongst others – to the restructuring, bailout and even bankruptcy of some of the world's largest financial institutions and, hence, to notable shifts/changes in the performance of the world's major banking centres (Derudder et al., 2010a). Due to the usual time lag of about one year between the initial stages of the data collection and the beginning of the analyses, the results presented in this dissertation are the "latest, but not up-to-date" (Derudder et al., 2010b) results on the world city network. A new data collection exercise is needed – and is, at the time this dissertation is written, in the process of being finalized – to measure the impact of the crisis on the spatial configurations of the WCN.

A second avenue for future research concerns not the changes in global/sectoral network connectivities of the cities *per se*, but rather the underlying forces that account for the observed major trends and shifts in the configurations of the WCN. Such an inquiry obviously requires a broader perspective on the globalization/urbanization-nexus, which implies, amongst others, the need for additional, macro-economic and socio-political data.

While the longitudinal analysis of the WCN constitutes one of the major contributions of this dissertation to the literature on urban networks at the global scale, the lack of a dynamic perspective on urban networks at the local scale is obviously one of its main limitations. Based on a single snapshot of APS procurement by the top-300 companies in Belgium taken in the summer/fall of 2009, Chapter 11 concluded that the Belgian urban system displays very little evidence for urban network formation. However, as de Goei et al. (2010) notice, urban systems are not 'born' polycentric, but they may be evolving in that direction. To capture – in a robust statistical analysis – the extent to which this is the case for the Belgian MCR, additional data gatherings are needed. These additional data should not only be gathered across different points in time, but also – preferably – at a wider scale (i.e. more correspondents, more equally distributed in spatial and sectoral terms…) and scope (i.e. not only large companies but also SMEs, more in-depth information on the *quality* and *content* of the transaction links…) than the data gathered in the context of this research.

14.2 Assumptions: testing the untested

Part 3 of this dissertation used transaction link data to identify the relevant firms and service centres for the articulation of the Belgian economy and hereby assessed the relevance of GaWC's selection of APS firms and cities. Although our analyses yielded some interesting insights, they were essentially quantitative in nature. This implies that we don't know much about the content of the provided services, which makes it difficult to really appreciate the function of a city as service centre. Clearly, Brussels and Antwerp appeared to be the two main service centres for the Belgian economy, and their importance as service centre for different sectors even largely reflected their sectoral network connectivities. As such, the results seemed to confirm that the presence of local offices of global service firms is indeed a good indication for the importance of a city as service provider for a specific sector. What this dissertation did not answer, however, is whether these 'obvious' world cities also perform 'world city functions' in that their services actually influence the strategic decisions of their clients (cf. Sassen's, 2001 notion of global command and control centres). As Parnreiter (2010) argued, it may be useful to break up world city functions into (i) the management of the world economy (i.e. allowing for a smooth functioning of clients' economic activities) and (ii) command and control functions (i.e. influencing clients' strategic decision making processes).

In relation to polycentric city-regions, there are two important assumptions that did not receive proper attention in this dissertation and therefore constitute important avenues for future research. The first often-made assumption is that urban specializations lay at the basis of urban complementarity and, hence, of functional polycentricity. As I already indicated in Chapter 11, it is important in this context to distinguish between sectoral and functional specialization.

Regarding the case of sectoral specialization, POLYNET's study of RhineRuhr – which was identified as the MCR with the highest degree of sectoral specialization between the different cities (Pain & Hall, 2006a, 95) – illustrated that urban specializations not necessarily translate into strong intra-regional functional linkages. In fact, the case of South East England revealed quite the opposite. In South East England, the "depth of global concentration in London has led to geographically wider, high-quality, intra-firm communication flows" (Pain & Hall, 2006a, 100), creating a complex pattern of functional links both between London and a number of secondary cities and between the secondary cities. The latter constitute important APS clusters of regional branches servicing major international clients located outside London. As such, what was initially described as a morphologically primate MCR with London as the First City turned out to be the most functionally polycentric MCR in North West Europe.

But do these findings also apply to functional polycentricity when it is studied in terms of APS transaction links rather than in terms of intra-firm links? It might very well be expected that a MCR where different cities have different sectoral specializations will generate a more spatially balanced pattern of transaction links than a situation where the majority of APS activity is clustered in only one city. In this context, an interesting case study would be to compare the spatial structure of transaction links in RhineRuhr to that in South East England.

While a situation of a sectoral specialization between different FURs was only found in a limited number of MCRs, functional specialization reoccurred throughout all the MCRs. As I explained in Chapter 11, it refers to the fact that First Cities have a clear distinctive hub function for high-complexity, high-skill global functions, which results from the tendency of international APS firms to cluster only in one city, and which sets them apart from all the other places in their regions (Pain & Hall, 2006b, 116). Thus, First Cities constitute the knowledge gateways that articulate their regions into the 'global city network'. Regional and national office networks on the other hand are spread out more evenly across the secondary cities to be close to local markets, but this network scale is "generally associated with less complex, lower value business functions" (Pain & Hall, 2008, 8). Hence, there is a clear functional specialization between the cities in a MCR. As our quantitative database contained no information on the content of the APS transaction links, we were not able to explore whether this functional specialization was also reflected in the spatiality of APS transaction links.

The second topic that did not receive much (if any) attention in this dissertation and that is closely related to the issue of urban specialization, is the often-made assumption that polycentric spatial development implies/contributes to sustainable economic growth. As I explained in Chapter 3, polycentricity is not only important as an analytical concept, but also – and particularly – as a normative planning strategy. Spatial planning documents at various spatial scales advance polycentricity as norm that should be achieved. Not only is it assumed to contribute to a region's economic competitiveness, it is also expected to promote regional spatial equity, social cohesion and sustainability by limiting commuter flows and urban sprawl.
In the POLYNET study, this assumption was however seriously called into question. The general observation seemed to be that, partly because of the continuing importance of face-to-face contacts, both morphologically and functionally polycentric regions are generating growing non-radial, inter-urban travel (Pain & Hall, 2008, 10). In combination with the fact that regional public transportation in most MCRs is predominantly organized in a hub-and-spoke structure and that, particularly for business journeys over relatively short distances, public transportation is not faster and certainly less flexible than the car, the continuing importance of face-to-face contacts results in a situation where the increasing business traffic is especially car reliant, which clearly compromises priorities for environmental sustainability.
The question whether and to what extent the assumed sustainability of (functional) polycentricity is in conflict with everyday reality when the focus is on APS transaction links was not explored in the present dissertation. Given the importance of the concept in spatial planning strategies, this question obviously constitutes an important topic for future research.

14.3 Scale: the relevance of spatial boundaries

Cities, or rather, the actors located in them, operate at a variety of different scales. Although the relative importance of these scales may vary for different cities (e.g. the difference in global connectivity between First Cities and secondary cities in the

POLYNET study) and different types of functions, urban relations are always local, regional, national and inter/transnational in reach. Obviously, this is also true for APS transaction links. The scale of APS provision by a service city like Brussels is local (i.e. APS provision to companies located in the Brussels Capital Region), regional (Central Belgium), national (Belgium), European and even global in reach.
The advantage of studying APS transaction links is that it allows to measure actual inter-city relations without making an a priori choice regarding the relevant scale of research. However, as this dissertation focused on service *procurement* by companies located in Belgium, it was not possible to capture/measure APS transaction links provided by Belgian cities beyond the Belgian territory. An interesting avenue for future research would therefore be not to focus on APS *procurement* by firms in a certain sector or region, but to focus on the geography of APS *provision* by (APS firms located in) a city. Such an inquiry would not only allow to better reconstruct the many ways in which this city is part of several 'nested city systems' at various spatial scales, it would also allow to test one of the main assumptions of world cities literature, namely that world cities are increasingly disconnected from their traditional urban hinterlands (cf. Gordon's, 2004 research on the export of financial and businesses services by London).
What our analyses could capture/measure, however, was the fact that the urban spheres of influence of a number of foreign service cities like New York and Tokyo indeed reach as far as the Belgian economy. As such, Taylor's concept of urban hinterworlds (Taylor, 2001b) does not only seem to hold in terms of indirect service provision (i.e. the servicing of a city *a* by another city *b* through a local office of a transnational APS firm, cf. the partial centralization model in Chapter 10), but also in a more direct way (cf. the centralization model in Chapter 10). In this context, and given the limited scale and scope of our qualitative survey, it might be interesting to also explore these different spatial models of service transaction links in more detail.

In the context of polycentric city-regions, an interesting topic for future research relating to the conceptual dimension of scale concerns the demarcation of the MCRs in general, and of Central Belgium in particular. One of the main conclusions of the POLYNET project was that, although a clear and crucial policy agenda was identified at an MCR scale, the geographical boundaries of the MCR are of far less relevance for the spatial scope of the daily operations of APS firms (Pain & Hall, 2008, 9). For APS firms operating at a regional or national scale, the MCR is in many cases too big, whereas for European and global APS firms, business does not stop at the edges of the MCR (Pain & Hall, 2006b, 119).
Since the focus of this dissertation was on service procurement by companies located in Belgium, it was not possible to capture/measure the spatial scope of service *provision* by Belgian cities beyond the Belgian territory. Nevertheless, given the presence of a number of foreign service cities in our dataset, it can be safely assumed that the spatial scope of service provision by Belgian-based APS firms, both local and international, equally transcends national boundaries as it does for their other business relations (Aujean et al., 2005; Pain & Hall, 2006a, 96).

What our analyses did reveal, and what also emerged throughout the discussion of the web survey results on business travel in the POLYNET study (Aujean et al., 2005) – although was not explicitly mentioned there – was the almost complete absence of urban relations crossing the linguistic border between Flanders and Wallonia. Although in the current political climate, statements like this may be quite controversial, such findings raise questions as to whether it is relevant/fruitful – at least when the focus is on APS transaction links – to study the spatiality or functional polycentricity of a *Belgian* urban system. It might for instance be more relevant to distinguish between a Flemish urban system (e.g. the Flemish Diamond) and a Walloon urban system, with Brussels as the overlapping region 'gluing' the Flemish and Walloon Region together. Given the limited scale of our survey, however, it is clear that such conclusions should be made with the necessary caution and that additional data are needed to assess whether this proposition is indeed valid or not.

Finally, not only the delineation of the MCR itself requires further attention. What may also be called into question is the delineation of the spatial units constituting the MCR. Introduced as a working definition to be revised in later stages of the project, POLYNET defined these spatial units in terms of commuting patterns (i.e. the functional urban regions), a definition that was also implemented in the present dissertation. However, as the focus of both studies is on APS firms, which typically display a tendency to concentrate in urban centres, a functional demarcation based on corporate APS clusters might have been an interesting and perhaps even more appropriate alternative. The MCR in its turn could then be defined not as a spatially continuous region, but rather as a sort of regional urban network constituting only the major APS clusters. Note, however, that for transaction link data, such a definition might be less appropriate as the 'user' firms tend to be less spatially concentrated. Here too, further research might provide interesting new insights.
As a final critical reflection on the dimension of 'scale' in this dissertation, I would like to add that such a functional approach would (also) have been a more appropriate methodology for defining the study area in the qualitative survey in the Port of Ghent. As I explained in section 4.1, the delineation of our study area – and therefore the selection of firms – was based on a geographical definition. This essentially implied that Volvo Trucks, one of the major automobile companies in the region, was not included in the survey. Obviously, every delineation has its advantages and disadvantages, but since the focus of our survey was on the automobile cluster in the Port of Ghent, a selection of companies based on a functional rather than geographical definition of the study area would have been a more appropriate methodology.

14.4 Data: attribute vs. relational data

Overall, this dissertation has used two types of data to measure inter-city relations and to study the spatiality of urban systems: attribute data (i.e. APS office locations), which are used as a *proxy* for intra-firm/inter-city flows of knowledge, and relational data (i.e. APS transaction links), which represent *actual* inter-firm/inter-city flows. The first type of data was used in Part 2, where changes in (the importance of) APS office locations were translated into changes in the global/sectoral network connectivity of cities in

the WCN. The main advantage of using attribute data is that they are relatively easy to collect as the information is in most cases readily available from corporate websites. The main problem is that the transformation to flow data is based on a number of assumptions which have been either not yet tested or have been contested. Therefore, although the GaWC model has made a valuable contribution to the literature on urban systems at the global scale, there is still a long way to go to empirically underpin many of the assumptions that constitute the conceptual basis of this model (cf. Jones, 2002; Nordlund, 2004; Lambregts, 2008).

Obviously, the opposite is true for inter-firm transaction link data. On the one hand, this type of data measures *actual* inter-firm relations and can therefore be aggregated to the level of inter-city relations without making assumptions. On the other hand, however, companies often consider this information as strategic and therefore confidential, which makes the data collection quite a difficult task, particularly for qualitative information. This dissertation has collected and used transaction link data to address some of the many research questions that can be answered when focusing on APS transaction links (cf. the contributions to the special issue in *Global Networks*, 2010, Volume 10, Issue 1). It hereby implicitly answered to a recent call by both urban and economic geographers to explore the potential benefits of a conceptual integration of the APS-based WCN model and research on global commodity chains (GCC, Gereffi & Korzeniewicz, 1994) integrating the global economy (Derudder & Witlox, 2010). Central to this call is the contention that a systematic inquiry into the backward linkages between APS firms and their clients might give more 'flesh' to the WCN literature by providing insights into the real-life connections and material links between specific cities (Vind & Fold, 2010, 58). By focusing on APS transaction links, the present dissertation endorses this argument.
However, given the limited scale and scope of both the qualitative and quantitative survey, the results discussed in Parts 3 and 4 should be interpreted as indicative rather than conclusive evidence for the geographical features of APS provision to the Belgian economy and for the geography of the Belgian urban system. Clearly – as I indicated at the end of each of the previous three sections – additional quantitative and qualitative research is needed, based on more, better and more sophisticated data to deepen the analysis and provide more information on the content of transaction links, the processes underlying the outsourcing of APS and the impact of both factors on the geography of transaction links. In doing so, rather than studying them as one homogeneous group, it will be both necessary and fruitful to distinguish more systematically between different types of APS sectors (e.g. legal services vs. ICT) and different types of functions (e.g. standardized vs. highly customized, strategic vs. routine). Both in sectoral and functional terms, different types of services have different locational preferences, display different degrees of interaction with clients, and have different impacts on their clients' decision making process. As such, any empirical study of the three dimensions of APS transaction links identified in Chapter 10 will provide a rather different picture depending on the type of service under consideration.

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NEDERLANDSE SAMENVATTING

INLEIDING

Dit doctoraatswerk beoogt een bijdrage te leveren aan het bestaande onderzoek naar de geografie van hedendaagse stedelijke systemen. Het vertrekt hierbij vanuit een visie op steden als centra voor geavanceerde diensten[12] (*advanced producer services* (APS) zie Sassen, 2001). De conceptuele achtergrond van dit proefschrift wordt gevormd door twee relatief recente onderzoekslijnen. De eerste onderzoekslijn betreft de literatuur met betrekking tot het wereldstedennetwerk model (*world city network*, WCN) ontwikkeld door de Globalization and World Cities (GaWC, http://www.lboro.ac.uk/gawc) onderzoeksgroep (Taylor, 2004). De tweede onderzoekslijn betreft de literatuur die de geografie van lokale stedelijke systemen bestudeert vanuit het perspectief van polycentrische stedelijke regio's (Kloosterman & Musterd, 2001; Hall & Pain, 2006). Van beide modellen wordt gesteld dat zij een potentieel interessant alternatief vormen voor Christaller's (1933) centrale-plaatsentheorie (Saey et al., 2005; Meijers, 2007). Hoewel Christaller's theorie gedurende vele decennia het geografisch onderzoek naar stedelijke systemen in sterke mate heeft beïnvloed, is de afgelopen jaren de vraag gerezen of zij nog langer geschikt is om de geografie van stedelijke systemen in de huidige mondiale economie te beschrijven en te verklaren.

Aan de basis van dit proefschrift liggen drie onderzoeksdoelstellingen:

1. Het meten van veranderingen in het wereldstedennetwerk in de periode 2000-2008;
2. Het kritisch testen van de relevantie van GaWC's selectie van APS bedrijven en wereldsteden voor de integratie van de Belgische economie in de mondiale economie; en
3. Het bestuderen van de geografie van het Belgisch stedelijk systeem vanuit het perspectief van transactielinks tussen APS bedrijven en hun zakelijke klanten.

Deze onderzoeksdoelstellingen vormen het onderwerp van respectievelijk Deel 2, Deel 3 en Deel 4 van dit proefschrift. Daar worden zij verder gespecificeerd in meer concrete onderzoeksvragen die op hun beurt het onderwerp vormen van één of meerdere hoofdstukken in de respectievelijke delen.

RESULTATEN

Deel 2 meet de veranderingen in het wereldstedennetwerk in de periode 2000-2008. Het maakt hierbij gebruik van twee bestaande datasets, verzameld door GaWC, die informatie bevatten over de aanwezigheid van 's werelds grootste APS bedrijven in een groot aantal wereldsteden voor het jaar 2000 en 2008. Hoofdstuk 6 onderzoekt de

[12] Omwille van deze focus op stromen van informatie en kennis in de APS sector zijn andere empirische benaderingen voor het meten van inter-stedelijke relaties niet relevant in de context van dit proefschrift. Zij worden dan ook verder niet besproken.

veranderingen die zich hebben voorgedaan in het wereldstedennetwerk in zijn geheel en in de mondiale netwerkconnectiviteit van de steden. De resultaten tonen enerzijds een algemene toename van de mondiale netwerkconnectiviteit, wat wijst op een groei van de mondiale APS sector in de periode 2000-2008 zowel in functionele zin (uitbreiding van bestaande kantoren) als in ruimtelijke zin (uitbreiding van het kantorennetwerk naar nieuwe steden). Op het niveau van de steden stellen we duidelijk een – in absolute en relatieve termen – afnemende connectiviteit vast van voornamelijk 'Westerse' steden, en een toenemende connectiviteit van steden in Pacifisch Azië en voornamelijk in China. Dit laatste duidt op een verschuiving en/of uitbreiding van de mondiale APS sector van West naar Oost.
Hoofdstuk 7 van dit proefschrift meet de veranderingen die zich hebben voorgedaan in het wereldstedennetwerk en in de mondiale netwerkconnectiviteit van de steden voor elke APS sector afzonderlijk. In grote lijnen wijzen de analyses uit dat, naast een aantal algemene veranderingen, de verschillende APS sectoren min of meer langs verschillende ruimtelijke trajecten zijn geëvolueerd. De sectoren accountancy, reclame en financiële diensten vertonen hierbij de grootste gelijkenissen, namelijk een significante toename van de totale sectoriële netwerkconnectiviteit en veranderingen in stedelijke netwerk connectiviteiten gelijkaardig aan de algemene trend hierboven beschreven. De sectoren juridisch advies en management consultancy vertonen de grootste verschillen, met respectievelijk slechts een kleine toename en zelfs een afname van de totale sectoriële netwerkconnectiviteit, en met minder eenduidige ruimtelijke patronen in de verandering van de stedelijke netwerk connectiviteiten.

Deel 3 – en meer bepaald Hoofdstuk 8 – van dit proefschrift test de relevantie van GaWC's selectie van APS bedrijven en wereldsteden voor de integratie van de Belgische economie. De empirische analyses zijn gebaseerd op de resultaten van een grootschalige e-mailenquête bij de top-300 bedrijven in België waarin gevraagd werd naar de naam en locatie van de voornaamste zakenpartner voor zeven verschillende types APS. Op basis van deze dataset onderzoekt Hoofdstuk 8 welke de voornaamste zakenpartners en dienstensteden zijn voor het verlenen van APS aan grote bedrijven in België, en gaat vervolgens na in welke mate deze resultaten in overeenstemming zijn met GaWC's selectie van, verondersteld relevante, APS bedrijven (i.e. de 25/75 grootste APS bedrijven ter wereld voor elke sector) en Belgische wereldsteden (i.e. Brussel, Antwerpen en Luik). Wat de bedrijven betreft, bevestigen onze analyses min of meer het belang van 's werelds grootste APS bedrijven voor het bedienen van de Belgische markt, hoewel dit sterk kan variëren tussen de APS sectoren onderling. Wat de steden betreft, bevestigen onze resultaten het belang van Antwerpen en, vooral, van Brussel als voornaamste dienstenstad. Enkel voor de 'minder evidente' steden blijken onze resultaten en GaWC's selectie enigszins te verschillen. In plaats van Luik, kwam in onze analyses vooral Gent naar voren als derde voornaamste stad.

Deel 4 van dit proefschrift bestudeert de geografie van het Belgisch stedelijk systeem op basis van transactielinks. Hoofdstukken 9 en 10 vormen een verkennend onderzoek naar de voornaamste geografische patronen. Hoofdstuk 9 gebruikt hiervoor de resultaten van de hierboven vermelde kwantitatieve dataset. Onze analyses wijzen op

drie algemene kenmerken van de stedelijke geografie van transactielinks in België: (i) de dominantie van Brussel als voornaamste dienstenstad, (ii) het bestaan van overlappende stedelijke invloedssferen, en (iii) het bestaan van transactielinks met dienstensteden in het buitenland. Uitgaande van deze ruimtelijke patronen kunnen we drie basisprincipes onderscheiden voor een mogelijk alternatieve theorievorming omtrent de geografie van hedendaagse stedelijke systemen: (i) de impact van de groei van wereldsteden zoals beschreven door Sassen (2001), wat de aanwezigheid van een omvangrijke APS sector in slechts een beperkt aantal steden verklaart, (ii) een bijkomend patroon van kriskras relaties tussen steden van gelijke en verschillende omvang, en (iii) de invloed van de verdeling van beslissingsbevoegdheden binnen multinationale firma's op de geografie van transactielinks.

Hoofdstuk 10 bestudeert de geografie van transactielinks in België op basis van een kwalitatieve dataset die informatie bevat over het uitbestedingsproces van APS bij bedrijven in de automobielsector in de haven van Gent. Deze gegevens werden verzameld aan de hand van een e-mailenquête en enkele semi-gestructureerde interviews met bedrijfsleiders. Naast een beschrijving van de voornaamste ruimtelijke patronen gaat Hoofdstuk 10 dieper in op de onderliggende locatiefactoren die deze ruimtelijke patronen verklaren. Bijzondere aandacht gaat hierbij naar de – in Hoofdstuk 9 veronderstelde met niet empirisch geteste – invloed van de verdeling van beslissingsbevoegdheden binnen multinationale bedrijven op de geografie van transactielinks. Hoewel deze invloed kan resulteren in velerlei ruimtelijke patronen, kamen vier scenario's in het bijzonder steeds opnieuw terug in onze resultaten: (i) centralisatie, waarbij de beslissingen over de uitbesteden van APS voor een of meerdere dochterondernemingen genomen worden door het moederbedrijf, (ii) gedeeltelijke centralisatie, waarbij de dochteronderneming 'bediend' wordt door een lokale vestiging van hetzelfde APS bedrijf dat diensten verleent aan het moederbedrijf, (iii) gedeeltelijke decentralisatie, waarbij beslissingen genomen worden door de dochterondernemingen, maar wel in wederzijds overleg met het moederbedrijf, en (iv) decentralisatie, waarbij de beslissingsbevoegdheid volledig in handen van de dochteronderneming ligt.

Hoofdstuk 11 uiteindelijk bestudeert de geografie van het Belgisch stedelijk systeem op een meer formele manier door na te gaan in welke mate Centraal België kenmerken vertoont van een functioneel polycentrische stedelijke regio. Hiertoe werden de waargenomen ruimtelijke patronen getoetst aan twee noodzakelijke voorwaarden: (i) het bestaan van een zekere graad van evenwicht in het belang van de verschillende steden als dienstencentrum voor APS, en (ii) de aanwezigheid van een proces van stedelijke netwerkintegratie, wat zich uit in het ontstaan van kriskras relaties tussen steden van dezelfde en van verschillende omvang. Onze analyses tonen aan dat Centraal België aan geen van beide noodzakelijke voorwaarden voldoet. Het Belgisch stedelijk systeem kan aldus niet omschreven kan worden als een functioneel polycentrische stedelijke regio, maar veeleer als een hiërarchisch stedelijk systeem met Brussel als voornaamste dienstenstad.

CONCLUSIES

De bijdrage van dit proefschrift aan het onderzoek naar de geografie van hedendaagse stedelijke systemen kan samengevat worden in termen van drie conceptuele dimensies:

1. *Dynamiek*: het onderzoek vervat in Deel 2 van dit proefschrift biedt een gedeeltelijk antwoord op het gebrek aan longitudinaal onderzoek in de wereldstedenliteratuur door het meten van ruimtelijke veranderingen in het wereldstedennetwerk in de periode 2000-2008.

2. *Assumpties*: het onderzoek vervat in Deel 3 van dit proefschrift vormt een aanvulling op GaWC's WCN model door het testen van een aantal assumpties aangaande de relevantie van 's werelds grootste/meest voor de hand liggende APS bedrijven en wereldsteden voor de integratie van regionale/nationale economieën in de mondiale economie, en door het introduceren van een alternatieve methode om potentieel relevante, maar minder voor de hand liggende APS bedrijven en steden te identificeren.

3. *Schaal*: het onderzoek vervat in Deel 4 van dit proefschrift draagt op drie verschillende manieren bij aan de geografische studie van lokale stedelijke systemen. Ten eerste biedt het een methodologische bijdrage, namelijk door de introductie van een nieuwe methodologie, op basis van APS transactielinks, voor het meten van inter-stedelijke relaties. Ten tweede biedt het een conceptuele bijdrage, namelijk door aan te tonen dat noch Christaller's centrale-plaatsentheorie, noch het concept van polycentrische stedelijke regio's geschikt is om de geografie van het Belgisch stedelijk systeem – althans wat betreft de stedelijke geografie van transactielinks – te beschrijven. En derde biedt het een empirische bijdrage, namelijk door het identificeren van een aantal basisprincipes voor een mogelijk alternatieve theorievorming omtrent de geografie van hedendaagse stedelijke systemen.

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