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# The world city network: Evaluating top-down versus bottom-up approaches

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## ABSTRACT

The growth of the knowledge economy has led to new forms of business networks linking cities and towns across different spatial scales. Various attempts have been made to analyse these networks empirically using the interlocking network model of the Globalization and World Cities (GaWC) research network. Two approaches can be distinguished from a spatial perspective: a global 'top-down' approach that studies the world city network from the perspective of the largest advanced producer service firms, and a macro-regional 'bottom-up' approach that starts with the most important knowledge-intensive firms located within specific territorial boundaries. This paper compares and critically assesses the methodological implications and empirical outcomes of both approaches with reference to case studies of the German space economy. Both approaches pursue similar objectives: to investigate external relations of cities, both transnationally and on the national scale. Differences exist in the theoretical argumentation: the top-down approach is grounded in world city research; the bottom-up approach is anchored in debates in regional science and economic geography. In this paper, we argue for the need of scale-sensitive interpretations of connectivity patterns resulting from different approaches to the interlocking network model and conclude with some tentative recommendations for the methodological direction of future research in world city network studies.

## 1. Introduction

Various attempts have been made to analyse city networks empirically using the interlocking network model (INM) devised by Taylor (2001) and subsequently employed in a wide range of studies by the Globalization and World Cities (GaWC) research network ([www.lboro.ac.uk/gawc](http://www.lboro.ac.uk/gawc)) and beyond (Chow & Loo, 2015; Derudder & Parnreiter, 2014; Martinus & Tonts, 2015; Sigler & Martinus, 2016).

In its initial specification, the INM is conceptualized as a global top-down approach that facilitates the study of the world city network from the perspective of the largest advanced producer services (APS) firms, which are interpreted as key economic actors in world city network formation (Taylor, 2004). However, the INM has also been conceptualized using a bottom-up approach, analysing the office networks of the most important APS firms located within specific territorial boundaries in order to evaluate functional urban hierarchies in regional or national urban systems.

What is missing from the literature is a systematic critical assessment of the methodological implications of using a top-down or bottom-up approach to studying the world city network. Taking this deficit as starting point, this paper investigates the following research

question: What are the key advantages and limits to using a top-down or bottom-up approach for the analysis of cities in a macro-regional or national context? We start with the hypothesis that the main advantage of the top-down approach lies in its provision of global data in order to compare primary cities on a global scale. The bottom-up approach, on the other hand, provides more differentiated and meaningful results to explore city-regional and national divisions of labour in advanced producer servicing.

The paper is structured in four sections. Following this introduction, the second section briefly outlines the general analytical framework of the INM as well as its application as a top-down and bottom-up approach. Section 3 presents the specific empirical settings and main analytical findings of top-down and bottom-up analyses of the German urban system. In the fourth section, we discuss some tentative recommendations for the methodological direction in using the INM, and conclude in Section 5 with key benefits and limitations of both approaches for the analysis of cities in a national context.

## 2. The interlocking network model

The INM has its origin in the early critique of an empirical and

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**Table 1**  
Application of the INM on different spatial scales (selected studies focusing on APS).

	Top-down	Bottom-up
Global scale	Taylor, 2001 Taylor, 2004 Taylor et al., 2011 Taylor, Derudder, Hoyler, & Ni, 2013 Taylor, Derudder, Faulconbridge, Hoyler, & Ni, 2014 Taylor & Derudder, 2016 Derudder & Taylor, 2017 Yang, Derudder, Taylor, Ni, & Shen, 2017	
National scale	Taylor et al., 2011 Hoyler, 2011 Derudder et al., 2013	Taylor, Evans, Hoyler, Derudder, & Pain, 2009 Schmitt & Smas, 2012 Lüthi, Thierstein, & Bentlage, 2013 Zhao, Liu, Derudder, Zhong, & Shen, 2015 Grove & Volkmann, 2016
Regional scale		Taylor, Evans, & Pain, 2008 Hoyler, Freytag, et al., 2008 Thierstein, Lüthi, Kruse, Gabi, & Glanzmann, 2008 Lüthi, Thierstein, & Goebel, 2010 Zhang & Kloosterman, 2016 Lüthi, Thierstein, & Bentlage, 2016 Bentlage, Thierstein, & Lüthi, 2016 Zhang, 2017

conceptual deficit in the literature on global and world cities. Taylor (1997) argues that many of these concepts concentrate simply on measuring data on world city *attributes*, while ignoring the critical importance of the *relations* within the global urban system. Taylor (2001) subsequently developed the INM to specify the ‘world city network’ based on the relationships between head offices and other internal offices of major APS firms operating across the world. The INM provides one specific way of addressing the question as to how inter-city relations can be empirically measured despite the chronic lack of data on inter-city flows.

Today, the INM is applied at global, national and regional scales and with different firm samples. Some authors use the largest APS companies in the world to document the integration of cities into the world city network (top-down). Others run the model with the largest APS companies in individual countries or regions (bottom-up). As shown in Table 1, both approaches – top-down and bottom-up – are widely used on the national scale. This provides an opportunity to directly compare the results and to evaluate the advantages and limits of both approaches in analysing the global integration and functional urban hierarchy in national urban systems.

### 2.1. The interlocking network model as a top-down approach

The global top-down approach is based on three major theoretical concepts. The first is John Friedmann's (1986) world city hypothesis, which describes the rise of a transnational urban network referring to a major geographical transformation of the capitalist world economy, the production systems of which are increasingly internationalized. This reconfiguration results in a new international division of labour whose main agents are transnational corporations with complex spatial and organizational structures. According to Friedmann (1986), the presence of these transnational enterprises makes world cities “basing points in the spatial organization and articulation of production and markets” (Friedmann, 1986: 71).

The second concept is Saskia Sassen's global city model, which associates cities with their propensity to engage with the internationalization and concentration of APS firms in the world economy (Sassen, 1991). Through their transnational spatial strategies, APS firms create world-wide office networks covering major cities in most or all world regions, and it is this very multitude of connections between these service complexes that gives rise to the formation of transnational urban systems and leading global cities such as New York, London and Tokyo (Sassen, 2001).

The third theoretical building block of the INM is Manuel Castells' immensely influential concept of a space of flows in the network society (Castells, 1996). The main point of Castells' argument is that technological networks have given rise to a shift from a *world* economy to a *global* economy with the capacity to work as a unit in real time on a planetary scale. A consequence of this emerging global economy is a new spatial logic determined by the pre-eminence of the space of flows over the space of places (Castells, 2000).

Based on these theoretical approaches, the INM was originally devised to allow identification of the globally most integrated nodes in advanced producer service networks, and to provide a more inclusive perspective on cities in globalization that takes into account hundreds of cities across the world, rather than focus on a few cities perceived to be atop an ‘urban hierarchy’. Recent studies taking such a top-down perspective are Taylor et al.'s (2011) comprehensive mapping of the external relations of 525 cities worldwide, Taylor et al.'s (2013) new world regionalization based on APS location strategies, and Taylor et al.'s (2014) analysis of strategic networks and places. In recent years, the INM has also been used to analyse the uneven geographies of the world city network and to track changes over time on a global scale, for example in the context of the recent financial and economic crisis (Derudder et al., 2010; Derudder & Taylor, 2016; Hanssens et al., 2011; Liu, Derudder, Witlox, & Hoyler, 2014).

However, the data gathered on the locational strategies of the most important APS firms globally can also be used to analyse cities at other scales. For example, Taylor et al. (2011) provide a detailed analysis of city connectivities at world-regional and national scales, highlighting substantive contrasts in the integration of major regions and states into the world city network. On the national scale, global network connectivities adhere broadly to the importance of a city in its national context but there are significant differences between countries dominated by a primate city (e.g. the UK) and those with a more balanced urban network (e.g. Germany).

### 2.2. The interlocking network model as a bottom-up approach

The bottom-up approach of the INM is anchored in debates in regional science and economic geography. It is used very heterogeneously and is often combined with other data (e.g. Grove & Blotevogel, 2011; Lüthi et al., 2010; Münter, 2011). It treats world cities as more than simply centre-cores; they are viewed as complex functional urban regions, encompassing several cities, networked in a polycentric regional or national urban system (Scott, 2001) driven by a spatial up-scaling of agglomeration economies (Lüthi et al., 2013). This process is highly determined by the achievements realized in transportation and telecommunication technologies. Hall (2009), for example, emphasizes that the costs of several modes of transport and communication have drastically declined and, in some cases, speed and reliability have significantly improved. New infrastructures in the form of high-speed trains stimulate the transformation of relations in time and space and further the dispersal of urban development (Hall, 2009).

However, traditional physical measures of functional regions – such as commuting catchment areas – are only partially relevant at the macro-regional level. Another integrating force is non-physical business linkages. The combination of physical and non-physical forms of connectivity implies a huge complexity and sophistication of polycentric urban systems. Even though traditional meeting points in the city

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