The London School of Economics and Political Science

The role of the global network of cities in the development of peripheral cities and regions

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Declaration

I certify that the thesis I have presented for examination for the MPhil/PhD degree of the London School of Economics and Political Science is solely my own work other than where I have clearly indicated that it is the work of others (in which case the extent of any work carried out jointly by me and any other person is clearly identified in it).

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Abstract

This study seeks to understand the implications of the global network of cities for the development of peripheral cities in peripheral regions (D cities) such as Lagos through the growth and expansion of their firms, by comparing the geography of this network with the geography of Lagos firms' global interactions. A first phase drew a sample of corporate location data spanning 1,625 cities to construct a graph of the global network, subdivided into seven regions and 11 industrial sectors. This was analysed with both visual and computational methods. A second phase involved fieldwork in which senior staff at 20 Lagos firms were interviewed about their firms' global and regional interactions. The location data thus obtained were used to construct a graph of the network centred on Lagos and spanning 219 cities, analysed in the same way.

While intrafirm ties remain important for describing the geography of the global network towards its core, interfirm ties may be increasingly important for describing its geography towards its periphery. Lagos' interfirm ties reveal that core cities in peripheral regions such as Johannesburg (C cities) play a weaker role than Friedmann's (1986) "world city hypothesis" suggests, while peripheral cities in core regions (B cities) play a stronger role. Lagos acts like a funnel, taking the products and knowledge developed in B cities and bringing them to market in other D cities. A theoretical framework is constructed, which suggests that rather than seek further ties to the existing core of the network, firms in D cities such as Lagos should broaden their connections amongst other peripheral cities (both B and D cities). This effectively puts their cities at the core of new components within the wider global network, a proposition which resonates with sociologist Immanuel Wallerstein's (1984) theories of "economic worlds" and with urbanist Jane Jacob's (1984) argument that "backward cities need one another".

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Vocabulary

Term	*Meaning*
City (or town)	A discrete, consolidated territory of intensive land uses; in other words, a city as defined by its physical extents rather than by its administrative or statistical extents
"World city"	A city renowned for having a major role in world history, especially as a centre of world power or of cultural production (Geddes, 1924; Hall, 1966), not used in this study
"Global city"	A city renowned for having a major role in the global economy, especially through the production of inputs related to the management of MNEs (Friedmann, 1986; Sassen, 2001a; Parnreiter, 2013)
"World city hypothesis"	A hypothesis developed by Friedmann and Wolff (Friedmann & Wolff, 1982; Friedmann, 1986) that the world's major economic capitals are articulated into a network with "global cities" such as London, New York and Paris at the head, and "regional articulators" (Beaverstock, Taylor, & Smith, 1999b, p. 1872) such as Johannesburg, Mumbai and Sao Paulo in semi-peripheral positions. Friedmann and Wolff use the term "world city", but they refer to a concept referred to in this study as a "global city".
"Regional articulator"	A city renowned for articulating economic interaction between the most globalised actors in the global economy and the economies of a developing region, such as Johannesburg plays in Sub-Saharan Africa (Beaverstock, Taylor, & Smith, 1999b, p. 1872)
Business unit	A locus of economic activity such as a factory, office or retail space, operated by a single firm
Firm	An organised producer of economic value in the form of goods and services, without regard to size, sector, or the number or location of business units operated by it. This term is preferred in abstract or theoretical contexts.
Company	A firm, especially a formally incorporated one. This term is preferred in concrete or empirical contexts.
Multilocational firm (MLF)	A firm comprising business units spread across several cities and towns, including all MNEs
Multinational enterprise (MNE)	A large firm comprising business units spread across several cities and towns and across several countries
Network of cities	A network whose nodes are cities host to business units of various firms and whose ties are the various intrafirm and interfirm relations between said units that stretch between the different cities
Global network	A network of cities without regard to national borders, comprising business units in each city and the relations between them
IWCNM	"Interlocking world city network model" (Hennemann & Derudder, 2012; Parnreiter, 2013); a body of methods converting firm location data into matrix data for the description of the geography of the global network
Taylor method or GaWC method	An IWCNM method relying on the locations of the head offices and regional offices of producer services firms, most extensively used by Peter Taylor and his colleagues in the Globalization and World Cities (GaWC) Research Network (Taylor, 2001; Taylor, Catalano, & Walker, 2002; Taylor, 2004; Taylor, et al., 2010)
Alderson and Beckfield method	An IWCNM method relying on the locations of parent companies and subsidiary companies of large, mostly multinational, enterprises, used by Alderson and Beckfield and their colleagues (Alderson & Beckfield, 2004; Alderson, Beckfield, & Sprague-Jones, 2010)
Region	A continental or supranational region, such as those into which the World Bank or United Nations classifies countries
Regional network	A global network comprising business units in a given region and their global connections
ECS network	A network comprising European (and Central Asian) cities and their global connections
NAC network	A network comprising North American cities and their global connections
EAS network	A network comprising East Asian (and Pacific) cities and their global connections
LCN network	A network comprising Latin American (and Caribbean) cities and their global connections
SSF network	A network comprising Sub-Saharan African cities and their global connections
MEA network	A network comprising Middle Eastern (and North African) cities and their global connections
SAS network	A network comprising South Asian cities and their global connections
West Africa	A region comprising the fifteen member nations of the Economic Community of West African States (ECOWAS)
West and Central Africa	A vague region used to refer to the apparent zone of influence of Lagosian businesses within Sub-Saharan Africa
Sector	One of the 21 sectors used in international industrial classification schemes such as ISIC rev. 4 (United Nations Department of Economic and Social Affairs, 2008) or NACE Rev. 2 (Eurostat, 2008)
Sectoral network	A global network comprising business units in a given sector and their global connections
Manufacturing	A global network of business units classified as "manufacturing"
Finance	A global network of business units classified as "financial and insurance activities"

Term	*Meaning*
Commerce	A global network of business units classified as “wholesale and retail trade” etc.
Mining	A global network of business units classified as “mining and quarrying”
ICT	A global network of business units classified as “information and communication”
Utilities	A global network of business units classified as “electricity, gas, steam & air conditioning supply”
Technical	A global network of business units classified as “professional, scientific and technical activities”
Admin	A global network of business units classified as “administrative and support service activities”
Logistics	A global network of business units classified as “transportation and storage”
Construction	A global network of business units classified as “construction”
Hospitality	A global network of business units classified as “accommodation and food service activities”
Services	A sector created for the purpose of collating business units in Lagos drawn from various sectors not including manufacturing and finance, and whose operations are oriented around service delivery to business clients; a global network of such units
Relation	One of various ways a business unit may relate with business units in other cities
Intrafirm	A relation between two or more business units within the same firm
Interfirm	A relation between two or more business units in different firms
Operations	A business unit’s relations with other business units internal to the same company
Customers	A business unit’s relations with cities home to large clusters of its customers
Supply	A business unit’s relations with its external suppliers
Knowledge	A business unit’s relations produced by its knowledge-related activities (training, education, etc.)
Capital	A business unit’s relations produced by the movement of money related to its operations
Networking	A business unit’s relations produced by its networking activities (conferences, trade tours, etc.)
Network graph	A diagram showing the nodes in a network and the relations between them
Plan (view)	A network graph drawn as a spring-embedded graph in which a city’s centrality may be read directly from its position in the graph
Elevation (view)	A network graph in which each city is located on the y-axis according to the difference between the number of headquarters it hosts and the number of subsidiaries it hosts, or, in the Lagos network, the difference between the number of ties it “sends” and “receives”
Geographic (view)	A network graph in which each city is located in its physical geographic position
k-value	A value giving a city’s position within a given network, with low k-values indicating a peripheral position, and high k-values indicating a position close to the core of the network
k-shell	A subset of cities within a given network sharing a specific k-value, that is, sharing a similar position within a given network with regards to its periphery and its innermost core
K-value	A value giving the number of k-shells in a given network, thus giving an indication of the density of its innermost core and the distance between this innermost core and the periphery of the network
Consolidated	A network with $K = 5$ to 15 typified by large numbers of “core cities”, “headquarter cities” and “foothold cities” q.v.
Transition	A network with $K = 3$ to 7 typified by increasing numbers of “headquarter cities” and “foothold cities”
Fragmented	A network with $K = 2$ typified by a few loosely connected “headquarter cities”
Degenerate	A network with $K = 1$ typified by a lack of connections between any existing “headquarter cities”, which are therefore “lone star cities”, q.v.
Egonetwork	A global network comprising business units in a given city (“ego”) and their global connections
Egocentric	An egonetwork typified by an overwhelming majority of direct connections centred on ego
Asymmetric	An egonetwork typified by a majority of direct connections centred on ego, with a sizeable minority of direct connections centred on a city other than ego, that is, on an “alter”
Altercentric	An egonetwork typified by a plurality of direct connections centred on an alter
Core region	The three regions generating very large numbers of ties in the global network, namely Europe and Central Asia, North America, and East Asia and the Pacific
Peripheral region	The four regions generating very small numbers of ties in the global network, namely Sub-Saharan Africa, Latin America and the Caribbean, Middle East and North Africa, and South Asia
Core city	A city having a k-value of 3 or higher within the global network, thereby constituting part of the core of the network (cf. below)
Peripheral city	A city having a k-value of 2 or lower within the global network, thereby constituting part of the periphery of the network

Term	*Meaning*
A cities	Core cities in core regions, such as London, New York or Tokyo
B cities	Peripheral cities in core regions, such as Izmir, Rochester or Pingdingshan
C cities	Core cities in peripheral regions, such as Johannesburg, Sao Paulo or Mumbai, equivalent to "regional articulators"
D cities	Peripheral cities in peripheral regions, such as Lagos, Quito or Kochi
Specialised city	A city host to clusters that have developed a specialisation in some sector or function
Networking city	A city specialised in facilitating introductions between firms including those in other cities, as through conferences and trade fairs
Headquarter city	A city that "sends" large numbers of ties to other cities, such as cities that host the headquarters of many MLFs and MNEs (Hymer, 1972), usually as the result of specialisation in some sector or function
Lone star city	A headquarter city that is poorly interconnected with other headquarter cities
Foothold city	A city that "receives" large numbers of ties to other cities, such as cities that host many subsidiaries of MLFs and MNEs, usually as the result of specialisation in some sector or function
Core city	A city specialised in the production of inputs of value to MLFs and MNEs, identified in part by having a k-value of 3 or higher within a given network, thereby constituting part of the core of that network (cf. above)
Innermost core city	A city having the highest possible k-value within a given network, that is, a constituent of the innermost k-shell of that network
Peripheral city	A city having a k-value of two or less within a given network, or not appearing in that network at all, that is, a constituent of the periphery of that network

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Chapter 1. Introduction

This study seeks to understand the implications of the global network of cities for the development of peripheral cities and regions, through the case of Lagos in Sub-Saharan Africa. The motivation for the project arose during a previous programme of studies in which two literatures, both focused on the structure of the global economy yet seemingly disconnected from each other, were brought together in sharp relief. On the one hand was the field of international development, which continues to operate within the twin paradigms of neoliberalism and the nation-state, and whose recommendations are put into practice by what can only be called the "development-industrial complex" (Breyman, 2010) (a play on Eisenhower's "military-industrial complex")—the web of national governments, intergovernmental organisations, and private sector and non-governmental contractors and consultants, who intervene in the economies of developing regions throughout the world. On the other hand was the "global cities" literature, an interdisciplinary scholarship figureheaded by John Friedmann and Saskia Sassen[1], who see the global economy as increasingly articulated through a global network of cities, with "global cities" such as London, Tokyo and New York at the head of this structure. This sparked the initial speculation driving this research: if it is true that the global economy is articulated through a global network of cities, whether "global cities" or otherwise, what does this mean for the cities and regions of the world in the periphery of this system? What does it mean for their development?

Thus this research seeks to add to our understanding of international development, not by situating itself within the international development literature but by contributing from outside it, from within the "global cities" literature, to learn what might be gleaned from that literature's perspective about the periphery of the global economy. The guiding intuition is the expectation that the economic development of a region such as Sub-Saharan Africa occurs not simply through technocratic manipulation of its economic institutions at the level of national policy, but specifically through the formation of entrepreneurial networks within and between its cities, just as is the case in core regions. This research is a small step towards vindicating that view or otherwise.

1.1. The research question

The research question is this: what is the role of the global network of cities in the development of (peripheral cities in) peripheral regions, such as is represented by the case of Lagos in Sub-Saharan Africa? This question has several components. The "global network of cities" is the network of businesses and the cities where they are located, similar to the way they are conceived of within the "global cities" literature, though it is more broadly conceived in this study as discussed in the next chapter. The term "global network of cities" ("global network" for short) is used in preference to the

[1] By "global cities" literature, I mean the literature on "world cities" that follows in the footsteps of Friedmann and Wolff (1982) and Friedmann's (1986) "world city hypothesis", as well as the literature on "global cities" that follows in the footsteps of Sassen (1991). I use "global cities" for both of these literatures for reasons discussed in the next chapter.

term “global city network” (or “world city network”) to remove any implicit appurtenance to the so-called “global cities” (or “world cities”) at the core of this network. While the cities that constitute the nodes of this network are the geographic arena for this research and the unit of investigation in the network analyses, it is the businesses whose relations constitute the ties of this network that are the actors in this study. The study is thus primarily a work of microeconomic rather than macroeconomic research. Accordingly, “development” refers to processes of economic growth and development rather than any property measured by macro-level aggregates such as gross national income per capita. Thus the study is also concerned with the qualitative characteristics of an economy more so than its quantitative dimensions. To be clear, this study cannot hope to address all the individual types of processes that make up the broad phenomenon of economic development per se, nor all the roles that the global network may play within them. While keeping these broader processes in view, this study nevertheless narrows its attention to one significant subset of these processes, namely how firms grow through expansion into new products and new markets, and how they form new networks and activate them to achieve this. In other words it focuses on the growth and development of individual firms, as a way of contributing to an understanding of the growth and development of wider urban economies.

Within this study a “region” is one of the seven continental macro-regions into which organisations such as the World Bank divide the world; that is, it is always a continental or supranational region such as “Sub-Saharan Africa” rather than a subnational region such as “southwest Nigeria”. A “city” is defined by the physical extents of the intensive land uses pertaining to it as explained in detail in the methodology, as opposed to its administrative extents such as its local government area. The phrase “(peripheral cities in) peripheral regions” needs to be understood in its context. Here, the unit of investigation is the city, and regions are considered as the sum of their constituent cities and towns, the vast majority of which are peripheral to the core cities in those regions. The study thus seeks to understand the development of peripheral regions by understanding the development of peripheral cities and towns in those regions. This study also distinguishes between the core regions Europe and the Middle East, North America, and East Asia and the Pacific, and the peripheral regions Sub-Saharan Africa, Latin America and the Caribbean, Middle East and North Africa, and South Asia. It also distinguishes between core cities and peripheral cities within the global network as determined by graph analytic techniques, regardless of region. There are thus four categories of city distinguished in this study:

A. Core cities in core regions—cities in the core of the global network and in a core region, such as London, New York or Tokyo;
B. Peripheral cities (and towns) in core regions—cities (and towns) in the periphery of the global network but in a core region, such as Izmir, Rochester or Pingdingshan;
C. Core cities in peripheral regions—cities in the core of the global network but in a peripheral region, such as Johannesburg, Sao Paulo or Mumbai; and,
D. Peripheral cities (and towns) in peripheral regions—cities (and towns) in the periphery of the global network and in a peripheral region, such as Lagos, Quito or Kochi.

By concerning itself with peripheral regions, this study is predominantly concerning itself with cities in the last of these categories (i.e. D cities), and what role the global network has on their development, that of the businesses within them, and that of the regions surrounding them.

1.2. The research project

The research project consisted of two phases. First, a series of network analyses visualising and describing the global network (and its regional and sectoral components) as a network graph based on secondary corporate location data, revealing the geographic structure of the network and its major subsystems. Second, a period of fieldwork comprising interviews with senior staff in 20 companies headquartered in Lagos, Nigeria, in which more detailed geographic data was collected on each company's interactions within the global economy in terms of operations, supply, knowledge, capital, and networking activities. These were used to recreate a sample of the global network centred on Lagos founded on microeconomic interactions, which could then be compared and contrasted with the findings of the secondary data analysis.

1.3. The dissertation

The dissertation comprises eight chapters and two appendices. This introduction (Chapter 1) has briefly presented the motivation for the research project and the guiding research question. The theoretical review (Chapter 2) discusses the "global cities" literature and its antecedents in Braudel (2002) and Wallerstein (1984), and the recommendations for local economic development contained within them, explored in comparison with the ideas concerning the economic development of cities in peripheral regions espoused by the urbanist Jacobs (1984). The methodology (Chapter 3) discusses problems related to mixed methods research within economics before explaining in detail the nested network analysis and qualitative methods used in this study.

Three chapters present the basic findings: Chapter 4, "The global network", presents a geography of the global network based on the secondary corporate location data. Chapter 5, "Lagos and its businesses", presents the qualitative data acquired during fieldwork in that city, while Chapter 6, "The Lagos network", analyses the same data considered as another network centred on Lagos, whose outlying features are compared with those of the global network. These are followed by Chapter 7, "A model of the global network", a discussion chapter that builds a more general model of the global network of cities and its role within the economies of peripheral cities in peripheral regions such as Lagos. The conclusion (Chapter 8) channels this into a response to the research question put forward in this introduction and discusses the implications of the findings for future research and policy.

The network analysis chapters should be read in conjunction with their eponymous appendices. Appendix A comprises graphs of the global network and should be viewed alongside Chapter 4. Appendix B comprises graphs of the Lagos network and should be viewed alongside Chapter 6.

Chapter 2. Theoretical review

To reiterate, the question guiding this research project is: what is the role of the global network of cities in the development of peripheral cities in peripheral regions such as Lagos? The focus of this review is the literature on "global cities" which inspired the question, and to understand what it has to say in response to this question we must start by clarifying what the global network is in itself.

2.1. The global network of cities

At the most basic level, the global network of cities may be identified according to the rudiments of network analysis. Each city in the world is a *node* in the network and they are all (with very few exceptions) connected to each other by various means. These connections or *ties* may take many different forms depending on the phenomenon one wishes to study: physical infrastructure (roads, rail lines, air lines, shipping routes, energy grids, telecommunications cabling, etc.), organisational relationships (parent companies and their remote subsidiaries, businesses and their remote suppliers and customers, intergovernmental and diplomatic relationships, etc.), physical flows of objects (cargo mail, vehicles), physical flows of people (migration patterns, the movements of businesspeople), informational flows (data or electronic funds transfers), and so on (Derudder, 2006). Cities exist, connections between them exist, and exist on a global scale; therefore the global network of cities exists. Which outward expressions of this network a researcher chooses to consider depends entirely on the subject they wish to examine.

In this case we are interested in the economic dimension of this network. But if the global network of cities is an economic phenomenon, then in the ontology of the discipline[2] this must be because it is populated by economic agents acting according to some form of self-interest, and whose behaviour gives rise to its existence. These agents may be individuals, families, businesses, or some other organisational unit; again, which agents a researcher chooses to consider depends entirely on the topic under investigation. But in this case other forms of connection—physical infrastructure, physical flows of objects, etc.—while interesting, must be secondary to these economic agents. Thus in this study, the global network of cities shall not refer simply to any system in which cities are connected worldwide, but specifically to a system in which cities are connected worldwide through the actions of economic agents in each city.

So far this is little different to the view of the world underpinning regional science. If we take it that a city and its surrounding territory comprise a (subnational) region, then we may say equally simply that regions exist, connections between them exist, and exist on a global scale; therefore a global

[2] "[…] if economics is to be thought of as a science, then it should explicitly be a *human* science. Especially does this require a recognition that its 'human' appellation derives from the ontological nature and constitution of its object of study, for, whatever else economic phenomena may be, the one irreducible characteristic that they all have in common is that they originate in the choices, decision making and actions of human agents." (Oakley, 1994, p. 2)

"mosaic" (to adapt Taylor's (2004) term) of regions exists. This is not entirely true, since regional science often considers regions comprising more than one discrete city, whereas city network literature tends to consider each discrete city as a separate node. Nevertheless the difference between the two views of the world—as a network of cities or as a mosaic of regions—is simply the difference between two ways of stylising the geometry of the world's surface (or in mathematical terms, simply a topological preference). However some routes of mathematical analysis become more obvious depending on which way is taken. For example, regression analysis is more easily performed on sets of regions, graph analysis (known to the social sciences as "network analysis") on sets of city-nodes. Once more it is partly a question of the topic under investigation. In this case, because the "global cities" literature has firmly established its view of the world as a set of city-nodes constituting a network, it is appropriate to retain that topological preference.

For some scholars, the choice of topology is a substantive issue. In his thesis on "the space of flows", Castells (2010, p. 407) proposes that the social space within which the processes of globalisation occur cannot be understood as a composite of regional territories but is a unitary space spanning across territories. The global network is the thing, and its manifestation in individual cities only fragments of this whole. While this conceptual distinction has no implications for the mathematical specification of the method, it nevertheless reinforces the view that network analysis rather than regression analysis is the more appropriate approach for this study.

Within the "global cities" literature, the agents and the connections they form between cities are usually as follows: in the "new international division of labour" (Fröbel, Heinrichs, & Otto, 1980), multinational enterprises (MNEs) develop global location strategies that assign different decision-making functions or production roles to offices in different cities (Hymer, 1972; Cohen, 1981; Brenner & Keil, 2006; Iammarino & McCann, 2013; Parnreiter, 2013). The sum of office locations assigned in this way creates a network characterised by a "single" global "spatial division of labour" as well as a "complex spatial hierarchy" repartitioned between a core, semi-periphery and periphery (Friedmann, 1986, pp. 70-71). MNEs also outsource much of these decision-making functions to producer services firms, which are "subject to agglomeration economies [and which] concentrate in global cities because of their dense, knowledge-rich and technology enabled environments" (Sassen, 2001a; Parnreiter, 2013, p. 19). In other words, the literature is concerned with the special ways in which the global network of cities is constructed during the current phase of globalisation (which various perspectives might call the post-colonial, the post-war, the post-industrial, etc.). Thus for the "global cities" literature, the global network is a system within which MNEs and producer services firms assign functions to actors in different cities around the world.

At this point we must begin to hold in our minds two definitions of the global network of cities. At one level it is a network of cities and the connections formed between them by economic agents in each city. At another level it is a specific spatial configuration of certain subsets of these actors—in other words, a specific geography. This is akin to the difference between a sample and a population. The first definition takes into account the entire population of actors that constitutes the global

network; the second definition restricts one's view to a sample of that population. One may make the standard assumption that the geography of the sample represents the geography of the population. On the other hand, one may have certain priors that a sample should be drawn selectively in accordance with a given theory or hypothesis. For example Taylor (2006) argues that his method chooses producer services firms strategically to accord with the key role Sassen (2001a) theorises for such firms within "global cities". As discussed below however, this study does not take this theorised role of producer services as a given, and thus retains the more conservative approach of attempting to draw a sample that will be representative of the population.

But we must also hold in our minds the difference between the global network of cities (however represented) and the wider global and urban economies that host the actors constituting the network. That the location patterns of a sample of actors constitute an identifiable geography is not very controversial. What is controversial is any attempt to extrapolate this into hypotheses regarding broader economic phenomena, such as the overall structure and composition of the economies hosting these actors, as Friedmann does when he writes that "the global control functions of world cities are directly related in the structure and dynamics of their production sectors and employment" and that "the driving force of world city growth is found in a small number of rapidly expanding sectors" (Friedmann, 1986, p. 73). Storper issues the following warning:

> *"Yet it is not clear that the world city hypothesis can stand in as an explanation of contemporary growth and change in the cities comprising the first and second tiers of its global urban hierarchy. While foreign transnationals are certainly visible in New York, Paris, São Paulo, London, Los Angeles, and Sydney, no research has ever shown that they constitute either the lion's share of growth or the structural "motor force" of metropolitan growth in any of them* [...] *."*
>
> (Storper, 1997, p. 234)

Parnreiter tries to walk the "global cities" literature back from such critiques by revising its intentions, proposing that despite all appearances:

> *"The global city paradigm does not intend to deal with the complexities of urban economies or city life, nor is it about the general connectedness of cities to the world economy. Rather, global city research is concerned with the geography of a very specific input into global commodity chains, namely the means by which their organization and control is made effective."*
>
> (Parnreiter, 2013, p. 29)

Yet the spirit of the original claims—that networked "global cities" have some role in structuring the "global economy", and not simply in structuring the geographies of MNEs—continues into recent years, for example in lines such as this: "the multiple circuits connecting major and minor global cities are the live infrastructure of the global economy" (Sassen, 2009).

Storper (1997) is right to warn that the global network represented by the sampling of actors used in the "global cities" literature, the global network constituted by the entire population of actors, and the wider global economy, must not be conflated nor assumed to correspond without empirical evidence. But this does not prevent us from using the methods of the "global cities" literature to describe the geography they capture, if our intention is then to explore how the geography of the network thus sampled corresponds to other geographies. This is the approach taken in this study, first to describe the geography of the global network based on one of the methods used in the "global cities" literature, then to compare that geography with the geography of Lagos firms' interactions within the global economy in general.

The literature's focus on MNEs and producer services firms is partly due to the ancestry of the literature and the influence of scholars such as Hymer, Cohen and Sassen. It is also partly due to empirical realities. The importance of these two types of agents is undeniable; for example, Iammarino and McCann (2013, p. 3) note that in 2006, MNEs "accounted for over 10 per cent of global GDP, and approximately one third of global exports", while Vitalli, Glattfelder and Battiston (2011) analyse the network formed by a mammoth sample of 600,508 "economic entities" around the world and find that just 50 firms, predominantly financial services firms, have indirect "control" over 39.78% of the sum of these entities, though this control is a rather abstract variety based largely on circuits of asset holdings. Nevertheless we must test whether they constitute a representative sample of the global network (letting alone the global economy).

To do this we need to ask what forms of self-interest, what economic behaviours underpin the activities of firms, such that they produce the interactions that constitute this network. Jarillo (1988, pp. 36, 34) asks these questions thusly: "How can a network be created and sustained?" "How can a network be economically efficient?" To answer them we should try to imagine a world where networks do not exist. Such a world would consist of firms dispersed arbitrarily across space, interacting with each other indiscriminately and anonymously over the surface of the planet in a global "fog" of economic exchange. But the fact is that these interactions become routinised along specific routes or through specific partnerships—that is, they become organised into a coherent network. If one likes, the fog is channelled into winds of trade. One of the most basic explanations for this routinisation is with regard to transaction costs (Jarillo, 1988; Blois, 1990). As Johansson and Quigley describe:

> *"if the same pair—a buyer and a seller—is involved in similar transactions regularly and frequently, the pair will have an incentive to organise the transaction procedures and processes so that costs are reduced. They may routinize this interaction, thus forming a transaction link between them. The buyer and seller represent nodes connected by a specified linkage."*
>
> (Johansson & Quigley, 2004, p. 169)

These partnerships may arise between firms in the same city, which for Johansson and Quigley is the phenomenon of agglomeration, or they may arise between firms in different cities, which they think of as the phenomenon of intercity networks. The common microeconomic origin of both

phenomena allows Johansson and Quigley to argue that both yield similar economic benefits for participants:

> *"networks among economic actors dispersed over space may act as a substitute for agglomerations at a single point, providing some or all of the utility gains and productivity increases derived from agglomeration."*
>
> (Johansson & Quigley, 2004, p. 166)

Thus the global network of cities may be a structure through which businesses in cities and regions with poor agglomeration efficiencies benefit from such efficiencies existing in other regions. Businesses in a peripheral city or region may use the global network to gain access to remote pools of foreign capital, skilled labour, products and knowledge that are otherwise impossible to procure within the local economy. By helping firms procure the resources required to expand and diversify at scale, networks may give developing cities and regions the chance to leapfrog towards new industries and niches of production. A salient example is the city of Nnewi in southern Nigeria, which despite its tiny size developed into a major industrial centre when local auto parts importers began procuring manufacturing equipment and training programmes from their Taiwanese suppliers, allowing them to upgrade and diversify their activities (Forrest, 1994; Bräutigam, 1999).

This leads to another argument, and one that is of vital importance in the current phase of globalisation. Businesses do not simply form networks to reduce transaction costs, but also to gain access to new knowledge, whether of new market opportunities, new products, new techniques, etc. (Ernst & Kim, 2002; Johansson & Quigley, 2004; Iammarino & McCann, 2006). This may even be motive enough to form networks by itself, but it may also arise as a direct or indirect product of the transaction cost motive:

> *"Information and knowledge diffuse quite easily among firms belonging to the same transaction network. In this case the spillover may be a by-product of transactions between firms in a network. As a consequence, a link or a network can function as a substitute for* [geographic] *proximity in the process of knowledge diffusion. Moreover, networks can be designed to include spillover mechanisms."*
>
> (Johansson & Quigley, 2004, p. 174)

Such networks are ideal breeding ground for innovation. In Boschma's (2005) perspective, the knowledge sharing required for effective innovation occurs most successfully at a middling level of "proximity" (where "proximity" may be geographic, cognitive, organisational, social or institutional). Both "too little" and "too much proximity may be detrimental to interactive learning and innovation" (Boschma, 2005, p. 61). Networks between businesses in different cities may help to strike the right balance, contributing to some of the "possible solutions" that Boschma recommends, such as providing a "mix of local 'buzz' and extra-local linkages", or connecting firms whose different contexts contribute to a "common knowledge base with diverse but complementary capabilities", or

a “loosely coupled system” (Boschma, 2005, p. 71). Here cognitive, institutional and other forms of proximity compensate for geographic proximity where it is absent.

In their study of “three French regions”, Rallet and Torre (1999) go one step further, suggesting that not only may partnering across distance be useful for innovation, but it may even be instrumental: “nonlocal relations appear as a key factor to develop innovation [sic] […] nonlocal relations should be encouraged by local development policies in the same way as local relations” (Rallet & Torre, 1999, p. 373). Here it may appear (and one may wish to argue) that the two agents involved in “nonlocal relations” are relying on “organisational proximity” (which they use as a cover term for what Boschma (2005) splits into “cognitive” and “organisational” proximity) once again as a substitute for geographic proximity. Though this is not quite the case Rallet and Torre (1999) argue. Rather, they argue for “organisational proximity” as more necessary than geographic proximity, and propose that geographic proximity is merely a dimension that assists in the exploitation of organisational proximities: “Geographical proximity is effective only if it coincides with the existence of organisational relationships. Whereas at the opposite extreme, one can imagine individuals developing informal interactions without being physically closed [sic]” (Rallet & Torre, 1999, p. 375). There is a little bit of sophistry here however, since Torre later goes on to reaffirm that “temporary geographical proximity”—reciprocal visits, conferences, etc.—is part of the glue that binds partners relating across distance (Rallet & Torre, 1999; Torre, 2008). But this nuance proves useful when considering businesses in Lagos, where nonlocal relations in unexpected locations play a major part in enabling Lagos firms to pursue new opportunities, and where temporary networking events such as trade fairs and conferences are instrumental in instigating these relations. Why can we not get to a stage where geographical proximity however fleeting becomes unnecessary? Storper and Venables (2004) would argue that it is face-to-face interaction—often precisely that of a very fleeting nature—that finally cements the trust and confidence needed to turn occasional “nonlocal” interaction into sustained nonlocal partnership.

While MNEs and producer services firms may be expert at exploiting these opportunities offered by networks, they are by no means the only types of businesses able to do so. Small, medium and large domestic enterprises may also form and participate in global networks for the purposes mentioned here—reduction of transaction costs, access to new opportunities, and the possibilities for innovation—and the sum of their activities in these respects may well have a strong role in the current phase of globalisation. As far as providing a basis for research on the global network of cities goes, there is good reason not to discount these agents.

In conclusion, if we want to understand the global network in the most general terms possible, we must retain a more general specification of it, namely that it is a spatial network of nodes and ties created by a sum of business units engaging with other business units around the globe, regardless of sector or function, their locations aggregated at the level of individual cities (as opposed to the levels of subnational regions or countries).

Of course, one must still have a sampling strategy, since it remains impossible to harvest location data on the full population of firms constituting the global network of cities. In this study, this is done by choosing all firms larger than a given revenue threshold but without regard to the nature of their product, as explained further below and in the methodology. In practice this will obviously capture a large number of MNEs anyway but, as in the sample used for this study, large domestic companies may still make up a sizeable minority alongside them.

2.2. Identifying the network

Having decided upon the scope of the global network, how do we identify it empirically? Mathematically, any kind of network may be represented by a matrix—a grid of values recording the size of ties between each possible pair of nodes; the question is what set of values should be used and how they should be procured. Within the literature, two types of values are commonly used. Peter Taylor and his colleagues (such as Ben Derudder) who constitute the Globalization and World Cities Research Network (GaWC) select samples of producer services firms (banks, accountants, lawyers, management consultants, etc.), give a weighting to each of the global, regional and national offices constituting each firm, compile these values into a non-directional rectangular city-firm matrix, which is then squared to produce a symmetric square city-city matrix (Taylor, 2001; Taylor, Catalano, & Walker, 2002; Taylor, 2004; Taylor, et al., 2010). Alderson and Beckfield use a sample of large firms in any sector (predominantly MNEs due to their size but not necessarily so), mark each relation between each company and their myriad subsidiaries as a directional tie in a stack of directional square city-city matrices, which are then compiled into a single directional square city-city matrix (Alderson & Beckfield, 2004; Alderson, Beckfield, & Sprague-Jones, 2010).

Thus both methods arrive at a square city-city matrix, which can be analysed using any of the tools provided by any of the network analysis literatures to calculate network properties for each city. These literatures include mathematical, physical, biological, computational and social network literatures among others, all of which share several analytical methods, and all of which contribute new analytical methods which may be applied to any of the other disciplines if a substantive justification can be developed for doing so. For example, one of the key methods used in this study, k-shell decomposition (Seidman, 1983) has found application in social, medical, and organisational research (Müller-Prothmann, 2006; Kratzer, Leenders, & Van Engelen, 2010; Kitsak, et al., 2010).

Most measures used in the "global cities" literature focus on identifying the most highly connected and most central cities in the network. Such cities are commonly thought of as "global cities", following Sassen (2001a), who uses the adjective "global" rather than "world" quite deliberately to highlight the "specificity" of those cities that fulfil functions within "the contemporary period" of globalisation and distinguish them from "world cities [...] a type of city which we have seen over the centuries" (Sassen, 2001a, p. xix), that is, to distinguish them from such "world cities" as Paris and Rome as described by Goethe (Gottmann, 1989; Taylor, 2004), Geddes (1924) and Hall (1966).

Sassen's term is clear enough, and is the term preferred in this study, yet it is not universally accepted. Friedmann (1986) used the term "world cities". Taylor (2004) also uses the term "world cities", though his theoretical framework is indebted to Sassen as well as to Friedmann, and even Derudder, one of his GaWC colleagues, argues that the GaWC method is more closely aligned to Sassen's "global cities" than to what Friedmann called "world cities" (Derudder, 2006). Finally, Alderson and Beckfield (2004) also use the term "world cities", and here Derudder (2006) agrees that their method is more closely aligned to what Friedmann called "world cities" than to Sassen's "global cities". It would seem that the literature wants us to label Sassen's conception and all that derive from it as "global cities", and to label Friedmann's conception and all that derive from it as "world cities".

However, Parnreiter has convincingly argued that "Friedmann's world cities [are] closer to Sassen's global cities than to earlier notions of world cities as capitals of empires or as the top of the global power hierarchy [as per Geddes (1924) and Hall (1966)], because both are [...] concerned with networked cities engaged in the articulation and governance of cross-border economic activities" (Parnreiter, 2013, p. 15). I believe that Sassen (2001a) and Parnreiter (2013) make the more sensible distinction, that the term "world cities" should be left to Goethe, Geddes (1924) and Hall (1966), and that the term "global cities" should be used for the contemporary phenomenon, whether conceived by Friedmann (1986), Sassen (2001a), Taylor (2004), Alderson and Beckfield (2004) or any other contributor to the "global cities" literature.

The important difference between the GaWC method (Taylor, 2004) and the Alderson and Beckfield (2004) method is the sampling strategy: the former restricts itself to producer services firms, the latter accepts firms in any sector. The GaWC method bases this restriction on theoretical assumptions which, it has been argued here, are not appropriate for this study, therefore this study hews to the Alderson and Beckfield (2004) method for the construction of the network matrix datasets.

The idea is that applying network analytical methods to these matrices will identify the world's hierarchy of "global cities", but what is the significance of this geography? First, one must be clear that this is a geography composed by a sample of firms constituting the global network, but it is not necessarily the geography that would result from the entire population of firms constituting the global network, which again is not necessarily the geography that would emerge from the global economy *in toto*. Careful comparison of the hierarchy produced by the network analytical methods with other evidence regarding the wider global network and the global economy overall must be brought to bear.

Second, Storper (1997, p. 236) effectively criticises attempts to identify any hierarchy of "global cities" in this manner as theoretically inconsequential: "In fact, the world city hierarchy it maps out corresponds quite neatly to already existing national urban hierarchies; all that is necessary is to draw international lines linking the national pyramids into a superpyramid. In this sense it adds

little to urban growth theory as a whole." If this is true then the global geography thus identified is likely simply one of many outward expressions of the interactions between these national hierarchies and the myriad macroeconomic forces that created them in the first place.

What would be interesting then is if this global network begins to diverge from the "superpyramid" arrangement that Storper suspects, cutting across national hierarchies in surprising ways. This means that there may still be a role for using these procedures if (a) we bear in mind the differences between the global network defined by the sample of firms used, the global network defined by the entire population of firms, and the global economy itself; (b) we remain aware of the possibility of other economic geographies intersecting with the global network however defined; and (c) we are specifically on the lookout for the interactions and contrasts between them. In this study the geography of the global network defined by the sample used here is compared against the economic geography of Lagos firms' interactions within the global economy, to assess whether the geography of the global network really does shape the way they pursue economic opportunity globally.

For another example: something that both IWCNM methods share is that they are based entirely on intrafirm connections (ties where the one company straddles two or more locations) and do not capture interfirm connections (ties where two companies in different locations engage in exchange across the distance between them) at all, potentially a very large source of bias. Derudder argues that this omission of interfirm data is of little concern, believing that the samplings of intrafirm connections made by the various teams may stand "as a surrogate for actual flows of interfirm information and knowledge" (Derudder, 2003, p. 104), in other words that a given set of intrafirm relations may stand as a proxy for the corresponding set of interfirm relations. However internalisation theory (Buckley & Casson, 2009) suggests that the two types of connections may produce significantly different geographies. Intrafirm connections arise specifically where transaction costs are high or the need for tacit knowledge is high, and interfirm connections where these barriers to exchange are low (Jones, 1997). It follows that the network models used thus far, being reliant on intrafirm connections, are biased towards those aspects of the global economy where transaction costs and tacit knowledge requirements are high. Where the transaction and information costs involved in contracting are low, as is the case for very high volume goods and services, or where other regulatory barriers intervene to prevent business units merging into the one company, these network models do not capture them. For example, the enormous production volumes contracted out between businesses in "Silicon Valley" and manufacturing units in the Pearl River Delta are not necessarily captured by the IWCNM, potentially a significant omission from any relational analysis of the global network.

In support of Derudder (2003) it might be argued that while the relationship between a tech company in San Francisco and a manufacturer in Guangzhou would not be captured, the GaWC method he and Taylor use could capture legal, finance or shipping companies that serve both parties. Derudder also argues that "offices generate more flows [of instruction and coordination] within a

firm's network than to other firms" and that therefore intrafirm connections are a greater source of a city's command power in the global economy than interfirm connections (Derudder, 2003, p. 105).

One can imagine, for example, that a law firm's headquarters in San Francisco has explicit command power over its subsidiary in Guangzhou, while a tech company merely has the soft power of market forces at its disposal in its relationships with its manufacturers. However, in reality, the soft power of interfirm relations may occasionally outweigh the hard power of intrafirm relations, especially when one cluster of firms engages heavily with a cluster of firms in another location. To continue the example, if one manufacturer in Guangzhou spoils its relationship with one tech company in San Francisco (for example, with a highly publicised ethical scandal), this may set off a wave of mistrust between other tech companies and other manufacturers. This is potentially a very important part of the economic workings of the global network of cities that a merely intrafirm analysis would miss. Thus when Derudder says his assumptions have "not yet been empirically tested but [are] inherently plausible" (Derudder, 2003, p. 105), he is right only in a limited sense: they are indeed plausible but it cannot be assumed that they will withstand empirical scrutiny.

But this is not an easy challenge to address, and the ideal method—complementing the intrafirm data of hundreds of the world's largest firms with data identifying all the interfirm relationships between them—is almost entirely insurmountable, and certainly insurmountable within the context of this study. No practical sampling method can definitively identify the overall structure of the global network of cities, but must content itself with identifying a specific dimension of it. It becomes a matter for individual studies to recognise the limitations of a given method and to complement it with others. In the case of this research project, an intrafirm network at the global scale along the lines of Alderson and Beckfield's (2004) sampling method is supplemented by a qualitative analysis combining intrafirm and interfirm relations at the scale of a single city (Lagos), in such a way that the latter can be used to make theoretical inferences about the former, including regarding the types of bias caused by the dependence on intrafirm data at the global scale, as explained further in the following chapter.

2.3. The shape and shifting of the network

Knowing a little more about the geographies we intend to identify empirically, what shape does the literature advise us to expect? As stated above, for many authors the global network comprises a core, semi-periphery and periphery (Friedmann, 1986; Taylor, 2004; Alderson & Beckfield, 2004), though this study uses different vocabulary as follows:

Table 2.1 Comparison of vocabulary

This study	*Friedmann (1986)*	*Beaverstock, Taylor and Smith (1999a)*	*Alderson and Beckfield (2004)*
A. Core cities in core regions	"Core: Primary City" "Core: Secondary City"	"World cities"; "evidence of world city formation"	"Primary"; "High-status clique"; "Low-status clique"
B. Peripheral cities in core regions	Not named	Not named	"Snob"; "Isolate"
C. Core cities in peripheral regions	"Semi-periphery: Primary City" "Semi-periphery: Secondary City"	"World cities"; "evidence of world city formation"	"Primary"; "High-status clique"; "Low-status clique"
D. Peripheral cities in peripheral regions	Not named	Not named	"Snob"; "Isolate"

But whereas in much of the "global cities" literature the overall structure within which these different types of cities are embedded seems relatively static, with individual cities merely shifting upwards and downwards within more or less the same hierarchical system, for their antecedents the network is rather more dynamic and polycentric. The core-periphery idea originates in Braudel and Wallerstein's concept of the "world-economy" or, as it should have been translated, the "economic world"[3]. An economic world is a region comprising several trading territories and which is for most purposes economically self-sufficient or self-containing (Braudel, 2002). In other words it is its own "world", can do without the fruits of other "worlds", or must do without them when the oceans, deserts or mountain ranges between two economic worlds are too perilous to conduct trade across. There may be many economic worlds on the face of the Earth at the same time, as was certainly the case before Europeans re-established contact with the Americas in the 15th century. At the centre (geographic, political, economic) of every economic world sits a "world-city" or, as it should have been translated, a "world city"[4], such as Venice during Europe's middle ages or London at the height of the British Empire. But as Braudel sees it, these cities do not remain in their positions forever; as the economies of these "worlds" evolve, there are frequent power shifts from one world city to another, then another, over the *longue durée*. As Wallerstein writes, "moments of true hegemony

[3] The term "world-economy" comes from Braudel's term "*économie-monde*", which he coined "as a particular meaning of the German term *Weltwirtschaft*" (Braudel, 2002, p. 22). The German term generally means "world economy" or "global economy", and is normally translated to and from French as "*économie mondiale*" (itself also normally translated to and from English as "world economy" or "global economy"), whereas the "particular meaning" that Braudel (2002) was trying to capture would have been best rendered in English by the phrase "economic world", since it refers to a regional economy that *is* its own world in a metaphoric sense, in that it is economically self-sufficient. The term "world-economy" is misleading because the convention of two nouns joined by a hyphen usually refers to a thing which *is* both nouns simultaneously, and neither of them in a metaphorical sense. For example, a "city-state" is literally both a city and a state, just as a "nation-state" is literally both a nation and a state, whereas a "world-economy" as Braudel intends it is literally a region, and only metaphorically a world.

[4] Again, Braudel coined "*ville-monde*" alongside "*économie-monde*", derived from the German "*Weltwirtschaft*" which already existed alongside "*Weltstadt*", coined by Goethe to refer to Paris and Rome (Gottmann, 1989; Taylor, 2004), and which had already been translated into English as "world city" by Geddes (1924) and adopted by Hall (1966) before Braudel published his text in 1979. There was no need to import into English a French derivation of a German term which had already been imported directly into English. The hyphenation makes for a misleading term for the same reasons as above.

are rare, and intercore rivalry is the normal state" (Wallerstein, 1984, pp. 5-6)[5]. And, as Taylor recalls, "the six hundred-year sequence Braudel describes for restructured Europe and the consequent modern world-system is Venice, Antwerp, Genoa, Amsterdam, London and New York" (Taylor, 2004, p. 14). Economic worlds are divided from each other in time as well as in space, as an economic world centred on one city evolves into a different economic world centred on another city.

Braudel goes on to argue (as does Wallerstein) that each economic world is structured economically and spatially into "a narrow *core*, a fairly developed middle zone and a vast *periphery*" (Braudel, 2002, p. 39) (emphases in original). For Braudel this middle zone or *semi-periphery* is the home state enjoined by the world city to help it dominate all other states in the economic world; for Wallerstein the semi-periphery is the handful of states that help the home state to dominate all the others (Wallerstein, 1976). Wallerstein's theorisation of the semi-periphery is stronger because it makes better sense of the dynamics of this whole system even as Braudel proposes it, which is that the economic centre does not shift from world city to world city like a volcanic hotspot moves under the surface of the earth, but rather, through the vicissitudes of capitalism, a city rises in some semi-peripheral state and becomes so strong that it eclipses even the world city that came before it (Braudel, 2002).

There are two ways of bringing about this succession of cities. Either the economic agents within this semi-peripheral city are successful in reorganising the core of the economic world around it; or they are successful in reorganising its periphery, making their own city the core of a new system that displaces the old regime rather than accedes to its throne. In Wallerstein's zero-sum game Marxist perspective there is little difference; both imply that the semi-peripheral city has centred the extraction of surpluses from the periphery onto itself rather than onto the existing core city (Wallerstein, 1976). But from a network perspective they imply two very different interpretations. In the first case the set of cities constituting the core of the network has simply been recalibrated to accept a new member. In the second case it may be that an entirely new core-periphery system has developed around the semi-peripheral city that competes with and dislodges the core-periphery system centred on the existing world city.

Which interpretation applies is an empirical matter to be determined through the observation of the economic agents themselves. If the core had simply re-centred itself around a semi-peripheral city, this would imply that a number of businesses and political institutions had moved their operations from the world city to the semi-peripheral city. But if a new core had really emerged in competition with the old one, this would imply that a number of businesses indigenous to the semi-peripheral city had gone out into the periphery, struck deals and formed partnerships with peripheral

[5] To clarify, while Braudel (2002) discusses the roles of cities in each era of the global economy, Wallerstein's (1976; 1984) analysis discusses the roles of various states without actually invoking the scale of the city. It is Friedmann's importation of Wallerstein's language into the urban dimension that enables the interweaving given here of these ideas.

businesses that directed trade into the semi-peripheral city at the expense of transactions and partnerships with businesses in the world city.

The final plank in Braudel and Wallerstein's theory of the economic world must be laid down before proceeding. Both writers believe that through successive eras of capitalist globalisation the European world has either subsumed or merged with all other economic worlds such that there really is now only one economic world on the face of the Earth, namely the global capitalist economy (Wallerstein, 1984; Braudel, 2002).

This means that the contemporary global economy may be analysed as an economic world with its world cities and its semi-peripheral cities just as any other economic world. Today's London and New York are the world city successors to yesterday's Venice and Amsterdam. But in this case how should we analyse the rise of China and its cities Beijing, Shanghai, and Guangzhou within the global network? Are they semi-peripheral cities that emerged by restructuring the core of the global network, or by restructuring the periphery? Are these cities rising because their agents are drawing business in core cities such as Munich, Chicago and Seoul away from partners in London, New York and Tokyo, dislodging these latter three from the centre of the global network? Or is it because they are drawing business in peripheral cities such as Mombasa, Caracas and Surat away from partners in Johannesburg, Sao Paulo and Mumbai, thus constructing a new global network core around themselves? These are the empirical questions that determine whether the global economy is composed of only a single core-periphery system, or whether it in fact contains two or more core-periphery systems in competition.

However if we put Braudel and Wallerstein's beliefs about the contemporary global economy into historical perspective, that is, into the context of their beliefs about the evolution of economic worlds in general, then it stands to reason that the global economy, like any other economic world, contains within it the embers of past economic worlds as it does the embryos of future economic worlds, all vying with the hegemon of the day. Likewise we may conclude that the global network of cities does not comprise a single core-periphery dynamic, but in fact comprises several core-periphery systems in various states of expansion and contraction, each with a different world city or semi-peripheral city at their head, and with each such city rising and falling within the (polycentric) global network of cities as the different economies evolve.

Both the polycentricity and the long-term dynamism inherent in the Braudel-Wallerstein conception of the global economy are somewhat lacking in much of the "global cities" literature it inspired, including much of the literature that espouses a global hierarchy of cities, which has a tendency to assemble into a single organisational hierarchy what may really just be a pecking order of cities that are heads of different economic subsystems. As will be seen below, this polycentricity and dynamism are also essential to the urbanist Jane Jacobs' (1984) understanding of how economic development arises between developing cities.

If the global network may contain multiple subsystems competing for hegemony, then it is reasonable to ask what these subsystems might normally be. The most obvious candidates are geographic; as Braudel and Wallerstein's own writings suggest, the economies of different geographic regions ebb and flow with the centuries. But their writings also point us to the concepts of long-term economic cycles and "leading sectors", and the "the regular shifts of locus" from one leading sector to another (Wallerstein, 1979, p. 665) as technology advances, and prior leading economies fail to integrate new technologies while lagging economies do so to their own great advantage (Brezis, Krugman, & Tsiddon, 1993). This suggests that the global network may also contain different sectoral subsystems, one or more of which are hegemonic in a given space and time while others rise to hegemony in the next economic cycle. At the very least, we should be prepared for the empirical probability that different sectors are articulated along very different geographies within the global network, part and parcel of the global spatial division of labour, and that this sectorality may have an impact in the economies of peripheral cities and regions.

2.4. Growth and development within the network

This brings us back to the microeconomics of the global network. We have cast off a number of assumptions particular to the "global cities" literature regarding what types of businesses do and do not contribute to constructing the global network (this study accept all types of businesses), what types of connections bind them (this study accept intrafirm and interfirm), and the degree of dynamism within the network (this study can imagine not a single hierarchy but several overlapping, competing and evolving hierarchies, geographic and sectoral). The global network of cities is simply the sum of the world's businesses, clustered in the world's cities, interacting across the globe; all other structural attributes of the network are a matter for empirical identification.

Having clarified what the global network is, what role does it play in the development of peripheral cities in peripheral regions? Again, this thesis does not attempt to address the entirety of this question, but to home in on the specific process of business growth and expansion that contributes to the development of a surrounding city and region. In this light, how should businesses in peripheral cities and regions operate within the network to best pursue their interests? In keeping with its preoccupations discussed earlier, the tendency in the "global cities" literature is to expect peripheral cities and regions and their businesses to seek to climb up through the existing hierarchy of the global network. In a global economy supposedly driven by the activities of MNEs and producer services firms, cities compete to attract local investment by these corporations in the form of business divisions implanted in their commercial areas (Borja, Castells, Belil, & Benner, 1997, p. 14; Ohmae, 2001). To look at it at a slightly different level, cities must provide the infrastructure that will allow the companies hosted there to become more productive and thus compete internationally more effectively (Porter, 2001; Sassen, 2001b; Borja, Castells, Belil, & Benner, 1997). But this has the same danger as that inherent in the more static conceptions of a global hierarchy of cities—that these highly articulated networks of global relations get reduced to a pecking order of cities, and that to develop, cities must simply do whatever they can to improve their ranking within

this pecking order. This can lead to a policy paradigm that is ultimately quite unstrategic as in the following recommendation:

> *"*[…] *as soon as a region in the world becomes articulated into the global economy,* […] *the setting up of an urban node for advanced services becomes a prerequisite, and it is invariably organized around an international airport, a satellite-telecommunications system, luxury hotels with appropriate security systems, English-language secretarial support, financial and consultancy firms familiar with the region, local and regional government offices capable of providing information and infrastructure to back up international investors and a local labour market having personnel skilled in advanced services and technological infrastructure*."
>
> (Borja, Castells, Belil, & Benner, 1997, p. 17)

As Storper (2013) argues, this kind of policy can never be more than half the story. He agrees that a "lower-income city-region" must "discover the transport/communication links that make its local factors more exploitable in the economy-wide division of labor", but advises that it "must simultaneously" also "discover its initial comparative advantage" (Storper, 2013, p. 226). As he rightly insists, "winning in the development process depends on successful specialization and respecialization" (Storper, 2013, p. 225), an assertion which resonates strongly with the story of technological change, lock-in and leapfrogging (Brezis, Krugman, & Tsiddon, 1993) implicit in the Braudel-Wallerstein model.

The policy paradigm described by Borja et al. (1997) ignores other lessons drawn from the Braudel-Wallerstein model of the global network. Borja et al. (1997) suggest that cities should try to rise through the ranks by coming into the service of the global core, whereas the Braudel-Wallerstein model proposes that cities may rise through the ranks indirectly, by displacing the global core. In the Borja-et-al. model, peripheral cities make themselves subordinate or dependent on the global core (both the cities and the corporations that constitute it); in the Braudel-Wallerstein model they make a regional periphery subordinate or dependent on themselves.

The Borja-et-al. paradigm can also be critiqued in that it appears to treat the prosperity of the global economy overall as a zero-sum game. There may be very little innovation involved and very little real value being added to the global economy if a location merely tries to insert itself within existing global value chains, whereas at least hypothetically the Braudel-Wallerstein model supposes that the evolution of the economic world from one world city to the next comprises a progression from an economy based on one set of commodities to an economy based on a more technologically advanced set of commodities.

Even if cities succeed in the way that the Borja-et-al. model implies, it is questionable whether this is beneficial for the economic development of the wider territory. As Cappellin observes:

> *"The specific function of major urban centres as a 'gateway' in the external relations of a region* [i.e. national or subnational territory] [...] *may contribute to better access for the regional economy* [i.e. national or subnational *etc.*] *to technological and market information, which may be crucial for its development.*
>
> *However, a new phenomenon lies in the transformation of urban centres from a function as centres of consumer services for the regional population to a function as nodes in the network of producer services, which are exchanged at the inter-regional and international level.*
>
> *Therefore the relative importance of the city-region relationships seems to decrease with respect to the importance of the relationships which interlink various cities of different regions and countries. In particular, some cities, where important restructuring processes are taking place, seem to detach themselves from their respective regions* [...] *as in all early phases of a new development process, new activities concentrate in particular poles and that implies an increase of disparities between the urban poles and their respective hinterlands."*
>
> (Cappellin, 1991, p. 237)

Furthermore it is questionable whether becoming a node within the global network is beneficial even for the development of the urban area itself. The "global cities" literature is more often filled with warnings and critiques than with recommendations when it comes to economic development. Inherent in both Friedmann's and Sassen's formulations of global cities are the massive social inequalities they commonly give rise to (Friedmann, 1986; Sassen, 2001a) though this is often due to incomes rising in the top brackets than being actively suppressed in the lower brackets (Fainstein, 2001). The upshot of all this is that the "global cities" literature has little positive to say about how peripheral cities and regions might hope to develop economically through the apparatus of the global network of cities, despite having much to say about how they are restructuring themselves in possibly vain attempts to do so.

2.5. Jacobs and the wealth of nations

In counterpoint to the rather ambivalent stance within the "global cities" literature, it is worth turning to a set of arguments put forward by Jacobs (1984). Her arguments regarding knowledge spillovers within cities have found a home within economic literature (e.g. Lucas (1988) and Glaeser et al. (1992)), but her arguments about economic development arising from the relationships *between* different cities *within* peripheral regions have had less reception. This particular strand of thought is laid down in *Cities and the Wealth of Nations* in a chapter entitled "Why backward cities need one another" (Jacobs, 1984, pp. 135-155). In her words this is as follows:

"All of today's highly developed economies were backward at one time, yet transcended that condition. Their accumulated experience demonstrates how the thing is actually done. Historically, we find two major patterns: reliance of backward cities upon one another, and economic improvisation. The Shah [of Iran] and Peter [of Russia] and their advisers were as far off the track as it is possible to be, trying as they did to wrest development from their simplistic two-way trade with much more advanced economies, and relying as they did upon already developed methods and products, thereby short-cutting indigenous trial, error and improvisation."

(Jacobs, 1984, p. 140)

What Jacobs means by "reliance of backward cities upon one another" bears a thorough examination since it strikes at the heart of this study, and is worth quoting at length to capture the style of her thinking. She draws from four periods in economic history wherein the three high-income regions of the contemporary global economy went through some period of economic awakening. For Europe, this begins in ninth-century Venice:

"Let us suppose that Venice had continued to concentrate on this simple two-way trade with more advanced Constantinople. In that case Venice would not have developed its own city economy. Any crude city-made goods that Venice might have produced—imitations of Constantinople's least sophisticated products—would have been of no interest in Constantinople. [...]

Venice did indeed develop: by acting like Constantinople without Constantinople's economy. This may seem laughable, that a primitive little settlement of fishermen, salt evaporators and loggers at the back of nowhere could start behaving like rich and mighty Constantinople at the very hub of things; but it did. The means Venice used was to launch itself into trade with other backward settlements [...] *that needed whatever imitations of Constantinople goods Venice was capable of producing.* [...]

If the depot settlements in Europe with which Venice dealt had remained content with a simple two-way trade with Venice, they would have had only dead-end supply economies. But instead they took to behaving like Venice. [...] *Merchants in Antwerp, besides buying wool and channeling it to Venice, began producing cloth for export to backward London, Paris, Genoa, and soon were trading all over Europe."*

(Jacobs, 1984, pp. 141-143)

For the US, it is the New England and Mid-Atlantic of the Antebellum period (roughly the 1780s to the 1860s or between the American Revolutionary War and the American Civil War):

"Boston, which started by exporting timber in the form of clapboards, and fish, and Philadelphia which exported grain, were the first American cities to start wriggling, like

> *Venice, out of this simple two-way, dead-end form of trade* [with Europe]. *That is, they began copying their simpler imports from Europe and exporting these to one another and to other backward settlements, and replacing their imports from one another.* [...] *New York was drawn fully into the volatile little network of backward intercity trade that had been pioneered in Boston and Philadelphia.* [...] *As new cities like Cincinnati, Pittsburgh and Chicago formed, they entered the network of volatile trade.* [...]
>
> *In the South, cities behaved differently. Charleston, Savannah, Richmond, St. Augustine and Williamsburg, rather than concentrating upon trade with one another, confined themselves for the most part to simple two-way, dead-end trade* [...] *They channelled out agricultural cash crops, received in return manufactured city goods, and did not use this trade as a springboard to launch themselves into volatile trade with one another. Consequently, they did not develop their own economies."*
>
> (Jacobs, 1984, pp. 145-146)

And in East Asia, it is both Tokyo in the late nineteenth century and Hong Kong in the late twentieth century:

> *"When Japan began developing its modern economy in the 1870s, Japanese cities behaved like those of Europe and the American North. They used their international trade in silk as a springboard for intensified and ramifying trade with one another. Tokyo played the role of Venice. Instead of remaining content with what its silk exports would buy from more highly advanced economies, it copied such imports as it could and exported them to other Japanese cities, which in turn did not remain content with that trade, but replaced many of Tokyo's new exports to them with their own production and cast up new exports to sell to Tokyo as well.* [...]
>
> *Hong Kong only two generations ago was an economically backward colonial depot city. While it is still a colony in name, economically it is anything but. It has played the role of Venice on the Pacific Rim, exporting its producers' goods and services to Singapore, Seoul, Taipei, in return buying products of cheap labor for incorporating into its own products and export contracts. But the Pacific Rim cities, like the cities of Europe, have not been content with simple two-way trade, whether with Hong Kong or other more highly developed cities, and in addition have concentrated heavily on trade both with one another and with more backward settlements, in the way that Taipei, for example, trades heavily with Kaohsiung, which in turn has replaced wide ranges of its imports from Taipei, in the process becoming, of course, an excellent customer for newer Taipei exports to it."*
>
> (Jacobs, 1984, pp. 146-147)

These four examples are summarised in the table below.

Table 2.2 Four examples of regional economic growth according to Jacobs (1984)

	Europe	*Northeast America*	*Japan*	*East Asia*
Hub cities	Venice	Boston, Philadelphia	Tokyo	Hong Kong
Trading cities	Antwerp, London, Paris, Genoa	New York, Cincinnati, Pittsburgh, Chicago	[Kyoto, Osaka, Nagoya[6]]	Singapore, Seoul, Taipei, Kaohsiung
Era	900 – 1200	1780 – 1900	1870 – 1940	1950 – 1984

Her argument then is that when a city wishes to develop economically, it starts with a wealthier city to which it can sell its primary commodities in exchange for imports—ensuring its survival—and capital goods—ensuring its ability to diversify—but must then seek poorer cities to which it can sell its newly-established manufactures and other sophomoric exports.

In this manner the developing city and the businesses within it exploit one of the few natural advantages they have over wealthier cities. Following Jacobs, poorer cities have less capital to purchase goods, but also less exacting requirements for the quality of those goods. They are therefore likely to turn away from wealthier cities' exports to a developing city's exports once the latter is able to start producing them, since it will be able to exercise its advantage in providing goods of lower quality which are nevertheless more suited to poorer cities' unexacting demands, at lower cost.

It also means that a developing city seeks to stand at the centre of a regional economy, rather than join itself to the hip of a wider global economy. In this, Jacobs' model of economic development correlates highly with the model of economic history provided by Braudel (2002) and Wallerstein (1984) and the story of technological life cycles (Brezis, Krugman, & Tsiddon, 1993) implicit within them, wherein one economic world emerges in the shadow of an older one by making itself the centre of a new economic network based on a new set of technologies, though it might be proposed that Jacobs intended a more horizontal sense of integration between "backward cities" than the hierarchical succession of cities implied by Braudel (2002) and Wallerstein (1984). Additionally, Jacobs contradicts recommendations such as those made by Borja et al. (1997) when she says that in order to develop, cities should not seek to improve their position in the existing global network but explicitly to create a new regional network around themselves.

2.6. Jacobs and economic history

How does Jacobs' interpretation of economic history stand up against the historical literature? For Western Europe she relies on the Belgian historian Henri Pirenne's account of "the revival of commerce" from the 10th century onwards (Pirenne, 1925). The "Pirenne thesis" as it is known to historians such as Verhulst consists of three arguments:

[6] Assumed; Jacobs mentions no cities.

1. *"International trade in the Mediterranean, especially with the Near East, had, he thought, survived the Germanic invasions and the fall of the Roman empire, so that the continuity of urban life in the Merovingian period was ensured";*

2. *"On the other hand,* [...] *at the beginning of the eighth century international trade collapsed, as Pirenne thought, because of the Arab conquest of the western Mediterranean* [Sea], [at which point] *towns as Pirenne defined them—that is, places of trade and industry which also had a proper municipal organization—inevitably disappeared."*

3. *"This new urban life appeared, as he saw it, in the course of the tenth century, when once more an external stimulus, the revival of trade, provoked the rise of new urban settlements [...] The tenth-century revival of trade, which holds such an important place in Pirenne's theory, [...] was in its turn once more due to external causes. These were primarily the restoration of long-distance connections with the Near East via Venice and Scandinavia."*

(Verhulst, 1989, pp. 4-5)

Presented as such within later literature, the Pirenne thesis reads like a vindication of Borja et al.'s (1997) recommendation that developing cities find their fortunes by turning towards existing wealthy cities. However, if we tease out Pirenne's own words, he describes a world much closer to Jacobs' interpretation, in which Venice becomes the source of a large trading network branching westwards into Europe:

> *"It was inevitable that the powerful economic movement, of which Venice was the center, should be communicated to the countries of Italy from which she was separated only by the lagoons. There she obtained the wheat and wine which she either consumed herself or exported, and she naturally sought to create there a market for the eastern merchandise which her mariners unloaded in greater and greater quantity on the quays by the Po."*
>
> (Pirenne, 1925, p. 88)

Later, the Eastern manufactures traded through this network are replaced with indigenous manufactures:

> *"There commerce gave rise to industry, and as it developed, Bergamo, Cremona, Lodi, Verona, and all the old towns, all the old Roman* municipia*, took on new life* [...] *Soon their surplus production and their fresh energy were seeking to expand abroad. In the south Tuscany was won. In the north new routes were laid out across the Alps. By the passes of the Splügen, St. Bernard and the Brenner, their merchants were to bring to the continent of Europe that same healthy stimulus which had come to them from the sea. They followed those natural routes marked by river courses—the Danube to the east, the Rhine to the north, and the Rhône to the west."*
>
> (Pirenne, 1925, p. 95)

Later historians have abandoned much of Pirenne's thesis regarding the collapse of trade during the Arab conquest due to more recent archaeological evidence suggesting that trade had collapsed much less than he thought, and that it regrew not through external forces but more simply due to the internal processes he nonetheless discussed—population growth, the stimulating effect of elite consumers on agricultural productivity, the encouragement of intraregional trade through trade fairs and merchant activities, etc. (Verhulst, 1989). While this weakens Pirenne's arguments regarding the grand lines of European medieval history in the eyes of other historians, the later historical evidence nevertheless supports Jacobs' arguments regarding economic development, with "backward cities" trading with one another and growing economically together without concern for the wealthiest markets of the era (Constantinople and the Middle East cities on the Silk Road).

Jacobs does not cite her inspiration for her understanding of economic growth in the US but her use of terms like "city regions", "supply regions" and "regions without cities" suggests she was heavily influenced by the growth of regional science from the 1950s onwards. One large debate concerned what types of interstate trade drove the growth of the US economy during the Antebellum period. According to the "Callender-Schmidt-North thesis" of "interregional trade", growth arose as "the country's three great regions"—the northeast, the south, and the Midwest—began to specialise in certain primary commodities according to their natural comparative advantages and trade these with each other (Pred, 1980, p. 40; Callender, 1902; Schmidt, 1939; North, 1955). The "intraregional" thesis associated with Allan Pred argued that trade between cities within each region (that is, within the north, and within the south) was of greater significance, especially as rail networks expanded from the northeast in the middle of the 19th century (Pred, 1980). This thesis had the benefit of making more sense of why the south fell behind the northeast so badly: "Pred shows that the major southern cities deviated from the regional patterns found elsewhere. Their intraregional links were rudimentary: for the most part, they were colonial outliers of the northeastern regional city system" (Mandelbaum, 1982). Interestingly for Jacobs, neither thesis challenges her proposition that "backward cities need one another", since neither argue that growth was driven primarily by trade with the much wealthier Europe.

Attempting to sort between them statistically, Riefler finds support for both, though slightly more for the intraregional thesis. He declares that in the northeast, dominated by Boston, Philadelphia and New York, "for the antebellum period commercial activity, both interregional and especially intraregional trade, appears to be the driving force generating urbanization." He continues: "During the post-bellum period manufacturing comes to the fore as the prime factor allowing cities to grow at a rate exceeding that of their hinterland" (Riefler, 1979, p. 961). Strictly speaking Riefler's dependent variable was urbanisation, not economic growth, nevertheless his findings accord with Jacobs' and Pirenne's readings of medieval Europe: an intraregional trade network in the hinterland of a peripheral city, upon which is built an intraregional market in indigenous manufactures.

There were certainly others for whom the US' growth in the nineteenth century was an export-led phenomenon, especially Douglass North (1961). However much of this has been discounted on

empirical grounds (Kravis, 1972; Engerman, 1977), since so many of the broad macroeconomic indicators show little role for exports in US productivity during this period: "Exports remained a small and relatively constant proportion of GNP [...] Changes in exports tended to lag behind changes in GNP. Exports were concentrated in agriculture, which was characterised by lower output per man and by slower growth than the rest of the economy." (Kravis, 1970, pp. 853-854)

For Jacobs this is two for two: in both medieval Europe and antebellum US the literature points to the economic growth of a developing region rising steadily through internal trade between its cities rather than through trade with cities in wealthier regions.

Finally in the case of East Asia, we find a very interesting comparison literature in the "wild-geese-flying" or "flying geese" model of Kaname Akamatsu (1962). In his model, which drew heavily from the experience of Japan (Blomqvist, 1996), different commodities and manufactures of increasing sophistication move through three overlapping stages of economic activity: first, a peripheral economy imports a product from a wealthy region; second, the peripheral economy learns to produce the product for its internal market; third, the peripheral economy begins to export the product back to the core economy. The key contribution of Akamatsu's model is the idea that within a peripheral region, different elements within the economy are at different stages of development, and that elements in less advanced stages follow sectors in more advanced stages one after the other like wild geese flying in formation. These elements may be different sectors: as less complex sectors move towards high-quality production and export, more complex sectors are represented by imports and low-quality production). They may be different goods within those sectors; for example, as less complex cotton products move towards high-quality production and export, more complex textiles are represented by imports and low-quality production). But they may also be different countries:

> *"the wild geese order of industrial development from the advanced countries to the less-advanced countries is not a one-series row, but is divided into several wild-geese-flying rows, one following another. There is a wild-geese-flying group with America taking the lead, and a Western European group with England and Germany taking the lead, as well as a comparatively small group with Japan taking the lead."*
>
> (Akamatsu, 1962, p. 18)

This is a polycentric or multicore model in the manner of Braudel and Wallerstein: in both models, there are multiple hierarchical formations, one formation occasionally surging past another, as the leaders of earlier formations tire: "Countries overcome each other, but no leading country is ever able to achieve anything but temporal advantages over its rivals. For some time, perhaps even for several decades, it may succeed in escaping its pursuers, but before long it is bound to become tired." (Korhonen, 1994, p. 99)

On the other hand this is not a "downward" or "backward"-looking model in the way that Jacobs proposes. In Jacobs' model, a succession of less and less developed places follow each other through the stages of development, each by exporting increasingly sophisticated goods to the less developed places behind it in the formation. In Akamatsu's, each exports to the more developed places ahead of it in the formation, especially to the most developed place, in his case Western Europe. The only suggestion of overlap between the two models is in the second stage of Akamatsu's model, wherein the developing economy is producing for the home market. If we can stretch the home market to include the even less developed markets surrounding the developing economy, then we may be able to say that Jacobs' model corresponds to the second of Akamatsu's three stages.

Akamatsu's emphasis on Japan's exports to wealthier markets may be a common explanation for Japan's development today, but if we sift further back into the literature, we find contemporaneous analyses of earlier phases of Japan's industrialisation that tell a story much more like Jacobs' model. Writing in 1929 (before the Great Depression), when Japan was known mostly for its exports of raw silk to the US, the Columbia Business School's John E. Orchard sought to acknowledge "the increasing importance of China and the rest of Asia in Japanese trade. [...] The cotton textile industry of Japan is almost completely dependent upon Asia for its export market." (Orchard, 1929, p. 198) Elsewhere he writes:

> *"For many years to come Japan will continue to depend, as in the past, upon two markets, the United States* [for its raw silk] *and Asia* [for its manufactures]. *Asia holds out much the greater promise.*[...] *It is to Asia that Japan must turn for any substantial expansion of her trade.*"
>
> (Orchard, 1933, pp. 74-75)

We can make sense of the contradictions between Orchard's and Akamatsu's observations if we see them as part of a sequence, in which a developing place grows first by exporting to less developed places (whether within the same country or in other less developed countries), and later, as its products increase in their sophistication, by exporting to more developed places. This adds a fourth set of elements in a peripheral region's economy that may follow a flying geese formation, namely export markets: as the sectors and the products within them produced by a given peripheral economy increase in their sophistication, the export markets for those products available to that peripheral economy progress from the least developed neighbouring economies towards the wealthiest economies worldwide.

This makes for a qualified three out of three for Jacobs' hypothesis: medieval Europe, antebellum US and industrialising Japan may all be interpreted as regions where "backward cities need[ed] one another" to launch their development, though at least in the case of Japan, later phases of export to wealthier places were needed to complete its transition to a highly developed economy.

Looking to the development of the four other East Asian economies Jacobs refers to—Hong Kong, South Korea, Singapore and Taiwan, or what were once called the Asian NICs (newly industrialised countries)—again we see conflicting interpretations of the role of export to wealthier places. An early neoliberal view saw these countries' openness to trade triggering a process of export-oriented industrialisation (EOI) credited with their rapid development (Brohman, 1996). But later literature insists on the "complementary role of internally oriented development": "Exports have undeniably accelerated growth in the NICs, but rising domestic demand and the creation of internal economic linkages also stimulated development" (Brohman, 1996, p. 117) (see also Hsiao (1987)). Brohman also observes a "flying geese pattern" as well as a "regional division of labor" between Japan, the Asian NICs, and the remaining ASEAN nations; evidence for both Akamatsu's and Jacobs' models, as well as for the global hierarchy of cities model discussed earlier:

> *"This regional division of labor has increased opportunities for the NICs, especially Hong Kong and Singapore, to develop as midlevel centers for administrative-managerial, financial, and commercial functions. In some cases, NIC domestic capitals have opened up branch plants in Asian countries with lower labor costs [...] In other cases, the NICs have become regional 'command and control' centers for foreign capitals with production facilities in neighboring lower-wage countries."*
>
> (Brohman, 1996, p. 120)

In the decades since *Cities and the Wealth of Nations*, as the ASEAN nations industrialised, another surge in intraregional trade within East Asia has been observed (Athukorala & Yamashita, 2006; Ando, 2006), though a large part of this is the circulation of components for products which are nonetheless destined for export to wealthier markets. "Backward cities" may need each other, but not always in the way Jacobs imagined. Not quite four out of four for Jacobs.

2.7. "Upward" versus "downward" growth

In the end we have two models of how businesses in developing cities and regions should orient themselves within the context of the global network of cities. On one side are scholars such as Borja et al. (1997) (not to mention generations of neoclassical economists) who argue that businesses in developing cities grow by orienting themselves "upwards", seeking customers in cities wealthier than their own. On the other are Jacobs and a number of economic historians who suggest that businesses in developing cities grow by orienting themselves "downwards", seeking customers in cities poorer than their own. The global network is an articulation through which core actors draw peripheral actors towards themselves, but is this something to be embraced or resisted?

As has been suggested, if these models are considered two parts of a sequence, they may not be so incompatible. Under Jacobs, a "backward" place develops by focusing on exporting to its more "backward" regional partners before exporting to wealthier places; under Akamatsu and the East Asian experience it produces initially for itself and then focuses heavily on exporting to wealthier

places, though this may be in partnership with more "backward" partners in the region. Arguably the two writers differ only by which part of a rather similar-sounding sequence they have chosen to emphasise. While Jacobs is focused on the dynamics of trade during early periods of development, the "export-oriented" literature which the East Asian experience inspired is often more focused on later periods of development, where perhaps a country's comparative advantages are coming to some sort of equilibrium, developed places are exporting to even more developed places, and vice versa. And yet the policy implications are very different: under Akamatsu the government and the producing sectors are focused overwhelmingly on export to wealthier places as their ultimate goal; under Jacobs they are focused overwhelmingly on export to more "backward" places.

Another interesting way of distinguishing these two models is by the predicted nature of consumer demand. Under Akamatsu and most neoclassical models, customers in wealthier cities are predominantly attracted by favourable prices, causing them to be attracted to developing cities' cheaper products. Under Jacobs, customers in wealthier cities are predominantly attracted by favourable product quality, causing them to be attracted to wealthier cities' products, requiring developing cities to search amongst similarly poor cities for customers.

A final way to distinguish between these models is in the terms of network analysis. Consider an idealised core-periphery network with a number of cities in each "region" of the network. When it comes to increasing their connections with other cities, core cities have only two options available to them: increase their connections with other core cities, or increase their connections with peripheral cities. As the core becomes saturated with core-to-core connections, it is natural that core cities become more likely to seek to connect with peripheral cities. This is observable whenever businesses in mature, consolidated industries in wealthy economies seek new trading in "emerging markets".

For peripheral cities, there are again only two options: increase their connections with core cities, or increase their connections with other peripheral cities. The first option represents Castells and Akamatsu's "upward" hypothesis of development through the global network; the second represents Jacobs' "downward" hypothesis of development. Thus the two hypotheses explored in the theoretical review above are not ad hoc musings on how developing cities and regions should seek to improve their position in the global economy, but the two and only two models of action available to peripheral actors within an idealised core-periphery network.

Yet increasing the ties between the core and the periphery improves the network positions of the core and the periphery at the same time. It is a question for empirical research whether increasing relations of this kind increases or decreases inequalities of power between the two regions. On the other hand, increasing the ties between peripheral cities increases the network positions of peripheral cities to the disadvantage of core cities by definition, decreasing inequalities between the two regions again by definition. Thus a purely topological analysis suggests that Jacobs' "downward" model of growth through the network is intrinsically better for inequality than Borja et al.'s "upward" model, whatever its impact on absolute levels of development.

If we extend this ideal model to a three-level network comprising a core, semi-periphery and a periphery, we approach the complexity offered by the Braudel-Wallerstein model. Cities in each of these three regions have a choice of three regions with whom to forge more ties, producing all the possibilities for polycentricity and instability or dynamism described above.

2.8. The research problem

What is the role of the global network of cities in the development of peripheral cities and regions? The answers yielded by the literature leave several further questions unresolved. There are contradictory conceptual models of the network itself, with a relatively static, single core model implied by Borja et al. and others, and a more dynamic multicore model in the hands of Braudel, Wallerstein and Jacobs. The recommendations that derive from the two models are directly opposed, with the former advising that cities orient themselves "upwards", the latter advising that cities orient themselves "downwards". The historical record is mixed as to which of these orientations have been primarily responsible for economic development in different regions of the world. The literature asserts the primacy of certain sectors which has not been fully confirmed by empirical evidence or supported by economic theory, and uses identification methods which treat these assertions as assumptions rather than as hypotheses to be tested. And there are very weak microeconomic foundations underpinning the central hypothesis under investigation—the formation and evolution of the global network of cities. The task for research is thus to go into a peripheral city and region and build a corpus of empirical evidence, upon which the microeconomic foundations may be laid out, the strength of one structural model weighed against another, and the dominance of one orientation measured against the other. The method by which this body of evidence is built is proposed in the following chapter.

Chapter 3. Methodology

As discussed in the previous chapter, with regards to identifying the global network of cities and its geography, the central method in the "global cities" literature is the interlocking world city network model (IWCNM) (Hennemann & Derudder, 2012; Parnreiter, 2013) method developed by Taylor and his GaWC colleagues (Taylor, 2001; Taylor, Catalano, & Walker, 2002; Taylor, 2004; Taylor, et al., 2010), with a major variation used by Alderson and Beckfield (Alderson & Beckfield, 2004; Alderson, Beckfield, & Sprague-Jones, 2010).

The previous chapter pointed to two issues in the construction of these methods. The first is the class of agents used. It was argued that in the very general definition of the global network used in this study, this network consists of all firms, large or small, domestic or multinational, regardless of sector, and that it is an empirical matter whether one class of firms (e.g. producer services firms) can be said to represent or even determine the geography of the network overall, not an assumption to be built into the method from the beginning. One can accordingly choose to follow Alderson and Beckfield's variation rather than Taylor's original method, since theirs accepts firms in any sector, not only the producer services firms sampled by Taylor.

Alderson and Beckfield's method has other benefits. For one, it is more achievable by a lone researcher: while Taylor and his teams must collect producer services firm location data by hand by stepping through individual company websites, Alderson and Beckfield may download their datasets from widely available databases. For another, Alderson and Beckfield's method allows for much more drilling down into the periphery of the network where the kinds of producer services firms Taylor and his teams handpick operate more rarely.

The second issue in the construction of these methods is that both major variations use only intrafirm relations to represent the network, whereas it has been argued that the geographies of the network's intrafirm and interfirm components may differ significantly, so that both must be incorporated. This issue is less easily addressed, because while large databases are available to provide large sets of intrafirm data for registered companies around the world, no equivalent databases exist that catalogue all the vastly more numerous interfirm ties between them. (For example, databases may attempt to list every subsidiary of every company of a certain size, but no database can begin to list every supplier, collaborator and client of those companies as well!) And to collect the amount of interfirm data needed to complement the trove of intrafirm data available is far beyond the capacities of any individual researcher. One is forced to be selective about where and how to collect interfirm data that can complement some subset of the available intrafirm data.

Where one cannot be satisfied with the quantity of interfirm data available, one can make up for it somewhat in the quality of interfirm data collected. Thus the decision was made to compile this data through qualitative research, relying on richer investigation of businesses' interfirm (and intrafirm) networks within a city to inform a richer understanding of the global network as a whole, in

theoretical if not in empirical terms. As Piore (2006) argues and as will be elaborated below, qualitative techniques are useful in the refinement of economic theory as well as in the wholesale reconstruction of economic theory. This means that the qualitative research conducted in the periphery of the network could be used to theorise upon the nature of the core of the network, and thus the workings of the network overall. Qualitative interfirm (and intrafirm) data taken from the periphery would thus complement the quantitative intrafirm data available for the core in rather a different way to what quantitative interfirm data from the core would offer. The qualitative approach also allows the study to begin to tackle some of the broader questions about the evolution of the network over the *longue durée* raised by Wallerstein (1984), Jacobs (1984) and others, though obviously one is increasingly venturing into the realm of speculation the further the qualitative findings are pushed.

3.1. The use of qualitative research

How then should quantitative research of the global network reliant upon intrafirm data be combined with qualitative research in the network's periphery? It is not enough simply to say that one shall use "mixed methods", for example. Yin (2006) argues that scholars often use this term erroneously to refer to what is really analytical triangulation—the comparison of findings produced in separate studies involving different methods directed towards similar research questions. This is an imprecise way of proceeding. Johnson and Onwuegbuzie define mixed methods as follows:

> *"the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study."*
>
> (Johnson & Onwuegbuzie, 2004, p. 17)

Yin elaborates the significance of this:

> *"The focus on a **single** study is critical to mixed methods research.* [...] *if a research effort consists of multiple, related studies rather than a single study, little distinctive contribution arises from attending to the use of multiple methods. In fact, when investigators have permitted a research effort to decompose into multiple studies, mixed methods research may not have taken place at all."*
>
> (Yin, 2006, p. 41) (Emphasis in original)

For Yin, a single study has occurred when the following are closely coordinated across all methods within the project: "1. Research questions [;] 2. Units of analysis [;] 3. Samples for study [;] 4. Instrumentation and data collection methods [;] 5. Analytic strategies" (Yin, 2006, p. 42). He admits that "analytical integration may be trickiest of all" (Yin, 2006, p. 45). And Piore specifies that qualitative data taken from a small number of cases cannot be analysed in the same way as quantitative data representing a large number of cases. In his words, case study data "cannot be treated directly as empirical evidence" but must be treated only as "inputs into the construction of

theory" (Piore, 2006, p. 17). In a much earlier paper he defines economic theory in very classical terms as "a set of rigorous theoretical propositions" which—

> *"starts from a model of economic man, purposively maximising a constrained objective function. It is concerned with the outcome of this maximising process and with the interaction of economic units behaving in this way."*
>
> (Piore, 1979, p. 563)

For Piore the purpose of qualitative research in economic theory is quite specific: it provides the evidence upon which the behavioural underpinnings of "economic man" (or woman, etc.; whether his or her rationality be perfect or bounded) may be challenged and revised or extended. However he allows a wide berth on how the qualitative findings are construed to do this. One may take a "minimalist approach" in which small fragments of interviewee behaviour are used to make subtle revisions to theory. Or one may take a "maximalist approach", using an interviewee's whole "narrative itself as the unit of observation" that yields "a pattern of cognition and behaviour totally different from that hypothesised in economics and rational choice behavioural models" (Piore, 2006, p. 21). In his own research Piore was concerned with the behaviour of individual people, for example labour workers, but his stance on the role of qualitative research in theory building may hold for larger organisations as well.

With these considerations in mind, this study proceeded in two main phases. A quantitative phase began with the construction of matrix data representing the global network and various regional and sectoral subsets thereof, followed by a description of the morphology and geography of those networks using visual and computational tools provided by (social) network analysis (Chapter 4). This was proceeded by a qualitative phase focused on the expression of these networks within one city—Lagos, Nigeria. Senior staff at 20 companies were interviewed to capture the geography of their interactions within the global economy (Chapter 5). These qualitative data were assembled into another matrix dataset representing Lagos' global networks, and the morphology and geography of these networks were described (Chapter 6) using the same tools as in Chapter 4. The qualitative data were also combined with the findings of the network analyses to develop a model of the growth and evolution of the overall network derived from microeconomic motives observed within the behaviours of the 20 companies (Chapter 7). The five points that Yin (2006) argues should be closely coordinated are addressed in the following manner.

1. Research question: The research question can be broken down into three parts: What is the geography of the global network of cities? What is the global geography surrounding the economy of a peripheral city in a peripheral region, such as Lagos? And what is the role of the former in the latter? The network analysis performed on the global network data addresses the first of these; the network analysis performed on the Lagos network data addresses the second; a comparison between the two sets of findings addresses the third. In addition, the

field research addresses all three parts qualitatively insofar as the sampled businesses in Lagos are concerned.

2. Units of analysis: In both network analyses, the unit is the city. And in both sets of network data, the relations between cities consist of the relations between businesses within each city.
3. Samples for study: The global network dataset draws a sample of businesses having annual turnover above a certain threshold ($10 billion) within the *Orbis* (Bureau van Dijk, 2011; 2012; 2013) database; the qualitative research, and thus the Lagos network dataset, draws a sample of businesses above a lower threshold ($1 million) from the same database. However these samples are not ideally coordinated; it was impossible to interview all businesses in Lagos over the lower threshold (let alone all businesses in Lagos over the higher threshold). So while the global network dataset comprises all companies above its threshold, the Lagos network comprises only a convenience sampling of companies above its threshold.
4. Instrumentation and data collection methods: The data collection methods used in the global network analysis and the qualitative research are purposefully different, so that the qualitative research can be used to develop theoretical ideas about the findings of the global network analysis, and so that the Lagos network analysis can point to geographies that the global network analysis cannot capture. However with regards to instrumentation, the same definitions of cities (both in general terms and for each individual city referred to in the datasets) and regions were retained for all phases of the research. It was the study's intention to retain the same definitions of sectors[7], though because of the small number of businesses available for interview in Lagos, several of these sectors had to be amalgamated for the Lagos network analysis, whereas they remained distinct in the global network analysis.
5. Analytic strategies: Though the network datasets capture different levels of detail regarding the businesses within them, the methods used to analyse the two datasets are almost completely identical throughout, to allow direct comparison between the outlying features of both sets. By contrast, the qualitative findings are analysed inductively, so as to produce the richest set of interpretations possible for application to the findings of the network analyses.

3.2. Network data collection

As explained, the method used for constructing the network matrix data derives from Alderson and Beckfield (2004). Their sample comprised the world's 500 largest corporations with headquarters and subsidiaries spanning 3,692 cities and towns with a "combined revenue of [...] $12.6 trillion in 2000 [...] more than twice (208%) the combined gross domestic product of the world's 156 poorest societies and equivalent to more than half (53%) the combined gross domestic product of the 24 member nations of the OECD in 2000 [...] a notable proportion of total world economic activity" (Alderson & Beckfield, 2004, p. 820).

[7] The 21 sectors used by most standard industrial classification schemes such as the *International Standard Industrial Classification of All Economic Activities* (United Nations Department of Economic and Social Affairs, 2008) (ISIC rev. 4) or the *Statistical classification of economic activities in the European Community* (Eurostat, 2008) (NACE rev. 2).

In line with their methods, the corporate information database *Orbis* (Bureau van Dijk, 2011) was accessed to collate company location data. In attempting to download this data and prepare it for analysis as a network (a process which required several iterations), it was found that the exact number of firms and locations that could be included in the data for this study came up against the limitations of the network analysis software being used—*Ucinet* by Borgatti, Everett and Freeman (2002)—which like many of the mathematical algorithms used to analyse matrix data slows down at an exponential rate for large numbers of nodes. While the creators of the software advise that "practically speaking many procedures get too slow around 5,000 – 10,000 nodes"[8], it was found during these iterations that for datasets of the kind used in this study, many procedures proved unworkable above approximately 2,000 nodes. The number of locations furnished by the dataset thus had to be reduced to below this figure.

The criteria that finally allowed this were as follows: Location records for all independent active companies with year's turnover greater than $10 billion in 2009 or 2010 (depending on available data) were extracted, together with subsidiaries over which they had at least 50% control. For companies with large "family trees" of subsidiaries, three "generations" of subsidiaries were included. Subsidiaries whose turnover was less than 1% of the turnover of the head company were dropped, meaning that all subsidiaries in the dataset had a year's turnover of at least $100 million. These criteria intended to ensure that the ties forming the network represented a sufficient amount of coordination and control between the head office and the subsidiary, the idea being that if a subsidiary represented less than 1% it would receive negligible levels of attention from its ultimate parent. Several overly large datasets were compiled and tested against the software packages before these criteria were finalised. The final dataset comprised 785 companies spanning 1,625 cities and towns with a combined year's turnover of $23.7 trillion, or about three-eighths of the world's total GDP of $63.0 trillion in 2010 (World Bank, 2011). Of these 785 family trees of parents and subsidiaries, 143 were domestic rather than multinational enterprises (MNEs), distributed across 18 countries, and 72 of these were single-city rather than multi-city or multilocational firms (MLFs), distributed across 47 cities in 13 countries, including 27 US cities and seven Japanese cities.

While the *Orbis* database contains data for a dozen or so years into the past, this data was not easily accessible in a way that was suitable for the project, because it did not store changes in each parent company's "family tree" of subsidiaries over time within the record for each parent. The data download system provided by the database could thus only connect companies to their current subsidiaries, not to any subsidiaries at any specific point in the past. In addition, the system made the connection in such a way that it provided only the subsidiary turnover figure for the latest available year, regardless of the year requested for the head company's turnover figure. As a result, only the latest year's network information can be extracted at any time, preventing any longitudinal analysis. This is a common problem for city network analysis, and both Taylor and his colleagues (Taylor, 2004; Taylor & Aranya, 2008; Derudder, et al., 2010) and Alderson and Beckfield

[8] Advice given on the software's website: http://www.analytictech.com/archive/ucinet.htm

(Alderson & Beckfield, 2004; Alderson, Beckfield, & Sprague-Jones, 2010) conduct their longitudinal analysis only by revisiting their sources at intervals of several years to compile new data series, as evinced by the publication dates of their research. The enormous effort required to compensate for the lack of longitudinal data was considered prohibitive for a lone researcher.

The datasets, which at this stage were simple spreadsheets with rows of information for each parent and each of its subsidiaries, were cleaned in an exhaustive manner. The location of each parent and subsidiary office was derived from the name of the city or town shown within its address. Each such name was reviewed for spelling errors and typographical variations (for example, Paris, Paris 01, Paris 75001, Paris Cedex 01, etc. were all recoded as Paris) and viewed individually on *Google Maps* (Google, 2011-2013) to verify whether it was an independent town, or a suburb of a larger city. Companies in suburbs of the same city, as defined in the following section, were deemed to be in the same city *tout court*, and their location recoded accordingly (for example, La Défense, Neuilly-sur-Seine, Boulogne-Billancourt, Courbevoie, etc. were all recoded as Paris). It was noted that a minority of locations appeared to be little more than very small towns and villages, especially in the highly industrialised regions of Western Europe where profitable and internationally sought enterprises can be supported within very small and remote settlements. Among other things, this suggests that the vocabulary used by Alderson and Beckfield (2004), wherein all locations in such datasets are indiscriminately referred to as "cities", is misleading in a minority of cases, even if it is correct for the majority of them.

With the location data now cleaned, rows duplicating the same parent-subsidiary-turnover record, which occurred frequently, were also deleted from the dataset. The final row data were imported into the social network analysis software package *Ucinet* (Borgatti, Everett, & Freeman, 2002) to create square directional matrices, in which the location of each head company sends ties to the locations of each subsidiary, with a tie strength equivalent to the turnover of the subsidiary multiplied by the fraction of ownership held by the parent. The turnover of the subsidiary can thus be said to represent the strength of the possibility of cooperation taking place between the two locations in order to administer the subsidiary entity. These matrices were also imported into the accompanying social network visualisation package *NetDraw* (Borgatti, 2002) with which all network diagrams shown here have been produced.

3.3. An empiricist approach to defining a location

This section describes how one city or town has been distinguished from neighbouring cities and towns for this study, though the detail provided here is offered partly as an interesting digression into the methodology of defining cities in towns in general, drawn from the experience gained in the course of this research.

As the names of cities and towns were being verified on *Google Maps* (Google, 2011-2013), and attempts were made to distinguish between independent towns and suburbs of larger cities, it

quickly became apparent that a clear methodology was required to distinguish borderline cases. However, many of the rationales used in various geographic and spatial economic literatures such as census areas or travel-to-work areas did not seem to make much sense applied to the diverse mosaics of land uses observed through satellite imagery. In addition, Forstall, Greene and Pick identify six general strategies used in determining the extent of individual cities and towns: "city proper", "administrative area larger than city proper", "urbanised area or urban agglomeration" where sub-municipal districts are aggregated depending on density, "urbanised area (administrative boundaries)" where municipal-level districts are aggregated depending on density, "official metropolitan area", and the special case of Chinese municipalities, where "the boundaries of the city proper typically include a substantial rural surrounding area" (Forstall, Greene, & Pick, 2009, pp. 279-282). They then go on to propose harmonising these with an algorithm which creates a different definition of an urban area for each city depending on its existing administrative composition and the types of census data it may or may not have at hand, rather than proposing a single definition for all cities. Given that I had decided to put before my eyes a finely-resolved image of the physical extents of every city and town in the dataset, I could choose to use these images directly to define each location rather than the approximations provided by the various strategies reliant on administrative demarcations.

But a visual specification was required that made sense of the hodge-podge of cities, towns and villages that populated my dataset, spread across vastly different continents and cultures, and exhibiting different states of temporal evolution, including slowly merging into one another. Furthermore, because I am also concerned with whether two firms located near each other are in fact in the same city or town or in two different cities or towns, I need a specification that identifies the edge conditions between these two possibilities, especially where two cities or towns are merging into one another.

I propose that there are three criteria that my specification must meet. It should be objective in terms of geography, i.e. able to identify discrete urban areas in any of the diverse physical manifestations of human settlement across different regions of the world, from the gentle plains of Western Europe to the steep dissected topography of northeast Asia. It should be objective in terms of history, i.e. able to identify cities and towns in any historical form, from the walled cities established in the Middle Ages to the sprawling suburbs of modern metropolises, and applicable to any decade so that it accommodates the possibility of longitudinal research at least in theory. It should be objective in terms of sociology, not influenced by how different societies conceive of nor administer their cities and towns, for example not taking as given units such as French *communes*, the UK's travel-to-work zones, or the USA's statistical conurbations, none of which are easily comparable at the international level.

The heuristic specification I propose to begin with is that whether a city, town or village, an urban settlement is *a discrete, consolidated territory of intensive land uses*. Developed in conjunction

with personally eyeballing every location in the dataset on *Google Maps* (Google, 2011-2013), it is therefore strongly empiricist.

"Intensive land uses" came to mean several types of land uses including business districts, industrial districts, container ports and associated distribution facilities, passenger airports and their enclosed runway clearances, and small parks of intensive recreational character. It came to include certain types of residential developments but not others. Specifically it included apartment buildings, terrace houses and post-war suburban housing sprawl (during which period Western nations appeared to be remarkably consistent in using lot sizes at or below the quarter-acre mark, at least from the perspective of satellite photography) but excluded countryhouse sprawl—areas dominated by single-family dwellings on lot sizes larger than one acre, a land use pertaining to the US northeast, uniquely amongst the geographies eyeballed in this study. It also excluded wilderness areas, forests and parks of low-intensity recreational character, and open-air agricultural uses.

"A discrete, consolidated territory" came to mean that the settlement presents itself to the sky as an uninterrupted fabric of such land uses filling up the landscape in all directions without discontinuity. Where such territory engulfs a large undevelopable topographic feature such as a harbour (e.g. San Francisco, Sydney, Hong Kong) or a range of steep hills (e.g. Los Angeles, Rio de Janeiro), these features were ignored, and the territory dissected by them was treated as a single unit (for example the continuous urban area surrounding San Francisco Bay from San Francisco and Oakland to San Jose was all recoded as San Francisco). However, wherever such fabric distended to become no more than a narrow strip of residential uses running alongside a single highway or other arterial route, this fabric was discounted, and the territories adjoining this narrow strip treated as two discrete locations. This was a frequent concern in South Korea and Japan.

Where two locations appear to be merging over time, they were considered to still be separate if the zone between their completely consolidated urban centres was more than 50% occupied by agricultural or other low-intensity use; they were considered to have merged once that proportion appeared to drop below 50%.

When this logic was applied to all locations in the dataset, very few controversies requiring judgement calls remained. The two areas presenting serious difficulty were the peri-urban regions of Tokyo, Nagoya, Osaka, New York and Chicago, for which the number of judgement calls to be made appeared to have negligible impact on the already gargantuan size of the main urban economy in question, and the polycentric urban area of the Ruhr valley, in which the 50% rule had to be applied on a case-by-case basis. Neither of these difficulties have a large impact on the geography of the global city network as a whole, nor on the analysis of Sub-Saharan Africa. The only possible controversy affecting the analysis of Sub-Saharan Africa was the interpretation of the separation between Johannesburg and the cities of Centurion and Pretoria to its north. In accordance with the 50% rule, these three locations were all kept separate in the datasets, a distinction which, like Tokyo

or New York, has made negligible impact on the already extreme dominance that Johannesburg has over the regional economy.

However, one may argue that while this method may have been applied in a manner that is internally without much controversy, external controversies nevertheless emerge in the expression of the resulting urban footprints. For example, readers familiar with cities such as Chicago, London, Los Angeles, New York and Paris may reject the bounds identified for those cities as too narrow, since they exclude outer suburban areas and satellite towns that many economic (especially regional) geographers would include. Like other limitations of the present research project, this potential criticism was noted very late in the study and could not be addressed without reiterating several months of network analysis operations. Instead, the present author simply acknowledges this limitation here.

While this method may seem to underdefine urban units for those readers, it may be noted that at the very least this method has resisted a certain type of confirmation bias prevalent in the "global cities" literature wherein cities are defined too broadly, thus overinflating the importance of large cities from the outset. It can be seen that the network positions for cities affected by this limitation do not appear to have been underestimated—London, Los Angeles, New York, etc. all still find themselves in the innermost core of the network even without the help of their outermost suburbs and satellite towns.

In any case, this method allowed the dataset representing the global network to be cleaned and prepared for analysis as a matrix. The dataset representing the Lagos network was cleaned in the same way, but first that data had to be collected in a qualitative phase of research.

3.4. Qualitative data collection

The objective of the second phase of the research project was to investigate a peripheral city in a peripheral region from an economic perspective. This phase focused on Lagos, an urban agglomeration of approximately 12 million people in southwest Nigeria, and the largest city by population in Sub-Saharan Africa, ahead of Kinshasa, Khartoum and Johannesburg (and also ahead of Cairo, which it has overtaken since 2010, making it the largest city by population on the African continent) (United Nations Department of Economic and Social Affairs, 2011). Lagos is also one of a few cities (the others are Accra, Dakar and Abidjan[9]) vying for dominance of the sub-region of West Africa, though Lagos is already the largest city and the largest urban economy in this region. This region forms a natural demographic basin, bounded by the Sahara Desert, the Cameroon highlands

[9] Lagos can boast the largest urban economy in the region, but it is beleaguered by unreliable energy provision and violent crime, causing many Anglophone businesses and other international organisations to turn to Accra. Though neither are part of the West Africa Economic and Monetary Union (or UEMOA from the French version of its name), a largely Francophone grouping with central bank in Dakar and common stock exchange in Abidjan.

and the Atlantic Ocean, and dominated throughout by non-Bantu-speaking peoples of the Niger-Congo language family, making it a coherent supranational territory of a similar order of magnitude to the European Union (EU) or the Association of Southeast Asian Nations (ASEAN) (Table 3.1). And as a (sub-)region with a rich history of intra- and interregional trade networks and identifiable urban systems stretching back at least 1,800 years (McIntosh & McIntosh, 1981; Bairoch, 1988; Coquery-Vidrovitch, 1993; Freund, 2007), it is as good a region as any part of Europe or Asia in which to conduct research into urban networks.

Figure 3.1 The more highly populated areas of West Africa
Source: *Google Maps* (Google, 2011-2013)

Table 3.1 ECOWAS, EU and ASEAN compared

(All data for 2009)	*Economic Community of West African States (ECOWAS)*	*European Union (EU)*	*Association of Southeast Asian Nations (ASEAN)*
Member countries	Benin, Burkina Faso, Cape Verde, Cote d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, Togo (15)	Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom (27)	Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, Vietnam (10)
Cities over 1 million	Lagos, Abidjan, Kano, Dakar, Ibadan, Accra, Abuja, Ouagadougou, Kumasi, Bamako, Conakry, Lomé, Kaduna, Benin City, Port Harcourt, Niamey, Ogbomosho (17)	Paris, London, Madrid, Barcelona, Berlin, Rome, Athens, Milan, Lisbon, Birmingham, Manchester, Brussels, Hamburg, Warsaw, Budapest, Vienna, Turin, Leeds, Marseille, Lyon, Porto, Munich, Stockholm, Sofia, Copenhagen, Glasgow, Prague, Helsinki, Dublin, Amsterdam, Lille, Rotterdam (32)	Manila, Jakarta, Bangkok, Ho Chi Minh City, Singapore, Hanoi, Surabaya, Medan, Hai Phong, Phnom Penh, Kuala Lumpur, Davao, Semarang, Ujung Pandang, Palembang, Klang, Bogor (16)
Land area	5,030,150 km^2	4,181,120 km^2	3,672,540 km^2
Population	295,327,965	498,643,211	580,992,298
GDP PPP (const. 2005 int'l $)	$474,937 million	$13,630,214 million	$2,416,145 million

Sources: World Bank (2013) and United Nations Department of Economic and Social Affairs (2011)

Fieldwork was carried out between May and August 2012, with all introductions and interviews conducted by the present author alone. The fieldwork centred on investigating a number of firms located in Lagos and ascertaining the geography of their intrafirm and interfirm connections to other cities, whether within West Africa or without. A list of candidate companies was drawn, again from the *Orbis* database (Bureau van Dijk, 2012), comprising every active company having year's turnover greater than $1 million in 2009 or 2010, whether an independent company or a subsidiary of another company. The $1 million threshold was required because the database proved to have unexpectedly few companies below this threshold, making those that were in the database below this threshold suspect. This furnished a total of 231 companies comprising $36.5 billion in year's turnover, including 55 companies with over $100 million in year's turnover, and 9 with over $1 billion. I attempted to contact every one of these companies using contact details found on their websites or through personal referrals. I was also given the opportunity to interview senior staff at DHL, a company which did not appear in the dataset, but which proved to offer important insights into the geography and trade balance of the regional economy.

Companies were contacted by email, by telephone, and by walking in off the street. Many of the email addresses found were invalid and most emails encountered no response. (Later, after subsequent contact attempts were successful, some interviewees said they treated the initial email as the work of a con artist or corporate spy.) Most telephone numbers were invalid or inaccessible because of the unreliability of Nigerian telecommunications and energy services. As a result of these difficulties, only 121 companies were successfully contacted.

Once contacted, company staff presented several challenges before granting interview. Many junior staff were reluctant to direct my enquiries upwards, reluctant even to give me their own first names over the telephone for fear of reprisals from their superiors, and many middle managers passed my calls between each other or directed me to their email inboxes rather than advance my request or lose face by simply saying "no". Initially I interpreted this as driven by a corporate fear of industrial espionage; however several later conversations made it clear that this was more often driven by each employee's individual fear of being caught misrepresenting the company to outsiders and being made accountable with their own jobs. This was reinforced by the fact that senior staff members, once encountered, never exhibited any of the same behaviour, not being beholden to any superiors in the same way. In many cases up to a dozen communications passed before an interview was granted. One major bank imposed a non-disclosure agreement preventing it and its staff from being named in any form of publication, though once that was signed it then made greater efforts than other banks to make its senior staff available. Other companies were confused by the geographic nature of the study, believing that their single-location enterprises could have little to contribute on the topic, until the meaning of the geographic dimension was explained in further detail. Only on two occasions did anyone ever simply say "no", (Zenith Bank Plc and the petroleum distributor Total Nigeria Plc), and only one of these did so unapologetically (Total Nigeria Plc), suggesting that a strong desire to avoid ever giving a flatly negative response is part of the local business culture, frustrating as that may be to an outsider.

In the end, only 20 companies made one or more of their staff available for interview. The sampling method can thus best be described as convenience sampling, where selection was done at the convenience of the interviewee rather than interviewer; nevertheless they include a variety of company sizes and industries, with one notable exception—the oil services industry. The seniority of the interviewee was usually relatable to the size of the company. Managing directors of some of the smallest companies responded directly to the first email without suspicion. Medium enterprises offered me a middle manager. The largest companies offered initially only their communications staff, who passed me to more senior employees only on rare occasions and after much correspondence. In some cases I could interview two or more employees on separate occasions or together, though this was sometimes only in passing as employees passed in and out of each other's offices and meeting rooms. One CEO gave me a personal tour of his factories.

Each interview was conducted face-to-face at the company's premises, except for one interview conducted in a café where a manager was visiting a client. Most interviews lasted very close to sixty minutes; a few were as brief as thirty minutes. Interviews were semi-structured, and followed an agenda comprising the following eight themes:

1. The history of the firm;
2. The geography of its operations;
3. The geography of its customer bases;
4. The backgrounds of its key staff;
5. Its network of suppliers and other business partners, their geography and the history of the relationships with each;
6. Activities related to the acquisition and absorption of new knowledge;
7. Activities related to the acquisition of capital and the financial instruments necessary for trade;
8. Activities related to networking, for example through conferences and trade fairs.

These themes were signalled to the interviewee in advance by placing between the interlocutors a large sheet of paper that presented these themes in a simple numbered list which read as follows:

1. History
2. Operations
3. Customers
4. People
5. Technology and partners
6. Knowledge
7. Capital
8. Networking

In the case of finance companies, points (5) and (7) were reversed, since the "suppliers" or "partners" of these companies are in fact the correspondent banks and reinsurance companies that partner with them on the supply of capital. No specially worded questions were asked; the interviewees were

simply asked to expound on each theme in turn, with additional questions asked where clarification or further information was desirable. In some interviews prior research had already identified a company's major products, suppliers and partners in advance[10]; these were written on other large sheets of paper to enable the interviewee to discuss them more rapidly.

Answers were recorded by taking handwritten notes and supplemented by electronic recordings made for the interviewer's private reference, though a few interviewees refused to be recorded, and for others the pace with which the interviewee granted access and began speaking substantively to the topics made recording impractical. For a few companies, whether to save time, to clarify information or simply to entertain and continue to engage the interviewee, answers were recorded by drawing a map of the geography of the company's interactions with regards to one theme or another, with the participation of the interviewee in the drawing.

3.5. Qualitative data analysis

The data collected in the interviews were analysed in two ways. First, as shown in Chapter 5, a written report was made on each company divided into each theme, though for some companies not all themes could be addressed and are omitted from their respective reports. Because some of the nominated themes proved less fruitful than others in stimulating discussion, the eight themes used to structure the interviews were recombined into six areas of discussion. After a general introduction covering each company's history and operations, the remaining five areas of discussion are (1) customers, (2) supply, (3) knowledge, (4) capital, and (5) networking. Again, in the case of banks and insurance companies points (2) and (4) are reversed.

The main concerns and most interesting themes arising from the interviews were collated in an inductive fashion, with each company report concluding with a summary of the most interesting themes arising within each interview, followed by a conclusion for each sector summarising the most interesting themes across each sector's company, followed by another conclusion summarising themes across the whole set of companies. These themes fed into the theory-building exercise conducted in Chapter 7.

Second, as discussed in Chapter 6 and presented in Appendix B, the references to various geographic connections made during the interviews were encoded into another set of square directional network matrices, in the following manner. Every instance where an interviewee referred to a connection between their company's activities and the presence and activities of other actors within Lagos or in any other city around the world was noted in a spreadsheet. For example, every reference to the location of a large customer base, a supplier, a training programme, a creditor, a conference, etc., was recorded. This information was supplemented by stepping through the

[10] If this research was not done before the meeting, it was certainly done afterwards; additional research especially of websites and publicly available data was undertaken in compiling the individual company reports presented in Chapter 5.

websites of every company interviewed, and scraping further information from each company's full record on the *Orbis* (Bureau van Dijk, 2013) database. The spreadsheet noted the company being interviewed, the sector it operated within, the cities involved in the connection, the direction of flow of inputs and outputs involved in the connection, whether those flows were intrafirm or interfirm, and which of the five final themes or functions those flows related to. These flows are exemplified further in the following table, however within the datasets they were encoded only by the name of the theme or function they relate to (the leftmost column), not by the names of the flows (the rightmost column).

Table 3.2 Types of flows in the Lagos network

Function	*"Headquarter city" (sender)*	*"Foothold city" (receiver)*	*Flow*
Operations	Head office	Branch or representative office	Organisational command
Suppliers	Supplier	Company	Products and services
Knowledge	Supplier, training centre, or university	Company staff worksite	Knowledge transfer
Capital	Investors, creditors	Company	Capital
	Company	Shareholders, creditors	Dividends, interest, etc.
	Banks, customers, counterparties, etc.	Banks, customers, counterparties, etc.	Trade finance
Networking	Company staff worksite	Conference or meeting location	Personnel

Various fractions of this spreadsheet were then fed into *Ucinet* (Borgatti, Everett, & Freeman, 2002) to be compiled as network matrices, all of which were square city-city matrices. First, all ties were thrown into a single network matrix, named the "Lagos network", spanning all 219 cities and towns engaged by the 20 firms interviewed. Second, all intrafirm ties were compiled into a matrix, followed by all interfirm ties. The ties pertaining to each of the three sectors used in the qualitative phase were compiled into matrices. The ties pertaining to each of the five themes or functions were compiled. Finally, matrices were compiled that divided the sectoral networks themselves into intrafirm and interfirm components, and into components pertaining to each of the five themes or functions, though not all of these smaller matrices proved to contain sufficient data for analysis. These network matrices were then analysed following the same method used for the global network matrices; this analytical method is set out below.

3.6. Network data analysis

The analytical methods used to describe the morphology of the global and Lagos networks depart significantly from the methods used in the "global cities" literature. This literature typically uses several algorithmic methods to calculate quantifiable properties related to network centrality and connectedness for each city in a matrix dataset, including (though not at all limited to) measures such as degree and betweenness (Freeman, 1979), eigenvector centrality (Bonacich, 1972), matrix core/periphery position (Borgatti & Everett, 1999), and block model assignments (White, Boorman, & Brieger, 1976). They then use these data to rank the various cities in each network dataset, typically focusing on the highest-ranking cities for each calculated property.

But within the literature on network analysis methodologies, some of these measures are increasingly considered obsolete with regards to identifying the most powerful actors within a network. Kitsak et al. (2010, p. 888) discuss the "identification of influential spreaders [of information] in complex networks", which one may interpret as the identification of the nodes with the highest capacity to govern the communication of information within a network. They argue that "in contrast to common belief, there are plausible circumstances where the best spreaders do not correspond to the most highly connected or the most central people" (Kitsak, et al., 2010, p. 888). Accordingly, this study will not persist with calculating many of the same types of centrality and connectedness properties used in the "global cities" literature, though it will come round to using the algorithm that Kitsak et al. (2010, p. 888) recommend as a better method of identifying influence within a network—Seidman's (1983) k-shell decomposition method—as described in much detail further down. However it will continue to calculate outdegree, indegree and total degree (Freeman, 1979) for the purpose of identifying outlying roles attributable to individual cities in each network. That is, it calculates these properties not to identify the most central or most connected cities, but to clarify individual city specialisations suggested visually by the network graphs, again as explained in much detail further down.

But first, it may also be considered premature to calculate any such properties for each city without yet knowing how the "landscape" of the whole network fits together. To put it one way, it could be said that calculating properties for cities in a network without first having depicted the morphology of that network in the form of a complete network graph is a bit like calculating altitudes for mountains in a mountain range without first having depicted the geography of that mountain range in the form of a map. We can identify the highest peaks and put them in a hierarchy, but do we really know how they are located in relation to each other, and to all of the other mountains and foothills in their hinterlands?

To address this, this study proposes a "whole-of-network" approach that relies on the analysis of graphs depicting the entire "topography" of each network, from the highest peaks to the flattest plains. The analysis proposes to use visual graphing methods strategically to depict complete networks in useful ways to put this "topography" in plain sight. It can then use qualitative information gleaned from the fieldwork and elsewhere to describe and interpret this topography and its emergent features.

This strategy centres on the simultaneous interpretation of two types of graphs produced by manipulating the output of the *NetDraw* software (Borgatti, 2002) which, to continue the metaphor of a mountain range, shall be called the "plan" and the "elevation". For example, in the first two graphs in the atlas that accompanies this dissertation, Figure A.1 is the plan view and Figure A.2 the elevation of the global network. The plan view is the basic graph provided by *NetDraw*, and consists of a "spring-embedded graph" in which nodes are pushed and pulled so as to minimise the apparent distance between adjacent nodes. The centrality or core-periphery status of a city may be gleaned

more or less directly by looking at their position on the plan, while the order of magnitude of the city's economy may be gleaned by looking at the diameter of the node representing the city.

The elevation graph is an innovation developed as part of this study through which the various structural roles played by different cities may be gleaned more or less directly by looking at their "altitude" in elevation. To explain further, recall that in the matrix data, cities host parent companies and subsidiaries, and that each tie between them has a strength equal to the turnover of the subsidiary. The vertical position of each city in the elevation view is equal to the sum of ties attached to the parent companies that it hosts, minus the sum of ties attached to the subsidiaries that it hosts. In network terminology it is the city's outdegree minus its indegree (Freeman, 1979).

In the global network, cities that overwhelmingly play host to large numbers of parent companies will have very high positions; cities that overwhelmingly play host to large numbers of subsidiary companies will have very low positions. In the Lagos network data, cities that were the "senders" of large numbers of ties will have high positions; cities that were the "receivers" of large numbers of ties will have low positions. Cities that have roughly equal numbers of both will appear in the middle of the graph, as will cities that have very low numbers of both. As a result the middle band usually appears very thickly populated. To distinguish between cities that have large numbers of both from cities that have very few of both, the circle representing each city is sized according to the sum of the absolute figures for each type of company (i.e. outdegree plus indegree). For example, in Figure A.6 showing an elevation view of the network pertaining to North America, London appears in the middle, but because it has very large numbers of both parents and subsidiaries in this subset of the network it appears much larger than all other cities in the middle band of this graph.

Apart from these positions, the elevation view continues to depict all the interconnections between different cities, so that the relationships between the various "peaks" may also be discerned. In effect, the elevation view is a cross-section of the "mountain range" formed by the network, with the viewer able to imagine cities variously as tall peaks, plunging river valleys, flat plains, and everything in between, and the ties between them appearing as sloping ridges, spurs and tributaries. By comparing plan and elevation views, the roles played by different cities are observed by seeing them jump out of the page in these graphs.

However this strategy cannot entirely avoid employing some algorithmic concepts. Though we may be less focused on calculating the "altitudes" of each individual "mountain", we still need some way of drawing lines across our "landscape" to make sense of the "topography". We also need some measure of significance, to determine whether what we see visually in the elevation graphs is trivial or non-trivial. When Kitsak et al. show that measures like centrality and connectedness are no longer the best for identifying the most "influential" nodes in a network, they "find [instead] that the most efficient spreaders are those located within the core of the network as identified by the *k*-shell decomposition analysis" (Kitsak, et al., 2010, p. 888), the Seidman (1983) method mentioned earlier. This method turns out to be a very powerful method for identifying not simply the highest

levels of the network, but also the relative positions of every other city in the network, consistent with a "whole-of-network" approach. It also gives us a very sound test of significance.

The network property identified by k-shell decomposition is known to mathematicians as "degeneracy", though we may also think of it as referring to concentric circles drawn in plan. Or, switching now to a new metaphor, we may think of it as referring to the layers of an onion.

To explain: many networks have an identifiable core and periphery. But in some cases these structures are so weak as to be trivial; in other cases there is a very thick intermediary structure between the innermost core and the outermost periphery indicating that the innermost core is very strong indeed. Not only is there a spectrum between these two extremes, there is also a critical threshold within this spectrum at which a core-periphery structure becomes non-trivial. We can imagine that a network is composed of layers just as an onion is—peel away successive peripheral layers and one will gradually reach the core. The degeneracy property quantifies this by providing a way to "count" the number of layers from the periphery to the core of a network, or to think about it another way, it provides a way to count how many layers can be ripped out of a network before it degenerates into disconnected fragments.

The algorithm used to quantify the degeneracy of a network was developed by Seidman (1983) as an improvement on previous methods such as density used to determine the robustness of social networks against fragmentation and to identify significant levels of clustering within them, another sign of its usefulness for our purposes. A network is composed of several layers, numbered from the periphery to the core, each of which is herein called a "k-shell"[11]. The number of k-shells composing a network is represented herein by the letter "K" and the term "K-value"; for example, a relatively robust network may have nine k-shells and thus have a K-value of 9, a relatively degenerate network may have only two k-shells and thus a K-value of 2. The number identifying each successive k-shell is represented herein by the letter "k" and the term "k-value". For example, the periphery of any network is the k-shell with a k-value of 1 (which may also be written as "k = 1"); the innermost core of a network with a K-value of 9 is the k-shell where k = 9.

Each k-shell is composed of a set of cities; each city thus also has a k-value identifying which k-shell they are in, thus indicating where a city is located in relation to the core and the periphery of its network. The number of k-shells in a network, and the cities populating each k-shell, are identified by the following algorithm (Seidman, 1983): Take a network, strip away every city connected to only one other city, and keep stripping away till no more can be stripped. These cities constitute the first k-shell (k = 1). Then strip away every remaining city connected to only *two* other remaining cities, and keep stripping away till no more can be stripped. These cities constitute the second k-shell (k = 2). Now strip away every remaining city connected to only *three* other remaining cities, and keep

[11] Seidman himself called them "k-cores", but since these layers may be in the core or the periphery, his term is considered misleading, and "k-shell", the common alternative used by Kitsak et al. (2010) and many others, is preferred here instead.

stripping away till no more can be stripped. These cities constitute the third k-shell (k = 3). Repeat the process until the entire network has been stripped away. Thus is each k-shell like a layer of an onion—peel one k-shell away to reveal the next.

One can see that large networks may have many k-shells, and small networks will likely have very few. For example, in this study the network pertaining to Latin America and the Caribbean has five k-shells (K = 5); the network pertaining to South Asia has two (K = 2). The number of k-shells or the K-value of a network is thus also a very useful way to summarise both its size and its "knittedness" (Seidman, 1983). Each increase in the value of K represents a significant jump in the complexity and capacity for power and influence attributable to the cities in the innermost core of a network. This is reinforced by Seidman's (1983, p. 278) remark on the rarity of large K-values: "most naturally occurring networks will not contain significant *k*-cores [k-shells] for large values of *k* [K]." Think then what it means if the Sub-Saharan African network has a K value of 2, while the European network has a K value of 12!

Exploring the mathematical implications of this algorithm, Seidman (1983) discovered that the k-shell k = 3 is a special boundary condition at which non-trivial "cliques"—small highly interconnected groups—begin to form in great number, and it is here that significant power and influence within the network can begin to be generated. As a corollary, k-shells where k = 2 remain relatively fragmented, while k-shells where k = 1 are completely "degenerate". For a visual illustration and intuitive understanding of this, look at the difference between the mining network (Figure A.23), the largest network by turnover for which K = 2, and the technical sector network (Figure A.29), the smallest network by turnover for which K = 3. The technical sector network looks two or three times more complex, despite being one-quarter smaller than the mining network.

This is our test of significance. When a network has K = 1, it is completely degenerate—none of its fragments are interconnected. Such networks are almost no use at all for any analytical purpose. When a network has K = 2, there are a few small power structures within it, a few interconnected hubs for example, but still the network is too fragmented for such hubs to constitute an effective and influential core. We can make observations of these networks, but they are not robust enough to rely upon without supporting observations from more significant networks. However when a network has K = 3, structures of power within it become sufficiently interconnected that strong loops of communication may form, and the cities that constitute these loops coalesce into an effective core system, a system which only increases in strength as higher K-values are encountered. Consequently, in this study findings related to networks and k-shells having K- and k-values of 3 or higher shall be treated as significant, findings related to networks and k-shells having K- and k-values of 2 shall not be treated as significant but may be referred to where they correspond with findings treated as significant elsewhere, and findings related to networks and k-shells having K- and k-values of 1 shall be dismissed. Note that this test is relevant to both the micro and macro levels of the network at the same time. At the moment that the condition K = 3 is reached, the core of the network becomes non-trivial, but so do the individual relationships that constitute that core.

Note also that this approach to determining significance differs from other approaches in the "global cities" literature. The approach here is rooted in the mathematics of network analysis itself whereas the approaches taken in the literature are often derived from the mathematics of statistical hypothesis testing with varying amounts of justifiability. For example Alderson and Beckfield (2004) run Monte Carlo simulations to decide whether their findings are due to chance or not, while Taylor (2004) simply makes the pragmatic decision to discard cities for which the calculated centrality and connectedness scores are less than 0.05 times the largest scores found in the data, an approach which effectively wipes from view the outermost periphery of the network.

Given that this threshold value of k = 3 distinguishes immediately between k-shells comprising significant loops and k-shells comprising only poorly interconnected fragments, and given that it is very rare for naturally occurring networks to reach this threshold, we can comfortably say that k-shells and cities meeting this threshold (i.e. having a k-value of 3 or higher) constitute the core of a given network, and that k-shells and cities falling below this threshold (i.e. having a k-value of 2 or lower) constitute the periphery. However, even where a given network has an overall K-value of 2, we should not attempt to think that its first k-shell constitutes its periphery and its second k-shell its core, even though the second k-shell is hypothetically the inner layer of that network. The fact is that this inner layer of any network having a K-value of 2 is still highly fragmented and poorly interconnected, meaning that the cities in this innermost k-shell are still peripheral in nature; such networks are in effect all periphery, no core.

We arrive at the very clear position that cities having k-values of 3 or higher are both significant to the network and part of the core of the network, and that cities having k-values of 2 or lower are both *not significant* to the network and part of the *periphery* of the network. This is an additional elegance of Seidman's (1983) algorithm—it creates a clear distinction between cities we can truly regard as core, and cities we can truly regard as peripheral.

We thus have a very clear set of tools for analysing the network data. We have a method for graphing the entirety of each network, both in plan and in elevation, which shows us the "topography" of the network, and the features of that topography. We have a method for identifying the number of layers that a network has from its periphery to its core, which also splits the network elegantly into a simple core-periphery dichotomy as required, and determines the significance of the features identified in the graphs. We also know which region each city belongs to.

Using these three main methods of distinguishing between different cities—region, k-shell, and graph position—this study will proceed by attempting to catalogue the different types of cities that populate the network according to these categorisations; this effort takes place in Chapter 4 for the global network and Chapter 6 for the Lagos network. Using the knowledge granted by the qualitative analysis in Chapter 5 and elsewhere, the study will then attempt to explain these different types of cities and use them to engage in theory-building to explain the morphology and evolution of the network overall; this effort takes place in Chapter 7.

Chapter 4. The global network

This chapter provides a description of the global network yielded by the secondary data. It should be read in conjunction with Appendix A, whose figures it will refer to throughout. The global network is presented first in its entirety, followed by a number of networks (subnetworks extracted from the global network) pertaining to each region and sector, followed by the West African network. Each of these networks are depicted in the atlas in a variety of network graphs produced using *Ucinet* (Borgatti, Everett, & Freeman, 2002) and *NetDraw* (Borgatti, 2002) software.

4.1. The global and regional networks

To recall, the global network comprises location data for all independent active companies with turnover greater than $10 billion in 2009 or 2010, together with subsidiaries over which they had at least 50% control. The dataset comprises 785 companies spanning 1,625 cities and towns with a combined turnover of $23.7 trillion. This network comprises 15 k-shells, indicating an extraordinary degree of coordination between agents in multiple sets of cities and firms across the face of the earth.

A subnetwork relating to each of the seven continental macro-regions into which organisations such as the World Bank divide the globe (Europe and Central Asia, Latin America and the Caribbean, etc. [12]) was extracted from the global network. However, these extracts are not regional networks in the sense of comprising only cities within each region. Rather they are extracts of the global network pertaining to each region, in other words the sum of all connections enjoyed by all cities within each region, whether those connections are inside or outside the same region. The reader is asked to bear in mind that phrases such as "the North American network" or "the South Asian network" may refer to a set of cities spanning the entire globe; what is essential is not that the cities are all in a given region, but rather that they are all connected to that region.

The global network may be very easily sorted into a set of core regions and a set of peripheral regions based on the sum of ties within and between each region, a simple application of the core-periphery identification methods described in Borgatti and Everett (1999). As shown in Table 4.1, the core regions are Europe, North America and East Asia; the peripheral regions Sub-Saharan Africa, Latin America, Middle East and South Asia. The contrast between them appears stark in this

[12] In this text Europe and Central Asia may be abbreviated to "Europe", East Asia and the Pacific may be abbreviated to "East Asia", and Middle East and North Africa abbreviated to "Middle East", especially in their adjectival forms. This is acceptable because the words being dropped in each case refer to subregions where very few cities appear within the datasets. Sub-Saharan African may also be abbreviated to "Sub-Saharan". In addition, the text may use World Bank three-letter codes to refer to each region or to the network pertaining to it, as follows: ECS: Europe (and Central Asia); NAC: North America; EAS: East Asia (and the Pacific); SSF: Sub-Saharan Africa; LCN: Latin America (and the Caribbean); MEA: Middle East (and North Africa); SAS: South Asia. (The codes ECA, EAP, SSA, LAC and MNA more familiar to the development literature are not used since they refer only to the developing countries in those regions.)

table, however this is an effect of the construction of the dataset, which has amplified the differences between headquarter locations and subsidiary locations. Nevertheless the regions in each set are exactly as one would expect, and the distinction between core regions and peripheral regions will be used throughout this study as a useful way to analyse the composition of the global network and its subnetworks, as well as the behaviour of firms in a city such as Lagos.

Table 4.1 Global core and peripheral regions

($ billion)	*Europe*	*North America*	*East Asia*	*SS Africa*	*Latin America*	*Middle East*	*South Asia*	*Total*
Europe	5,815	1,119	754	529	488	52	20	8,777 (54.5%)
North America	1,966	2,248	562	95	134		7	5,011 (31.1%)
East Asia	524	295	1,068	30	23		16	1,957 (12.2%)
Sub-Saharan Africa	14	1	2	157				175 (1.1%)
Latin America	2	47	5		41			96 (0.6%)
Middle East	9	12	1			21		43 (0.3%)
South Asia	19	19	2		1		1	42 (0.3%)
Total	8,350 (51.9%)	3,741 (23.2%)	2,394 (14.9%)	810 (5.0%)	687 (4.3%)	74 (0.5%)	44 (0.3%)	16,101 (100.0%)

4.1.1. Morphology

Figure A.1 in the atlas shows that the global network is highly consolidated around a single core of several dozen cities, diffusing gradually towards a large periphery[13]. There is no clear break from the core to the periphery (despite the fact that the graphing software creates the illusion of concentric bands), and the network is not perceptibly fragmented. This is compared to the seven regional networks, where morphologies vary from "consolidated" at the higher end to "fragmented" at the lower end.

The seven regional networks are vastly different in scale, from the South Asian network (SAS) representing $86 billion[14] to the European network (ECS) representing $11.3 trillion in turnover, and this produces their varied morphologies. At the top are ECS (Figure A.3) and the North American network (NAC; Figure A.5; $6.4 trillion), both having very large, highly consolidated networks very closely resembling the global network in morphology and in power (K = 12 and 9 respectively). At the bottom are the Middle Eastern network (MEA; Figure A.9; $96 billion) and the South Asian network (SAS; Figure A.15), both having very sparse, fragmented networks embodying very little structural power (K = 2 for both).

[13] It is noteworthy that Figure A.1 is substantially identical to Figure 3 in Alderson, Beckfield and Sprague-Jones (2010, p. 1909) depicting "the 2007 world city system" using methods which have inspired the methods used here.

[14] Recall that these do not reflect the GDP of their respective regions' economies, but rather refer to an aggregation of fully controlled subsidiaries both inside and outside the region, which is only loosely related to the region's own GDP.

In the middle are three somewhat anomalous networks. The East Asian network (EAS; Figure A.7; $3.4 trillion) is similar in scale (K = 7) to NAC and ECS, yet has a slightly different morphology to them. It is not completely consolidated; there is a slight fragmentation visible where Tokyo is the sole hub for a large cluster of cities, as are Osaka and Seoul for smaller clusters of cities. This kind of fragmentation is more typical of very small networks like SAS than of very large ones like NAC. And then, drawing these three independent hubs together is a connective tissue of "global cities" (from inside and outside the region), which also form a hub for yet another cluster of cities. It would seem that the East Asian network is nearing the end of a period of transition between one type of morphology and the other.

The Latin American network (LCN; Figure A.11) is of moderate scale ($744 billion; K = 5), and its morphology also appears to be in a transitional phase from a small, fragmented network to a large, consolidated one. A number of outlying cities appearing as "peaks" and "valleys" in the elevation views are beginning to interconnect, and many other cities are contributing to the consolidation of the network around them. The Sub-Saharan network (SSF; Figure A.9; $847 billion) is slightly larger than LCN, yet still has the very sparse, fragmented network (K = 2) typical of the smallest networks. The set of regions and their morphological categorisations are presented in Table 4.2. Here it is apparent that in general there is a correlation between the size of a given network, the number of k-shells in that network, and the morphology of that network, which transitions from small, fragmented networks to large, consolidated networks. It is also apparent that the one exception to this pattern is the Sub-Saharan network, which is unusually fragmented for the level of economic activity it represents. Why this might be becomes clearer when we see the morphologies of the different sectoral networks, discussed in section 4.2 below.

Table 4.2 Morphologies of the global and regional networks

Network	*Turnover represented ($ m)*	*K*	*Morphology*
Globe	16,100,551	15	Consolidated
ECS	11,314,581	12	Consolidated
NAC	6,447,866	9	Consolidated
EAS	3,372,477	7	Transitional
SSF	847,383	2	Fragmented
LCN	744,442	5	Transitional
MEA	95,588	2	Fragmented
SAS	85,972	2	Fragmented

4.1.2. Decomposition

The cities and towns appearing in each of the global and regional networks are listed in the following tables, best browsed in conjunction with the plan views for each network in the atlas. Locations are sorted into their respective regions (the columns) and k-shells (the rows). The top row represents the highest k-shell, that is, the innermost core of the network, while the bottom row

represents the lowest k-shell, that is, the outermost periphery of the network. Counts are given for the number of locations in each cell, and counts and percentages are given for each row and column. In the lowest k-shell ($k = 1$) locations may be too numerous to list individually, especially for the largest networks; in these cases counts are given for each country that hosts more than one location instead. In each table, core regions and peripheral regions are divided by a vertical line between them, and core k-shells ($k \geq 3$) and peripheral k-shells ($k \leq 2$) are divided by a horizontal line between them (though this may be obscured by the pagination). The tables are thus divided into four types of locations for each network: (a) core cities in core regions, (b) peripheral cities and towns in core regions, (c) core cities in peripheral regions, and (d) peripheral cities and towns in peripheral regions. Several of the smaller networks have only two k-shells. Here no horizontal line is drawn between them, emphasising the fact that, following Seidman (1983), the second k-shell does not constitute a theoretically significant core, and that both k-shells in such networks may be considered peripheral in nature. Such networks have only two types of locations: (b) peripheral cities and towns in core regions and (d) peripheral cities and towns in peripheral regions. Finally, not every region is represented in each of the regional networks, especially the smaller networks where connections between peripheral regions are rarer. Where this is the case, the columns for empty regions have been removed.

These tables describe the general geography of the global network identified by this study, however they will be presented without comment here, simply as a record of the empirical findings, with various data drawn out for use and discussion in subsequent chapters.[15]

[15] The author acknowledges that for many readers, especially regional geographers, this study appears to separate out many outer suburban areas and satellite towns which those readers would normally include as integral to the larger urban regions with which they are associated, especially in the case of outer suburban areas and satellite towns of Chicago, London, Los Angeles, New York and Paris. Please see section 3.3 for a further acknowledgement and discussion of this issue.

Table 4.3 Regional and k-shell decomposition of the global network

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Latin America*	*Middle East*	*South Asia*	*Total*
15	Amsterdam, Basel, Brussels, Cologne, Dublin, Hamburg, London, Madrid, Milan, Moscow, Munich, Paris, Rome, Schaffhausen, St Helier, Stockholm, Warsaw, Zurich (18)	Atlanta, Chicago, Dallas, Houston, Los Angeles, Minneapolis, New York, San Francisco, Toronto, Washington (10)	Hong Kong, Osaka, Seoul, Singapore, Sydney, Tokyo (6)		Mexico City, Sao Paulo (2)		Mumbai (1)	37 (2.3%)
14	Barcelona, Dusseldorf, Frankfurt, The Hague, Hanover, Luxembourg, Mannheim, Rotterdam, Slough, Stuttgart, Turin, Utrecht, Vevey (13)	Boston, Detroit, Hamilton (Bermuda), Milwaukee, Philadelphia, St Louis (6)	Bangkok, Kuala Lumpur, Melbourne, Shanghai, Toyota (5)		Buenos Aires (1)			25 (1.5%)
13	Copenhagen, Oslo (2)	Charlotte, Cincinnati, Hartford, Louisville, Phoenix, Pittsburgh, Seattle, Wilmington (8)						10 (0.6%)
12	Budapest, Darmstadt, Espoo, Helsinki, Newbury, Prague, Vienna (7)	Armonk, Cleveland, Columbus, Montreal, New Brunswick, Norwalk, Omaha, St Petersburg, Whitehouse Station (9)		Johannesburg (1)				17 (1.0%)
11	Berlin, Crawley, Geneva, Trieste, Walldorf (5)	Purchase (1)	Beijing, Hiroshima, Nagoya (3)			Tel-Aviv (1)		10 (0.6%)
10	Chertsey, Heerlen, Hemel Hempstead, Leuven, Sandviken (5)	Akron, Denver, Indianapolis, Miami, North Chicago (5)	Suzhou (1)		Bogota, Rio de Janeiro, Santiago (3)		Delhi (1)	15 (0.9%)
9	Essen, Istanbul, Lisbon (3)		Kariya, Manila, Shenzhen, Shizuoka (4)					7 (0.4%)
8	Antwerp, Bilbao, Birmingham, Bristol, Bucharest, Heidelberg, Herzogenaurach, Lyon, Manchester, Swindon, Swords, Trappes, Zug (13)	Benton Harbor, Fairfield, Framingham, Peoria, Richmond, San Diego, Stamford (7)	Auckland, Kyoto, Suwa (3)		Lima, Manaus, Monterrey, Porto Alegre (4)			27 (1.7%)
7	Athens, Bad Homburg, Gothenburg, Hoofddorp, Mainz (5)	Melville, Nashville (2)	Guangzhou, Jakarta (2)					
6	Bracknell, Bratislava, Bremen, Bunnik, Cergy, Hertogenbosch, Karlsruhe, Kunzelsau, Linz, Stavanger, Treviso (11)	Austin, Calgary, Midland, Morristown, Orlando, Salt Lake City (6)	Taipei (1)					18 (1.1%)
5	Aberdeen, Bonn, Breda, Duisburg, Edinburgh, Farnborough, Guildford, Lille, Luton, Maidenhead, Neu Isenburg, Pozuelo de Alarcon, Reading, Salzgitter, Selm, Windsor, Zagreb (17)	Eden Prairie, Franklin, Moline, Raleigh, San Ramon, Tampa (6)	Brisbane, Chon Buri, Hamamatsu, Perth, Tianjin (5)			Dubai (1)		29 (1.8%)
4	Augsburg, Basingstoke, Bielefeld, Bologna, Cambridge, Derby, Dortmund, Eschborn, Genoa, Ghent, Glasgow, High Wycombe, Krefeld, Lausanne, Leeds, Majadahonda, Olten, Palma, Poznan, Redhill, St Petersburg, Stevenage, Tres Cantos, Warwick, Wroclaw, Wuppertal (26)	Baltimore, Battle Creek, Bentonville, Dayton, Kansas City, Las Vegas, Memphis, Portland, Providence, Smithfield, Thousand Oaks, Vancouver (12)	Fukuoka, Kitakyushu, Nanjing, Wuxi (4)	Durban (1)			Kolkata (1)	44 (2.7%)

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Latin America*	*Middle East*	*South Asia*	*Total*
3	Aachen, Baden, Basel, Belfast, Bergen, Bielsko-Biala, Camberley, Charleroi, Cork, Coventry, Florence, Funchal, Haarlem, Katowice, Krakow, Leatherhead, Leicester, Mechelen, Meerbusch, Milton Keynes, Newcastle, Nuremberg, Oberhausen, Oeiras, Oostende, Ostrava, Perth, Plock, Ratingen, Richmond, Russelsheim, Sant Cugat del Valles, Schwalbach, Toulouse, Valletta, Warrington, Woking (38)	Birmingham, Bridgeport, Columbia, Decatur, Des Moines, Edmonton, Farmington Hills, Greensboro, Greenville, Hampton, Hopkinton, Huntsville, Jackson, Jacksonville, Madison, Middletown, New Orleans, Norfolk, San Antonio, Savannah, Toledo, Tulsa, Warren, Waterloo, Wichita, Windsor, Woonsocket (27)	Adelaide, Ansan, Anyang, Bayan Lepas, Busan, Dalian, Hangzhou, Incheon, Pohang, Qingdao, Sendai, Seongnam, Seosan, Siheung, Takasaki, Ulsan, Wellington (17)	Douala, Nairobi, Pretoria (3)	Belo Horizonte, Curitiba, San Juan, Sumare, Willemstad (5)	Cairo, Casablanca (2)	Chennai (1)	93 (5.7%)
2	Aarau, Aarhus, Addlestone, Alcala de Henares, Almere, Almetyevsk, Aprilia, Arnhem, Aschaffenburg, Baar, Baarn, Basildon, Belgrade, Bensheim, Bethune, Biskupice-Podgorne, Bochum, Borehamwood, Born, Bradford, Breukelen, Brunswick, Bussy-St-Georges, Cagliari, Cardiff, Celle, Cernusco sul Naviglio, Cheadle, Dielsdorf, Drunen, Duren, Ede, Eindhoven, Enkhuizen, Fleurus, Fribourg, Gouda, Granollers, Graz, Grenoble, Halifax, Hanau, Hesperange, Hilversum, Horsham, Huddersfield, Kaluga, Kazan, Kelsterbach, Kerava, Klagenfurt, Koblenz, Kolding, Laakirchen, Ladenburg, Lahti, Lainate, Larne, Leiden, Liege, Maastricht, Malmo, Manati, Marseille, Munster, Naples, Nizhny-Novgorod, Northampton, Norwich, Nottingham, Novi Sad, Oberursel, Offenburg, Oosterhout, Orleans, Palau Solita i Plegamans, Peterborough, Pilsen, Poing, Portsmouth, Quattordio, Quickborn, Regensburg, Reims, Rickmansworth, Ringaskiddy. Rochdale, Rotkreuz, Rouen, Saarbrucken, Sarreguemines, Schwerte, Seville, Shannon, Sofia, Tallinn, Tampere, Tananger, Telford, Timisoara, Tiszaujvaros, Tremblay-en-France, Tubingen, Tuusula, Tychy, Ulm, Unterschleissheim, Upplands Vasby, Verona, Vilnius, Vitoria, Volketswil, Watford, Weesp, Welwyn Garden City, West Malling, Wetzlar, Winterthur, Yeovil, York, Zwolle (121)	Athens, Beaverton, Bloomington, Bowling Green, Cincinatti, Dover, Dublin, Fairmont, Fort Smith, Fort Wayne, Franklin Lakes, Hamilton (Canada), Harrisburg, Honolulu, Issaquah, Kanata, Lawrence, Lincoln, London, Little Rock, Marlborough, Maryville, North Wales, Ottawa, Pleansanton, Plymouth, Reading, Reno, Rochester, Shelton, Sidney, Sioux Falls (32)	Asan, Azumino, Canberra, Changwon, Chongqing, Dongguan, Fukui, Fukushima, Gumi, Gyeongju, Himeji, Huizhou, Imizu, Inazawa, Kakegawa, Kitakami, Koga, Kurashiki, Naha, Ningbo, Sakata, Sapporo, Shenyang, Shimonoseki, Uijeongbu, Utsonomiya, Yokosuka, Zhuhai (28)	Cape Town, East London, Lagos (3)	Betim, George Town, Guayaquil, Medellin, Panama City, Port of Spain, Santo Domingo, Toluca (8)	Rabat, Riyadh (2)	Bangalore, Karachi, Pune (3)	197 (12.1%)
1	Devnya, Limassol, Minsk, Mytilini, Pirot, Tbilisi; Austria (13), Belgium (25), Czech Republic (25), Denmark (3), Finland, (9), France (73), Germany (129), Hungary (14), Ireland (10), Italy (59), Lithuania (2), Luxembourg (9), Netherlands (26), Norway (10), Poland (36), Portugal (4), Romania (4), Russia (25), Slovakia (11), Slovenia (5), Spain, (37), Sweden (23), Switzerland (35), Turkey (2), Ukraine (2) United Kingdom (72); (669)	Canada (14), USA (174); (188)	Baguio, Batu Pahat, Hsinchu, Napier, Port Moresby; Australia (5), China (22), Indonesia (2), Japan (95), South Korea (16), Thailand (3); (148)	Abidjan, Bamako, Blantyre, Brazzaville, Dakar, Dar-es-Salaam, Libreville, Mazabuka, Niamey, Ouagadougou, Walvis Bay; South Africa (7); (18)	Barranquilla, Caracas, Cordoba, Curaçao, Montevideo, Quito, San Jose, San Salvador; Brazil (23), Chile (3), Mexico (12), Puerto Rico (4); (50)	Amman, Chekka; Algeria (3), Israel (2), Tunisia (2); (9)	Dhaka, Islamabad; India (3); (5)	1087 (66.9%)
Total	952 (58.6%)	320 (19.6%)	227 (14.0%)	26 (1.6%)	74 (4.5%)	15 (0.9%)	12 (0.7%)	1625 (100.0%)

Table 4.4 Regional and k-shell decomposition of the European network

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Latin America*	*Middle East*	*South Asia*	*Total*
12	Amsterdam, Basel, Brussels, Cologne, Dublin, Dusseldorf, Frankfurt, Hamburg, London, Luxembourg, Madrid, Mannheim, Milan, Moscow, Munich, Paris, Rome, Schaffhausen, Slough, St Helier, Stockholm, Stuttgart, Utrecht, Warsaw, Zurich (25)	Chicago, Minneapolis, New York, San Francisco (4)	Seoul, Sydney, Tokyo (3)		Sao Paulo (1)			33 (2.7%)
11	Barcelona, Budapest, Copenhagen, Espoo, The Hague, Hanover, Helsinki, Oslo, Prague, Rotterdam, Trieste, Turin, Vevey, Vienna (14)	Dallas, Los Angeles, St Louis, St Petersburg, Washington (5)	Hong Kong, Singapore (2)		Mexico City (1)			22 (1.8%)
10	Berlin, Darmstadt, Walldorf (3)	Atlanta, Milwaukee (2)	Osaka (1)		Buenos Aires (1)		Mumbai (1)	8 (0.6%)
9	Chertsey, Crawley, Hemel Hempstead, Leuven, Lisbon, Newbury (6)	Armonk, Hamilton (Bermuda), Toronto (3)	Bangkok (1)					10 (0.8%)
8	Antwerp, Bristol, Bucharest, Essen, Geneva, Heerlen, Heidelberg, Istanbul, Swindon, Trappes, Zug (11)	Boston, Cincinnati, Cleveland, Detroit, Houston, New Brunswick, Norwalk, Philadelphia (8)	Kuala Lumpur, Shanghai, Toyota (3)			Tel-Aviv (1)		23 (1.9%)
7	Athens, Birmingham, Gothenburg, Herzogenaurach, Lyon, Manchester, Swords (7)	Whitehouse Station (1)	Hiroshima, Melbourne (2)	Johannesburg (1)				11 (0.9%)
6	Bilbao, Bracknell, Bratislava, Bremen, Bunnik, Cergy, Hoofddorp, Karlsruhe, Linz, Mainz, Sandviken, Stavanger, Treviso (13)	North Chicago, Phoenix, Seattle (3)	Beijing, Suwa (2)		Bogota, Rio de Janeiro (2)			20 (1.6%)
5	Aberdeen, Bad Homburg, Bonn, Breda, Duisburg, Farnborough, Guildford, Hertogenbosch, Kunzelsau, Lille, Maidenhead, Pozuelo de Alarcon, Reading, Salzgitter, Selm, Windsor, Zagreb (17)	Akron, Benton Harbor, Charlotte, Framingham, Hartford, Pittsburgh, Stamford (7)	Manila (1)		Lima, Santiago (2)			27 (2.2%)
4	Augsburg, Basingstoke, Bologna, Derby, Dortmund, Edinburgh, Eschborn, Genoa, Ghent, Glasgow, High Wycombe, Krefeld, Lausanne, Luton, Majadahonda, Neu Isenburg, Olten, Palma, Redhill, St Petersburg, Tres Cantos, Warwick, Wroclaw, Wuppertal (24)	Fairfield, Louisville, Montreal, Morristown, Purchase, Wilmington (6)	Kyoto, Shizuoka, Taipei (3)		Manaus (1)	Dubai (1)		35 (2.8%)
3	Aachen, Baden, Basel, Belfast, Bielefeld, Bielsko-Biala, Camberley, Cambridge, Charleroi, Cork, Coventry, Florence, Funchal, Haarlem, Katowice, Krakow, Leeds, Leicester, Mechelen, Meerbusch, Nuremberg, Oberhausen, Oeiras, Oostende, Ostrava, Perth, Plock, Poznan, Ratingen, Richmond, Russelsheim, Schwalbach, Toulouse, Valletta, Warrington, Woking (36)	Columbus, Indianapolis, Melville, Miami, Peoria, Raleigh, Richmond (7)	Auckland, Brisbane, Jakarta (3)	Nairobi (1)	Curitiba (1)	Casablanca (1)	Delhi, Kolkata (2)	51 (4.1%)

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Latin America*	*Middle East*	*South Asia*	*Total*
2	Aarau, Aarhus, Addlestone, Alcala de Henares, Almere, Almetyevsk, Aprilia, Arnhem, Aschaffenburg, Baar, Baarn, Basildon, Belgrade, Bensheim, Bergen, Bethune, Biskupice-Podgorne, Bochum, Borehamwood, Born, Bradford, Breukelen, Brunswick, Bussy-St-Georges, Cagliari, Cardiff, Celle, Cernusco sul Naviglio, Cheadle, Dielsdorf, Drunen, Duren, Ede, Eindhoven, Enkhuizen, Fleurus, Fribourg, Gouda, Granollers, Graz, Grenoble, Halifax, Hanau, Hesperange, Hilversum, Horsham, Huddersfield, Kaluga, Kazan, Kelsterbach, Kerava, Klagenfurt, Koblenz, Kolding, Laakirchen, Ladenburg, Lahti, Larne, Leiden, Liege, Maastricht, Malmo, Marseille, Milton Keynes, Munster, Naples, Nizhny Novgorod, Northampton, Norwich, Nottingham, Novi Sad, Oberursel, Offenburg, Oosterhout, Orleans, Palau Solita i Plegamans, Peterborough, Pilsen, Poing, Portsmouth, Quickborn, Regensburg, Reims, Rickmansworth, Ringaskiddy, Rochdale, Rotkreuz, Rouen, Saarbrucken, Sarreguemines, Schwerte, Seville, Shannon, Sofia, Stevenage, Tallinn, Tampere, Tananger, Telford, Timisoara, Tiszaujvaros, Tremblay-en-France, Tubingen, Tuusula, Tychy, Ulm, Unterschleissheim, Upplands Vasby, Verona, Vilnius, Vitoria, Volketswil, Watford, Weesp, Welwyn Garden City, Wetzlar, Winterthur, Yeovil, York, Zwolle (121)	Austin, Beaverton, Birmingham, Calgary, Dayton, Denver, Greensboro, Greenville, Hopkinton, Huntsville, Jacksonville, Las Vegas, Little Rock, Memphis, Moline, Nashville, New Orleans, Omaha, Princeton, Smithfield, Thousand Oaks (21)	Adelaide, Guangzhou, Hamamatsu, Kariya, Nagoya, Nanjing, Suzhou, Wellington, Wuxi (9)	Lagos, Pretoria (2)	Belo Horizonte, Betim, Guayaquil, Monterrey, Porto Alegre, Willemstad (6)	Cairo, Rabat, Riyadh (3)	Karachi (1)	163 (13.1%)
1	Devnya, Limassol, Minsk, Mytilini, Pirot, Tbilisi; Austria (13), Belgium (24), Czech Republic (25), Denmark (3), Finland (9), France (73), Germany (129), Hungary (14), Ireland (10), Italy (60), Lithuania (2), Luxemboug (9), Netherlands (26), Norway (10), Poland (35), Portugal (4), Romania (4), Russia (25), Slovakia (11), Slovenia (5), Spain (38), Sweden (23), Switzerland (35), Turkey (2), Ukraine (2), United Kingdom (72); (669)	Canada (7), USA (81); (88)	Bayan Lepas, Chon Buri, Hsinchu, Malang; Australia (4), China (5), Japan (2), Korea (8); (23)	Abidjan, Bamako, Blantyre, Dakar, Dar es Salaam, Douala, Libreville, Mazabuka, Niamey, Ouagadougou; South Africa (7); (17)	Caracas, Cordoba, George Town, Panama City, Port of Spain, San Jose, San Salvador, Santo Domingo; Brazil (12), Chile (2), Colombia (2),Mexico (6); (30)	Amman, Chekka, Shoham; Algeria (2), Tunisia (2); (7)	Dhaka, Islamabad; India (4); (6)	840 (67.6%)
Total	946 (76.1%)	155 (12.5%)	53 (4.3%)	21 (1.7%)	45 (3.6%)	13 (1.0%)	10 (0.8%)	1243 (100.0%)

Table 4.5 Regional and k-shell decomposition of the North American network

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Latin America*	*Middle East*	*South Asia*	*Total*
9	Amsterdam, Brussels, Dublin, London, Madrid, Milan, Munich, Paris, Schaffhausen, Stockholm, Zurich (11)	Armonk, Atlanta, Boston, Charlotte, Chicago, Cincinnati, Columbus, Dallas, Denver, Hamilton (Bermuda), Hartford, Houston, Indianapolis, Los Angeles, Louisville, Milwaukee, Minneapolis, Montreal, New Brunswick, New York, North Chicago, Norwalk, Omaha, Philadelphia, Phoenix, Pittsburgh, San Francisco, Seattle, Toronto, Washington, Whitehouse Station, Wilmington (32)	Melbourne, Seoul, Singapore, Sydney, Tokyo (5)		Mexico City, Sao Paulo (2)			50 (6.8%)
8	Rome, Sandviken (2)	Akron, Cleveland, Detroit, Miami, Purchase, Richmond (6)	Osaka, Shanghai (2)					10 (1.4%)
7	Basel, Dusseldorf, The Hague, Luxembourg, Newbury (5)	Melville (1)	Hong Kong (1)		Buenos Aires (1)			8 (1.1%)
6	Geneva, Hamburg, Moscow, Rotterdam (4)	Austin, Fairfield, Framingham, Nashville, Orlando, Peoria, Salt Lake City, St Louis (8)					Mumbai (1)	13 (1.8%)
5	Bracknell, Cologne, Copenhagen (3)	Benton Harbor, Calgary, Eden Prairie, Franklin, Midland, Morristown, San Diego, Stamford (8)		Johannesburg (1)	Monterrey, Santiago (2)		Delhi (1)	15 (2.0%)
4	Hanover, Leeds, Oslo, St Helier, Stevenage, Turin, Utrecht, Warsaw (8)	Baltimore, Battle Creek, Bentonville, Dayton, Kansas City, Las Vegas, Memphis, Moline, Providence, Raleigh, Smithfield, Tampa, Vancouver (13)	Bangkok, Kuala Lumpur, Shenzhen, Suzhou (4)		Porto Alegre (1)	Tel-Aviv (1)		27 (3.7%)
3	Bad Homburg, Barcelona, Birmingham, Chertsey, Darmstadt, Heerlen, Heidelberg, Leatherhead, Maidenhead, Mainz, Neu Isenburg, Newcastle, Sant Cugat del Valles, Slough, Swords, Windsor (16)	Bridgeport, Columbia, Decatur, Des Moines, Edmonton, Farmington Hills, Greenville, Hampton, Huntsville, Jackson, Jacksonville, Madison, Middletown, New Orleans, Norfolk, Portland, Princeton, San Antonio, Savannah, Thousand Oakes, Toledo, Tulsa, Warren, Waterloo, Wichita, Windsor, Woonsocket (27)	Auckland, Manila, Toyota (3)		Bogota (1)			47 (6.4%)
2	Aarhus, Antwerp, Aprilia, Athens, Basingstoke, Berlin, Bielefeld, Bilbao, Bonn, Breda, Bremen, Cambridge, Cork, Crawley, Edinburgh, Espoo, Farnborough, Frankfurt, Gothenburg, Haarlem, Hemel Hempstead, Hoofddorp, Istanbul, Koblenz, Larne, Leicester, Lyon, Manchester, Mannheim, Mechelen, Orleans, Portsmouth, Prague, Reading, Redhill, Richmond, Schwalbach, St Petersburg, Stavanger, Stuttgart, Vevey, Walldorf, Watford, West Malling, Wroclaw, Wuppertal, Zug (47)	Athens, Beaverton, Birmingham, Bloomington, Bowling Green, Denver, Dublin, Fairmont, Fort Smith, Fort Wayne, Franklin Lakes, Greensboro, Hamilton (Canada), Harrisburg, Honolulu, Hopkinton, Issaquah, Kanata, Lawrence, Lincoln, London, Marlborough, Maryville, North Wales, Ottawa, Pleasanton, Plymouth, Reading, Reno, Rochester, San Ramon, Shelton, Sidney, Sioux Falls (35)	Anyang, Bayan Lepas, Beijing, Chon Buri, Guanghou, Hangzhou, Jakarta, Kariya, Nagoya (9)	Durban (1)	Lima, Manati, Manaus, Rio de Janeiro, San Juan, Sumare, Willemstad (7)		Chennai, Pune (2)	101 (13.7%)

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Latin America*	*Middle East*	*South Asia*	*Total*
1	Bratislava, Kiev, Kranj, Tbilisi; Austria (3), Belgium (7), Czech Republic (3), Finland (4), France (21), Germany (42), Hungary (3), Ireland (8), Italy (15), Luxembourg (3), Netherlands (16), Norway (3), Poland (11), Portugal (2), Romania (3), Spain (7), Sweden (8), Switzerland (15), United Kingdom (45); (223)	Canada (14), USA (172); (186)	Baguio, Bogor; Australia (4), China (12), Japan (6), Korea (7); (31)	Douala, East London (2)	Calama, Curaçao, George Town, Medellin, Montevideo, Panama City, Port of Spain, Santo Domingo; Brazil (6), Mexico (5), Puerto Rico (4); (23)	Cairo (1)	Bangalore (1)	467 (63.3%)
Total	319 (43.2%)	316 (42.8%)	55 (7.5%)	4 (0.5%)	37 (5.0%)	2 (0.3%)	5 (0.7%)	738 (100.0%)

Table 4.6 Regional and k-shell decomposition of the East Asian network

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Latin America*	*Middle East*	*South Asia*	*Total*
7	Amsterdam, Brussels, London, Munich, Paris, Schaffhausen, Stockholm (7)	Chicago, Dallas, Los Angeles, Louisville, Minneapolis, New York, San Francisco (7)	Bangkok, Beijing, Hong Kong, Kariya, Kuala Lumpur, Melbourne, Nagoya, Osaka, Seoul, Shanghai, Shenzhen, Shizuoka, Singapore, Suzhou, Sydney, Tokyo, Toyota (17)					31 (6.1%)
6	Cologne, Madrid, Milan, Moscow, Zurich (5)		Hiroshima, Kyoto, Suwa, Taipei (4)					9 (1.8%)
5	Dublin, Vevey (2)	Atlanta, Pittsburgh, Toronto, Wilmington (4)	Auckland, Chon Buri, Guangzhou, Jakarta, Manila, Tianjin (6)	Johannesburg (1)				13 (2.6%)
4	Basel, Heerlen, Sandviken, Slough, St Helier (5)	Detroit, Hartford, Houston, New Brunswick, San Ramon, St Petersburg, Washington, Whitehouse Station (8)	Brisbane, Fukuoka, Kitakyushu, Nanjing, Perth, Wuxi (6)					19 (3.8%)
3	Dusseldorf, Frankfurt, Heidelberg, Mannheim, Meerbusch, Stuttgart, Utrecht, Walldorf (8)	Akron, Cincinnati, Hamilton (Bermuda), Peoria, Phoenix, San Diego, Seattle (7)	Adelaide, Ansan, Anyang, Busan, Dalian, Hamamatsu, Hangzhou, Incheon, Pohang, Qingdao, Sendai, Seongnam, Seosan, Siheung, Takasaki, Ulsan (16)				Delhi (1)	32 (6.3%)
2	Almere, Biskupice-Podgorne, Chertsey, Crawley, Darmstadt, Espoo, Geneva, Glasgow, Hamburg, Hanover, Helsinki, Hertogenbosch, Herzogenaurach, High Wycombe, Hoofddorp, Laakirchen, Pilsen, Swords, Trappes, Warsaw (20)	Armonk, Austin, Boston, Cleveland, Columbus, Indianapolis, Melville, Midland, Milwaukee, North Chicago, Purchase, St Louis (12)	Asan, Azumino, Bayan Lepas, Canberra, Changwon, Chongqing, Dongguan, Fukui, Fukushima, Gumi, Gyeongju, Himeji, Huizhou, Imizu, Inazawa, Kakegawa, Kitakami, Koga, Kurashiki, Naha, Ningbo, Sakarta, Sapporo, Shenyang, Shimonoseki, Uijeongbu, Utsunomiya, Wellington, Yokosuka, Zhuhai (30)		Manaus, Mexico City, Monterrey, San Juan (4)		Mumbai (1)	67 (13.2%)
1	Copenhagen, Hesperange, Jorvas, Valletta; Austria (3), Belgium (7), Czech Republic (6), France (9), Germany (26), Hungary (3), Italy (13), Netherlands (8), Poland (5), Russia (3), Slovakia (4), Spain (8), Sweden (3), United Kingdom (25); (127)	Canada (2), USA (46); (48)	Baguio, Batu Pahat, Hsinchu, Napier, Port Moresby; Australia (5), China (22), Indonesia (2), Japan (95), South Korea (16), Thailand (3); (148)		Buenos Aires, Bogota, Quito, San Salvador; Brazil (2), Mexico (3); (9)	Dubai, Tel-Aviv (2)	Chennai (1)	335 (66.2%)
Total	174 (34.4%)	86 (17.0%)	227 (44.9%)	1 (0.2%)	13 (2.6%)	2 (0.4%)	3 (0.6%)	506 (100.0%)

Table 4.7 Regional and k-shell decomposition of the Sub-Saharan African network

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Total*
2	Hamburg, London, Paris (3)			Cape Town, Douala, Durban, Johannesburg, Lagos, Nairobi, Pretoria (7)	10 (17.2%)
1	Brussels, Catania, Crawley, Ede, Heerlen, High Wycombe, Luxembourg, Munich, Newbury, Schaffhausen, Stuttgart, Zurich, 12)	Akron, Bentonville, Cincinnati, Dallas, Fairfield, Houston, Omaha, Pittsburgh, Portland, San Francisco, Toronto, Washington (12)	Auckland, Nagoya, Singapore, Sydney, Tokyo (5)	Abidjan, Bamako, Blantyre, Bloemfontein, Brazzaville, Dakar, Dar es Salaam, East London, Evander, Libreville, Mazabuka, Niamey, Ouagadougou, Phalaborwa, Polokwane, Port Elizabeth, Secunda, Vanderbijlpark, Walvis Bay (19)	48 (82.8%)
Total	15 (25.9%)	12 (20.7%)	5 (8.6%)	26 (44.8%)	58 (100.0%)

Table 4.8 Regional and k-shell decomposition of the Latin American network

k	*Europe*	*North America*	*East Asia*	*Latin America*	*South Asia*	*Total*
5	Bilbao, London, Madrid, Paris (4)	Washington (1)		Bogota, Buenos Aires, Lima, Mexico City, Porto Alegre, Rio de Janeiro, Santiago, Sao Paulo (8)		13 (8.2%)
4	Leuven, Zurich (2)	Dallas, New York (2)				4 (2.5)
3	Basel, Brussels, Darmstadt, Milan, Stockholm, Stuttgart (6)	Benton Harbor, Chicago, Hamilton (Bermuda), Toronto, Wilmington (5)	Sydney, Tokyo (2)	Curitiba, Manaus, Monterrey (3)		16 (10.1%)
2	Amsterdam, Barcelona, Cologne, Luxembourg, Munich, Oslo, Reading, Rome, Swords, Turin, Utrecht (11)	Houston, Los Angeles, Milwaukee, Peoria, Purchase, St Louis, Whitehouse Station (7)	Seoul (1)	Belo Horizonte, Betim, George Town, Guayaquil, Manati, Medellin, Panama City, Port of Spain, Santo Domingo, Toluca, Willemstad (11)		30 (18.9%)
1	Bergen, Bielefeld, Dublin, Hanover, Herzogenaurach, Linz, Lisbon, Mannheim, Sandviken, Slough, St Helier, Sunderland, Sundsvall, Vevey, Vitoria (15)	Akron, Armonk, Atlanta, Beaverton, Bentonville, Boston, Calgary, Cambridge, Charlotte, Cincinnati, Cleveland, Columbus, Detroit, Memphis, Miami, Midlothian, Minnneapolis, Moline, North Chicago, Norwalk, Phoenix, Pittsburgh, San Diego, San Francisco, Sayreville, St Petersburg, Tampa, Thousand Oaks, Tulsa (29)	Osaka, Singapore (2)	Aguascalientes, Antofagasta, Arecibo, Barcarena, Barceloneta, Barranquilla, Belem, Brasilia, Cabo Santo Agostinho, Calama, Caracas, Cienega de Flores, Ciudad del Carmen, Cordoba, Coronel, Cubatao, Curaçao, Florianopolis, Gaspar, Guadalajara, Guayama, Hermosillo, Horizontina, Irapuato, Jacarei, Juncos, Limeira, Maringa, Mexicali, Mogi Guacu, Montevideo, Niteroi, Nova Lima, Ouro Branco, Piracicaba, Quito, Recife, Salvador, San Jose, San Juan del Rio, San Juan, Serra, Sumare, Taubate, Tijuana, Tlajomulco de Zuniga, Varzea Paulista, Villahermosa, Vitoria (49)	Mumbai (1)	96 (60.4%)
Total	38 (23.9%)	44 (27.7%)	5 (32.1%)	71 (44.7%)	1 (0.6%)	159 (100.0%)

Table 4.9 Regional and k-shell decomposition of the Middle Eastern network

k	*Europe*	*North America*	*East Asia*	*Middle East*	*Total*
2	Milan, Paris, Zurich (3)			Cairo, Rabat, Riyadh, Tel-Aviv (4)	7 (15.6%)
1	Amsterdam, Berlin, Bielefeld, Bristol, Castleford, Dresden, Krakow, London, Luxembourg, Mannheim, Newbury, Prague, Saltburn by the Sea, Slough, Treviso, Trieste, Ulm, Utrecht, Vevey, Zagreb (20)	Los Angeles, Miami, New York, North Wales, Toronto (5)	Nagoya, Taipei (2)	Algiers, Amman, Annaba, Beer-Sheva, Casablanca, Chekka, Dubai, Monastir, Oran, Shoham, Tunis (11)	38 (84.4%)
Total	23 (51.1%)	5 (11.1%)	2 (4.4%)	15 (33.3%)	45 (100.0%)

Table 4.10 Regional and k-shell decomposition of the South Asian network

k	*Europe*	*North America*	*East Asia*	*Latin America*	*South Asia*	*Total*
2	Amsterdam, London, Munich, Newbury, Paris (5)	San Francisco (1)	Seoul (1)		Chennai, Delhi, Karachi, Kolkata, Mumbai (5)	12 (21.1%)
1	Basel, Brussels, Coventry, Darmstadt, Dudelange, Funchal, Gottingen, Heidelberg, Milan, Moscow, Reading, Rome, Sandviken, Schwalbach, Stockholm, Vevey, Warrington, Warwick, Zurich (19)	Akron, Atlanta, Benton Harbor, Chicago, Columbus, Detroit, Los Angeles, Minneapolis, New York, Purchase, Toronto, Wilmington (12)	Gunsau, Hamamatsu, Perth, Sydney, Tokyo, Yeongju (6)	Sao Paulo (1)	Ahmedabad, Bangalore, Dhaka, Islamabad, Junagadh, Pune, Tumkur (7)	45 (78.9%)
Total	24 (42.1%)	13 (22.8%)	7 (12.3%)	1 (1.8%)	12 (21%)	57 (100.0%)

4.1.3. Global core and peripheral cities

As has been seen, each network may be decomposed into four types of locations: (a) core cities in core regions, (b) peripheral cities and towns in core regions, (c) core cities in peripheral regions, and (d) peripheral cities and towns in peripheral regions. For example, the number of locations of each type in the global network is shown in the following table.

Table 4.11 Global core and peripheral cities

(No. of cities)	*Core regions*	*Peripheral regions*	*Total*
Core cities	313 (A)	28 (C)	341 (21.0%)
Peripheral cities (and towns)	1,186 (B)	98 (D)	1,284 (79.0%)
Total	1,499 (92.2%)	126 (7.8%)	1,625 (100.0%)

It is immediately obvious that peripheral cities and towns in core regions constitute by far the largest of the four sets of locations within the global network. However, recall that any network must be by definition simply some extracted part of the global network. This means that every location in any of the regional networks (or the sectoral networks which are to follow), whichever type they are within their own networks, may also be classified according to the type of location they are in the global network. In effect, there are four types of cities in the world, as described in the introduction:

A. Cities in the core of the global network and in a core region of the global network, such as London, New York or Tokyo;
B. Cities (and towns) in the periphery of the global network but in a core region of the global network, such as Izmir, Rochester or Pingdingshan;
C. Cities in the core of the global network but in a peripheral region of the global network, such as Johannesburg, Sao Paulo or Mumbai; and,
D. Cities (and towns) in the periphery of the global network and in a peripheral region of the global network, such as Lagos, Quito or Kochi.

These types—A, B, C and D—will be referred to by these letters here and in later chapters (as they have been in the table above) when it becomes necessary to refer to them often.

It may be useful to recall the difference between being in the core or the periphery, and being in a core or peripheral region. To be in the core or the periphery means to be a city or town with a certain position in the network, regardless of the number of networked cities and towns in one's region. To be in a core or peripheral region means to be a city or town in a region whose character is determined by the number of networked cities and towns within it, rather than by the positions of any of those cities or towns.

This is a classification system that extends beyond the cities and towns appearing in the dataset to any city and town in the world. Any city and town in the world may obviously be classified by its region. But any city and town in the world not appearing in the dataset may also be classified by default as being in the periphery of the global network. Thus any city and town in the world not appearing in the dataset may be a type B or type D city. It thus becomes obvious that while there are 341 type A or type C cities in the world, the number of type B or type D cities and towns are innumerable. These classifications are important because of the emphasis the "global cities" literature places on type A and C cities in the articulation of the global economy. As will be discussed in later chapters, the real story may be quite subtly different.

4.1.4. Outlying cities

Apart from a general decomposition of the cities and towns in each part of each network, the elevation views presented in the atlas show very strongly that a tiny number of cities are clear outliers in each network. For example, in the global network (Figure A.2), London and Paris have vertical positions nearly twice as high as the third highest city, Tokyo, and far above the remaining 1,622 cities that constitute this network. The existence of these outliers indicates the existence of specialised roles within the network, for example sectoral clusters of global significance (e.g. the San Francisco area's IT cluster), functional clusters of global significance (e.g. London and Paris's role as favourable locations for MNE headquarters) or functional clusters of regional significance (e.g. Johannesburg's role as a gateway to Sub-Saharan Africa).

To illustrate this, the first step taken is to catalogue the outliers in each network. Outliers are identified along four attributes used in the construction of the elevation views: outdegree, indegree, total degree and net degree. Outdegree is the sum of ties sent out from a location, an indicator of the sum of parent companies headquartered there. Indegree is the sum of ties directed into a location, an indicator of the sum of subsidiaries headquartered there. Total degree is the sum of these two figures; this was used to determine the size of the circle representing each location in both the plan and elevation views of each network. (Originally formulated by Freeman (1979), these attributes are among the most basic in social network analysis.) Net degree is the difference between the two figures (i.e. outdegree minus indegree); this was used to determine the vertical position of the circle representing each location in the elevation views as explained in the methodology. For outdegree, indegree and total degree, an outlier is defined as any location whose value on one of those attributes is in the top half of the range of values exhibited by all locations on that attribute. For net degree, an outlier is as any location whose value is in the top half of the range of all net positive values or in the bottom half of the range of all net negative values. For example, in the global network (Figure A.2), London and Paris are the only outliers in the top half of all net positive values, while Hong Kong and The Hague are the only outliers in the bottom half of all net negative values.

The outliers for each of the global and regional networks on all of these attributes are shown in the tables below. Outliers on outdegree or positive net degree may suggest the presence of a

"headquarter city"—a city or town hosting the headquarters of several parent companies. Outliers on indegree or negative net degree suggest the presence of a "foothold city"—a city or town hosting several subsidiaries, that is, places where MNEs have a "foothold". Outliers on total degree are not necessarily "headquarter" or "foothold" cities but may suggest the presence of other forms of specialisation, sectoral or functional. These roles are indicated in the tables. The tables also indicate the strength of each outlier by showing the margin between them and the largest non-outlier for the relevant attribute; the tables are also ranked by this margin value. It is immediately apparent that there are a lot of redundancy and a lot of theoretically significant (in the sense of Seidman (1983)) cases in these tables, which will be discussed immediately below them.

Table 4.12 Outlying cities in the global network

City	*Outlying attribute*	*Value ($ m)*	*Largest non-outlier*	*Margin*	*Role indicated*
London (k = 15)	Total degree	2,790,415	1,173,900	1,616,515	Specialised city
London (k = 15)	Outdegree	2,043,127	831,533	1,211,594	Headquarter city
London (k = 15)	Net degree (positive)	1,295,839	489,166	806,673	Headquarter city
Paris (k = 15)	Net degree (positive)	1,224,177	489,166	735,011	Headquarter city
Paris (k = 15)	Outdegree	1,559,342	831,533	727,809	Headquarter city
Paris (k = 15)	Total degree	1,894,507	1,173,900	720,607	Specialised city
Hong Kong (k = 15)	Net degree (negative)	700,627	254,984	445,643	Foothold city
London (k = 15)	Indegree	747,288	370,163	377,125	Foothold city
Hong Kong (k = 15)	Indegree	711,523	370,163	341,360	Foothold city
The Hague (k = 14)	Net degree (negative)	582,948	254,984	327,964	Foothold city
The Hague (k = 14)	Indegree	624,032	370,163	253,869	Foothold city
Johannesburg (k = 12)	Indegree	415,415	370,163	45,252	Foothold city

Table 4.13 Outlying cities in the European network

City	*Outlying attribute*	*Value ($ m)*	*Largest non-outlier*	*Margin*	*Role indicated*
London (k = 12)	Total degree	2,790,415	685,258	2,105,157	Specialised city
London (k = 12)	Outdegree	2,043,127	417,009	1,626,118	Headquarter city
Paris (k = 12)	Total degree	1,894,507	685,258	1,209,249	Specialised city
Paris (k = 12)	Outdegree	1,559,342	417,009	1,142,333	Headquarter city
London (k = 12)	Net degree (positive)	1,295,839	375,402	920,437	Headquarter city
Paris (k = 12)	Net degree (positive)	1,224,177	375,402	848,775	Headquarter city
London (k = 12)	Indegree	747,288	370,163	377,125	Foothold city
The Hague (k = 11)	Net degree (negative)	582,948	221,516	361,432	Foothold city
The Hague (k = 11)	Indegree	624,032	370,163	253,869	Foothold city
Hong Kong (k = 11)	Net degree (negative)	419,084	221,516	197,568	Foothold city
Johannesburg (k = 7)	Net degree (negative)	307,484	221,516	85,968	Foothold city
Hong Kong (k = 11)	Indegree	420,997	370,163	50,834	Foothold city

Table 4.14 Outlying cities in the North American network

City	*Outlying attribute*	*Value ($ m)*	*Largest non-outlier*	*Margin*	*Role indicated*
New York (k = 9)	Total degree	1,044,711	479,314	565,397	Specialised city
New York (k = 9)	Outdegree	692,730	204,734	487,996	Headquarter city
Dallas (k = 9)	Outdegree	574,453	204,734	369,719	Headquarter city
Dallas (k = 9)	Net degree (positive)	440,475	132,009	308,466	Headquarter city
San Francisco (k = 9)	Outdegree	472,469	204,734	267,735	Headquarter city
London (k = 9)	Total degree	735,911	479,314	256,597	Specialised city
San Francisco (k = 9)	Net degree (positive)	365,202	132,009	233,193	Headquarter city
Dallas (k = 9)	Total degree	708,431	479,314	229,117	Specialised city
New York (k = 9)	Net degree (positive)	340,749	132,009	208,740	Headquarter city
London (k = 9)	Indegree	363,097	162,471	200,626	Foothold city
New York (k = 9)	Indegree	351,981	162,471	189,510	Foothold city
London (k = 9)	Outdegree	372,814	204,734	168,080	Headquarter city
Chicago (k = 9)	Indegree	316,562	162,471	154,091	Foothold city
Amsterdam (k = 9)	Net degree (negative)	229,864	104,307	125,557	Foothold city
Amsterdam (k = 9)	Indegree	270,780	162,471	108,309	Foothold city
San Francisco (k = 9)	Total degree	579,736	479,314	100,422	Specialised city
Hong Kong (k = 7)	Net degree (negative)	162,287	104,307	57,980	Foothold city
Chicago (k = 9)	Net degree (negative)	153,810	104,307	49,503	Foothold city

Table 4.15 Outlying cities in the East Asia network

City	*Outlying attribute*	*Value ($ m)*	*Largest non-outlier*	*Margin*	*Role indicated*
Tokyo (k = 7)	Total degree	1,173,900	448,385	725,515	Specialised city
Tokyo (k = 7)	Outdegree	831,533	304,552	526,981	Headquarter city
Hong Kong (k = 7)	Net degree (negative)	700,627	254,984	445,643	Foothold city
Hong Kong (k = 7)	Indegree	711,523	332,367	379,156	Foothold city
Hong Kong (k = 7)	Total degree	722,419	448,385	274,034	Specialised city
Tokyo (k = 7)	Net degree (positive)	489,166	222,531	266,635	Headquarter city

Table 4.16 Outlying cities in the Sub-Saharan African network

City	*Outlying attribute*	*Value ($ m)*	*Largest non-outlier*	*Margin*	*Role indicated*
Johannesburg (k = 2)	Total degree	589,401	96,138	493,263	Specialised city
Johannesburg (k = 2)	Indegree	415,415	94,733	320,682	Foothold city
London (k = 2)	Total degree	380,046	96,138	283,908	Specialised city
London (k = 2)	Net degree (positive)	367,540	96,138	271,402	Headquarter city
London (k = 2)	Outdegree	373,793	173,986	199,807	Headquarter city
Johannesburg (k = 2)	Net degree (negative)	241,429	94,733	146,696	Foothold city

Table 4.17 Outlying cities in the Latin American network

City	*Outlying attribute*	*Value ($ m)*	*Largest non-outlier*	*Margin*	*Role indicated*
Sao Paulo (k = 5)	Indegree	140,557	47,350	93,207	Foothold city
Sao Paulo (k = 5)	Net degree (negative)	132,749	42,352	90,397	Foothold city
Sao Paulo (k = 5)	Total degree	148,365	72,497	75,868	Specialised city
Mexico City (k = 5)	Indegree	112,543	47,350	65,193	Foothold city
Paris (k = 5)	Outdegree	126,239	61,876	64,363	Headquarter city
Paris (k = 5)	Net degree (positive)	125,703	61,876	63,827	Headquarter city
Mexico City (k = 5)	Net degree (negative)	103,362	42,352	61,010	Foothold city
Paris (k = 5)	Total degree	126,775	72,497	54,278	Specialised city
Willemstad (k = 2)	Indegree	100,728	47,350	53,378	Foothold city
Mexico City (k = 5)	Total degree	121,724	72,497	49,227	Specialised city
Willemstad (k = 2)	Total degree	118,106	72,497	45,609	Specialised city
Willemstad (k = 2)	Net degree (negative))	83,350	42,352	40,998	Foothold city
Madrid (k = 5)	Outdegree	72,497	61,876	10,621	Headquarter city
Madrid (k = 5)	Net degree (positive)	72,497	61,876	10,621	Headquarter city

Table 4.18 Outlying cities in the Middle Eastern network

City	*Outlying attribute*	*Value ($ m)*	*Largest non-outlier*	*Margin*	*Role indicated*
Paris (k = 2)	Total degree	27,048	9,134	17,914	Specialised city
Paris (k = 2)	Outdegree	26,874	9,134	17,740	Headquarter city
Paris (k = 2)	Net degree (positive)	26,700	9,134	17,566	Headquarter city
Tel-Aviv (k = 2)	Total degree	26,064	9,134	16,930	Specialised city
Oran (k = 1)	Indegree	20,281	5,250	15,031	Foothold city
Oran (k = 1)	Net degree (negative)	20,281	5,250	15,031	Foothold city
Tel-Aviv (k = 2)	Outdegree	22,907	9,134	13,773	Headquarter city
Algiers (k = 1)	Total degree	20,789	9,134	11,655	Specialised city
Algiers (k = 1)	Outdegree	20,281	9,134	11,147	Headquarter city
Oran (k = 1)	Total degree	20,281	9,134	11,147	Specialised city
Tunis (k = 1)	Indegree	15,903	5,250	10,653	Foothold city
Tunis (k = 1)	Net degree (negative)	15,903	5,250	10,653	Foothold city
Algiers (k = 1)	Net degree (positive)	19,773	9,134	10,639	Headquarter city
Tel-Aviv (k = 2)	Net degree (positive)	19,750	9,134	10,616	Headquarter city
Dubai (k = 1)	Indegree	14,445	5,250	9,195	Foothold city
Dubai (k = 1)	Net degree (negative)	14,445	5,250	9,195	Foothold city
Tunis (k = 1)	Total degree	15,903	9,134	6,769	Specialised city
Dubai (k = 1)	Total degree	14,445	9,134	5,311	Specialised city

Table 4.19 Outlying cities in the South Asian network

City	*Outlying attribute*	*Value ($ m)*	*Largest non-outlier*	*Margin*	*Role indicated*
Mumbai (k = 2)	Total degree	54,958	17,268	37,690	Specialised city
Mumbai (k = 2)	Outdegree	42,272	7,131	35,141	Headquarter city
Mumbai (k = 2)	Net degree (positive)	29,586	7,131	22,455	Headquarter city
Delhi (k = 2)	Indegree	17,268	6,535	10,733	Foothold city
Delhi (k = 2)	Net degree (negative)	17,268	6,535	10,733	Foothold city
Mumbai (k = 2)	Indegree	12,686	6,535	6,151	Foothold city
Atlanta (k = 1)	Indegree	10,577	6,535	4,042	Foothold city
Atlanta (k = 1)	Net degree (negative)	10,577	6,535	4,042	Foothold city
Toronto (k = 1)	Indegree	8,639	6,535	2,104	Foothold city
Toronto (k = 1)	Net degree (negative)	8,639	6,535	2,104	Foothold city

We may prune these tables in the following manner. Where the same role is indicated twice for the same city in the same network, discard the instance with the lower margin. Where both "headquarter" and "foothold" roles are indicated for the same city in the same network (which by definition means that a "specialised" role is also indicated), and the margin for one is twice the margin for the other (which is usually the case), discard the lower; otherwise, discard both and retain only the "specialised" role (which is the case only for London in the North American network). Where a "specialised" role is indicated alongside only one other role (i.e. one only of "headquarter" or "foothold") for the same city in the same network, discard the "specialised" role. Finally, discard any cities with $k \leq 2$ in a given network, since according to the interpretation of Seidman (1983) used here, the roles these cities play cannot be network-wide. This leaves us with 14 cities worth highlighting at this stage as shown in Table 4.20.

We could of course have collapsed these further. London and Paris' regional roles are simply reflective of their roles as headquarter cities at the global level; likewise, Hong Kong, The Hague and Johannesburg's regional roles are reflective of their roles as foothold cities at the global level. It is quite easy to interpret these roles as reflective of functional clusters of global importance within each city: for London and Paris, they are clusters specialised in supporting the headquarter functions of large global companies; for Hong Kong, the Hague and Johannesburg, they are most likely clusters specialised in articulating the activities of large global companies within specific regions. This function, which we might call an interregional gateway function, may also describe Amsterdam's role as a foothold city for large North American companies operating in European markets, Chicago's role as a foothold for global companies entering North American markets, and Sao Paulo and Mexico City's roles as host to subsidiaries controlled by parent companies in Paris and Madrid. This gives Madrid a function we might describe as "imperial" (which is slightly more parochial than the wholeheartedly global functions of London and Paris). This leaves us with four cities which are simply home to large numbers of global companies compared to other cities in their respective regions: Tokyo, New York, Dallas, and San Francisco.

Table 4.20 Significant outlying cities in the global network

City	*Network*	*Role*	*Margin ($ m)*
London	Global	Headquarter city	1,211,594
	European	Headquarter city	1,626,118
	North American	Headquarter city	256,597
Paris	Global	Headquarter city	735,011
	European	Headquarter city	1,142,333
	Latin American	Headquarter city	64,363
Tokyo	East Asian	Headquarter city	526,981
New York	North American	Headquarter city	487,996
Hong Kong	Global	Foothold city	445,643
	European	Foothold city	197,568
	North American	Foothold city	57,980
	East Asian	Foothold city	445,643
Dallas	North American	Headquarter city	369,719
The Hague	Global	Foothold city	327,964
	European	Foothold city	361,432
San Francisco	North American	Headquarter city	267,735
Chicago	North American	Foothold city	154,091
Amsterdam	North American	Foothold city	125,557
Sao Paulo	Latin American	Foothold city	93,207
Johannesburg	Global	Foothold city	45,252
	European	Foothold city	85,968
Mexico City	Latin American	Foothold city	65,193
Madrid	Latin American	Headquarter city	10,621

4.2. Sectoral networks

In addition to the regional networks described above, a second series of subnetworks were extracted from the global network, one for each of the 21 sectors listed in ISIC rev. 4 (United Nations Department of Economic and Social Affairs, 2008) and NACE rev. 2 (Eurostat, 2008). Each sectoral network comprises parent-subsidiary ties where the subsidiaries are classified under the relevant sector; the parents on the other hand may come from any sector. For example a bank classified under "financial and insurance activities" may own companies classified under "electricity, gas, steam and air conditioning supply", "construction", and "transportation and storage"; ties relating to these three sets of companies would be assigned to their three respective sectors[16].

[16] If it were the other way around or even somewhere in the middle, vast segments of many sectors in the global economy (perhaps up to 40% of the whole global economy) would be assigned disproportionately to "financial and insurance activities" because of finance sector businesses' controlling interests in so many other sectors, as Vitali, Glattfelder and Battiston's (2011) study of "the network of global corporate control" using the same database confirms.

Ties were extracted for each sector based on the industrial classification of each subsidiary in each tie in the dataset. Eight sectors had completely degenerate networks (K = 1) and two were entirely absent from the data; these ten sectors[17] were dropped from the study. This left 11 sectors, which will be referred to as follows for brevity: were dropped, leaving 11 sectors that could be used in this study.

Table 4.21 Sectors used in this study

Name	*ISIC Rev. 4/NACE Rev. 2 sector*
Manufacturing	C – Manufacturing
Finance	K – Financial and insurance activities
Commerce	G – Wholesale and retail trade; repair of motor vehicles and motorcycles
Mining	B – Mining and quarrying
ICT	J – Information and communication
Utilities	D – Electricity, gas, steam and air conditioning supply
Technical	M – Professional, scientific and technical activities
Admin	N – Administrative and support service activities
Logistics	H – Transportation and storage
Construction	F – Construction
Hospitality	I – Accommodation and food service activities

4.2.1. Morphology

Like the regional networks, the 11 sectoral networks are vastly different in scale, from hospitality at $57 billion in turnover[18] to manufacturing at $4.6 trillion, producing a similar spectrum in morphologies. The three largest sectors—manufacturing (Figure A.17; K = 7), finance (Figure A.19; $3.4 trillion; K = 6) and commerce (Figure A.21; $3.2 trillion; K = 7)—are of similar scale to the EAS network ($3.4 trillion; K = 7). They each have very large, highly consolidated networks as per the two even larger regional networks—ECS and NAC—and the global network. However in the manufacturing network a clear fragment surrounding Tokyo is visible. This is the first indication of a high level of symmetry between regional and sectoral extracts: both converge towards a consolidated morphology at similar, very high amounts of total turnover; and in both cases the major exception is in East Asia centred on Tokyo.

The symmetry is just as apparent at the bottom end of the scale. The three smallest sectoral networks—logistics (Figure A.33; $285 billion), construction (Figure A.35; $280 billion) and hospitality (Figure A.37)—are of similar order of magnitude to the MEA ($96 billion) and SAS ($86

[17] (A) agriculture, forestry and fishing; (E) water supply; sewerage, waste management and remediation activities; (L) real estate activities; (O) public administration and defence; compulsory social security; (P) education; (Q) human health and social work activities; (R) arts, entertainment and recreation; (S) other service activities; (T) activities of households as employers; undifferentiated goods- and services-producing activities of households for own use (absent from the data); and (U) activities of extraterritorial organizations and bodies (absent from the data).

[18] Once again, these do not reflect the GDP of the sector, but an aggregation of the turnover of subsidiaries within it.

billion) networks, and like them have very sparse, fragmented networks with very little structural power (K = 2 for all).

Between these extremes two types may be observed. Recall that amongst the regional networks, SSF ($847 billion) was slightly larger than LCN ($744 billion), but while LCN was in a phase of transition toward the consolidated morphology of the largest networks (K = 5), SSF was still as fragmented as the smallest networks (K = 2), making SSF seem like the greater anomaly. Amongst the sectoral networks, the five remaining sectors are all of similar scale to these two regional networks. But two of them—mining ($926 billion) and utilities ($794 billion)—both remain quite fragmented with low structural power (K = 2 for both), whereas the other three—ICT ($910 billion), technical ($685 billion) and admin ($652 billion)—have all begun periods of transition with some structural power beginning to accumulate amongst their largest cities (K = 4, 3 and 4 respectively). They are not far along this transition; visually there is little to distinguish, say, the elevation view for admin (Figure A.32; K = 4) and logistics (Figure A.34; K = 2). But what is important to observe in this type of graph is how, as networks transition, there emerges more complex interaction "below the line" (that is, increasing number of cities appearing as "valleys" or "foothold cities" due to their beginning to attract large numbers of subsidiaries), as well as more interaction between cities at the top of the graph (increasing coordination between cities hosting large numbers of headquarters), visible most clearly in the ICT (Figure A.26) and technical sectors (Figure A.30). This is the hallmark of the transition towards consolidation that is missing across the K = 2 networks.

Table 4.22 Morphologies of the sectoral networks

Network	*Turnover represented ($ m)*	*K*	*Morphology*
Manufacturing	4,553,243	7	Consolidated
Finance	3,418,045	6	Consolidated
Commerce	3,180,950	7	Consolidated
Mining	925,973	2	Fragmented
ICT	910,112	4	Transitional
Utilities	793,972	2	Fragmented
Technical	684,972	3	Transition
Admin	551,968	4	Transition
Logistics	285,276	2	Fragmented
Construction	280,180	2	Fragmented
Hospitality	56,601	2	Fragmented

In the regional networks, the anomaly of SSF was difficult to interpret. But in the sectoral networks, the anomaly presented by the mining and utilities sectors seems fairly easy to understand. Mining and utilities are sectors with very high barriers to entry, therefore are populated by much fewer, much larger firms. By contrast ICT, technical and admin are all sectors requiring very little more than a computer and some college-level training to enter, meaning that they are populated by far greater numbers of small firms which, when some of them grow, are more easily corralled into global conglomerates (or are more easily spun out into global firms).

The observed symmetry between regional and sectoral networks at several scales suggests that we can borrow interpretations developed for sectoral networks and apply them to regional networks (and vice versa). Through this, we can propose that the fragmentation of the SSF network, anomalous amongst the regional networks, is because of high barriers to entry, just as it is in the mining and utilities sector. However in the case of the SSF network, this need not be because of the huge capital costs required to launch new enterprises as it is in mining and utilities, but simply because of other enormous difficulties involved in formalising a business and developing scale economies in Sub-Saharan Africa.

Table 4.23 The spectrum of morphologies in the global network

Network	*Turnover represented ($ m)*	*K*	*Morphology*
Globe	16,100,551	15	Consolidated
European	11,314,581	12	Consolidated
North American	6,447,866	9	Consolidated
Manufacturing	4,553,243	7	Consolidated
Finance	3,418,045	6	Consolidated
East Asian	3,372,477	7	Transitional
Commerce	3,180,950	7	Consolidated
Mining	925,973	2	Fragmented
ICT	910,112	4	Transitional
Sub-Saharan	847,383	2	Fragmented
Utilities	793,972	2	Fragmented
Latin American	744,442	5	Transitional
Technical	684,972	3	Transitional
Admin	551,968	4	Transitional
Logistics	285,276	2	Fragmented
Construction	280,180	2	Fragmented
Middle Eastern	95,588	2	Fragmented
South Asian	85,972	2	Fragmented
Hospitality	56,601	2	Fragmented

With this, a solid understanding of the evolution of networks begins to emerge, which helps to highlight the strangeness of the last remaining anomaly: the EAS network. Whether we are talking about regions or sectors, at the lowest end there is a relatively undifferentiated landscape of small cities and small firms, amongst which one or two cities begin to amass subsidiaries in a number of other cities, which may be through acquisition or organic growth. These may be global from the outset; there is no need to start by amassing subsidiaries amongst one's regional neighbours, though this may also happen. As a regional or sectoral economy grows, a period of transition is triggered in which coordination begins to develop "above" and "below" the "line": "headquarter cities" begin to develop subsidiaries within each other, creating communication between global centres (above the line); they also begin to co-locate subsidiaries in other places, which become "foothold cities" for the sector (below the line). The speed at which this occurs depends on typical firm size and barriers to entry for the relevant region or sector. This period of consolidation continues, creating increasingly

dense networks of communication above and below the line as K increases, culminating with two or three cities becoming runaway "peaks" or outlying "headquarter cities", focal points for communication between all levels of the network. Only five networks analysed in this chapter have reached this point, which are in order of turnover the ECS, NAC, manufacturing, finance and commerce networks.

The EAS network (which would come between the finance and commerce networks) thus presents a challenge to this linear model, and it is difficult to trace this to any particular network effect. Figure 4.1 confirms the source of the fragmentation of the EAS network: Hong Kong, Singapore and London share most of their immediate connections with other major cities in the region, whereas Tokyo, Osaka and Seoul tend to keep large numbers of immediate connections to themselves. This degree of "hoarding" is unusual even in the case of Tokyo; Figure 4.2 confirms that Tokyo "hoards" a somewhat larger number of immediate connections within its own regional network than its peers London, Paris and New York; it is also more hegemonic within its own regional network than its peers. Figure 4.3 and Figure 4.4 show that this is not because of its role in either of the sectors it dominates (manufacturing and commerce); in both sectors Tokyo's egonet (network of immediate connections) is similar to the sector's other "headquarter cities" (London and Paris in manufacturing, Paris in commerce). At this point we must therefore ascribe the anomaly of the EAS network to "network externalities", i.e. to factors outside of network morphology, such as organisational demands peculiar to the Japanese and South Korean economies, or a cultural frontier between the business world of East Asia and the business world of Europe and North America—in other words to lacks of cognitive or institutional proximity (Boschma, 2005).

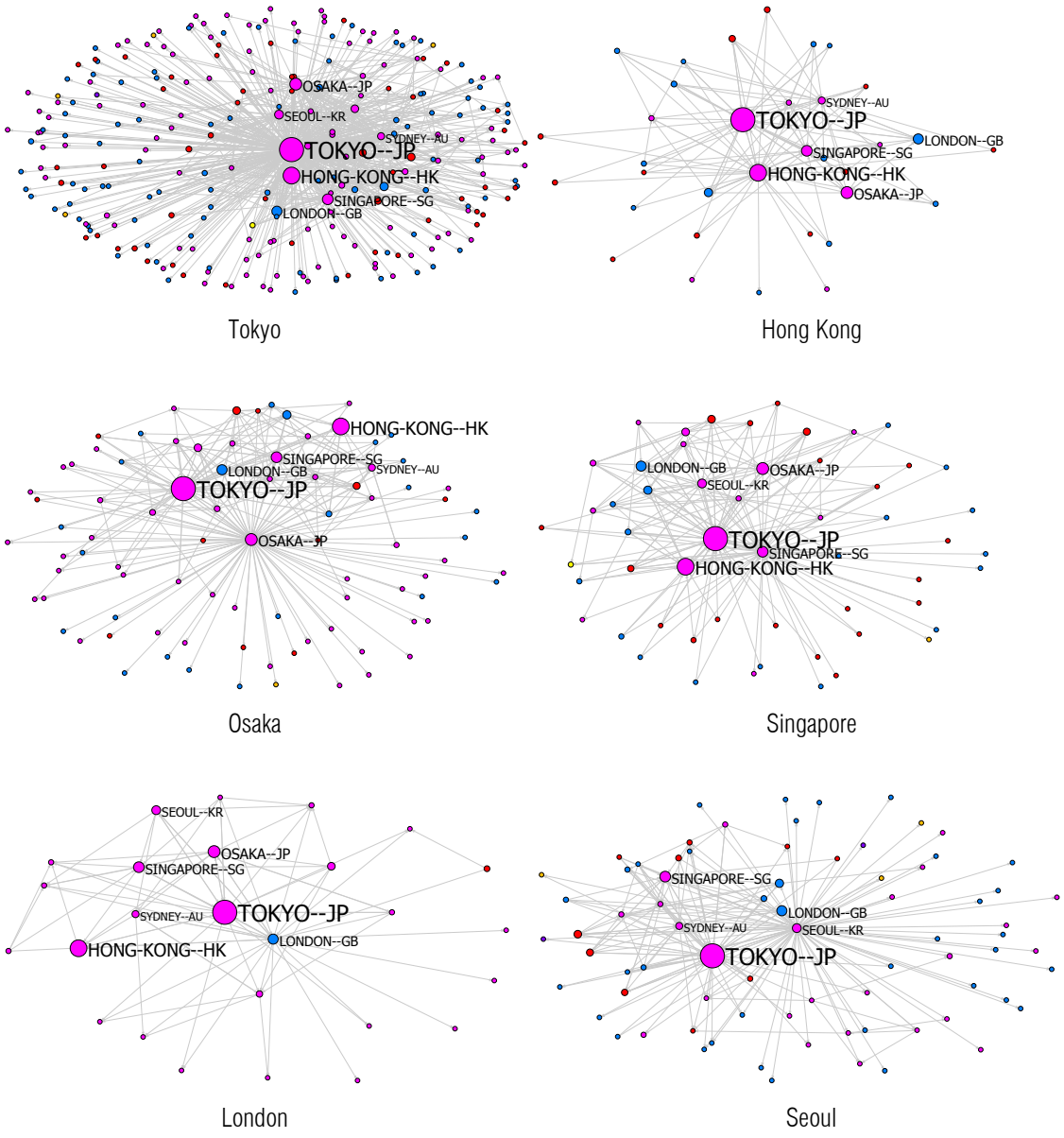
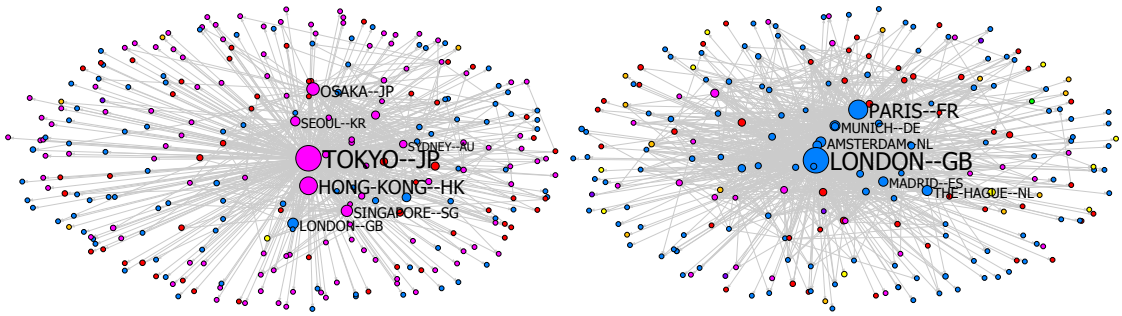
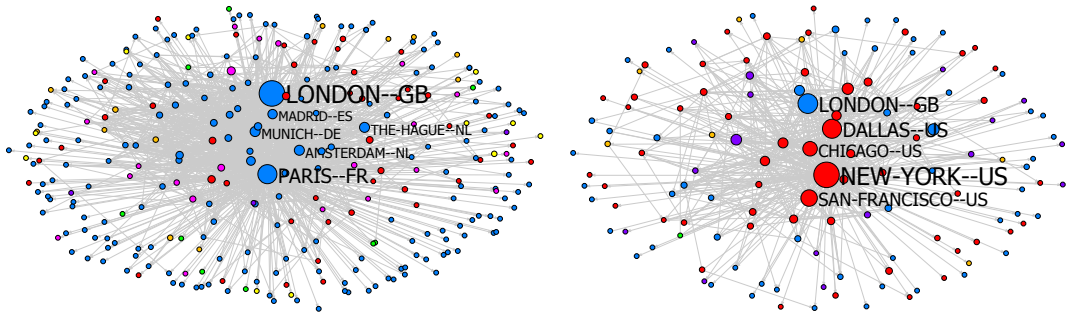


Figure 4.1 Egonets (networks of immediate connections) of the six largest cities within the EAS network



Tokyo's egonet in EAS

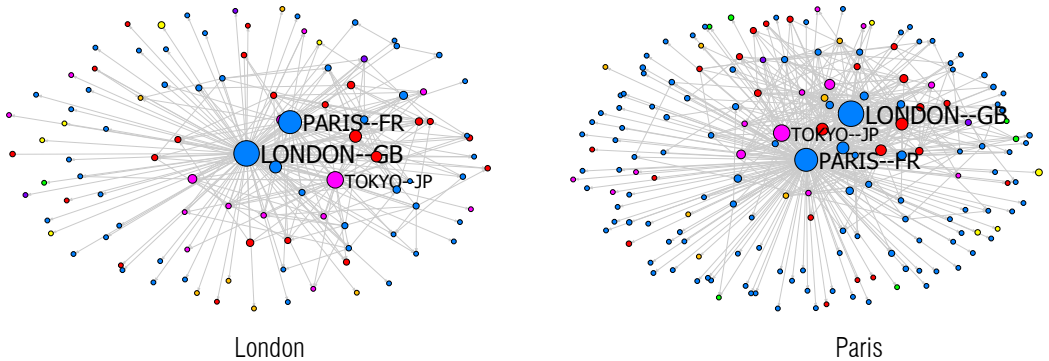
London's egonet in ECS



Paris' egonet in ECS

New York's egonet in NAC

Figure 4.2 Egonets of the "global quadrumvirate" cities within their respective regional networks



London

Paris

Tokyo

Figure 4.3 Egonets of the three largest cities (by turnover) in the manufacturing network

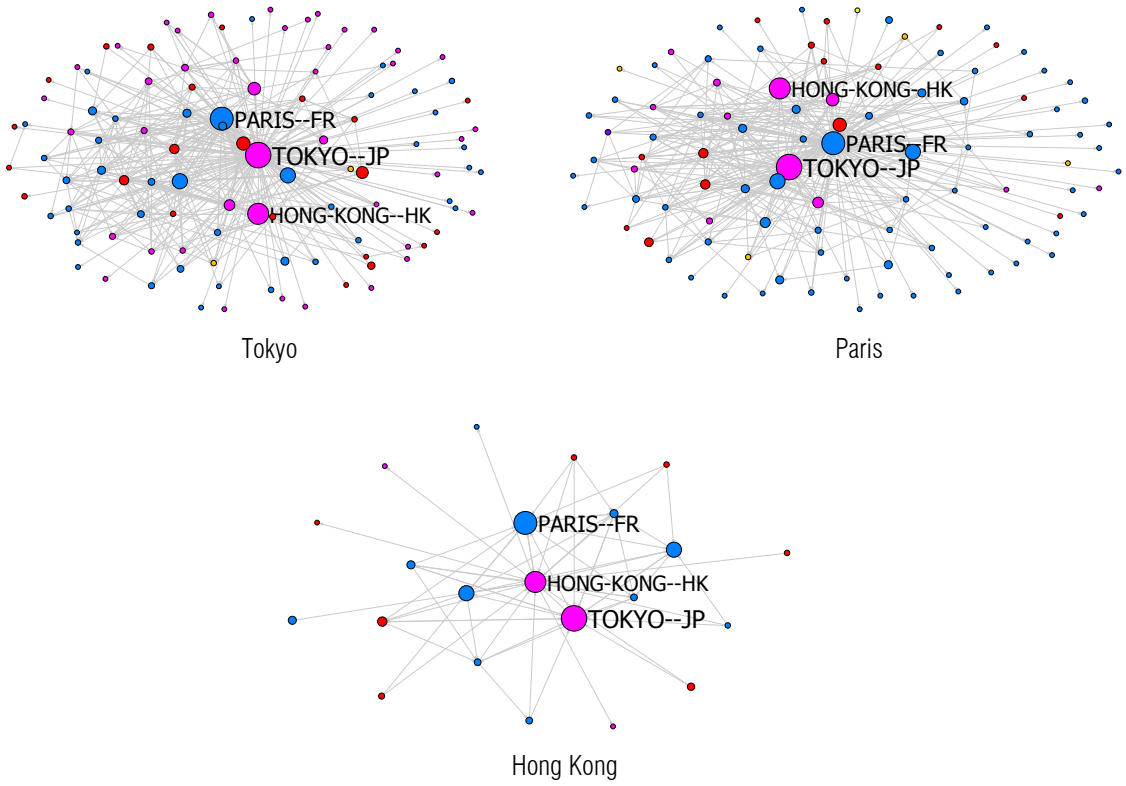


Figure 4.4 Egonets of the three largest cities (by turnover) in the commerce network

4.2.2. Decomposition

The cities and towns appearing in each of the sectoral networks are listed in the following tables, once again best browsed in conjunction with the plan views for each network in the atlas. As with the regional networks, these geographies are presented here without comment simply as a record of the empirical findings of the study; various data will be drawn out for use and discussion in subsequent chapters.

Table 4.24 Regional and k-shell decomposition of the manufacturing network

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Latin America*	*Middle East*	*South Asia*	*Total*
7	Amsterdam, Barcelona, Basel, Brussels, Cologne, Hamburg, Leuven, London, Luxembourg, Madrid, Milan, Moscow, Munich, Paris, Rome, Schaffhausen, Slough, St Louis, Stockholm, Vevey, Zurich (21)	Atlanta, Chicago, Cleveland, Dallas, Detroit, Los Angeles, Minneapolis, New York, Pittsburgh, Purchase, San Francisco, Toronto, Washington, Whitehouse Station, Wilmington (15)	Bangkok, Kuala Lumpur, Melbourne, Osaka, Seoul, Singapore, Suzhou, Sydney, Tokyo (9)		Buenos Aires, Mexico City, Sao Paulo (3)		Delhi, Mumbai (2)	50 (4.7%)
6	Darmstadt, Dublin, Dusseldorf, Heidelberg, Helsinki, Mannheim, Stuttgart, Turin (8)	Benton Harbor, Boston, Hamilton (Bermuda), Hartford, Houston, Montreal, Omaha (7)	Hong Kong, Shanghai (2)		Manaus (1)	Tel-Aviv (1)		19 (1.8%)
5	Antwerp, Bristol, Cergy, Heerlen, Oslo, Rotterdam, Swords, Warsaw, Zug (9)	Cincinnati, Columbus, New Brunswick, North Chicago (4)	Jakarta, Kariya, Nagoya, Toyota (4)	Johannesburg (1)	Monterrey (1)			19 (1.8%)
4	Athens, Berlin, Bracknell, Breda, Bucharest, Copenhagen, Guildford, Hanover, Istanbul, Maidenhead (10)	Akron, Charlotte, Indianapolis, Louisville, Milwaukee, Morristown, Philadelphia, Seattle, St Petersburg (9)	Auckland, Beijing, Chon Buri, Guanghou (4)		Porto Alegre, Rio de Janeiro (2)			25 (2.4%)
3	Augsburg, Bad Homburg, Basingstoke, Bielsko-Biala, Birmingham, Bremen, Budapest, Dortmund, Espoo, Essen, Frankfurt, Genoa, Ghent, Gothenburg, Karlsruhe, Linz, Lisbon, Lyon, Poznan, Prague, Salzgitter, Sandviken, St Petersburg, Swindon, Toulouse, Vienna (26)	Battle Creek, Greenville, Miami, Midland, Moline, Nashville, Norwalk, Raleigh, Toledo (9)	Incheon, Kyoto, Manila, Seosan, Shenzhen, Tianjin (6)	Nairobi (1)	Lima, Santiago, Sumare (3)		Kolkata (1)	46 (4.3%)
2	Aprilia, Aschaffenburg, Baarn, Baden, Basel, Bergen, Bielefeld, Bilbao, Biskupice-Podgorne, Bochum, Bratislava, Camberley, Cambridge, Charleroi, Cheadle, Coventry, Duisburg, Edinburgh, Farnborough, Glasgow, Granollers, The Hague, Hemel Hempstead, Kaluga, Katowice, Koblenz, Laakirchen, Leiden, Liege, Luton, Newbury, Newcastle, Northampton, Offenburg, Pilsen, Poing, Portsmouth, Quattordio, Russelsheim, Sant Cugat del Valles, Sarreguemines, St Helier, Stevenage, Tampere, Telford, Timisoara, Tres Cantos, Tychy, Utrecht, Vitoria, Warwick, Weesp, Welwyn Garden City, Wetzlar, Wroclaw, Wuppertal (56)	Armonk, Athens, Austin, Beaverton, Bowling Green, Calgary, Denver, Fairfield, Franklin, Greensboro, Hamilton (Canada), Huntsville, Leatherhead, Lincoln, London, Maryville, North Wales, Peoria, Phoenix, Plymouth, Princeton, Providence, Richmond, San Diego, Sidney, Smithfield, Wichita (27)	Adelaide, Ansan, Anyang, Asan, Azumino, Bayan Lepas, Busan, Changwon, Dalian, Fukui, Fukuoka, Gumi, Gyeongju, Hamamatsu, Hiroshima,, Huizhou, Imizu, Kakegawa, Kitakami, Kitakyushu, Koga, Kurashiki, Pohang, Qingdao, Shizuoka, Suwa, Ulsan, Wuxi, Yokosuka (29)	Durban (1)	Belo Horizonte, Bogota, Guayaquil, Manati, Medellin, Willemstad (6)	Cairo, Casablanca (2)	Bangalore, Chennai, Pune (3)	124 (11.7%)
1	Devnya, Gebze, Mytilini, Tallinn, Valletta, Zagreb, Zaporizhzhya; Austria (6), Belgium (20), Czech Republic (21), Denmark (3), Finland (8), France (62), Germany (76), Hungary (9), Ireland (5), Italy (46), Lithuania (2), Luxembourg (3), Netherlands (18), Norway (7), Poland (30), Portugal (2), Romania (3), Russia (8), Serbia (2), Slovakia (11), Slovenia (4), Spain (23), Sweden (22), Switzerland (21), United Kingdom (56); (475)	Canada (8), USA (109); (117)	Baguio, Batu Pahat, Taipei, Wellington; Australia (6), China (19), Indonesia (2), Japan (80), South Korea (15), Thailand (3); (129)	Blantyre ,Dar es Salaam, Lagos, Mazabuka; South Africa (5); (9)	Cordoba, George Town, San Jose; Brazil (16), Mexico (10), Puerto Rico (4); (33)	Amman, Chekka, Dubai, Rabat; Algeria (2), Israel (2), Tunis (2); (10)	Dhaka; India (2), Pakistan (2); (5)	778 (73.3%)
Total	605 (57.0%)	188 (17.7%)	183 (17.2%)	12 (1.1%)	49 (4.6%)	13 (1.2%)	11 (1.0%)	1061 (100.0%)

Table 4.25 Regional and k-shell decomposition of the finance network

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Latin America*	*Middle East*	*South Asia*	*Total*
6	Amsterdam, Dublin, Frankfurt, The Hague, London, Madrid, Milan, Munich, Paris, Rome, Trieste, Turin, Warsaw, Zurich (14)	Charlotte, Chicago, Los Angeles, Minneapolis, New York, San Francisco, Toronto (7)	Sydney, Tokyo (2)		Mexico City, Sao Paulo (2)			25 (7.1%)
5	Basel, Brussels, Copenhagen, Hamburg, Luxembourg, Moscow, Rotterdam, St Helier, Stockholm, Utrecht (10)	Boston, Hamilton (Bermuda), Hartford, Washington (4)	Singapore (1)		Santiago (1)			16 (4.5%)
4	Barcelona, Bilbao, Budapest, Cologne, Vienna (5)	Cincinnati, Dallas, Philadelphia, Wilmington (4)	Hong Kong, Seoul (2)		Bogota (1)			12 (3.4%)
3	Bucharest, Edinburgh, Guildford, Helsinki, Istanbul, Manchester, Prague, Schaffhausen (8)	Armonk, Atlanta, Baltimore, Denver, Fairfield, Houston, Indianapolis, Las Vegas, Milwaukee, Montreal, Omaha, Pittsburgh, Purchase, Richmond, Salt Lake City, Seattle, Stamford (17)	Auckland, Melbourne, Osaka (3)		Buenos Aires, Rio de Janeiro (2)			30 (8.5%)
2	Aachen, Aarau, Aberdeen, Bonn, Bracknell, Bristol, Dusseldorf, Eindhoven, Florence, Geneva, Gouda, Halifax, Heidelberg, Hesperange, Leeds, Lisbon, Maidenhead, Mannheim, Shannon, Slough, Stevenage, Stuttgart, Swindon, Treviso, Wroclaw, Zagreb (26)	Akron, Columbus, Des Moines, Dover, Louisville, North Chicago, Norwalk, Peoria, Phoenix, Sioux Falls, St Louis, Warren (12)	Jakarta, Kuala Lumpur, Perth, Toyota (4)	Johannesburg (1)	Lima, Monterrey (2)	Cairo (1)		46 (13.0%)
1	Bratislava, Oslo, Sofia, Tbilisi, Vilnius; Austria (2), Belgium (2), France (3), Germany (16), Italy (10), Netherlands (21), Poland (2), Russia (2), Serbia (2), Sweden (4), Spain (8), Switzerland (8), United Kingdom (42); (127)	Canada (8), USA (60); (68)	Bangkok, Bayan Lepas, Hsinchu, Port Moresby, Wellington; China (3), Japan (3), Korea (3); (14)	Cape Town, Lagos, Nairobi (3)	Caracas, George Town, Port of Spain, Quito, San Juan, Willemstad; Brazil (3); (9)	Casablanca, Tel-Aviv (2)	Karachi, Mumbai (2)	225 (63.6%)
Total	190 (53.7%)	112 (31.6%)	26 (7.3%)	4 (1.1%)	17 (4.8%)	3 (0.8%)	2 (0.6%)	354 (100.0%)

Table 4.26 Regional and k-shell decomposition of the commerce network

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Latin America*	*Middle East*	*South Asia*	*Total*
7	Amsterdam, Basel, Brussels, Cologne, Hamburg, London, Madrid, Milan, Moscow, Munich, Paris, Stockholm, Stuttgart, Utrecht, Warsaw, Zurich (16)	Chicago, Dallas, Houston, Los Angeles, Miami, Minneapolis, New Brunswick, New York, Phoenix, San Francisco, Toronto (11)	Bangkok, Hiroshima, Hong Kong, Melbourne, Nagoya, Osaka, Seoul, Shizuoka, Singapore, Sydney, Tokyo, Toyota (12)		Mexico City (1)			40 (7.6%)
6	Budapest, Copenhagen, Dublin, Dusseldorf, Hemel Hempstead, Oslo, Prague, Slough, Trappes (9)	Framingham, Hamilton (Bermuda), Norwalk, St Petersburg (4)	Kuala Lumpur (1)		Sao Paulo (1)			15 (2.8%)
5	Bucharest, Darmstadt, Espoo, Geneva, Hanover, Helsinki, Herzogenaurach, Kunzelsau, Rome, Sandviken, Schaffhausen, St Helier, Vienna (13)	Cincinnati, Columbus, Montreal, North Chicago (4)	Kyoto, Suwa, Taipei (3)		Buenos Aires (1)		Mumbai (1)	22 (4.2%)
4	Frankfurt, Gothenburg, The Hague, Hertogenbosch, Lyon, Mannheim, Turin, Vevey, Walldorf (9)		Fukuoka, Kariya, Shanghai (3)	Johannesburg (1)				13 (2.5%)
3	Barcelona, Bracknell, Bristol, High Wycombe, Hoofddorp, Istanbul, Krefeld, Leeds, Lille, Linz, Luxembourg, Mainz, Manchester, Milton Keynes, Rotterdam, Salzgitter, Schwalbach (17)	Atlanta, Bentonville, Detroit, Eden Prairie, Melville, Midland, Omaha, Peoria, Pittsburgh, St Louis, Vancouver, Washington (12)	Hamamatsu, Manila, Takasaki (3)					32 (6.1%)
2	Alcala de Henares, Athens, Baar, Bad Homburg, Berlin, Bielefeld, Birmingham, Bradford, Bratislava, Breda, Bremen, Chertsey, Coventry, Enkhuizen, Farnborough, Funchal, Graz, Grenoble, Heerlen, Heidelberg, Klagenfurt, Krakow, Lainate, Leuven, Lisbon, Majadahonda, Newbury, Oberhausen, Oeiras, Plock, Reading, Rickmansworth, Rotkreuz, Sant Cugat del Valles, Schwerte, Tres Cantos, Treviso, Unterschleisshim, Upplands Vasby, Warwick, Zug (41)	Akron, Armonk, Austin, Benton Harbor, Boston, Charlotte, Cleveland, Decatur, Denver, Edmonton, Hopkinton, Indianapolis, Louisville, Morristown, Orlando, Philadelphia, Richmond, Salt Lake City, San Antonio, San Diego, Seattle, Tampa, Whitehouse Station, Wilmington (24)	Auckland, Beijing, Fukushima, Inazawa, Kitakyushu, Naha, Pohang, Sapporo, Sendai, Shenzhen (10)	Durban (1)	Lima, Santiago (2)	Tel-Aviv (1)		79 (15.0%)
1	Belgrade, Cigli, Kiev, Koper, Nykoping, Sofia, Zagreb; Austria (4), Belgium (11), Czech Republic (4), Denmark (3), Finland (6), France (19), Germany (52), Hungary (3), Ireland (6), Italy (18), Luxembourg (3), Netherlands (13), Norway (3), Poland (6), Portugal (2), Romania (2), Russia (9), Spain (7), Switzerland (14), United Kingdom (28); (220)	Canada (8), USA (54); (62)	Siheung, Chon Buri; Australia (2), China (4), Japan (24); (32)	Dakar, East London (2)	Bogota, Montevideo, Willemstad; Brazil (4), Mexico (2); (9)	Dubai (1)		326 (61.9%)
Total	325 (61.7%)	117 (22.2%)	64 (12.1%)	4 (0.8%)	14 (2.7%)	2 (0.4%)	1 (0.2%)	527 (100.0%)

Table 4.27 Regional and k-shell decomposition of the mining network

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Latin America*	*Middle East*	*South Asia*	*Total*
2	Aberdeen, Geneva, London, Paris, Stavanger, Tananger Windsor (7)	Calgary, Chicago, Dallas, Denver, Houston, Phoenix, Toronto (7)	Melbourne (1)		Santiago, Willemstad (2)			17 (20.5%)
1	Almetyevsk, Astrakhan, Birmingham, Brussels, Bugulma, Celle, Cologne, Dublin, Essen, Haarlem, The Hague, Heidelberg, Istanbul, Kassel, Khanty Mansiysk, Leatherhead, Leeds, Leicester, Madrid, Maidenhead, Manchester, Mannheim, Markfield, Milan, Moscow, Nadym, Novi Sad, Novy Urengoy, Noyabrsk, Orenburg, Oslo, Saltburn by the Sea, Trappes, Vevey, Vienna, Whitegate, Zurich (37)	Bakersfield, Birmingham, El Dorado, Los Angeles, New Orleans, New York, Pittsburgh, San Ramon (8)	Brisbane, Darwin, Kuala Lumpur, Osaka, Perth, Sydney, Tokyo, Wellington (8)	Johannesburg, Niamey, Phalaborwa, Polokwane, Secunda (5)	Antofagasta, Buenos Aires, Calama, Curaçao, Santo Domingo, Villahermosa (6)	Tel-Aviv (1)	Mumbai (1)	66 (79.5%)
Total	44 (53.0%)	15 (18.1%)	9 (10.8%)	5 (6.0%)	8 (9.6%)	1 (1.2%)	1 (1.2%)	83 (100.0%)

Table 4.28 Regional and k-shell decomposition of the ICT network

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Latin America*	*Middle East*	*South Asia*	*Total*
4	Amsterdam, Dublin, London, Madrid, Milan, Munich, Newbury, Paris, Stockholm, Walldorf (10)	Armonk, Los Angeles, New York, San Francisco, Washington (5)	Sydney, Tokyo (2)					17 (10.3%)
3	Brussels, Copenhagen, Dusseldorf, Zurich (4)	Atlanta, Dallas, Phoenix, Seattle (4)	Singapore (1)	Johannesburg (1)	Sao Paulo (1)			11 (6.7%)
2	Espoo, The Hague, Hemel Hempstead, Pozuelo de Alarcon, Prague, Reading (6)	Boston, Chicago, Kansas City, Melville, Norwalk, Philadelphia, San Diego (7)	Auckland (1)	Douala (1)	Buenos Aires, Mexico City, Rio de Janeiro (3)		Mumbai (1)	19 (11.5%)
1	Aarhus, Athens, Banbury, Barcelona, Bergen, Berlin, Biel/Bienne, Boadilla del Monte, Bonn, Bratislava, Bristol, Bucharest, Cardiff, Cologne, Crawley, Ehningen, Frankfurt, Genoa, Glasgow, Guildford, Hamburg, Helsinki, Kelsterbach, Kirchheim, Lausanne, Lisbon, Maastricht, Mannheim, Oslo, Rome, Schaffhausen, Slough, St Helier, Tallinn, Turin, Utrecht, Venlo, Vianen, Vilnius, Warrington, Warsaw, Woking, Zagreb, Zoetermeer (44)	Ashburn, Austin, Bedford, Bedminster, Columbia, Dayton, Denver, Dublin, Farmington Hills, Fort Walton Beach, Hamilton (Bermuda), Hopkinton, Houston, Jacksonville, Kanata, Lake Charles, Lubbock, Marlborough, Milwaukee, Minneapolis, Montreal, Morristown, New Brunswick, New Glasgow, Norfolk, Oklahoma City, Ottawa, Pleasanton, Reno, Salt Lake City, Stamford, Stellarton, St Louis, St Petersburg, Tampa, Toronto, Warren (37)	Beijing, Fukuoka, Hong Kong, Kariya, Kyoto, Manila, Melbourne, Nagoya, Naha, Osaka, Pohang, Seongnam, Seoul, Toyota, Gothenburg, Hiroshima, Sendai (17)	Abidjan, Bamako, Brazzaville, Libreville, Ouagadougou (5)	Belem, Belo Horizonte, Bogota, Brasilia, Curitiba, Lima, Maringa, Recife, San Salvador, Santiago, Willemstad (11)	Cairo, Rabat (2)	Chennai, Delhi (2)	118 (71.5%)
Total	64 (38.8%)	53 (32.1%)	21 (12.7%)	7 (4.2%)	15 (9.1%)	2 (1.2%)	3 (1.8%)	165 (100.0%)

Table 4.29 Regional and k-shell decomposition of the utilities network

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Latin America*	*South Asia*	*Total*
2	Barcelona, Dusseldorf, Essen, Frankfurt, Karlsruhe, Lisbon, London, Madrid, Milan, Olten, Paris, Reading, Rome, Seville, Warsaw (15)	Charlotte, New York, Washington (3)			Panama City, Santiago, Sao Paulo (3)		21 (12.2%)
1	Augsburg, Basel, Berlin, Bilbao, Birmingham, Bratislava, Brunswick, Brussels, Budapest, Budweis, Cagliari, Carrickfergus, Chemnitz, Coventry, Dortmund, Ellwangen, Ettlingen, Furstenwalde, Glasgow, Hajduszoboszlo, Halle, Hamburg, Hanover, Helmstedt, Hertogenbosch, Kabelsketal, Kassel, Kladno, Larne, Las Palmas, Laufenburg, Lausanne, Lille, Locarno, Maidenhead, Malmo, Mannheim, Moscow, Munich, Newcastle, Niedergosgen, Norilsk, Nottingham, Ostrava, Oviedo, paderborn, Palma, Perth, Prague, Quickborn, Recklinghausen, Regensburg, Rheinfelden, Richmond, Rosmalen, Rotterdam, Salzgitter, Scarcroft, Siegen, Sion, Stuttgart, Swindon, Tiszaujvaros, Toledo, Turin, Valencia, Warrington, Wesel, Yekaterinburg, Zurich, Zwolle (71)	Akron, Atlanta, Augusta, Baltimore, Baton Rouge, Beaumont, Birmingham, Boston, Calgary, Chicago, Cincinnati, Clarksburg, Cleveland, Clinton, Columbus, Des Moines, Fairmont, Greensburg, Gulfport, Houston, Indianapolis, Ithaca, Jackson, Kennett Square, Kingsport, Little Rock, Lusby, Marlborough, Miami, New Gloucester, New Orleans, Omaha, Pensacola, Philadelphia, Plainfield, Portland, Richmond, Rochester, Savannah, Syracuse, Toronto, Westborough, Wilmington, Windsor (44)	Anyang, Bangkok, Dangjin-gun, Dongguan, Guangzhou, Gwangju, Gyeongju, Jincheng, Kamisu, Kunming, Nagano, Nanning, Niihama, Pohang, Sakata, Sakura, Sendai, Seoul, Shenzhen, Tokyo (20)	Douala, Libreville (2)	Barranquilla, Buenos Aires, Florianopolis, Fortaleza, Guayama, Hermosillo, Niteroi, Porto Alegre, Port of Spain, Rio de Janeiro, Santo Domingo, Vitoria (12)	Ahmedabad, Kolkata (2)	151 (87.8%)
Total	86 (50.0%)	47 (27.3%)	20 (11.6%)	2 (1.2%)	15 (8.7%)	2 (1.2%)	172 (100.0%)

Table 4.30 Regional and k-shell decomposition of the technical network

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Latin America*	*Middle East*	*Total*
3	Amsterdam, Basel, Dublin, Dusseldorf, London, Luxembourg, Madrid, Milan, Munich, Paris, Rome, St Helier, Stuttgart (13)	Chicago, Los Angeles, New York, San Francisco, Washington (5)	Hong Kong, Osaka, Tokyo (3)				21 (11.3%)
2	Augsburg, Barcelona, Berlin, Bremen, Brussels, Chertsey, Copenhagen, Eschborn, Frankfurt, Hamburg, Hanover, Heerlen, Helsinki, Leuven, Mainz, Majadahonda, Manchester, Mannheim, Meerbusch, Neu Isenburg, Oberhausen, Oberursel, Stockholm, Trappes, Turin, Zurich (26)	Atlanta, Charlotte, Cincinnati, Dallas, Denver, Detroit, Fairfield, Houston, Louisville, Milwaukee, Philadelphia, Seattle, St Louis (13)	Kyoto, Melbourne, Singapore (3)				42 (22.6%)
1	Almetyevsk, Arnhem, Aschheim, Bad Homburg, Bertrange, Bietigheim, Bilbao, Bonn, Bracknell, Cambridge, Carmignano di Brenta, Celle, Clermont Ferrand, Cologne, Contern, Darmstadt, Derby, Dijon, Dortmund, Duisburg, Duren, Ehningen, Enkhuizen, Erfurt, Essen, Gernsheim, Granollers,The Hague, Hallbergmoos, Hameln, Heidelberg, Henningsdorf, Hertogenbosch, Herzogenaurach, Holzwickede, Hoofddorp, Hythe, Kazan, Koblenz, Kolding, Kronberg, Lisbon, Lorrach, Maintal, Monheim, Moscow, Munsbach, Newcastle, Nice, Nuremberg, Olten, Oslo, Oviedo, Oxford, Poing, Pozuelo de Alarcon, Prague, Ratingen, Sandviken, Schaffhausen, Schwalbach, Selm, Stadthagen, St-Sauveur, Swords, Toulouse, Urmond, Utrecht, Vasteras, Vevey, Vienna, Waalwijk, Warsaw, Warwick, Wehr, Zaragoza (76)	Albuquerque, Alexandria, Armonk, Austin, Bloomfield, Boston, Chantilly, Chesterbrook, Cleveland, Colorado Springs, Cranberry Township, Dayton, Glassport, Greenville, Hamilton (Bermuda), Hartford, Indianapolis, Kanata, Midland, Nashville, North Chicago, Ogden, Omaha, Phoenix, Pittsburgh, Shelton, Stamford, St Petersburg, Thousand Oaks, Toronto, Tulsa, Wilmington, Wilton, Windsor (34)	Fukuoka, Hiroshima, Nagoya, Okazaki, Pohang, Seoul, Siheung, Toyota, Yongin (9)	Johannesburg, Walvis Bay (2)	Willemstad (1)	Tel-Aviv (1)	123 (66.1%)
Total	115 (61.8%)	52 (28.0%)	15 (8.1%)	2 (1.1%)	1 (0.5%)	1 (0.5%)	186 (100.0%)

Table 4.31 Regional and k-shell decomposition of the admin network

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Latin America*	*Total*
4	Amsterdam, Copenhagen, Crawley, Hanover, London, Oslo, Paris, Stockholm, Zurich (9)	Milwaukee (1)	Tokyo (1)			11 (7.8%)
3	Brussels, Dusseldorf, Frankfurt, Hamburg, Madrid, Milan (6)	New York, Norwalk, Washington (3)	Singapore (1)			10 (7.1%)
2	Cologne, Dublin, Helsinki, Luton, Palma, Schaffhausen, St Helier, Utrecht, Vienna, Warsaw (10)	Atlanta, Chicago, Dallas, Houston, Los Angeles, Miami, San Francisco, Toronto (8)		Johannesburg, Pretoria (2)	Mexico City (1)	21 (14.9%)
1	Baden-Baden, Bad Hersfeld, Barcelona, Basel, Birmingham, Bonn, Borehamwood, Broadway, Chertsey, Coventry, Dortmund, Drunen, Edinburgh, Eschborn, Espoo, Essen, Farnborough, Florence, Ghent, Groot Bijgaarden, Haarlem, The Hague, Heerlen, Heidelberg, Hemel Hempstead, Herzberg, Hoofddorp, Kelsterbach, Lausanne, Leatherhead, Leicester, Lyon, Maidenhead, Majadahonda, Mannheim, Mechelen, Neu Isenburg, Oberursel, Oostende, Oxford, Perth, Peterborough, Pozuelo de Alarcon, Puerto de la Cruz, Reading, Redhill, Reims, Richmond, Ringaskiddy, Rochdale, Rolling, Rome, Rotterdam, Russelsheim, Slough, St Albans, Swindon, Trondheim, Urmond, York, Zaltbommel (61)	Austin, Birmingham, Boston, Calgary, Chesterbrook, Cincinnati, Colorado Springs, Denver, Fairfield, Hamilton (Bermuda), Hartford, Indianapolis, Jacksonville, Memphis, Montreal, Omaha, Peoria, Philadelphia, Phoenix, Pittsburgh, Salt Lake City, Seattle, Springdale, St Petersburg, Waterloo, Whitehouse Station (26)	Anyang, Hong Kong, Kariya, Manila, Nagoya, Nishio, Osaka, Seongnam, Seoul, Sydney, Utsunomiya (11)	Port Elizabeth (1)		99 (70.2%)
Total	86 (61.0%)	38 (27.0%)	13 (9.2%)	3 (2.1%)	1 (0.7%)	141 (100.0%)

Table 4.32 Regional and k-shell decomposition of the logistics network

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Latin America*	*Middle East*	*Total*
2	Amsterdam, Brussels, Hanover, London, Paris, Stockholm (6)	Atlanta (1)	Tokyo (1)				8 (7.0%)
1	Addlestone, Almere, Antwerp, Arkhangelsk, Basel, Bielefeld, Bonn, Born, Bristol, Budapest, Cannes, Chaykovsky, Cologne, Copenhagen, Crawley, Derby, Doortmund, Dublin, Duisburg, Dusseldorf, Frankfurt, Geneva, Ghent, Guildford, The Hague, Hamburg, Helsinki, Hoofddorp, Kelsterbach, Khanty Mansiysk Krasnoyarsk, Kunzelsau, Landquart, Leatherhead, Madrid, Mannheim, Milan, Minsk, Morlaix, Moscow, Munich, Nantes, Nizhny Novgorod, Pau, Peterborough, Ponzano Veneto, Quer, Rome, Rugby, Selm, Siofok, St Petersburg, Sundsvall, Tremblay-en-France, Treviso, Ukhta, Unna, Vienna, Yugorsk, Zurich (61)	Calgary, Chicago, Cincinnati, Columbus, Dallas, Hamilton (Bermuda), Harrison, Houston, Jackson, Lakeland, Los Angeles, Memphis, Minneapolis, Montreal, New York, Omaha, Orlando, Philadelphia, Richmond, Savannah, St Louis, Toronto, Washington (23)	Canberra, Chikusei, Hong Kong, Inabe, Ishinomaki, Kariya, Nara, Osaka, Perth, Seoul, Singapore, Sydney, Tomakomai, Toyota, Uijeongbu (15)	Cape Town, Durban, East London, Johannesburg (4)	Mexico City, Sao Paulo (2)	Algiers, Oran (2)	107 (93.0%)
Total	67 (58.3%)	24 (20.9%)	16 (13.9%)	4 (3.5%)	2 (1.7%)	2 (1.7%)	115 (100.0%)

Table 4.33 Regional and k-shell decomposition of the construction network

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Latin America*	*Middle East*	*Total*
2	Antwerp, Brussels, Bunnik, Dublin, Essen, London, Madrid, Mannheim, Munich, Paris, Prague, Schaffhausen, Stuttgart, Vienna, Warsaw (15)	Atlanta, New York (2)	Sydney (1)				18 (14.9%)
1	Aberdeen, Albacete, Bad Hersfeld, Barton-upon-Humber, Belfast, Berne, Bethune, Bilbao, Birmingham, Bologna, Bristol, Budapest, Camberley, Cologne, Crawley, Farnborough, Frankfurt, Funchal, Gelsenkirchen, The Hague, Hamburg, Heerlen, Hemel Hempstead, Horsham, Istanbul, Kill, Leatherhead, Le Port Réunion, Leuna, Lille, Lyon, Maastricht, Magny-les-Hameaux, Mainz, Manchester, Milan, Moscow, Mulhouse, Nantes, Norilsk, Noyon, Oeiras, Olten, Oxford, Piaseczno, Portsmouth, Redhill, Regensburg, Ringwood, Rome, Rotterdam, Sint Truiden, Slough, Spittal, Stadl Paura, Stockholm, Tadcaster, Trappes, Utrecht, Vevey, Watford, Wels, Windsor, Zurich (64)	Chicago, Dallas, Hartford, Honolulu, Houston, Huntsville, Las Vegas, Los Angeles, Miami, Milwaukee, Montreal, Morristown, Orlando, Pittsburgh, San Diego, Seattle, St Louis, Toronto, Washington, West Point, Wilmington, Woodbridge (22)	Changwon, Fukuoka, Hiroshima, Hong Kong, Kashima, Kitakyushu, Osaka, Seongnam, Seoul, Suwon, Taipei, Tokoname, Tokyo (13)	Dakar (1)	Ciudad del Carmen, Porto Alegre (2)	Dubai (1)	103 (85.1%)
Total	79 (65.3%)	24 (19.8%)	14 (11.6%)	1 (0.8%)	2 (1.7%)	1 (0.8%)	121 (100.0%)

Table 4.34 Regional and k-shell decomposition of the hospitality network

k	*Europe*	*North America*	*East Asia*	*Latin America*	*Total*
2	Chertsey, London, Milan, Paris, Treviso, Zurich (6)	Chicago, Toronto, Washington (3)			9 (18.0%)
1	Barcelona, Birmingham, Borehamwood, Brussels, Copenhagen, Farnborough, Helsinki, Hoccheim, Lisbon, Madrid, Manchester, Marseille, Moscow, Neu Isenburg, Rotterdam, Santa Coloma de Cervello, Stavanger, Trappes, Tremblay-en-France, Turin, Warsaw, Woking (22)	Charlotte, Los Angeles, Louisville, New York, Orlando, Philadelphia (6)	Bangkok, Beijing, Changsha, Kyoto, Melbourne, Nanjing, Osaka, Qingdao, Shanghai, Shenyang, Shenzhen, Sydney (12)	San Juan (1)	41 (82.0%)
Total	28 (56.0%)	9 (18.0%)	12 (24.0%)	1 (2.0%)	50 (100.0%)

4.2.3. Outlying cities

Once again, the elevation views of each sectoral network presented in the atlas show a number of outliers for each network. These are shown in the following tables.

Table 4.35 Outlying cities in the manufacturing network

City	*Outlying attribute*	*Value ($ m)*	*Largest non-outlier*	*Margin*	*Role indicated*
London (k = 7)	Total degree	674,709	240,868	433,841	Specialised city
Paris (k = 7)	Total degree	586,725	240,868	345,857	Specialised city
London (k = 7)	Outdegree	554,701	241,226	313,475	Headquarter city
Paris (k = 7)	Outdegree	503,939	241,226	262,713	Headquarter city
London (k = 7)	Net degree (positive)	434,693	208,082	226,611	Headquarter city
Paris (k = 7)	Net degree (positive)	421,153	208,082	213,071	Headquarter city
Tokyo (k = 7)	Total degree	374,837	240,868	133,969	Specialised city
Tokyo (k = 7)	Indegree	133,611	63,861	69,750	Foothold city
Singapore (k = 7)	Indegree	132,059	63,861	68,198	Foothold city
Chicago (k = 7)	Indegree	125,862	63,861	62,001	Foothold city
Hong Kong (k = 6)	Net degree (negative)	117,515	57,879	59,636	Foothold city
London (k = 7)	Indegree	120,008	63,861	56,147	Foothold city
Hong Kong (k = 6)	Indegree	119,498	63,861	55,637	Foothold city
Hamburg (k = 7)	Indegree	104,395	63,861	40,534	Foothold city
Hamburg (k = 7)	Net degree (negative)	93,653	57,879	35,774	Foothold city
New York (k = 7)	Indegree	98,601	63,861	34,740	Foothold city
Singapore (k = 7)	Net degree (negative)	86,303	57,879	28,424	Foothold city
Paris (k = 7)	Indegree	82,786	63,861	18,925	Foothold city
Milan (k = 7)	Net degree (negative)	75,042	57,879	17,163	Foothold city
Essen (k = 3)	Indegree	76,141	63,861	12,280	Foothold city
Milan (k = 7)	Indegree	75,755	63,861	11,894	Foothold city
Madrid (k = 7)	Net degree (negative)	68,972	57,879	11,093	Foothold city
Washington (k = 7)	Indegree	72,504	63,861	8,643	Foothold city
Madrid (k = 7)	Indegree	72,427	63,861	8,566	Foothold city
Rotterdam (k = 5)	Net degree (negative)	63,861	57,879	5,982	Foothold city
Essen (k = 3)	Net degree (negative)	63,440	57,879	5,561	Foothold city
Chicago (k = 7)	Net degree (negative)	62,141	57,879	4,262	Foothold city
Pretoria (k = 1)	Net degree (negative)	60,108	57,879	2,229	Foothold city
Cape Town (k = 1)	Net degree (negative)	59,143	57,879	1,264	Foothold city

Table 4.36 Outlying cities in the finance network

City	*Outlying attribute*	*Value ($ m)*	*Largest non-outlier*	*Margin*	*Role indicated*
London (k = 6)	Total degree	850,534	281,462	569,072	Specialised city
London (k = 6)	Outdegree	616,690	187,137	429,553	Headquarter city
London (k = 6)	Net degree (positive)	382,846	176,116	206,730	Headquarter city
New York (k = 6)	Outdegree	390,150	187,137	203,013	Headquarter city
Paris (k = 6)	Total degree	461,612	281,462	180,150	Specialised city
New York (k = 6)	Total degree	458,727	281,462	177,265	Specialised city
Paris (k = 6)	Outdegree	342,331	187,137	155,194	Headquarter city
New York (k = 6)	Net degree (positive)	321,573	176,116	145,457	Headquarter city
Johannesburg (k = 2)	Indegree	266,668	131,548	135,120	Foothold city
Johannesburg (k = 2)	Net degree (negative)	251,874	124,860	127,014	Foothold city
London (k = 6)	Indegree	233,844	131,548	102,296	Foothold city
Paris (k = 6)	Net degree (positive)	223,050	176,116	46,934	Headquarter city
Baar (k = 1)	Net degree (positive)	144,978	124,860	20,118	Foothold city
Baar (k = 1)	Indegree	144,978	131,548	13,430	Foothold city

Table 4.37 Outlying cities in the commerce network

City	*Outlying attribute*	*Value ($ m)*	*Largest non-outlier*	*Margin*	*Role indicated*
Hong Kong (k = 7)	Net degree (negative)	369,895	102,372	267,523	Foothold city
Tokyo (k = 7)	Total degree	488,439	243,848	244,591	Specialised city
Hong Kong (k = 7)	Indegree	372,212	173,110	199,102	Foothold city
Tokyo (k = 7)	Outdegree	356,654	163,032	193,722	Headquarter city
Paris (k = 7)	Outdegree	353,539	163,032	190,507	Headquarter city
Paris (k = 7)	Total degree	427,223	243,848	183,375	Specialised city
Paris (k = 7)	Net degree (positive)	279,855	122,462	157,393	Headquarter city
Hong Kong (k = 7)	Total degree	374,529	243,848	130,681	Specialised city
Tokyo (k = 7)	Net degree (positive)	224,869	122,462	102,407	Headquarter city
San Francisco (k = 7)	Net degree (positive)	164,626	122,462	42,164	Headquarter city
San Francisco (k = 7)	Outdegree	178,659	163,032	15,627	Headquarter city
London (k = 7)	Total degree	244,345	243,848	497	Specialised city

Table 4.38 Outlying cities in the mining network

City	*Outlying attribute*	*Value ($ m)*	*Largest non-outlier*	*Margin*	*Role indicated*
London (k = 2)	Total degree	606,142	108,224	497,918	Specialised city
London (k = 2)	Outdegree	531,638	85,914	445,724	Headquarter city
London (k = 2)	Net degree (positive)	457,134	82,398	374,736	Headquarter city
The Hague (k = 1)	Net degree (negative)	414,323	49,469	364,854	Foothold city
The Hague (k = 1)	Indegree	414,323	74,504	339,819	Foothold city
The Hague (k = 1)	Total degree	414,323	89,430	324,893	Specialised city

Table 4.39 Outlying cities in the ICT network

City	*Outlying attribute*	*Value ($ m)*	*Largest non-outlier*	*Margin*	*Role indicated*
Dallas (k = 3)	Total degree	136,598	65,009	71,589	Specialised city
Dallas (k = 3)	Outdegree	102,204	45,696	56,508	Headquarter city
New York (k = 4)	Outdegree	88,942	45,696	43,246	Headquarter city
New York (k = 4)	Net degree (positive)	77,612	36,732	40,880	Headquarter city
New Brunswick (k = 1)	Indegree	74,911	36,571	38,340	Foothold city
New Brunswick (k = 1)	Net degree (negative)	74,911	36,571	38,340	Foothold city
Dublin (k = 4)	Net degree (positive)	73,740	36,732	37,008	Headquarter city
New York (k = 4)	Total degree	100,272	65,009	35,263	Specialised city
San Francisco (k = 4)	Net degree (positive)	70,930	36,732	34,198	Headquarter city
Madrid (k = 4)	Outdegree	78,773	45,696	33,077	Headquarter city
Dallas (k = 3)	Net degree (positive)	67,810	36,732	31,078	Headquarter city
San Francisco (k = 4)	Outdegree	76,446	45,696	30,750	Headquarter city
Dublin (k = 4)	Outdegree	74,911	45,696	29,215	Headquarter city
Madrid (k = 4)	Total degree	94,006	65,009	28,997	Specialised city
Madrid (k = 4)	Net degree (positive)	63,540	36,732	26,808	Headquarter city
Newbury (k = 4)	Net degree (positive)	57,868	36,732	21,136	Headquarter city
Atlanta (k = 3)	Indegree	53,965	36,571	17,394	Foothold city
San Francisco (k = 4)	Total degree	81,962	65,009	16,953	Specialised city
Atlanta (k = 3)	Net degree (negative)	52,174	36,571	15,603	Foothold city
Milan (k = 4)	Outdegree	61,247	45,696	15,551	Headquarter city
Newbury (k = 4)	Outdegree	57,868	45,696	12,172	Headquarter city
Dublin (k = 4)	Total degree	76,082	65,009	11,073	Specialised city
Milan (k = 4)	Total degree	75,628	65,009	10,619	Specialised city
Milan (k = 4)	Net degree (positive)	46,866	36,732	10,134	Headquarter city
New Brunswick (k = 1)	Total degree	74,911	65,009	9,902	Specialised city
Armonk (k = 4)	Net degree (positive)	42,853	36,732	6,121	Headquarter city
Tokyo (k = 4)	Net degree (positive)	39,541	36,732	2,809	Headquarter city
Washington (k = 4)	Indegree	38,416	36,571	1,845	Foothold city
Slough (k = 1)	Indegree	38,281	36,571	1,710	Foothold city
Slough (k = 1)	Net degree (negative)	38,281	36,571	1,710	Foothold city

Table 4.40 Outlying cities in the utilities network

City	*Outlying attribute*	*Value ($ m)*	*Largest non-outlier*	*Margin*	*Role indicated*
Dusseldorf (k = 2)	Total degree	257,493	105,081	152,412	Specialised city
Dusseldorf (k = 2)	Outdegree	254,343	104,677	149,666	Headquarter city
Dusseldorf (k = 2)	Net degree (positive)	251,193	104,273	146,920	Headquarter city
Munich (k = 1)	Indegree	101,178	40,800	60,378	Foothold city
Munich (k = 1)	Net degree (negative)	101,178	40,800	60,378	Foothold city
Hanover (k = 1)	Indegree	69,657	40,800	28,857	Foothold city
Hanover (k = 1)	Net degree (negative)	69,657	40,800	28,857	Foothold city
Madrid (k = 2)	Indegree	60,105	40,800	19,305	Foothold city
Madrid (k = 2)	Net degree (negative)	60,105	40,800	19,305	Foothold city

Table 4.41 Outlying cities in the technical network

City	*Outlying attribute*	*Value ($ m)*	*Largest non-outlier*	*Margin*	*Role indicated*
Paris (k = 3)	Total degree	116,850	53,992	62,858	Specialised city
Paris (k = 3)	Outdegree	110,874	51,049	59,825	Headquarter city
Paris (k = 3)	Net degree (positive)	104,898	48,365	56,533	Headquarter city
Munich (k = 3)	Indegree	78,356	29,169	49,187	Foothold city
Munich (k = 3)	Net degree (negative)	71,654	25,726	45,928	Foothold city
Munich (k = 3)	Total degree	85,058	53,992	31,066	Specialised city
Stuttgart (k = 3)	Total degree	81,316	53,992	27,324	Specialised city
Hong Kong (k = 3)	Net degree (negative)	52,866	25,726	27,140	Foothold city
Hong Kong (k = 3)	Indegree	53,429	29,169	24,260	Foothold city
Luxembourg (k = 3)	Net degree (negative)	47,940	25,726	22,214	Foothold city
Luxembourg (k = 3)	Indegree	47,940	29,169	18,771	Foothold city
St Helier (k = 3)	Net degree (positive)	62,331	48,365	13,966	Headquarter city
St Helier (k = 3)	Outdegree	62,331	51,049	11,282	Headquarter city
St Helier (k = 3)	Total degree	62,331	53,992	8,339	Specialised city
Stuttgart (k = 3)	Outdegree	57,624	51,049	6,575	Headquarter city

Table 4.42 Outlying cities in the admin network

City	*Outlying attribute*	*Value ($ m)*	*Largest non-outlier*	*Margin*	*Role indicated*
London (k = 4)	Total degree	198,139	82,513	115,626	Specialised city
London (k = 4)	Indegree	107,384	43,804	63,580	Foothold city
London (k = 4)	Outdegree	90,755	29,176	61,579	Headquarter city
Osaka (k = 1)	Outdegree	80,304	29,176	51,128	Headquarter city
Osaka (k = 1)	Net degree (positive)	78,095	29,176	48,919	Headquarter city
Hong Kong (k = 1)	Net degree (negative)	77,188	29,176	48,012	Foothold city
St Helier (k = 2)	Outdegree	63,133	29,176	33,957	Headquarter city
St Helier (k = 2)	Net degree (positive)	63,133	29,176	33,957	Headquarter city
Hong Kong (k = 1)	Indegree	77,188	43,804	33,384	Foothold city
Singapore (k = 3)	Net degree (negative)	60,874	29,176	31,698	Foothold city
Milwaukee (k = 4)	Outdegree	60,367	29,176	31,191	Headquarter city
Milwaukee (k = 4)	Net degree (positive)	60,367	29,176	31,191	Headquarter city
Hanover (k = 4)	Outdegree	55,563	29,176	26,387	Headquarter city
Hanover (k = 4)	Net degree (positive)	54,519	29,176	25,343	Headquarter city
Zurich (k = 4)	Outdegree	48,231	29,176	19,055	Headquarter city
Zurich (k = 4)	Net degree (positive)	48,013	29,176	18,837	Headquarter city
Singapore (k = 3)	Indegree	61,174	43,804	17,370	Foothold city
Oslo (k = 4)	Net degree (negative)	43,804	29,176	14,628	Foothold city

Table 4.43 Outlying cities in the logistics network

City	*Outlying attribute*	*Value ($ m)*	*Largest non-outlier*	*Margin*	*Role indicated*
Dallas (k = 1)	Total degree	40,835	20,281	20,554	Specialised city
Omaha (k = 1)	Outdegree	32,485	14,141	18,344	Headquarter city
Omaha (k = 1)	Net degree (positive)	32,485	14,141	18,344	Headquarter city
Dallas (k = 1)	Indegree	31,685	15,285	16,400	Foothold city
Paris (k = 2)	Outdegree	29,263	14,141	15,122	Headquarter city
Johannesburg (k = 1)	Outdegree	29,150	14,141	15,009	Headquarter city
Johannesburg (k = 1)	Net degree (positive)	29,150	14,141	15,009	Headquarter city
Paris (k = 2)	Net degree (positive)	28,521	14,141	14,380	Headquarter city
Dallas (k = 1)	Net degree (negative)	22,535	10,081	12,454	Foothold city
Omaha (k = 1)	Total degree	32,485	20,281	12,204	Specialised city
Oran (k = 1)	Net degree (negative)	20,281	10,081	10,200	Foothold city
Paris (k = 2)	Total degree	30,005	20,281	9,724	Specialised city
Johannesburg (k = 1)	Total degree	29,150	20,281	8,869	Specialised city
Tremblay-en-France (k = 1)	Net degree (negative)	17,140	10,081	7,059	Foothold city
Atlanta (k = 2)	Outdegree	21,112	14,141	6,971	Headquarter city
Atlanta (k = 2)	Net degree (positive)	21,112	14,141	6,971	Headquarter city
Algiers (k = 1)	Outdegree	20,281	14,141	6,140	Headquarter city
Algiers (k = 1)	Net degree (positive)	20,281	14,141	6,140	Headquarter city
Oran (k = 1)	Indegree	20,281	15,285	4,996	Foothold city
Minneapolis (k = 1)	Net degree (negative)	14,870	10,081	4,789	Foothold city
Durban (k = 1)	Net degree (negative)	14,661	10,081	4,580	Foothold city
Cologne (k = 1)	Outdegree	18,475	14,141	4,334	Headquarter city
Cologne (k = 1)	Net degree (positive)	18,475	14,141	4,334	Headquarter city
Hamburg (k = 1)	Net degree (negative)	14,021	10,081	3,940	Foothold city
Moscow (k = 1)	Outdegree	17,914	14,141	3,773	Headquarter city
Moscow (k = 1)	Net degree (positive)	17,914	14,141	3,773	Headquarter city
Seoul (k = 1)	Outdegree	17,788	14,141	3,647	Headquarter city
Seoul (k = 1)	Net degree (positive)	17,788	14,141	3,647	Headquarter city
Cape Town (k = 1)	Net degree (negative)	13,482	10,081	3,401	Foothold city
Houston (k = 1)	Net degree (negative)	12,561	10,081	2,480	Foothold city
Tremblay-en-France (k = 1)	Indegree	17,140	15,285	1,855	Foothold city
Atlanta (k = 2)	Total degree	21,112	20,281	831	Specialised city
Hamburg (k = 1)	Indegree	15,865	15,285	580	Foothold city
London (k = 2)	Total degree	20,489	20,281	208	Specialised city

Table 4.44 Outlying cities in the construction network

City	*Outlying attribute*	*Value ($ m)*	*Largest non-outlier*	*Margin*	*Role indicated*
Madrid (k = 2)	Net degree (positive)	80,096	35,965	44,131	Headquarter city
Madrid (k = 2)	Outdegree	80,440	36,926	43,514	Headquarter city
Madrid (k = 2)	Total degree	80,784	37,887	42,897	Specialised city
Hong Kong (k = 1)	Indegree	41,000	17,986	23,014	Foothold city
Hong Kong (k = 1)	Net degree (negative)	41,000	17,986	23,014	Foothold city
Essen (k = 2)	Indegree	29,362	17,986	11,376	Foothold city
Essen (k = 2)	Net degree (negative)	29,362	17,986	11,376	Foothold city
Schaffhausen (k = 2)	Net degree (positive)	45,758	35,965	9,793	Headquarter city
Schaffhausen (k = 2)	Outdegree	45,758	36,926	8,832	Headquarter city
Schaffhausen (k = 2)	Total degree	45,758	37,887	7,871	Specialised city
Hong Kong (k = 1)	Total degree	41,000	37,887	3,113	Specialised city

Table 4.45 Outlying cities in the hospitality network

City	*Outlying attribute*	*Value ($ m)*	*Largest non-outlier*	*Margin*	*Role indicated*
Chertsey (k = 2)	Outdegree	19,759	4,967	14,792	Headquarter city
Chertsey (k = 2)	Net degree (positive)	19,759	4,967	14,792	Headquarter city
Chertsey (k = 2)	Total degree	19,759	9,250	10,509	Specialised city
Charlotte (k = 1)	Indegree	12,946	4,619	8,327	Foothold city
Charlotte (k = 1)	Net degree (negative)	12,946	4,619	8,327	Foothold city
Paris (k = 2)	Outdegree	11,453	4,967	6,486	Headquarter city
Treviso (k = 2)	Outdegree	11,182	4,967	6,215	Headquarter city
Treviso (k = 2)	Net degree (positive)	11,182	4,967	6,215	Headquarter city
Paris (k = 2)	Net degree (positive)	10,664	4,967	5,697	Headquarter city
Milan (k = 2)	Indegree	9,250	4,619	4,631	Foothold city
Milan (k = 2)	Net degree (negative)	9,250	4,619	4,631	Foothold city
Charlotte (k = 1)	Total degree	12,946	9,250	3,696	Specialised city
Paris (k = 2)	Total degree	12,242	9,250	2,992	Specialised city
Washington (k = 2)	Indegree	7,312	4,619	2,693	Foothold city
Washington (k = 2)	Net degree (negative)	6,853	4,619	2,234	Foothold city
Treviso (k = 2)	Total degree	11,182	9,250	1,932	Specialised city

Like the regional networks, these may be collapsed into a single list of significant outlying cities using a similar procedure, resulting in the following list.

Table 4.46 Significant outlying cities in the sectoral components of the global network

City	*Network*	*Role*	*Margin ($ m)*
London	Finance	Headquarter city	429,553
	Manufacturing	Headquarter city	313,475
	Admin	Specialised city	115,626
	Commerce	Specialised city	497

City	*Network*	*Role*	*Margin ($ m)*
Hong Kong	Commerce	Foothold city	267,523
	Manufacturing	Foothold city	59,636
	Technical	Foothold city	27,140
Paris	Manufacturing	Headquarter city	262,713
	Commerce	Headquarter city	190,507
	Finance	Headquarter city	155,194
	Technical	Headquarter city	59,825
New York	Finance	Headquarter city	203,013
	ICT	Headquarter city	43,246
	Manufacturing	Foothold city	34,740
Tokyo	Commerce	Headquarter city	193,722
	Manufacturing	Foothold city	69,750
	ICT	Headquarter city	2,809
Singapore	Manufacturing	Foothold city	68,198
	Admin	Foothold city	31,698
Chicago	Manufacturing	Foothold city	62,001
Dallas	ICT	Headquarter city	56,508
Munich	Technical	Foothold city	49,187
San Francisco	Commerce	Headquarter city	42,164
	ICT	Headquarter city	34,198
Hamburg	Manufacturing	Foothold city	40,534
Dublin	ICT	Headquarter city	37,008
Madrid	ICT	Headquarter city	33,077
	Manufacturing	Foothold city	11,093
Milwaukee	Admin	Headquarter city	31,191
Hanover	Admin	Headquarter city	26,387
Luxembourg	Technical	Foothold city	22,214
Newbury	ICT	Headquarter city	21,136
Zurich	Admin	Headquarter city	19,055
Atlanta	ICT	Foothold city	17,394
Milan	Manufacturing	Foothold city	17,163
	ICT	Headquarter city	15,551
Oslo	Admin	Foothold city	14,628
St Helier	Technical	Headquarter city	13,966
Essen	Manufacturing	Foothold city	12,280
Washington	Manufacturing	Foothold city	8,643
	ICT	Foothold city	1,845
Stuttgart	Technical	Headquarter city	6,575
Armonk	ICT	Headquarter city	6,121
Rotterdam	Manufacturing	Foothold city	5,982

Table 4.47 Types of significant outlying cities in the global network

City	*Roles*	*Global and regional networks (geographic-functional roles)*	*Sectoral networks (sectoral roles)*
London	Headquarter city	European, Global	Finance, manufacturing
	Specialised city	North American	Admin, commerce
Paris	Headquarter city	European, Global, Latin American	Manufacturing, commerce, finance, technical
Tokyo	Headquarter city	East Asian	Commerce, ICT
	Foothold city		Manufacturing
New York	Headquarter city	North American	Finance, ICT
Hong Kong	Foothold city	Global, East Asian, European, North American	Commerce, manufacturing, technical
Dallas	Headquarter city	North American	ICT
The Hague	Foothold city	European, Global	
San Francisco	Headquarter city	North American	Commerce, ICT
Chicago	Foothold city	North American	Manufacturing
Amsterdam	Foothold city	North American	
Sao Paulo	Foothold City	Latin American	
Johannesburg	Foothold city	European, Global	
Singapore	Foothold city		Manufacturing, admin
Mexico City	Foothold city	Latin American	
Munich	Foothold city		Technical
Hamburg	Foothold city		Manufacturing
Dublin	Headquarter city		ICT
Madrid	Headquarter city	Latin American	ICT
	Foothold city		Manufacturing
Milwaukee	Headquarter city		Admin
Hanover	Headquarter city		Admin
Luxembourg	Foothold city		Technical
Newbury	Headquarter city		ICT
Zurich	Headquarter city		Admin
Atlanta	Foothold city		ICT
Milan	Foothold city		Manufacturing
	Headquarter city		ICT
Oslo	Foothold city		Admin
St Helier	Headquarter city		Technical
Essen	Foothold city		Manufacturing
Washington	Foothold city		Manufacturing, ICT
Stuttgart	Headquarter city		Technical
Armonk	Headquarter city		ICT
Rotterdam	Foothold city		Manufacturing

When we combine Table 4.46 with Table 4.20 (producing Table 4.47), we find that nine of the 14 cities having significant outlying roles in the global and regional networks—London, Paris, Tokyo, New York, Hong Kong, Dallas, San Francisco, Chicago and Madrid—have those geographic-functional roles matched by roles in specific sectors. At first one could argue that it is a matter of

observational equivalence whether they acquire their outlying sectoral roles by virtue of their geographic-functional roles, or the other way around. However the fact that many more cities have sectoral roles than geographic-functional roles, and the fact that the cities having only sectoral roles are generally smaller than the cities that have both types of roles, suggest that the sectoral roles come first, and that the geographic-functional roles are built on top of them. But there are also a handful of exceptions to this: The Hague, Amsterdam, Sao Paulo, Johannesburg, Mexico City. These are the very cities described earlier as having "interregional gateway roles", a type of role which is evidently important enough to emerge without having to build upon prior sectoral specialisations.

And yet, while London and Paris have sectoral roles that may well have had a hand in generating the geographic-functional roles they now play in the global network, these cities more than any other in the network seem to add up to far more than the sum of their parts. Here we must highlight the fact that these two cities have clearly generated for themselves a very special functional role within the global network, which is in supporting and optimising the very uppermost strategic functions of global businesses across all sectors and regions, the apex of what Hymer calls the "Level I" of business administration (Hymer, 1970; Iammarino & McCann, 2013).

4.3. Implications

This chapter has furnished us with a geography of the global network based on the location patterns of a large sample of companies and their subsidiaries. It has shown that this network features a number of cities (only the most outlying of which have been catalogued here) with important specialisations, many of which are sectoral, but some of which are functional. Amongst the functional specialisations that cities may develop, some relate to the emergence of the specific geography of the network itself, for example interregional gateway cities such as Hong Kong and Johannesburg, and "imperial" cities such as Madrid. We can pick out from the decompositions other specialisations which are functional rather than sectoral, for example Hamilton (Bermuda) and St Helier (Jersey) host large numbers of companies by virtue of being tax havens rather than for any sectoral specialisations they might have developed. And while many cities play host to the headquarters of many companies by virtue of their individual sectoral and functional specialisations, some cities, most importantly London and Paris, have come to specialise in the very matter of hosting the headquarters of companies.

However the critique levelled by Storper (1997) at Friedmann's (1986) "world city hypothesis" is that whatever story this geography tells about MNEs, it remains relatively inconsequential for the working of the global economy at large. No attempt has been made to address this question in this chapter. Rather, the geography laid out in this chapter becomes fodder for subsequent chapters to address this question. Specifically, it is to be seen amongst Lagos and its businesses whether they exploit the geography of this global network in pursuing opportunity wherever they find it worldwide, or whether this geography does indeed prove inconsequential for them.

Chapter 5. Lagos and its businesses

This chapter assembles the data collected through fieldwork undertaken in Lagos, Nigeria between May and August 2012. The data consists predominantly of interviews with senior staff of 20 companies headquartered in the city, as well as other knowledge gleaned in the process of setting up these interviews, or from publicly available financial data and online research.

The chapter begins with an introduction to the city, then presents reports on each of the 20 companies organised into three sectors: finance, services, and manufacturing. The reader is warned that this is the longest chapter in this dissertation (close to 30,000 words) and that it is extremely repetitive by necessity. The reader may choose to review only the summaries entitled "Themes" at the end of each company report, or even simply the sections entitled "Common themes" at the end of each sectoral grouping of companies and the larger section "Themes common across sectors" at the end of the chapter. The reader may then refer back to the detailed company reports as required.

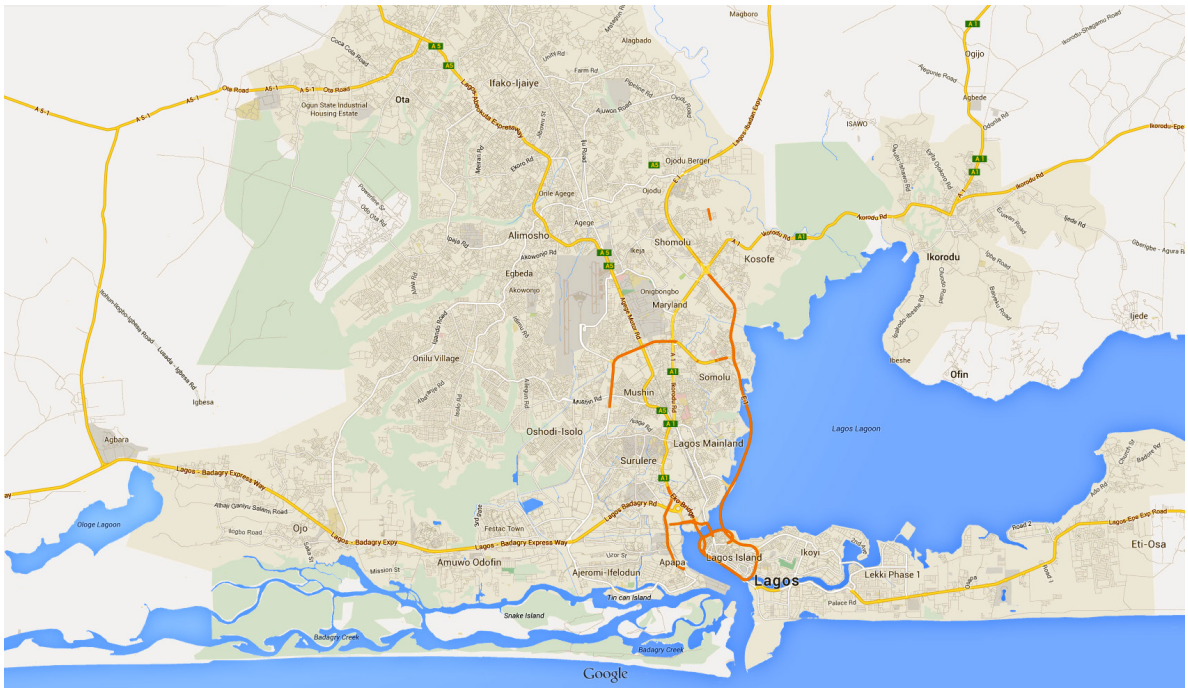


Figure 5.1 The metropolitan area of Lagos
Source: *Google Maps* (Google, 2011-2013)

Aggregate statistics identifying the scale of Lagos are fraught with problems, but on any measure the city looms large by African standards. A national census conducted in 2006 put the population of Lagos state at 9.1 million, which would have been 6.5% of the national census total of 140.4 million, or 6.4% of the World Bank's (2013) 2006 estimate of 143.3 million; however the figures for Lagos state were ruled invalid by the national census tribunal in 2013. The more accepted figure is that ascertained by a shadow census conducted by the Lagos state government also in 2006, which put the state population at 17.6 million, with 85% or 14.9 million living within the metropolitan area (though this metropolitan area also spills over into Ogun state to the north). Applying for

simplicity's sake the growth rate implied by the World Bank's 2012 population estimate of 168.8 million to the state population calculated by the shadow census, the population of Lagos state may now (i.e. in 2013) be around 21.2 million, with around 18 million in its main metropolitan area.

Like most commercial capitals, its economic performance figures much larger than its population as a proportion of national activity. According to World Bank figures, "in 2006 Lagos contributed 30 per cent of Nigeria's GDP, consumed more than 60 per cent of its energy, collected 65 per cent of its value added tax (VAT), and accounted for 90 per cent of its foreign trade and 70 per cent of its industrial investments" (Filani, 2012, p. 15). Given that the World Bank (2013) estimated Nigeria's GDP in 2006 at $145.4 billion (current US dollars) and at $262.6 billion in 2012, once again a simplistic geometric extrapolation of national GDP to 2013 suggests that Lagos' 30% share may now be equal to around $86.9 billion. In 2010 it would have been around $68.8 billion, which according to the OECD Metropolitan Areas Database (Organisation for Economic Co-operation and Development, 2012) would have placed Lagos between Copenhagen ($74.5 billion) and Helsinki ($62.7 billion) in terms of GDP, and higher than Zurich ($58.1 billion), often thought of as a major "global city". Thus also the 231 companies totalling $36.5 billion in year's turnover represented in the dataset used to identify interviewees for this study constitute a significant proportion of economic activity in the city. This is notwithstanding the reality that a large share of this activity is informal, even if this research project has focused on the city's formal sector. Combining these figures suggests that GDP per capita for 2012 in Lagos state was around $3,810 (current US dollars) or $6,532 at purchasing-power parity, higher (as one would expect) than the World Bank's (2013) estimate for the nationwide GDP per capita in 2012 of $1,555 or $2,666 at purchasing-power parity.

Unlike the "South South" or far southern region centred on Port Harcourt 440 km to the southeast, the area surrounding Lagos is not part of the oilfields for which the Nigerian economy is known, though there are companies in Lagos that provide services to companies in those far southern oilfields, or that manage the distribution and retail of oil and gas products to Nigeria's domestic consumers. Instead, Lagos' economy is dominated by shipping and distribution, a range of heavy and light industrial activity, a strong professional services sector (amongst which the banking sector is especially well developed), and a number of entrepreneurs at the small- and medium-enterprise level, each of which are highly geographically localised within different districts of the city, as described in the following section.

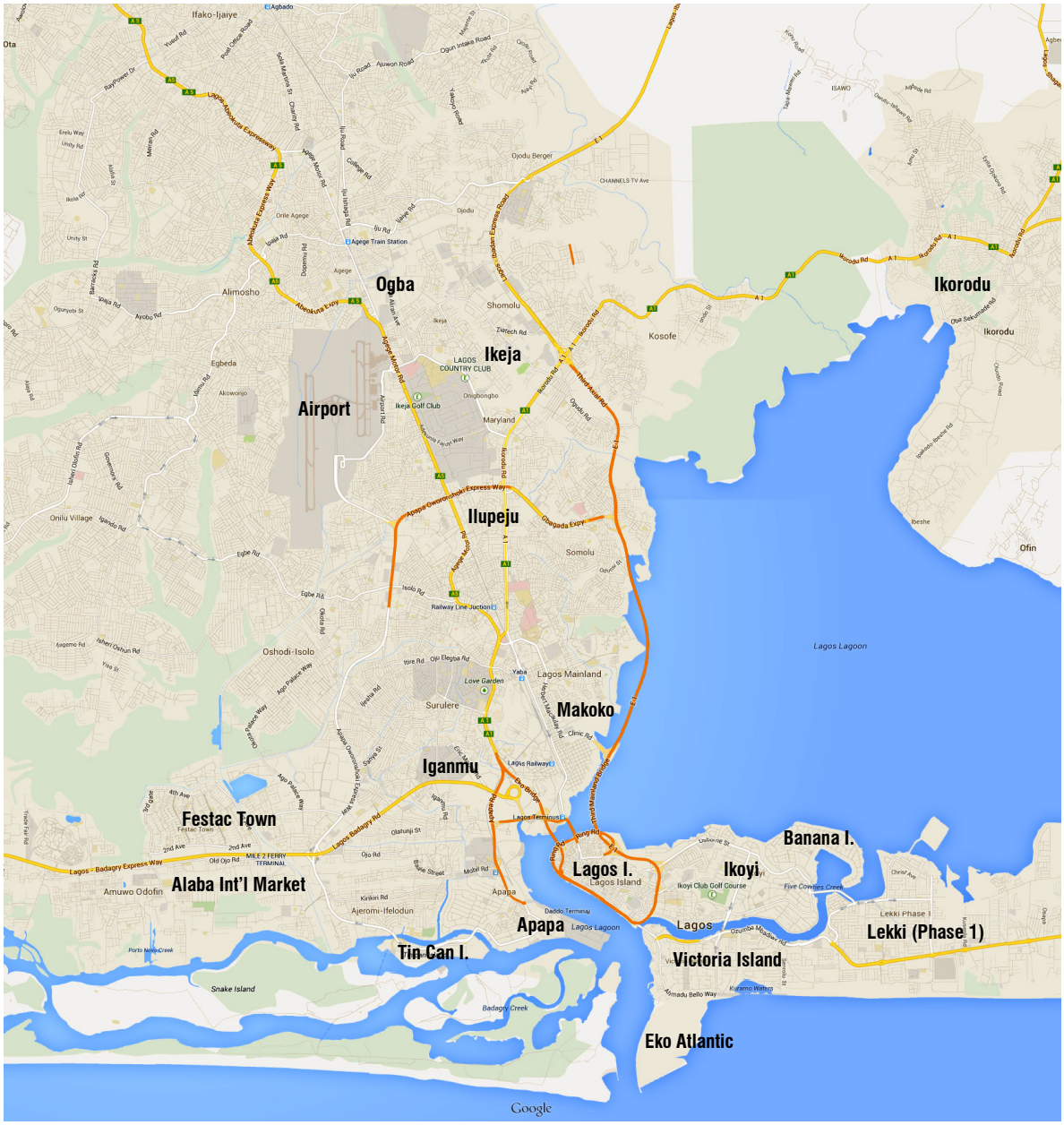


Figure 5.2 Districts cited in the study
Source: *Google Maps* (Google, 2011-2013)

5.1. The geography of Lagos

The metropolitan area of Lagos, an agglomeration of approximately 18 million people covering parts of Lagos and Ogun States in the southwest of Nigeria, is laid out in an L shape around its eponymous lagoon. The base of the L is "the island", actually an island and a peninsula, comprising 'Lagos Island' and Ikoyi on one island in the centre, and Victoria Island now appended to the Lekki peninsula stretching from just south of Lagos Island to the easternmost extremity of Lagos State. The stem of the L is "the mainland", the vast majority of the built area sprawling northward along the western edge of the Lagoon into Ogun State. Apart from the extremely heterogenous Lagos Island, development on "the island" is typically upper or middle class, low density, recently built, spacious and orderly, with many US-style residential subdivisions and only occasional informal

settlements. 'The mainland' is much more an "ordinary city", to borrow Robinson's (2005) phrase, an expansive tapestry of low-to-middle class high streets and residential areas, industrial estates, and informal settlements, climbing steadily towards a hillier suburban landscape dissected by shallow forested gullies in the north.

The businesses approached for this study are largely clustered within a handful of discrete districts, which tell the history of the city's development. The first such cluster is Lagos Island, the home of the national government during the colonial and independence eras, and whose office towers of the same age house the city's traditional financial district, with the headquarters of several leading banks (e.g. First Bank of Nigeria Plc, United Bank for Africa Plc, Union Bank of Nigeria Plc, Sterling Bank Plc, Wema Bank Plc, Mainstreet Bank Plc) marching up Marina and Broad Street towards the Central Bank of Nigeria branch on Tinubu Square, where they meet a tangle of colonial streets filled with lower class retailers and bazaars. Some, such as First Bank (est. 1894) began as white-owned businesses in the colonial era, but are firmly in the hands of Nigerian chairmen today.

Figure 5.3 The skyline of Lagos Island seen from Victoria Island. Source: author.

The second set of districts comprises the stagnating independence-era industrial estates on the mainland, including Iganmu in the local government area (LGA) of Surulere in the south, and Ilupeju, Ikeja and Ogba in the LGA of Ikeja in the north. The most significant and profitable tenants of these estates are big-brand foreign multinationals producing fast-moving consumer goods (FMCG) for the local market (e.g. Guinness Nigeria Ltd, Nigerian Bottling Company Plc—the local Coca-Cola licensee, Nestlé Nigeria Plc, PZ Cussons Nigeria Plc, Unilever Nigeria Plc, 7Up Bottling Company Plc, Cadbury Nigeria Plc, Glaxosmithkline Consumer Nigeria Plc), and a smaller presence of struggling indigenous manufacturers, typically of capital goods (e.g. Nigerian Bag Manufacturing Company Plc, Vitafoam Nigeria Plc, First Aluminium (Nigeria) Plc, Nigerian Wire Industries Plc,

Nigerian Ropes Plc). The other major presence here are empty and abandoned buildings, marking businesses that have shifted to Ghana or elsewhere, or simply given up, as Nigeria's early industrialisation experiments collapsed. Built on what must have been relatively open land at the time, they are now thoroughly ensconced within the fabric of informal settlements and lower class suburbs that their collapse generated.

The third district comprises the ports of Apapa and Tin Can Island, in the south of "the mainland", which houses the heaviest industries in the city (e.g. Flour Mills Nigeria Plc, Dangote Sugar Refinery Plc, MRS Oil Nigeria Plc, Dangote Flour Mills Plc). Unlike the stagnating industrial estates to its north and the post-colonial streetscape of the Lagos Island financial district, the port areas have grown and modernised steadily throughout the late twentieth century, with a legion of cranes and gantries standing confidently over the length of the river, and a thousand heavyweight trucks clogging the surrounding streets. To the west of these are some important local business areas, including Festac Town, the site of the 1977 Lagos International Trade Fair and still often referred to as "Trade Fair Complex", and the Alaba International Market, a warren of streets constituting one of the largest communities of electronics stallholders in Africa.

The fourth district is Victoria Island to the south of Lagos Island, whose orderly though flood-prone streets have seen much of their low-density housing converted into low- and medium-density offices over the past thirty years, as banks, oil distributors and other large businesses (e.g. Oando Plc, Zenith Bank Plc, Total Nigeria Plc, Guaranty Trust Bank Plc, Ecobank Nigeria Plc, Forte Oil Plc, Access Bank Plc, Keystone Bank Plc, Skye Bank Plc, Mobil Oil Nigeria Plc, Stanbic IBTC Bank Plc) have sought cleaner development sites than those afforded by the colonial centre, and have taken over land left by departing national government officials gone to Abuja. Also in Victoria Island, and spreading east into the subdivisions of Lekki, is a layer of smaller, younger, knowledge-based enterprises (e.g. C & I Leasing Plc, Prime Sources Ltd, Global Ocean Engineers Nigeria Ltd, Ibejige Services Ltd, Amazon Energy Manpower Services Ltd, Microspace Solutions Ltd, Internet Solutions Nigeria Ltd, HSI Ltd, Alliance Integrated Global Resources Ltd, Tenece Professional Services Ltd, Mtech Communications Plc), formed as young professionals gain the confidence to strike out on their own. The Lekki Free Trade Zone associated with Lagos is several kilometres further to the east, in the southeast of Lagos State well outside the metropolitan area.

If the mythmaking of the Lagos State Government holds true, the fifth district will be Eko Atlantic, a massive land reclamation project extending the footprint of Victoria Island and Lekki by an area equivalent to 15% of Manhattan, which is hoped to become a spectacular new "global city" of crystalline office buildings and condominiums, the likes of which the African continent has never seen. However the rhetoric does not match the logic of supply and demand. One would be more reassured that Eko Atlantic will become a "global city" like Dubai or Singapore if there were overheating demand for commercially developable land in Lagos, and unbearably high densities of office space and speculative development in the neighbouring areas of Victoria Island and Lekki. Whereas currently these suburbs are still very low-density compared to the global city centres Lagos

aspires to emulate, with freestanding two-storey development and large empty sites covering much of their area. If development controls are such that only high-density projects are allowed so as to match the imagined format of the "global city", then Eko Atlantic is likely to become just as much a patchwork of overdeveloped and underdeveloped sites sitting side-by-side for years to come as Victoria Island, Lekki, and previous land reclamation project Banana Island are today.

Thus the geography of Lagos reveals the history of its economic development—a colonial service capital, an independence-era industrial centre, a handling centre for the country's commodities, a hive of new entrepreneurial activity, and a would-be "global city". It is a history that contains winners and losers—the near total collapse of indigenous manufacturing, the supremacy of the oil industry and conglomerates like the Dangote Group—and suggests similarly mixed outcomes in the future: Lagos' indigenous tech entrepreneurs or its "global city" pretensions could each go the way of its indigenous industry ambitions.

The following are outlines of each company whose staff could be interviewed. They have been divided into three categories. "Finance companies" comprises seven banks and one insurance company. "Service companies" contains an assortment of service providers (including one small *bureau de change*), technology companies, importer-distributors and importer-manufacturers, all of whom are characterised by highly collaborative interactions with their (essentially commercial or institutional) clients. A final category, "manufacturing companies", comprises two manufacturers of inputs destined for clients in other manufacturing or extraction industries, both of which are characterised by large factory installations implanted in traditional industrial areas.

5.2. Finance companies

Seven banks and one insurer could be reached during the course of the fieldwork. Six are indigenous to Nigeria, one is indigenous to Togo, and one is headquartered in New York, yet all display somewhat similar geographies as far as their Nigerian operations are concerned.

The recent histories of many banks were intertwined with recent reforms introduced by the Central Bank of Nigeria (CBN). Headquartered in Abuja but maintaining a branch in Lagos much as the US Federal Reserve maintains a branch in New York, the CBN has taken a staunchly activist role in shaping the Nigerian banking industry over the past ten years, forcing through a major recapitalisation and consolidation exercise that reduced the number of banks from 89 to 25, and instigating significant corporate governance reforms (Ewulu, 2007). Less successfully according to one interviewee, it has also pushed banks to expand internationally, especially into the UK market. These initiatives were driven by a desire that Nigerian banks "be competent and competitive players in the African regional and global financial system" in the face of increasing consolidation in the global financial industry (Soludo, 2007, p. 9). The geography of this concern is instructive: the CBN was not concerned about North American or European banks devouring the local industry, but by its marginalisation on the global stage due to comparable consolidation processes taking place in

Argentina, Brazil, South Korea, South Africa and Malaysia, Nigeria's imagined future competitors (Soludo, 2007, pp. 10-11).

In the past few years, banks have been forced to divest themselves of non-banking subsidiaries, which has allowed many to throw off somewhat unprofitable interests in mortgage broking, registrar services, insurance and other sideline businesses and focus on their core economic function: financial intermediation. The consolidation process has been universally regarded as a success, and the renewed professionalism and sense of strategy amongst Nigerian bank employees stands out within the business landscape of Lagos.

5.2.1. First Bank of Nigeria Plc

First Bank of Nigeria Plc (First Bank) is the oldest and one of the largest banks in Nigeria, established in 1894 as the Bank of British West Africa. It has representative offices in Beijing, Johannesburg and Abu Dhabi, owns a Congolese bank headquartered in Kinshasa, and operates a subsidiary in London (FBN Bank UK Ltd) which itself has a representative office in Paris.

Table 5.1 First Bank of Nigeria Plc

Annual report	*31 Mar 2008*	*31 Mar 2009*	*31 Dec 2009*	*31 Dec 2010*	*31 Dec 2011*
Operating revenue	$1,034m	$1,093m	$856m[19]	$1,182m	$1,608m
Total assets	$12,962m	$13,658m	$14,534m	$15,297m	$18,136m
Number of employees	8,856	8,537	8,757	8,154	NA

Source: Bureau van Dijk (2013)

Like many Nigerian banks, First Bank held until recently several subsidiaries engaged in non-bank services such as pension management, insurance broking, mortgage broking, registrar services and foreign currency services. Under regulations introduced by the current chairman of the CBN, Sanusi Lamido Sanusi (a former CEO of First Bank) banks may no longer engage in non-banking activities. Whereas many banks have sold their non-banking subsidiaries, First Bank has restructured itself so that it is now owned by a holding company, which itself now owns all the former subsidiaries. However First Bank retains its direct ownership of the banking subsidiaries in London and Kinshasa.

Like many of the banks that have thrived through the consolidation, First Bank has recently sought to expand into other parts of Africa, however it has taken the strategic decision to do this through the acquisition of banks with strong brands in their respective markets rather than attempt to grow the First Bank brand in other territories from scratch in competition with existing banks. As part of this effort "to break into some African markets", it set up a desk, "First Bank International Banking", within its corporate development department to scan the continent and study opportunities in detail. In 2012 it completed its purchase of the Banque Internationale de Crédits sarl (BIC), the largest

[19] Previous nine months only

bank in the Democratic Republic of Congo. Despite the level of unrest in the east, First Bank noted that the DRC is a large country with a large economy compared to most other takeover targets, and were impressed with BIC's track record.

Domestically, there are no back office operations "outsourced" to other locations outside Lagos. Back office processing (account openings and closures, home loan assessments, *etc.*) for branches across the country are being centralised within a new office in the Iganmu neighbourhood. This will include a "learning centre" for the training of staff nationwide.

5.2.1.1. Customers

Despite its global operations, First Bank's customers remain overwhelmingly Nigerian companies or individuals, or foreign MNEs (such as oil and gas conglomerates) operating in Nigeria. Almost all its cross-border activities involve Nigerian companies or business units as one party to the transaction.

Much of the international activity involves the London subsidiary and its representative office in Paris. These offices serve Nigerian customers wishing to operate in Anglophone or Francophone West Africa, or customers in those regions wishing to operate in Nigeria, and both offices do a lot of underwriting for these customers. Because these offices are backed by the regulatory supervision of the UK Financial Services Authority (FSA), they can offer a far greater sense of security for foreign counterparties than their parent company in Lagos.

Within Nigeria, its customers are grouped into several sectors: retail (for individuals), private banking (high net worth individuals), corporate banking (small and medium sized businesses), institutional banking (MNEs with complex organisational structures) and government banking. These groups are divided into "north" and "south" regions managed in Lagos and Abuja respectively.

5.2.1.2. Capital

Like most Nigerian banks, First Bank relies on its network of "correspondent banks" to source structural finance and to share in the risk associated with major transactions. These correspondent banks are headquartered throughout the world; however the majority of them liaise with First Bank through their own representatives or subsidiaries in London or another international banking hub. First Bank has also secured a development loan from the Canadian International Development Agency (CIDA) in Ottawa.

5.2.1.3. Knowledge

Each of First Bank's locations is engaged in knowledge acquisition. The corporate development department in Lagos conducts a lot of its research activities; the bank also relies on its network of subsidiaries and representative offices to acquire knowledge within their regions. Much knowledge

acquisition is managed through the selection and positioning of staff. The manager of each subsidiary and representative office is a native of each country—i.e. the Beijing head is Chinese, the Paris head is French, *etc.*—so that each office is fully cognisant of the local context. The global head of strategy is a Nigerian American who previously worked as a McKinsey consultant.

The learning centre in Iganmu, "First Academy", will serve to disseminate knowledge throughout its Nigerian staff. It will also be part of a partnership with Lagos Business School to conduct research on financial instruments and the financial sector in Nigeria. (The Lagos Business School operated as an arm of a university in Spain before a university charter was established in Nigeria in 2002, at which time it became a faculty of the Pan-African University.) The First Academy curriculum includes language training, with staff currently learning French and Chinese among others. Increasingly the bank hopes to encourage cross-posting of staff across Africa and across the world, to encourage cross-cultural understanding.

5.2.1.4. Networking

The bank's subsidiaries and representative offices play the leading role in monitoring the business environments in their contexts, to learn about new opportunities and to "make the appropriate handshakes" with potential customers and correspondent banks. They are hoping to extend a foothold into the Americas in the future, but for now rely on their existing correspondent banks for opportunities in these regions.

To expand their networks within the Commonwealth, the bank maintains strong connections with the British, Canadian and South African High Commissions and their trade ministries. First Bank has also pursued certifications in continuity management, information security management, *etc.*, as issued by the British Standards Institution (BSI), signalling to a global business audience that the entirety of the bank's operations are in line with global professional standards.

An example of their involvement in industry conferences is a promotional campaign launched for a recent offshore oil technology conference in Houston, where they presented a portfolio of their lending, investment and research activities within the oil and gas sector.

5.2.1.5. Themes

First Bank exhibits a number of tropes common to many Nigerian banks. As the banking reforms mounted, it faced the choice of divesting itself of non-banking subsidiaries or restructuring itself to hold onto them. It is pursuing a strategy of geographic expansion into Africa, and must choose strategies that will allow it to outflank its Nigerian competitors with similar ambitions: should it acquire foreign banks or open foreign subsidiaries? Should it move into West or Central Africa? Anglophone or Francophone countries?

Like many of its peers, First Bank remains predominantly a Nigerian concern with transnational operations, rather than a transnational concern with operations in Nigeria, though this will evolve as its expansion strategy begins to show fruit. This is in slight contrast with the following case study, Ecobank, which is arguably a transnational concern which happens to have its head office in Lomé, and in clear contrast with a bank like HSBC, a global concern which chooses to have its head operations in London. It is also interesting that much of First Bank's networking activities follow old Commonwealth allegiances while ignoring Latin America, despite the growing opportunities there.

Like its peers First Bank also relies heavy on a global network of correspondent banks for its international dealings, and these global networks rely heavily on London, both as a physical location for their coordination efforts, and as a regulatory environment that can provide a sense of trust, confidence and security for these activities. It demonstrates that London's role as a global city, affirmed by the case of First Bank, is not only that of a place where agglomeration economies are realised within the financial sector, but also that of a "global guarantor" and regulatory benchmark-setter within the global economy.

5.2.2. Ecobank Nigeria Ltd

Ecobank Nigeria Ltd (Ecobank) is part of one of the most recognisable brands in West Africa. The group is headquartered in Lomé, Togo, but has operations throughout West and Central Africa, and operates in an integrated fashion. Proof of this are products such as a "Regional Card" which allows customers to withdraw local currency from Ecobank ATMs in any country without incurring the charges of a credit card supplier such as Visa or MasterCard, a "Rapid Transfer" which allows for simplified foreign currency transfers, and "Omni" which allows corporate clients to manage salary payments online from any country.

Table 5.2 Ecobank Nigeria Ltd

Annual report	*31 Dec 2007*	*31 Dec 2008*	*31 Dec 2009*	*31 Dec 2010*	*31 Dec 2011*
Operating revenue	$229m	$283m	$273m	$285m	$330m
Total assets	$2,640m	$3,262m	$2,378m	$3,015m	$6,963m
Number of employees	2,449	2,868	3,052	2,776	7,759

Source: Bureau van Dijk (2013)

Table 5.3 Ecobank Transnational Inc. (parent company in Lomé)

Annual report	*31 Dec 2007*	*31 Dec 2008*	*31 Dec 2009*	*31 Dec 2010*	*31 Dec 2011*
Operating revenue	$544m	$792m	$875m	$900m	$1,196m
Total assets	$6,550m	$8,306m	$9,007m	$10,467m	$17,162m
Number of employees	NA	11,211	11,097	10,003	23,355

Source: Bureau van Dijk (2013)

Its growth across the region has predominantly been through acquisitions, and grew from 15 countries in 2007 to 32 countries in 2012. It has operated in Nigeria since 1989 and built its presence through the acquisition of four local banks: All States Trust Bank, Hallmark Bank, African International Bank, and most recently Oceanic International Bank, a bank whose licence was revoked and whose assets were sold off by the CBN's Asset Management Corporation.

Ecobank operates representative offices in London, Paris, Shanghai and Dubai, though none of these are subsidiaries. Within Nigeria it operates six regional offices: three in different parts of Lagos (Lagos Island, Ikeja, and Apapa), one in Ibadan which manages the southwest of Nigeria excluding Lagos, one in Abuja for the north, and one in Port Harcourt for the south.

All underwriting for Ecobank's cross-border customers is handled by a desk called Ecobank Capital, which has a strong presence in London where it coordinates with Ecobank's correspondents.

5.2.2.1. Knowledge

Ecobank operates a centralised research and product development unit in Lomé, though their work is derived on knowledge supplied by managers in each of the regional offices. However its informational technology department that helps build many of the products is centralised in Accra. Its product research is centralised in Lomé, based on knowledge acquired by regional managers in each country.

5.2.2.2. Themes

While less could be gleaned about Ecobank's operations due to the limited access allowed, the case reaffirms two patterns seen in other banks. The first is the ways that West African banks pursue expansion across the region either through acquisition of local banks in new territories or establishment of new subsidiaries, and expansion into either West or Central Africa or both. The second is the choice between acting as a national bank engaged in cross-border activities as in First Bank, or as a regional bank operating in an integrated fashion across all countries, which is Ecobank's model.

5.2.3. Intercontinental Bank UK Plc

An interview could be conducted with the chief operations officer (COO) of Intercontinental Bank UK Plc, the London subsidiary of Intercontinental Bank Plc (Intercontinental), a Nigerian bank that had been wound up by the CBN and seen its assets bought by Access Bank Plc (Access), a larger Nigerian bank. Since Access Bank Plc already has its own London subsidiary, it does not need another one, so this COO was in the process of reapplying for the subsidiary's UK banking licence so that it could be sold off to some other foreign bank needing a foothold in London.

Table 5.4 Intercontinental Bank (UK) Plc (subsidiary in London)

Annual report	*31 Dec 2007*	*31 Dec 2008*	*31 Dec 2009*	*31 Dec 2010*	*31 Dec 2011*
Operating revenue	$0.00m	$1.17m	$2.11m	$1.88m	$2.63m
Total assets	$3.81m	$42.57m	$59.60m	$110.33m	$97.25m
Number of employees	3	8	7	20	20

Source: Bureau van Dijk (2013)

Table 5.5 Intercontinental Bank Plc (parent company in Lagos)

Annual report	*29 Feb 2008*	*28 Feb 2009*	*31 Dec 2009*	*31 Dec 2010*	*31 Dec 2011*
Operating revenue	$1,065m	$589m	$319m[20]	$309m	wound up
Total assets	$11,804m	$6,388m	$4,231m	$4,703m	wound up
Number of employees	10,261	12,217	11,964	5,368	wound up

Source: Bureau van Dijk (2013)

Table 5.6 Access Bank Plc (parent company after takeover, in Lagos)

Annual report	*31 Mar 2008*	*31 Mar 2009*	*31 Dec 2009*	*31 Dec 2010*	*31 Dec 2011*
Operating revenue	$353m	$472m	$384m[21]	$456m	$626m
Total assets	$8,773m	$4,758m	$4,608m	$5,285m	$10,293m
Number of employees	NA	NA	NA	NA	NA

Source: Bureau van Dijk (2013)

He offered insight into how a Nigerian bank sets up a London office, and why. One of the key decisions is whether the London office will be a branch or a legally independent subsidiary. The latter is often chosen because it means that the London operation will be regulated by the FSA, an important signal to foreign clients needing to do business with Nigerian clients and vice versa that the bank has achieved a world-class level of prudence and reliability. It is also useful to achieve FSA clearance since this gives banks an easier ride trying to set up branches in Europe, the Middle East and elsewhere, where regulatory authorities are likely to accept an FSA licence as evidence that they can safely issue their own. London is also the largest foreign exchange market in the world, especially important for a country like Nigeria dependent on large oil exports.

He warned that obtaining interviews with bank staff in Lagos could be notoriously difficult, and indeed was unsuccessful in helping obtain access to his parent office in Nigeria, a problem which plagued the entire fieldwork process: "You'll find them exceptionally frustrating. I'd be stunned if you get into any of the banks."

[20] Previous 10 months only

[21] Previous nine months only

5.2.3.1. Customers

While some of the business done by the short-lived UK subsidiary was underwriting for trade between Nigerian business units and foreign counterparties, a lot of the business was on the secondary market, i.e. the buying and selling of risk, and lending from one bank to another. For example, "Citibank would finance a huge oil shipment, e.g. 100 million [pounds or dollars]; they want to offload some of their risk [...] they sell a bit of business ["five or 10 million"] to us."

5.2.3.2. Capital

As a result of its secondary finance activities the UK subsidiary was instrumental to the financing of the parent company through its ability to liaise with global lending institutions and procure large credit facilities from them.

5.2.3.3. Knowledge

When the Nigerian parent wanted to set up a subsidiary in London, it simply advertised for the main positions such as COO through the local financial press and recruitment agents, as a result acquiring the knowledge of individuals experienced in the London financial sector.

5.2.3.4. Supply

To contract legal, auditing and other consulting companies, the London team would either call for tenders or handpick consultants based on their own experience and knowledge of the industry. This was not without conflict, however. When it came to the bank's IT systems and software, the London staff wanted to call for tenders, whereas the Nigerian parent insisted on their using the same software used for their Nigerian operations, since that would be cheaper for the Nigerian parent even though it was considered inappropriate by the Londoners. "What's best for trade finance in Nigeria isn't necessarily what's best for the UK," said the COO.

5.2.3.5. Themes

This UK subsidiary provides insight into the role London plays for many banks in Nigeria, and some of the difficulties Nigerian banks encounter in making sense of requirements in the London financial sector. Not only does London play "global guarantor" for businesses seeking to trade with Nigerian counterparties; it also plays this role for regulators around the world, who rely on the rigours of the FSA compliance regime as a signal that banks are fit to operate in their own contexts.

5.2.4. Keystone Bank Ltd

During the consolidation of the banking industry, banks that failed to meet the heightened capitalisation requirements had their licences revoked and their operations auctioned off by the CBN. Keystone Bank Ltd (Keystone) was one of the new banks created through this process, when funds were injected into the assets of the former Bank PHB Plc (PHB). Keystone retained PHB's subsidiaries in Sierra Leone, the Gambia, Liberia and Uganda, all profitable assets. As a result of this recent history, however, Keystone is more focused on simply stabilising the bank's operations—raising deposits, improving standards, growing its "loanbook", increasing its profit margins—than on pursuing opportunities outside Nigeria.

There is not yet any publicly available financial data for Keystone Bank Ltd.

Table 5.7 Bank PHB Plc (predecessor to Keystone Bank Ltd)

Annual report	*30 Jun 2007*	*30 Jun 2008*	*31 Dec 2009*	*31 Dec 2010*	*31 Dec 2011*
Operating revenue	$211m	$531m	$554m[22]	NA	wound up
Total assets	$3,001m	$8,815m	$3,731m	NA	wound up
Number of employees	1,352	2,214	NA	NA	wound up

Source: Bureau van Dijk (2013)

5.2.4.1. Customers

While many of the technology companies interviewed report that bank loans are very unfavourable, Keystone reports that there is still a "very high rate of applications", creating a lot of competition between lenders. One of its strategies to maximise its lending capacity is to encourage small traders to form associations to whom it can lend with a lower level of risk. "You can more easily track them" when they come together in groups.

Trade finance tends not to engage much with Nigeria's limited export sector. "The oils [oil and gas multinationals] do the big transactions for themselves"; small banks like Keystone must focus on smaller multinationals and importers. The young strategists being interviewed repeat the refrain: "[We] Nigerians, we do more of imports than exports."

A major difference between retail corporate banking in Nigeria and say, the UK, is that in the UK, "most branch staff stay in the branch", whereas in Nigeria, banks send marketers out "door-to-door", to visit company managers and encourage them to make deposits.

[22] Previous 18 months

5.2.4.2. Themes

Again the very limited access yields less specific information than one would like; the main lesson is the sentiment echoed by many companies during the fieldwork, which is that when the oil and gas sectors (themselves based mainly in Port Harcourt) are removed from the picture, Nigeria's economy is highly import-dependent, reflected in the trade finance demands of its businesses.

Keystone continues to benefit from the successful expansion strategy of its predecessor, which chose to move into secondary Anglophone countries such as Liberia and Uganda rather than larger Anglophone markets such as Ghana and Kenya where competition might have been too intense.

5.2.5. "Lagos Bank"

By the time interviews were being conducted with this bank (whose real name cannot been disclosed), it had been established that most banks follow similar patterns; these interviews focused instead on the history of the banking reforms and how they affected the growth strategies of the bank.

When Olusegun Obasanjo was re-elected to the presidency in 2003, he brought a very strong economic team, people who were not politicians, including Ngozi Okonjo-Iweala (formerly managing director of the World Bank) as minister of finance and Chukwuma Charles Soludo, first as his economic adviser, then as chairman of the CBN.

The head of this bank's treasury believed that since 2004 the CBN had been governed by two strong figures, Soludo, a "very erudite and respected economist" and professor, followed by Sanusi, "a maverick". Regarding the consolidation process conducted under Soludo, this head of treasury commented: "that, I think, was a master stroke; we could then recruit skills from overseas, and we could very easily raise capital." This bank rapidly acquired another Nigerian bank with a significantly different geographic coverage to its own, which gave it the capital base to survive the consolidation.

In his opinion the biggest thing Soludo did wrong was mismanage Nigeria's interest rates during the global financial crisis. Soludo "kept singing this song about the Nigerian economy being decoupled" from the global crisis, that its oil exports could see it through. But Nigeria's economy wasn't decoupled; in December 2008, "oil prices crashed and it was terrible." There was a huge devaluation of the naira, and a reversal of capital flow as people kept taking money out of Nigeria. Before and after the crisis, this bank kept receiving greater and greater requests for dollars from its customers. When the oil price crashed, the biggest problem such customers faced was not the price of the dollar relative to the naira, it was the liquidity of the dollar itself—"people were willing to pay anything to access dollars, but dollars could not be sourced. That was the very low point of Soludo's governorship of the bank."

By the time Soludo sought a second term, this head of treasury believes he had gotten too close with the bankers he was meant to be supervising: "they showed him the good things of life; he got a bit distracted." One of Soludo's errors was to maintain the availability of "universal banking licences", which permitted banks to enter into non-banking services. This error was corrected by Soludo's successor, Sanusi. Sanusi had been "a top risk manager" at United Bank for Africa and at First Bank, then CEO of First Bank. He cleaned up the behaviour of the industry, and forced banks to divest their non-banking subsidiaries, in which he believed they did not have the skill sets, to focus on the productivity and the health of the core banking services sector. This was certainly the right view to take of this bank's own subsidiaries, all of which had been loss-making, "because we rushed into them," according to this head of treasury. Sanusi had said, "no, focus on being a commercial bank, or a merchant bank, or a regional bank, etc."

Following the consolidation, this bank began to diversify geographically. While other Nigerian banks moved into Ghana, Liberia and Sierra Leone, this bank moved into Francophone West Africa, a decision made easier by the availability of a common market banking licence covering eight countries. They lobbied the UEMOA (*Union économique et monétaire ouest-africaine*, or West African Economic and Monetary Union) to allow a common market licence to a Nigerian bank; "we pushed for it, made them see the value of it." This proved highly successful, with the Benin subsidiary turning a profit within four years, and the Togo branch of this subsidiary within six months. The balance sheets of each of these subsidiaries are independent, but the risk management is coordinated across the group.

This head of treasury was also willing to talk about complaints made by many of the industrial and services sector managers interviewed in this fieldwork that interest rates on commercial loans were prohibitive. To this he said, "the main risk is country risk, which manifests in terms of loan [conditions], but also the number of instruments available to you. We can't obtain 10-year facilities, for example," because foreign institutions do not yet trust the Nigerian context. He points out that, "Nigeria didn't have a sovereign rating until two or three years ago. You have to work extra hard as a Nigerian to get investors, compared to a bank in say Kazakhstan or Brazil, because of the negative impression overseas." Nigerian government 30-day treasury bills themselves have yields of 13 to 14%. It is getting easier: "we now have a listing on the London stock exchange though, which was unimaginable a few years ago."

Two other factors push up costs for Nigerian loanseekers. On one hand, there is huge competition amongst banks to win depositors, who can thus demand high levels of interest on their deposits. On the other, he believes the costs of operating a bank in Nigeria can be "double" the cost in developed countries. He goes to the window of his office to point down to a small power plant at the bottom of the bank's multi-storey headquarters: four diesel generator sets the size of small buses and a universal power supply (UPS) hooked up to the bank's IT infrastructure. They have a generator set, a UPS and 24-hour security at every office and branch. As for moving cash between them, "it *costs*, hugely so," is his turn of phrase. These are "things overseas banks take for granted."

The financial data for this bank have not been included here to resist identification.

5.2.5.1. Customers

The head of treasury split his understanding of the bank's clientele into oil and non-oil companies. The oil and gas sector constituted a "completely different graph": the bulk of exports consisted of crude to "westernised nations", and the bulk of imports refined products from the US and Europe. "But if you exclude crude oil and refined products, the map changes completely, the balance swings to Asia, to China"—for manufactured goods—while "a lot of the midsized [trade] and pharmaceuticals go through India."

Domestically the bank splits its customers into seven regions: Lagos 1 (downtown and the port at Apapa), Lagos 2 (the rest of the mainland including Ikeja and Alaba International Market), the west (including Ibadan, Benin City, Ilorin and Akure), the "south-south" (Port Harcourt, Calabar, Oyo, *etc.*) the southeast (Enugu, Owerri, Onitsha, *etc.*), North 1 (which includes Abuja and Kaduna) and North 2 (which centres on Jos and Maiduguri, what the head of treasury calls the "Boko Haram" region—a reference to the extremists who have terrorised the north).

5.2.5.2. Finance

In terms of this bank's interactions with global financial markets, 80% of its dollar clearing is done in New York, but this is largely a technological exercise. The more involving activity is trade finance (organising letters of credit, risk offsetting) which must be negotiated for each transaction, 80% of which is done in London even for dollar- and yen-denominated transactions. While its correspondents are located around the world in cities such as Tokyo and Dubai, negotiations are still conducted between their respective London offices. After London and New York, a few other services are managed directly in Frankfurt.

Another major source of structural finance are the development finance institutions such as the International Finance Corporation (IFC, part of the World Bank Group) in Washington DC, with which the bank has a 70-million US-dollar facility, and the African Export-Import Bank in Cairo, which recently offered a 100-million US-dollar 7-year facility. Long term loans such as these cannot usually be sought from commercial banks, whose facilities are usually limited to one year.

5.2.5.3. Knowledge

One episode shows how the bank has benefited from outside knowledge. In 2009 the bank—the entire group—reported its first loss, which came as a shock to the system. The bank decided to hire

consultants—Oliver Wyman, headquartered in Paris[23]—to comb through their operations. The team consisted of "Americans, Africans, Germans", but were based in London with some in Johannesburg. The bank had said "we're not going to brief you, just ask whatever you want to ask." From that point, "they worked with us for an entire year. After their initial report, we had a team of 50 of our staff dedicated to analysing and implementing the changes on the entire corporate group … We didn't want them to just hand in their report and go." This is how the subsidiaries were found to be underperforming; Sanusi's reforms "just helped with the push by saying 'get rid of these other businesses'." The pension business was kept (as well as the banking subsidiaries) and is now profitable. The others—the registrars, the mortgage company, the insurance company—were sold off.

Internally, each staff member must attend some form of training twice a year. The bank has training schools in Lagos (in Victoria Island), Owerri and Abuja; consultants may be brought in from overseas to conduct trainings.

5.2.5.4. Supply

The bank uses Oracle Flexcube, as well as software developed in-house in Lagos.

5.2.5.5. Networking

Networking consists of "a lot of phone calls, a lot of travel to Cairo and Washington, and obviously we are in London all the time." While a lot of cash management occurs in New York, "because it's seamless, it doesn't require much travel." Despite there being a much greater volume of business occurring in New York, there is much more travel to London. Travel tends to occur for structural finance more than trade finance, "but we do travel for trade finance of two years or longer, since these more resemble structural financing." A large trade finance deal for a customer buying capital goods on two- to three-year terms can involve travel to London, for example.

5.2.5.6. Themes

The first interesting observation of this bank's experiences of interacting within global financial markets is that despite its close coordination with partners in New York and London (including face-to-face travel), this cannot in any way circumvent the restrictions imposed by the national context, specifically the high level of sovereign risk associated with Nigeria and the resulting regime of high interest rates (both in terms of treasury bills and competition for depositors). The national context remains a significant constraint on the behaviour and efficiency of the global city network as a set of business relationships.

[23] "We couldn't get McKinsey so we got the next best."

The second is how a clear distinction is made between the nature of New York within the network and the nature of London. While both are financial hubs from the perspective of the global division of labour, there is a fine division of labour between them even from the narrower perspective of the financial sector itself, with currency transactions prevalent in New York and trade finance transactions prevalent in London.

A separate observation is how the Nigerian economy itself is split between oil and gas on the one hand (export of crude, import of refined products) and the import of manufactured goods on the other, and how these have very separate geographies, almost independent geographies from Nigeria's perspective.

5.2.6. Citibank Nigeria Ltd

A limited interview was afforded with a vice president of Citibank Nigeria. Part of one of the world's largest financial institutions, Citibank Nigeria plays an intermediary role in Citigroup's activities in West Africa. It is governed by Citigroup's EMEA (Europe, Middle East and Africa) office in London, while the strategy for sub-Saharan Africa is overseen from Johannesburg. Citibank Nigeria has three representative offices within West Africa but is not wholly responsible for them: London shares in the oversight of the Accra representative office, Johannesburg shares in the oversight of offices in Dakar and Abidjan.

Despite Nigerians' belief that Lagos is a hub for the region, my interlocutor concurs that West Africa is very fragmented economically: "We agree! That's what we've been telling the Nigerian government!" He repeats the refrain: "Nigeria is import-dependent, mostly."

Table 5.8 Citibank Nigeria Ltd

Annual report	*31 Dec 2007*	*31 Dec 2008*	*31 Dec 2009*	*31 Dec 2010*	*31 Dec 2011*
Operating revenue	$129m	$130m	$154m	$122m	$77m
Total assets	$1,152m	$1,188m	$1,216m	$1,718m	$2,346m
Number of employees	282	248	245	246	NA

Source: Bureau van Dijk (2013)

Table 5.9 Citigroup Inc. (parent company in New York)

Annual report	*31 Dec 2007*	*31 Dec 2008*	*31 Dec 2009*	*31 Dec 2010*	*31 Dec 2011*
Operating revenue	$79,875m	$46,832m	$86,159m	$87,636m	$77,861m
Total assets	$2,187,631m	$1,938,470m	$1,856,646m	$1,913,902m	$1,873,878m
Number of employees	375,000	323,000	265,000	260,000	266,000

Source: Bureau van Dijk (2013)

5.2.6.1. Customers

Unlike most local banks and their mostly local clients, Citibank Nigeria's clients are predominantly foreign companies (US and European, but increasingly Indian and Chinese as well) seeking to do business in Nigeria, most commonly selling consumer goods to the large local population. Some are foreign brands manufacturing in Nigeria, but the cost of energy makes this minimal compared to Ghana. With regards to China, there are state-owned enterprises interested in building infrastructure in Nigeria, private equity firms looking for investment opportunities, and manufacturers headquartered in Beijing and Shanghai looking to set up local operations. Many businesses coming into Nigeria make their first port-of-call in Johannesburg, because the infrastructure and institutions to accommodate global interests are better established in South Africa. Nevertheless they are usually a good fit with Citibank because "we tend to sync with their strategy, their global strategy, the way they cascade down to Nigeria." Domestically they operate branches in Lagos, Abuja, Port Harcourt and Kano as well as two nominally "rural branches", which the CBN requires to address spatial inequalities.

5.2.6.2. Capital

Citibank Nigeria can rely on the entire Citi family to help fulfil its financing requirements; nevertheless interbank lending is overwhelmingly in London, but other funds flow through New York, Moscow, Beijing, Shanghai and Mumbai.

5.2.6.3. Knowledge

Citigroup has a plethora of products available to customers in different countries, but it is the job of the Lagos office to see which are applicable to the Nigerian context, which meet the particular demands of Nigerian customers. These are customised by product development teams in Lagos. Strategy staff have been sent to conferences and training programmes in Lagos, Abuja, Johannesburg, London and Istanbul, and conferences in Lagos, Abuja, Johannesburg, London and New York.

5.2.6.4. Themes

Ostensibly, Citigroup's capacity to help businesses expand geographically goes in both directions—into and out of Nigeria—so it is important to note that Citibank Nigeria's clientele is overwhelmingly foreigners coming to Nigeria rather than Nigerian businesses seeking to expand "upwards".

This interview also points to the importance of Johannesburg as a gateway into sub-Saharan Africa and even into Francophone West Africa, not only because of the cluster of businesses located there, but also because of the presence of enabling infrastructure and institutions.

5.2.7. Aiico Insurance Plc

Aiico Insurance Plc (Aiico) began in the 1960s as an offshoot of the US company AIG. In the 1980s AIG was forced to divest 60% of its holdings to indigenous owners, and has since divested entirely. 5% of Aiico is owned by Aiico Bahamas; this was originally a vehicle for AIG's ownership, but now has no connection to AIG.

Aiico has "zero presence outside Nigeria", based on the deliberate choice to first exploit the vast and unpenetrated domestic market before thinking about smaller neighbouring markets. Its strength is in life insurance, and it is seeking to expand into oil and gas, retail (life, and public liability), travel and health, though health must be done through a subsidiary since it requires a separate licence.

Table 5.10 Aiico Insurance Plc

Annual report	*31 Dec 2007*	*31 Dec 2008*	*31 Dec 2009*	*31 Dec 2010*	*31 Dec 2011*
Operating revenue	$39.6m	$56.4m	$58.8m	NA	NA
Total assets	$109.9m	$209.1m	$204.8m	NA	NA
Number of employees	301	293	301	NA	NA

Source: Bureau van Dijk (2013)

5.2.7.1. Customers

Aiico is spread across five "footprints": Lagos, Abeokuta and Akure in the southwest, Kano in the north, Abuja in the centre, and Aba for the east and southeast. A subsidiary, Multishield Ltd, has branches in Port Harcourt, Enugu, Abuja, Maiduguri and Sokoto. Aiico has looked at entering markets such as Ghana and Togo and decided "the business case just isn't there."

5.2.7.2. Capital

Like the banks, Aiico participates heavily in global financial markets, but the geography is that of the large reinsurers rather than of the global financial capitals. Aiico favours long term relationships to open market transactions, and over time has "built a shortlist" of partnership deals that it renews every year. Zurich Re and Munich Re are at the top of the list internationally, Africa Re locally. Aiico also has agents in London to help spread its exposure across the large investors with an appetite for risk located in such a city.

Nigerian regulations require composite insurance companies such as Aiico to have $5bn in capital on hand; Aiico has $9bn. A local round of public offering in 2007 raised $4bn. Aiico have looked for direct foreign investors, but want "a foreign investor with experience. We don't want just some private capital investor breathing down our necks about repayments."

5.2.7.3. Knowledge

Aiico reports using foreign consultants less and less, but has previously hired consultants in Boston and Paris. However it has a good record of hiring staff with consultancy experience—in Shanghai, Boston (Stax), Toronto, Abuja and London (Accenture, Cap Gemini), and is considering accepting investment capital from interests in Johannesburg, on the condition that the investor has foreign experience in insurance to share. The policy of hiring former consultants arose when the chairman's son returned from London to join the company, and began hiring key personnel through his own international networks.

New product lines come through insurance brokers who sell niche products for other insurers, and approach Aiico advising that they develop these products as well, so that the brokers can sell these for them too. For example, Cooper Gay, an insurance broker based in the UK, advised that Zurich Re was starting to reinsure "terrorism" policies (damage caused by bombings, loss of income, *etc.*), and that Lloyds were starting to retail them, so Cooper Gay is now helping Aiico liaise with Zurich Re to develop the product. When it comes to developing new products, their software supplier (see below) sends staff across to help customise their software for these new products.

Aiico also supports staff pursuing further education, including masters at the University of Chicago Booth School of Business, INSEAD in Abu Dhabi, and Harvard in Boston.

5.2.7.4. Supply

Aiico's software (TurnQuest Insurance Suite) is made by Turnkey Africa, a Kenyan company that has grown enormously with financial software tailored to African contexts. Aiico staff travelled to Nairobi to witness it, and brought it to Lagos for demonstrations, before purchasing. They were referred by an insurance company in Kenya, and Aiico's decision to adopt it was heavily influenced by their user testimonials.

Aiico's financial advisers include PricewaterhouseCoopers, Rand Merchant Bank and KPMG—in each case their Lagos offices and their Nigerian staff. AXA Capital has also tried to enter into business with them as a way of entering into the Nigerian market.

5.2.7.5. Networking

All the insurance companies in Africa meet at a conference each year, where they are joined by the large international reinsurers (last year it was held in Khartoum). Most travel is for training seminars and industry knowledge forums where leading-edge products are discussed. Brokers such as Cooper Gay, through whom 80% of Aiico's clients are signed, are instrumental in keeping Aiico abreast of opportunities.

5.2.7.6. Themes

Aiico exhibits a narrow focus on the Nigerian market shared by some businesses in other sectors, but in contrast to local manufacturers who wish to export but can't due to lack of competitiveness or government trade restrictions, Aiico is able to but chooses not to. The Aiico case hints not only at an ongoing role for London even in specific financial markets such as insurance, but also a geographic division of labour within the global IT and software market, with Nairobi emerging as an African software hub distinct from cities such as San Francisco and Bangalore. The Aiico case also shows a strong pattern within Nigerian businesses to acquire knowledge through the hiring of staff and consultants with experience in highly advanced economies such as the US and Western Europe.

5.2.8. Mainstreet Bank Ltd

Mainstreet Bank Ltd (Mainstreet) is another product of the consolidation process (in this case built from the former Afribank), and is likewise still owned by the CBN, making it difficult to pursue aggressive strategies until the CBN finds a suitable private-sector investor to take the bank off its hands. Mainstreet is still in the process of preparing its non-core subsidiaries (pensions, insurance, *etc.*) for sale and divestment.

There is not yet any publicly available financial data for Mainstreet Bank Ltd.

Table 5.11 Afribank Nigeria Plc (predecessor to Mainstreet Bank Ltd)

Annual report	*31 Mar 2008*	*31 Mar 2009*	*31 Dec 2009*	*31 Dec 2010*	*31 Dec 2011*
Operating revenue	$128m	NA	$176m[24]	$56m	wound up
Total assets	$2,988m	NA	$1,852m	$1,737m	wound up
Number of employees	NA	NA	3,432	3,073	wound up

Source: Bureau van Dijk (2013)

5.2.8.1. Customers

Mainstreet focuses its operations in Lagos, Ibadan, Abuja and Port Harcourt, and banking product innovation can draw on ideas from all four regions, but products will have different levels of success in each. For example, foreign exchange products do better in the "[south-]east and [south-]west" than in the north where the economy is much more undocumented, whereas 0% interest savings accounts only has appeal in the north where it complies with sharia banking law.

Mainstreet covers very few oil-related transactions, since these companies organise their own finance on international markets, and therefore the types of trade that remain are much more indicative of the Lagosian economy than of the extractive industries that dominate the national

[24] Previous nine months only

balance sheet. On the import side, 60% of trade finance is for purchasing manufactured goods from Guangzhou. After this, money flows out to Istanbul (due to a strong connection to Türkiye İş Bankası, known in the UK as "Isbank"), London, Milan and Rome, Madrid, Hong Kong, Kuala Lumpur (for raw materials for steel manufacturing), Houston, Mumbai, New York and Amsterdam (oil-related imports). On the export side, Mainstreet deals with a few companies exporting to Banjul in the Gambia, Lomé in Togo, and New York, with the commodities being primarily tobacco, seeds, cocoa and coffee.

5.2.8.2. Capital

With regards to interbank lending, Mainstreet's institutional finance team liaise overwhelmingly with banks in London (and with a number of Nigerian and Lebanese banks through their desks in London), but also liaise directly with banks in Frankfurt, Johannesburg, Stockholm, Beirut, Dubai and Abu Dhabi, Jeddah, and with United Bank for Africa's desk in New York. The rationale for choosing different banks rests on the how Mainstreet and other banks spread the risks of large commercial transactions. London banks will often sell a share of the risk for a 30 million tonne cargo shipment to small banks like Mainstreet, for example, whereas a bank in Beirut is more likely to trade risk on much smaller deals.

5.2.8.3. Knowledge

The research teams involved in developing and customising the different products travel within Nigeria to garner ideas and improve their understanding of customers far more than they travel outside the country to import them. From Mainstreet's perspective it is easier to pay for conference calls and other technological solutions to communicate with foreign counterparts than to travel to Dubai, London or Washington DC, *etc.*

5.2.8.4. Networking

To maintain their relationships with correspondent banks and build new partnerships, the institutional finance team sometimes go on roadshows to London and similar centres to explain the qualities of Mainstreet's commercial lending and risk buying portfolios to other banks.

5.2.8.5. Themes

The most interesting information emerging from the Mainstreet case is the geography of its trade finance operations. Since it is too small to engage in oil-related transactions, Mainstreet's trade activities offer a view into the specifics of the Lagos economy. It is interesting to see the common refrain confirmed that "Nigeria", and in particular Lagos, is an "import-dependent economy", and also surprising that so much of Lagos' imports might be funnelled through just one geographic connection: the manufacturing metropolis of Guangzhou. Interesting also to see how parochial

Mainstreet's export-related activities appear by comparison, with independent exports only to very small neighbouring countries, and parent-company-driven exports channelled through New York.

5.2.9. Common themes

Taken together these eight banking and insurance companies paint a picture that rather reinforces a view of the global city network as a hierarchical structure dominated by London, and to a lesser extent by New York and a handful of other financial centres. But it also offers the view that there is qualitative differentiation between these centres, that there is a global spatial division of labour even within the financial sector.

The trade finance patterns that emerge from these companies confirm the view that Lagos "is an economy based on importation", but also that this importation follows very specific channels, e.g. manufacturing from Guangzhou, plant and equipment from Mumbai, technology from San Francisco. Not only might the global city network be conceived of as a hierarchy, but it also ought to be understood as comprising several spatial divisions of labour, with individual cities that play qualitatively distinct roles within the global economy (Guangzhou as the world's manufacturer, London as its banker), as well as individual cities that play distinct roles within each regional economy (Nairobi as Africa's software hub, Nnewi and Aba as Nigeria's manufacturing hubs).

5.2.9.1. Customers

While most banking and insurance companies interviewed remain Nigerian concerns with transnational activities rather than global concerns with administrative functions in Nigeria (First Bank, Intercontinental/Access, Keystone, 'Lagos Bank', Aiico, Mainstreet), the larger banks are engaging in an increasingly successful process of geographic expansion (First Bank, Ecobank, 'Lagos Bank'). And while many banks have subsidiaries and representative offices in the world's leading financial centres (First Bank, Ecobank, Access), these are not the beachheads of these expansion processes. Rather it is by spreading into West and Central Africa, opening new subsidiaries ('Lagos Bank') or acquiring smaller local banks (First Bank, Ecobank) in neighbouring countries that Nigerian banks have achieved growth.

The impact of the consolidation process described in the introduction to this sector is that Nigerian banks have embarked on several forms of geographic expansion, though none seem to match the highly global geography that Soludo anticipated. Rather than compete horizontally with other rapidly developing economies such as Brazil or Malaysia, they have expanded "upwards" and "downwards" with degrees of success that are instructive for this study.

Three geographies of expansion emerge in this fieldwork. The first was the wave of Nigerian banks opening subsidiaries in London in 2007-08, e.g. Zenith Bank (UK) Ltd, Union Bank UK Plc, FBN Bank (UK) Ltd (owned by First Bank), Guaranty Trust Bank (UK) Ltd, Access Bank UK Ltd (owned

by Access) with the encouragement of the CBN, in a superficial attempt to globalise Nigerian banking. Many of these (e.g. Intercontinental) got their fingers burnt by the global financial crisis of the same years when it was revealed how too much of the Nigerian banking sector relied on interbank lending instead of deposit taking and relending for their profitmaking. They all retain a foothold in London today, but this serves more to manage their liquidity and better serve their customers in West Africa than as an exercise in strategic speculation.

The second is the network of representative offices and foreign partner banks that Nigerian banks develop to maintain a foothold within each of the world's largest capital markets (First Bank, Ecobank, Intercontinental/Access), typically a representative or subsidiary in London and perhaps Paris, as well as Dubai, Johannesburg and Shanghai, with partner banks in Frankfurt, New York, Beirut and other cities. The purpose of these two geographies is both to provide Nigerian banks with access to foreign capital markets, but also to assist their African business customers in their transactions with European or other foreign companies by using their European or other foreign representatives to underwrite letters of credit. An interesting variation of this geography is First Bank, whose representative office in Paris is part of its London subsidiary, not the Nigerian parent. The Paris office exists primarily to provide its customers in Francophone West Africa with the same services that the London subsidiary provides its Anglophone West African customers.

The third geography of expansion observed amongst Nigerian banks is a more thoughtful incursion into other parts of West and Central Africa, exhibited by First Bank's recent purchase of BIC, the Democratic Republic of Congo's largest bank, 'Lagos Bank"s recent creation of subsidiaries across Francophone West Africa, and Ecobank's presence across the continent from Senegal to Tanzania and Zimbabwe. This expansion occurs through both consolidation and organic growth but is typically funded through internal capital, rather than leveraged upon global capital markets. These are usually banks that came out of the consolidation process a winner, and are now pivoting from London-Europe ambitions to pan-African ones. This is a direct vindication of Jane Jacobs' thesis of "downward" expansion: a number of businesses in a "backward" city try to form connections in a highly advanced "city" in the belief that this will create "development"; it does not, but they retain their connections there to maintain their liquidity; they then try to form connections in "even more backward" cities and succeed in creating growth and development for their businesses and for their home economies by doing so.

5.2.9.2. Capital

At least within the banking and insurance sector, London remains the most important hub for the world's financial markets, with most companies needing a foothold there simply to maintain their liquidity. New York follows in second, and a number of other cities proceed rather predictably: Dubai, Frankfurt, Paris, Beirut, Mumbai, Istanbul, Tokyo, Beijing, Shanghai, Zurich, etc. Ostensibly this is strong evidence for a hierarchical view of the global city network. However it remains to be

seen whether, at least from the perspective of Lagos, this emergent hierarchy is an attribute of the global economy as a whole, or simply a peculiarity of the world's financial markets.

What also emerges is a global division of labour within the financial sector with very strong implications for how Lagos' banks interact with the economy as a whole. Enormous volumes of currency transactions may take place in New York, but it is still London that commands most of Nigerian banks' attention and absorbs most of their energies, since it is in London that the relatively smaller (though still huge in absolute terms) volumes of trade finance and risk spreading must be negotiated deal-by-deal.

5.2.9.3. Knowledge

Nigeria's banks and insurance companies have very active strategies for knowledge acquisition, relying heavily on recruitment of key personnel with experience in very high-level financial and business environments (First Bank, Intercontinental, Aiico), the use of consultants with global reach ('Lagos Bank'), the maintenance of subsidiaries and representative offices in key financial centres (First Bank, Ecobank, Intercontinental/Access), and to a lesser extent attendance at conferences (First Bank, Citibank Nigeria, Aiico). Others make strong use of dedicated in-house research teams harvesting and exploiting knowledge from across their own branches (Ecobank, 'Lagos Bank', Citibank, Mainstreet). To absorb this knowledge they have firm policies for in-house training of staff (First Bank, 'Lagos Bank'), often with very elaborate training programmes and training facilities, and occasionally for supporting further education overseas (Aiico).

These knowledge activities are typically focused on one of two very specific objectives: developing new products for their customers within Nigeria (or West and Central Africa more broadly), or improving the efficiency, professionalism and ultimately the profitability of their operations. Crucially, all of this knowledge activity is *not* applied to expanding into those US, European and Middle Eastern markets where much of the knowledge originated. In other words, Nigeria's banks and insurance companies pursue knowledge in "upward" locations as a means to exploit their commercial opportunities in "downward" locations, and not the other way around: further evidence in favour of Jacobs' hypothesis.

5.2.9.4. Supply

Banks and insurance companies rely little on suppliers of plant, equipment and raw materials in the way that service and industrial companies do. Nevertheless the answers revealed in this section reinforce the view that IT for the banking and insurance sector is centralised into a very small number of locations, notably San Francisco, Bangalore and, within Africa, Nairobi (Aiico).

5.2.9.5. Networking

The networking strategies of these companies is similar to their knowledge strategies, though perhaps less energetic. They rely on the networking efforts of their subsidiaries and representative offices in key financial centres, their numerous partnerships with correspondent banks, brokers and reinsurers, attendance at conferences, sending out roadshows (First Bank), and drawing on the personal contacts of senior staff hired for their foreign experience. These are to some extent evidence of "upward" networking, as many of these activities are made in attempts to develop new working partnerships with financial institutions and large corporate clients in wealthy cities, whether financial centres such as London or business centres such as Houston.

5.2.9.6. The importance of regulatory environments

One or two other themes presented themselves during the course of the interviews that do not necessarily fit into the categories discussed above but which are critical for our understanding of Lagos and the global city network. The first is the importance of regulatory environments revealed by the experience of the banks interviewed. Despite the banks' successes in expanding geographically, they are as a rule limited by their national operating context—its high sovereign risk and high base interest rates, foreign perceptions of Nigeria, the costs imposed by its unreliable energy supply and lack of security, and the competition for depositors.

Outside Nigeria, one of the low-hanging fruit is Francophone West Africa, where the existence of a common market and common banking licence has helped at least one bank expand rapidly across that part of the region.

The fieldwork also shows what London provides apart from the multitudes of financial institutions operating there: a sound regulatory environment, professional operating standards, recognised processes for obtaining approvals and certifications, easier paths of entry into approvals processes in other territories.

What this shows is that the global city network does not allow banks to circumvent or undermine national governments' attempts to regulate financial activity within their borders. Rather the global city network seems to reinforce and even to rely upon the regulatory regime established by national governments for each city.

National regulatory regimes even allow the global city network to differentiate itself into a global spatial division of labour. London has developed a specialisation in financial regulation (through institutions such as the FSA and BSI) so that other cities can specialise on other aspects of the global financial architecture (e.g. currency trading in New York, venture capital in San Francisco); an authorised presence in London offers some assurance to businesses and regulators in other cities that a bank is viable wherever they operate in the world.

5.2.9.7. "An economy based on importation"

The final common theme is the one that best represents how Lagos is situated within the global economy. The widely-held notion that, outside the oil and gas industry, Nigeria and especially Lagos are import-dependent economies points to a key difference between Lagos and cities like London, Guangzhou, San Francisco or Nairobi: whereas those cities define themselves by what they produce and export, Lagos defines itself inversely; it seemingly makes no special contribution to the global economy, has no special role within the global spatial division of labour, and therefore has no special status as a "global city". However, the ways in which its banks have begun to expand geographically suggest that it may indeed become a financial hub for West and Central Africa, in which case it may begin to take its place in the constellation of cities that articulate the world's financial markets in each region.

5.3. Service companies

Ten service-based companies could be reached, and once interviews were granted their senior staff generally proved far more accessible and generous with their responses than the mid-level staff usually encountered in the banks. Apart from the global logistics company, they are all indigenous to Lagos, have highly adaptable entrepreneurial cultures, share a do-it-yourself aversion to external finance, and exhibit rather similar and surprisingly complex global geographies with regards to their suppliers, their training programmes and their networking activities, while exhibiting fairly conventional geographies with regards to their customers, typically focused entirely within West and Central Africa, if not entirely within Nigeria itself.

5.3.1. DHL International Nigeria Ltd and DHL Aviation (Nigeria) Ltd

Murtala Muhammed International Airport in Lagos serves as the hub for DHL's West African and Nigerian operations. The group's operations are split between two companies with separate lines of command, with customer services managed by DHL International Nigeria Ltd which reports to Johannesburg, aviation by DHL Aviation (Nigeria) Ltd which reports to Bahrain.

There is no financial data publicly available for DHL Aviation (Nigeria) Ltd or DHL International Nigeria Ltd.

Table 5.12 Deutsche Post AG

Annual report	*31 Dec 2007*	*31 Dec 2008*	*31 Dec 2009*	*31 Dec 2010*	*31 Dec 2011*
Operating revenue	$95,832m	$78,454m	$68,575m	$70,481m	$69,952m
Total assets	$346,629m	$365,967m	$50,044m	$50,485m	$49,696m
Number of employees	536,350	451,515	424,686	418,946	423,502

Source: Bureau van Dijk (2013)

5.3.1.1. Customers

A Boeing 767 flies from Leipzig via Brussels to Lagos every morning where it is unpacked and re-sorted; reloaded 727s fly onward to Abidjan and Libreville from which a fleet of ATR 42s fly out to every major city in West and Central Africa. In another facility domestic packages are loaded onto trucks and vans bound for Abuja, Port Harcourt, and several smaller sorting centres throughout Lagos.

A number of DHL staff repeat the sentiment that "Nigeria is an economy based on importation." From their perspective there is vastly more material coming into the country (and indeed the entire region of West Africa) than going out, the imports being predominantly motor parts, electrical and computing goods, and household wares, all manufactured in wealthy economies or the BRICs. Even the high volume of medical samples leaving the country merely signifies the importation of services, being sent as they are to laboratories in Europe and South Africa for tests that Nigerian hospitals cannot perform.

Because there is so much empty space (an average of 90%) on flights returning to Europe, a large team is dedicated to marketing the extra space as a cargo service, typically to clients with time-sensitive, high-value goods, and DHL have agreements with a number of independent agents throughout the region to fulfil the same mission. They usually end up exporting perishables such as pineapples and other fruits, though one of their largest export customers is a leatherworking company in Kano that trucks up to 40 tonnes per week to the airport for export to the fashion industry in Spain and Italy.

5.3.1.2. Supply

Apart from the Boeing 767 owned by DHL in Leipzig, DHL do not own the planes that operate their network in West Africa. They are supplied and operated by two aviation contractors: Allied Air, based in Lagos, operates the Boeing 727s, and Solenta, in Johannesburg, operates the ATRs. The handling of containers is contracted to Landover Company Ltd, and on the airport tarmac to NAHCO Aviance (Nigerian Aviation Handling Company Plc), largely owned by British Airways, Air France, Lufthansa and one of only two logistics companies licenced to operate on the tarmac by the airport. DHL own a few tractors to assist in movements outside the tarmac area, sourced from New Holland, Massey Ferguson and Linde.

Figure 5.4 Sorting sacks at DHL's Lagos airport facility. Source: author.
Airport codes reveal the geography of DHL's global logistics network. From left to right and top to bottom: Paris, Amsterdam, Leipzig, Cincinnati, Johannesburg, Nairobi, Brussels, London City, East Midlands, Heathrow (twice) and London (all airports)

Figure 5.5 Sorting bays at DHL's Lagos airport facility. Source: author.
The geography of DHL's West African logistics network: Niamey, Conakry, Bamako, Bissau, Banjul, Praia, Dakar

5.3.1.3. Knowledge

Most of DHL's knowledge activities are centralised in various European offices. The Nigerian office use a number of pieces of software developed in-house by IT teams in Brussels and East Midlands International Airport.

5.3.1.4. Themes

We now see that one of the city's most important logistics companies shares the perspective of several of the banks in one important regard: that there is a strong imbalance between the imports and exports moving in and out of Lagos, and little apparent role for Lagos within the global division of labour indicated by their cargo.

However the fact that a global logistics company as important as DHL chooses Lagos as its base not only for West Africa but also for much of Central Africa (as far south as Cabinda) demonstrates the city's potential to become an even broader logistics and value-adding hub within the region.

5.3.2. JNC International Ltd

JNC International Ltd (JNC) is a medical equipment importer, set up eight years prior by a pharmacist, and now operating from a brand new purpose-built showroom and office off Lagos' fashionable Awolowo Road in Ikoyi. The equipment, especially the heavier power and electronic machinery, is often sold on payment plans or lease arrangements, so a large part of dealings is determining the credit worthiness of the medical centre or hospital making the purchase. It has offices in Lagos, Abuja and Asaba.

Table 5.13 JNC International Ltd

Annual report	*2007*	*2008*	*2009*	*2010*	*2011*
Operating revenue				$14.0m	
Total assets				NA	
Number of employees				34	

Source: Bureau van Dijk (2013). Other years unavailable

5.3.2.1. Customers

JNC's customers divide into two categories. Until recently, public sector hospitals constituted the bulk of the business; these are spread across the country, including every state capital, though are often managed by the federal ministry of health in Abuja. In the past two years, smaller private hospitals and clinics which were previously unable to get finance to buy the expensive equipment JNC sells now can. A lot of JNC's business with them involves tendering to supply to new hospitals, as well as setting up payment plans, lease financing, maintenance contracts and other financial instruments. It is not that these hospitals were too small, but that they were not trusted by credit institutions in the past: "the barrier to entry [into purchase transactions] is credit rather than size per se." This private sector clientele is largely concentrated in Lagos. The new offices were built to show off JNC's products in style to these clients, an important aspect of doing business in the city.

JNC has plans to expand into other West African markets but takes the attitude of "let's conquer Nigeria first before we go out." They expect to branch out into the English-speaking West African countries first—Ghana, Sierra Leone, Liberia. In the meantime they have vendors redistributing their equipment in the region.

5.3.2.2. Supply

JNC import equipment from several brands, notably Olympus, Toshiba, ArjoHuntleigh, Maquet and Carestream, and sourced from a number of large and small cities including Tokyo, Luton and Abingdon (UK); Getinge and Stockholm (Sweden); Rastatt, Melsungen and Wietmarschen (Germany); and Boston and Rochester (US).

5.3.2.3. Knowledge

The CEO of JNC used to be the country manager for ArjoHuntleigh in Nigeria; when they pulled out of the country, she asked to become their independent representative. This seeded the business model (and knowledge base) for the company. Other senior staff have worked in hospitals as doctors or administrators.

JNC invests heavily in the training of its engineers and project staff, having sent them to manufacturers in Tokyo and Hamburg (Olympus), Cairo and Amman (Toshiba), Dubai, Rochester, Cardiff and London, and having brought manufacturers' trainers to Lagos. When training is conducted in Lagos, JNC invites clients—hospital administrators and their technical staff—to participate as a way of promoting new technologies to them. JNC has also provided funds for staff to pursue postgraduate studies in medical engineering overseas.

5.3.2.4. Capital

JNC employs four sources of finance: shareholder equity, ploughing profits back into the business, financing from local banks, and vendor financing. Vendor financing may be in the form of letters of credit, bills for collection, or the provision of guarantees by third parties. Their own purchases are made using trade finance 30% of which is provided by Barclays in London and the remainder by a handful of local banks with subsidiaries in foreign jurisdictions such as Access Bank. JNC is starting to entertain private equity investors—they are partnering with a Nigerian investor and considering an overture by investors in Bangalore to set up a joint venture company.

5.3.2.5. Networking

Similar to their training activities, JNC staff attend conferences (medical equipment, radiology, exhibitions) around the world—Hamburg, Zurich, Paris, Dubai, Johannesburg—to discover new

technologies and bring them to market in Nigeria. There is also a large conference called MedicAfrica held in Lagos itself.

5.3.2.6. Themes

The first of the indigenous service companies featured in this chapter, JNC exhibits three very strong tendencies prevalent in the sector. First, they engage heavily in importation, sourcing products from several locations across wealthier economies to sell to the domestic market (and in the future, the regional market). Second, they network widely to establish partnerships with new suppliers, and invest extensively in training their staff (and informing their customers) in the various products available, especially by sending either staff or trainers across the seas for face-to-face instruction. Thirdly their attitude to finance is focused much more on leveraging internal profits and finding investors who can provide advice and industry knowledge than on leveraging formal financing on the open market.

5.3.3. Penuel Technologies Ltd

Penuel Technologies Ltd (Penuel) is a provider of telecommunications and security solutions, for whom the bulk of business comes through being the licensed distributor of Hitachi consumer electronics products in West Africa. Apart from its head office in suburban Lagos, where eight staff work, Penuel has an office opening up in São Tomé and Principe, another (soon to be closed) in Monrovia, and a representative office in New York.

Table 5.14 Penuel Technologies Ltd

Annual report	*2007*	*2008*	*2009*	*2010*	*2011*
Operating revenue				$11.2m	
Total assets				NA	
Number of employees				18	

Source: Bureau van Dijk (2013). Other years unavailable

5.3.3.1. Customers

Penuel's Lagos office serves customers in Benin Republic as well as Nigeria. Its São Tomé office will open its own branch in Praia, Cape Verde (though legally it will be set up as a direct subsidiary to the Nigerian company). Penuel is also planning to open Hitachi-branded stores throughout Nigeria, first in Lagos (two stores including one in the Alaba International market), Abuja, Kano, Port Harcourt, Warri, Uyo and Onitsha, then hopefully in all other state capitals. Regarding specific customers, Penuel has worked for Coca Cola's operations in Monrovia, as well as being part of a security project for the City of Monrovia.

5.3.3.2. Supply

Penuel's connection to Hitachi was created when a client needed (39 million naira worth of) multimedia projectors and was insisting on Hitachi because of their durability. Penuel tried to source them through a third party in New York, but they failed to supply for nine weeks, and in the end Penuel had to hire an attorney to pursue them. Penuel then contacted Hitachi directly, and in communicating with a Hitachi vice president in Beijing, discovered that Hitachi had placed an embargo on sales to Nigeria for the past 14 years due to failures to pay. When Penuel offered to pay up front for a shipment of 400 units, Hitachi lifted the embargo and eventually made Penuel their Nigerian representative for multimedia products, LCD televisions and other consumer electronics, as well as the representative for all Hitachi products in Sao Tome and Principe and Liberia. Orders for Hitachi are placed with Hitachi's Lyon office; the money is sent to Hitachi's bank in London, after which an office in Paris instructs an office in Amsterdam to supply the equipment to Lagos (or Sao Tome or Monrovia) by air.

Apart from Hitachi, Penuel also supplies technological products manufactured in Guangzhou, Chicago and Izmir in Turkey. Penuel has a representative in Guangzhou (Jubilite Global Ltd) who sources many of the East Asian products; suppliers may be headquartered in Japan or Taiwan but with manufacturing operations in Guangzhou or nearby Shenzhen where Jubilite sources them.

5.3.3.3. Knowledge

Penuel conduct staff training sessions in Lagos to explain any new products they are bringing to the West African market. They may also send staff to training sessions initiated by the suppliers, or have them do online training programmes, especially for their tracking systems.

One staff member went to London to attend a training session conducted by Barclays Bank. While he was there they asked to hire him away from Penuel. He worked for Barclays for four years, and is now coming back to rejoin Penuel, opening the Sao Tome branch. Another woman trained as a lawyer in the US; another man studied in Donesk, one of many Nigerians who have pursued studies in technical disciplines in Russia.

5.3.3.4. Capital

Penuel's directors are proud of the fact that "we don't go to banks, we don't do loans; we operate on goodwill." They have never gone to a bank to ask for a loan, though one Nigerian bank has offered a loan of 500 million naira. Banks within Nigeria can charge interest rates of up to 33%, whereas Penuel know they can find lenders through international contacts offering between 3 and 5%, and have had one agent in London propose a loan at 6%. However to open the chain of Hitachi stores, it is partnering with a local investor who is putting in between 3 and 5 million US dollars.

5.3.3.5. Networking

Penuel's directors used to travel to Taipei to source suppliers, but on discovering that an old Nigerian classmate is now the managing director of a technology company in Guangzhou, having married a Chinese woman, they now source a lot of Asian products through him. The directors attend conferences to identify new suppliers, in Taipei, Shenzhen (Guangzhou), Copenhagen and Dubai.

5.3.3.6. Themes

Here we see two expansion strategies common to many services companies in Nigeria. The first is to pair with a larger company with a recognisable brand to expand into many locations at once, as Penuel is doing with the Hitachi-branded stores across Nigeria. The second is the strategy adopted by several banks, which is to expand across West Africa, using the knowledge gained in one location to expand into other locations in the region, in this case using knowledge about Sao Tome and Principe to leap into Cape Verde, another Portuguese-speaking country.

There is also the common tendency not only to source suppliers across many regions, but also to use agents or representative offices to do the networking for them in their given region, as Jubilite does from its base in Guangzhou. Finally there is also the common desire to shun Nigerian bank lending and seek investors who can contribute knowledge and advice for the growth of the business.

5.3.4. Commint Bureau de Change Ltd

This money transfer and currency conversion business operates with a family ethos from the first floor of a colonial shopfront building in the business district of Lagos Island. Managed by a wife and husband (the wife is senior), it prides itself on encouraging the training and employment of children of existing staff members, the husband pointing to a handful of mother-and-daughter pairs working side-by-side.

Table 5.15 Commint Bureau de Change Ltd

Annual report	*2007*	*2008*	*2009*	*2010*	*2011*
Operating revenue				$11.0m	
Total assets				NA	
Number of employees				45	

Source: Bureau van Dijk (2013). Other years unavailable

5.3.4.1. Customers

Commint's customers overwhelmingly send money between the UK and Nigeria, and orders are taken through a network of trusted agents and sub-agents in London, Manchester, Birmingham, and other UK cities, as well as through their office in Lagos.

5.3.4.2. Supply

Commint's suppliers are their agents and sub-agents, since most of the company's work comes through them. The relationships with these agents are built up carefully over time; the husband travels to the UK several times a year to check on existing agents and meet potential new ones. He is very firm that agents comply exactly with the procedures and habits that Commint have developed, and is quick to discipline or dismiss agents who fail to fall in line.

5.3.4.3. Knowledge

A lot of the work is managed using software and templates developed in-house by Commint's IT staff. These staff studied in Nigeria but have been sent for training in the US. They too travel regularly to the UK to ensure that Commint's agents are fully compliant with the in-house procedures.

5.3.4.4. Capital

Commint makes a small amount of money in commissions on money transfers but makes the bulk of its profit by currency trading and speculation to maximise their margins, keeping a float in each currency for these purposes. (This also allows the transfer service to be conducted instantaneously, as it does not have to wait for a real currency exchange to occur.) Other than this there is no need to seek outside investment or debt finance.

5.3.4.5. Networking

Commint's relationships with its agents are built up carefully over time through the husband's travels, usually initiated by word of mouth, one agent suggesting to another potential agent to get involved. Nigerians living in Spain and Italy have approached Commint seeking to become agents for those countries, but Commint is waiting for these personal relationships and levels of trust to build up organically before officially accrediting agents in these unfamiliar markets.

5.3.4.6. Themes

This business was rather anachronistic compared to other services businesses interviewed, from its dusty, yellowing offices in an old colonial rowbuilding to the simplicity and lack of formality in its

relationships with its agents. As such it had little in common with the more dynamic entrepreneurially minded businesses operated from contemporary buildings in the new middle class suburbs other than its ties to the Nigerian diaspora, its commitment to training its staff, and the echoes of old colonial geographies in its operations.

5.3.5. Nigachem Nigeria Ltd

Nigachem Nigeria Ltd (Nigachem) is a civil explosives manufacturer for the construction, quarrying and extraction industries. Nigachem "started as a kind of merchandising outfit," importing ammonium nitrate from 1989 and emulsion-based explosive material from 2004, before getting into manufacturing in 2009 with the help of a joint-venture partner based in Nagpur, India. Nigachem supplies two types of explosives: "packaged explosives", where the chemical components have already been mixed together and are transported in packages; and "bulk", where components are transported separately in tanks and mixed on site; in both cases detonators always travel on a separate consignment to prevent accidents en route. Apart from their offices in suburban Lagos, Nigachem maintains offices in Abuja and Ibadan, and manufacturing and storage facilities in remote towns outside these urban areas, and employs around 128 staff divided half-and-half between its factory-based teams and its administrative and sales teams.

Table 5.16 Nigachem Nigeria Ltd

Annual report	*2007*	*2008*	*2009*	*2010*	*2011*
Operating revenue		$10.0m	$10.0m		
Total assets		NA	NA		
Number of employees		28	38		

Source: Bureau van Dijk (2013). Other years unavailable

5.3.5.1. Customers

Nigachem's clients are all within Nigeria. It has received enquiries from potential customers in Ghana, Mali, Togo, Ivory Coast, Niger, Chad, Cameroon and the Central African Republic, but cannot sell to them due to Nigerian security regulations preventing the cross-border sale of explosives.

There are eight dealers in explosives within Nigeria, but Nigachem is one of only two manufacturers. They are lobbying the Nigerian government to allow manufacturers to sell to neighbouring countries, "as a way of earning foreign currency."

One of the challenges in distributing to its customers is that every shipment by road must be accompanied by government officials. Nigachem is aware that this will become an even more complicated enterprise once it starts engaging in cross-border sales.

5.3.5.2. Supply

Just as Nigachem's manufacturing and storage facilities tend to be in remote locations outside urban areas, so too are its foreign suppliers often located in relatively rural locations where explosives can be manufactured safely, such as St-Martin-de-Crau and Selles-St-Denis (France), Ardeer (UK), Montville (Ohio), and Karlstad and Köping (Sweden) as well as a few larger cities such as Johannesburg and Kiev). Nigachem's joint venture partner brought plant and machinery with them, using these as payment-in-kind for the Nigachem shares it acquired.

5.3.5.3. Knowledge

The person who started the company had several years' experience working for a large explosives manufacturer in the UK, and brought a lot of that knowledge with him. When Nigachem wished to enter manufacturing, it did so in joint venture with a manufacturer in Nagpur, which has become extremely active in the managing of the business. There are now 11 Indians managing production, originally drawn to Nagpur from different parts of India (Maharashtra, Uttar Pradesh, Andhra Pradesh, Bihar) before being sent to Lagos.

The directors of Nigachem (and their joint-venture partner) have attended seminars and training sessions conducted by their suppliers in their respective locations (Ohio, Ardeer, Sweden, etc.) and attend conferences abroad. Once this knowledge has been acquired by the directors it is absorbed through in-house training sessions conducted in Nagpur and Lagos.

5.3.5.4. Capital

When Nigachem needed capital, it was unable to avail of the CBN's Bank of Industry funds, a special government facility for ailing industries, since Nigachem was deemed not sufficiently "near the point of collapse". Apart from some minor financing from Nigerian banks, Nigachem has come to rely on the joint venture with the Nagpur-based manufacturer for its financing. For internal reasons the funds themselves were directed from the Indian company's Amsterdam-based subsidiary.

5.3.5.5. Networking

Nigachem maintains relations with sourcing agents in Guangzhou, Beirut and Dubai who scan international markets for new suppliers. When the agents are called upon to arrange purchases, they simply organise for it to be shipped from the source; the materials do not go through the agents' locations. The relationships with these sourcing agents, and with many of the long-term suppliers, were developed by the chairman through his experience in the UK.

5.3.5.6. Themes

There is an interesting geographic phenomenon here in which existing geographic assemblages of suppliers, distributors and knowledge is exploited by economic agents in two locations. First, an assemblage of suppliers and distributors focused on Ardeer in the UK was redeployed for the benefit of economic agents in Lagos; secondly an assemblage of staff, knowledge, plant and machinery focused on Nagpur in India was also redeployed for the benefit of Lagos. The offshooting of a new company or venture in a new location thus effects the reshaping of much broader geographic networks of economic relationships in the process.

Nigachem is also a company where the concept of the "global city" is of very limited relevance. Because of the hazardous nature of the industry, Nigachem's suppliers as well as its own industrial facilities are predominantly based in small towns or rural areas. The company's only interaction with canonical "global cities" is the location of its sourcing agents, though this cannot be easily discounted. The fact that these agents are in Guangzhou and Dubai shows that even an industry with little overall reliance on global cities still relies on them for the increased opportunities for meeting new contacts and forming new business connections that those cities provide.

The fact that the third city for sourcing new suppliers is Beirut is noteworthy as well. Beirut appears as a networking hub for other service companies in Lagos (especially Internet Solutions in 5.3.8 below); and it is also a location for many correspondents of Nigerian banks. While it is not thought of as a canonical "global city" in most of the rest of the world, Beirut is thus seen to be an important city within Lagos' own global city network, in part because of the sizeable Lebanese minority that has made its home in Lagos for some generations.

5.3.6. Hunt's Products International Ltd

Hunt's Products International Ltd (Hunts) is an FMCG importer and distributor, supplying to supermarket chains and petty traders throughout Nigeria, with its headquarters at the Lagos Trade Fair Complex in Festac Town in the west of the city. Hunts also manages a logistics subsidiary (Hunt's Logistics Ltd) through which they organise the transportation of other importers' goods on international shipping lines (such as Maersk).

Table 5.17 Hunt's Products International Ltd

Annual report	*2007*	*2008*	*2009*	*2010*	*2011*
Operating revenue				$4.5m	
Total assets				NA	
Number of employees				NA	

Source: Bureau van Dijk (2012). Other years unavailable

5.3.6.1. Customers

Hunts' main customer is Shoprite, a South African supermarket chain which began to expand into Nigeria in 2006. Hunts manages ten staff in its headquarters in Festac Town distributing to Shoprite and several other supermarket chains in the city (Itunu, Festac, Grocery Bazaar, Pet Store and Park and Shop), three staff in Enugu distributing to Shoprite, Roban and two other small supermarkets, and are looking to open an office in Ilorin to liaise with the Shoprite that has opened there. Hunts has customers in Abuja but manages those relationships from its Lagos office. It also has a representative agent in Tema (Accra) who resells its imports in Ghana.

5.3.6.2. Supply

Among its major labels, Hunts supplies Shoprite and its other customers with Koo goods and Savanha wines from South Africa, Sun Mark toiletries from London, Princes hot dogs and other processed meat products in Liverpool, and Mayador cider from Villaviciosa (Spain).

It is seeking to import Hero baby food products from Alcantarilla (Spain), but because of the sensitivities of its target market it is first being submitted to government testing and approval.

5.3.6.3. Knowledge

As a simple trading and distributing concern, most of the skills can be learnt on the job. The business development manager interviewed for this study had only attended specialist training once, to obtain some marketing skills.

5.3.6.4. Capital

Similarly, Hunts finds not much need for formal lending facilities. They have however accepted capital from high-net-worth individuals in Lagos and Enugu, and use letters of credit and other financial instruments when dealing with Shoprite.

5.3.6.5. Networking

Hunts' business took off when its chairman participated in a trade mission to South Africa organised by Tiger Brands, a South African FMCG producer, where Hunts established a relationship with Koo, one of its subsidiaries. Through its relationship with Koo it developed connections to other South African brands including Savanha wines. When Shoprite opened in Nigeria, Koo was able to refer Shoprite's management to Hunts, making them Hunts' biggest customer.

The connections to the Spanish brands Mayador and Hero were formed when a trade delegation led by the chancellor of the Spanish government came to Lagos, and Hunts' chairman was subsequently

invited to Spain to meet the directors of FMCG producers across the country. Hunts' managing director has also visited Sao Paulo and Rio de Janeiro to establish contacts with furniture makers, but was unable to import any due to industrial protection policies in Nigeria.

5.3.6.6. Themes

Hunts is another services and trading company whose geography of suppliers has only a minor relationship with the world's network of global cities, with some based in canonical cities like Johannesburg and London, and others based in rural areas of Spain. Like many trading companies it is an active networker, relying on these activities to identify new suppliers around the world and thus develop potential competitive advantages within its home market.

Hunts is another example of a company that shies from leveraging formal finance to increase the scale of its operations. It also exemplifies a company that grows on the back of a larger brand, expanding across Nigeria alongside Shoprite just as Penuel are doing with Hitachi.

An interesting discussion is raised on how Hunts' customers may be mapped onto different social classes. Hunts views itself as selling to three categories of customer: to the upper middle classes through Shoprite, to the lower middle classes through the smaller supermarket chains, and to the lower classes through the many small local redistributors. The business development manager interviewed is cognisant that most shoppers in this third category are merely "surviving", and feels that the increasing wealth concentrated in Lagos is not doing much to improve their lives.

5.3.7. Microspace Solutions Ltd

Microspace Solutions Ltd (Microspace) was set up in 2008 by a group of Nigerian electronics engineers, many of whom had studied together in Dundee, Scotland. The firm began with a patented vehicle fleet management system sold to logistics companies in Nigeria, but has diversified into different technology spheres since, including power management technologies for mobile phone infrastructure installations developed in partnership with General Electric India (GE) in Bangalore, and environmental management technologies for the oil and gas sector. The project coordinator noted that "most companies trying to get into oil are trying to get into trading", whereas Microspace "are more for solutions", trying to find a competitive advantage in their intellectual expertise and technological innovation.

Microspace has operations in six Nigerian cities: Lagos, Enugu (maintenance centres related to its partnership with GE), Benin, Gombe, Abuja and Sokoto.

Table 5.18 Microspace Solutions Nigeria Ltd

Annual report	*2007*	*2008*	*2009*	*2010*	*2011*
Operating revenue				$2.31m	
Total assets				NA	
Number of employees				39	

Source: Bureau van Dijk (2013). Other years unavailable

5.3.7.1. Customers

For its fleet management solutions, one of its major customers or "partners" is Aquila Capital, a company that provides armoured vehicles for transporting cash to banks, telecommunications companies and retailers, including Airtel, Mobil and Ericsson. It also provides solutions for Coca-Cola's fleet of distribution vehicles.

For its oil and gas solutions, one of its major customers is Platform Petroleum, which has one office in Lagos, and one in Sapele in Delta state.

For its power management solutions, one of its major clients is Airtel, with whom it liaises through its Lagos and Abuja offices, and elsewhere as problems arise on sites throughout the country. The partnership with GE makes up 25% of the business; they liaise with GE through its offices in Lagos and Bangalore.

Microspace is currently involved in two interesting expansion plans. One is to partner with the telecommunications retailer Glo to expand into 15 countries across Africa: Burkina Faso, Chad, the Republic of Congo, the Democratic Republic of Congo, Gabon, Ghana, Kenya, Madagascar, Malawi, Niger, Rwanda, Seychelles, Tanzania, Uganda, Zambia. To set up an office in the first of these (Ghana), they have used a lawyer in Accra sourced through a contact in Nigeria. The other is an explicit ambition to become the first internationally-known electronics brand headquartered in Nigeria, pursuing an interesting two-track marketing strategy, as well as a supply-chain strategy typical of any Fortune 500 company. For the African market, components will be built in Shenzhen, software written in Bangalore, and final products assembled in a factory in Lagos. For the rest of the world, the same components and software will be assembled at a factory in Munich, for the company to avail itself of a "made in Germany" label that will give their brand cachet on the international market.

5.3.7.2. Supply

Apart from its partnership with GE India from whom they source a lot of the technology involved in providing power management solutions, Microspace sources additional equipment from Rianna and PMI, both in Lagos.

5.3.7.3. Knowledge

Like most technology companies interviewed, Microspace maintain a substantial training programme for their staff. Staff are sent overseas, or trainers are brought into Lagos, to learn about new products or technology or to learn about other aspects of business such as cost management and administration. A trainer has come in from Bangalore to teach Microspace's staff about robotics technologies on the market; another has been brought in from Shanghai. The project coordinator also mentions Microspace's "train the trainer" programme, where his boss goes to Johannesburg, Bangalore or other cities to learn about new technologies so that he can train his staff himself on his return to Lagos.

The project coordinator is also considering pursuing studies at George Mason University in Washington DC which would be funded by the company. Microspace's technical staff come not only from Lagos and other cities in the southwest but also from Kano, Jos, Benin and Asaba.

5.3.7.4. Capital

Microspace operates a zero-inventory approach, preferring to construct its contracts to assure its cash flow remains positive throughout each project. However, because they wish to expand aggressively they are thinking of approaching very large institutional sources of finance, including the Export-Import Bank of the United States in Washington DC.

5.3.7.5. Networking

Like many technology companies Microspace's directors make several trips per year to attend conferences—recently in Las Vegas, Hanover and Munich—to identify new suppliers and partners.

5.3.7.6. Themes

Microspace is a very instructive company, having significant points of similarity and points of difference with many other technology companies interviewed. Its similarities are its emphasis on "providing solutions" rather than simply distributing equipment, its expansion on the back of a much larger company (its partnership with Glo), its systematic training of its staff, its active networking at conferences and trade fairs around the world, and its desire to avoid financing and retain a cash-positive business model from project to project.

It's major point of difference is its ambition to become an electronics brand with global recognition, making it almost the only Nigerian company interviewed with any interest in capturing a global consumer base. The fact that it is pursuing this strategy at the same time as pursuing its expansion across Central Africa means that it is consciously pursuing both "upward" and a "downward" strategies at the same time, making it an ideal test company for the hypotheses explored in this

study; unfortunately we will have to wait some years to know which of these seeds yields the bigger crop.

5.3.8. Internet Solutions Nigeria Ltd

Internet Solutions Nigeria Ltd (Internet Solutions) is a technology firm opened in 1998 by a group of second- and third-generation Lebanese Nigerian entrepreneurs who had studied in the UK. It was established originally to be a basic internet service provider (ISP) to both commercial and individual consumers, but as it was learned how underdeveloped the internet backbone was in Nigeria—"we hit a wall in terms of infrastructure"—it became a provider of complete internet access solutions with services ranging from domain registration and web hosting to more sophisticated packages including satellite connections, high speed and multimedia connections, multiple telephone line management solutions, voice over internet protocol connections and connection security. (Regarding multiple phone line management, the director comments on how impossible it is to set up a "hunt" line through Nigeria's telcos, preventing companies from listing just one phone number that can receive multiple simultaneous phone calls or redirect calls to individual staff telephones.) Because of the capital-intensiveness of these solutions—it still "costs more today to connect a client [in Lagos] to Abuja than to London"—Internet Solutions focuses on a smaller number of large institutional clients who can support these costs.

Table 5.19 Internet Solutions Nigeria Ltd

Annual report	*2007*	*2008*	*2009*	*2010*	*2011*
Operating revenue				$2.31m	
Total assets				NA	
Number of employees				95	

Source: Bureau van Dijk (2013). Other years unavailable

5.3.8.1. Customers

Internet Solutions operates several project teams—"we call them 'points of presence'"—in Port Harcourt, Ibadan, Abuja and Kano who are deployed throughout their respective corners of the country, as well as a "liaison office" in Accra.

This Ghanaian office opened purely in response to customer demand. Over a period of one year the Lagos office received several business enquiries from Ghana; the director started to travel to Accra on factfinding missions, and eventually opened the office with the help of a Ghanaian contact found through friends in Lagos.

The director commented that it is easy to poach prospective customers with the simple phrase, "I heard you're unhappy with your internet service," since he knows that because of the state of infrastructure in the country, nine out of ten businesspeople will reply, "how did you know?"

5.3.8.2. Supply

Internet Solutions purchases bulk bandwidth from international satellite companies as well as from the operators of the submarine cables now girdling Africa's coasts. For example, the West African Cable System (WACS) was constructed and opened to traffic in 2012, significantly improving internet speeds in Lagos.

For the suppliers of technology and equipment, Internet Solutions prefer to liaise indirectly through agents in Beirut rather than deal with companies headquartered in cities like San Francisco themselves, even when those companies have their own representatives in Lagos already.

5.3.8.3. Knowledge

Internet Solutions sends its technical staff for training and certification courses overseas in cities such as Beirut and Dubai, or by bringing them together for sessions with a supplier's trainer flown into Lagos. Its directors attend numerous exhibitions and conferences to learn about new technologies and products entering the market, and subscribe widely to mailing lists and magazines. The two directors studied in Beirut and London.

5.3.8.4. Capital

As the director put it, "every year we make money, we've always ploughed a major proportion of that back into the business." Otherwise, the company has never sought external finance, simply staying cash-positive throughout each project. But "nothing is set in stone"; they will entertain any investor offering "a very good deal", as long as that investor does not want to influence the management of the company. "If we have loans that push us in a certain direction, we would not be as free," freedom being an important value for many technology companies in Lagos.

5.3.8.5. Networking

The experience of opening an office in Ghana is instructive for how networking occurs in a region such as West Africa. As the director explained, "I had a friend who recommended a contact in Ghana and he said, 'I financially guarantee him.' Trust is very important in this region; there's no way to redress issues, there's no way to verify. So these kinds of recommendations are very important." For every new contact or customer, the director used to make a habit of checking their websites to see how substantial they are, and sending a driver to their business address to make sure the business really exists. A friend making a statement such as "I financially guarantee him" helps simplify this whole dilemma. The directors attend conferences such as CeBit in Hamburg, Cable and Wireless in New York, and another in London.

5.3.8.6. Themes

Internet Solutions exemplifies many patterns typical of technology companies including a business model built on providing "solutions" rather than simply products, an emphasis on training to obtain certifications and maintain their knowledge of the market, active networking at conferences and exhibitions, and avoidance of external finance, especially finance that comes with managerial constraints.

Another important tendency is the way the business has evolved to fill an unexpected niche. Expecting to become an ordinary ISP, the company has grown to provide a suite of interrelated services (such as satellite connections) directly to consumers that would ordinarily be transacted by different business-to-business (B2B) companies inside the telecommunications sector, but because of Nigeria's lack of infrastructure become a direct concern of end users.

5.3.9. Tenecé Professional Services Ltd

Tenecé Professional Services Ltd (Tenecé, pronounced "Tennessee") is a technology company providing software, IT and administrative solutions to large institutional clients in the government, university and corporate sectors. "Using Tenecé as a cashcow," its CEO has springboarded from technology into real estate developments and consultancy to the oil and gas sector.

Table 5.20 Tenecé Professional Services Ltd

Annual report	*2007*	*2008*	*2009*	*2010*	*2011*
Operating revenue				$2.16m	
Total assets				NA	
Number of employees				46	

Source: Bureau van Dijk (2013). Other years unavailable

5.3.9.1. Customers

Tenecé operates out of four locations with explicit client-targeting strategies in each: it opened first in Lagos, the site of Nigeria's largest financial and business sectors, then in Enugu for its large number of universities and government institutions, Abuja for its federal government institutions and growing business sector, and then Port Harcourt to serve the oil and gas industry. In 2012 it registered a company name in Ghana and plans to open an office in Accra by the end of 2013. Its CEO also hopes to open an office in Dubai with the help of a close friend.

5.3.9.2. Supply

Several of Tenecé's "OEMs"—original equipment manufacturers—are located both in major technology cities such as San Francisco and New York, but several are also in less obvious cities such as Moscow, Tel-Aviv, Raleigh in North Carolina and Edirne in Turkey.

5.3.9.3. Knowledge

Tenecé has the most sophisticated knowledge strategy identified in this fieldwork. It has established its Enugu location as its "centre of excellence", where young graduates trained in the city's many universities are selected and employed in the research and development of software and other products to be sold throughout the country. "Our clients would never know that we're building software applications in Enugu and selling it to banks in Lagos."

Tenecé actively invests in its staff, not only sending many out for technical training and certification with vendors in the US and UK, but also paying for postgraduate education for key personnel, including MBAs or other masters-level degrees in Leeds, Boston (i.e. Harvard) and Cranfield. In the case of the employee sent to Leeds for his MBA, he was paid 50% of his salary throughout his studies. One staff member at Enugu was even a graduate of the London School of Economics!

Many technology companies share Tenecé's desire to provide solutions rather than products, but only Tenecé's director ties this business model so explicitly to the idea of knowledge: "Our original investments were in the knowledge space. Most companies start out with trading. We are more interested in 'solutions'; 'solutions' was very good for us. Entry barriers are high because the intellectual barriers are high, so competition is low, margins are high."

This befits the CEO's own knowledge-rich background: a young and charismatic Igbo entrepreneur who studied at Insead in Fontainebleau, worked as a technology consultant for Accenture in Lagos, then as a manager for various companies created by Tony Elumelu before developing this business. (Tony Elumelu is a past CEO of United Bank for Africa (UBA), a well-known business mogul in Nigeria and an active protagonist of Lagos' entrepreneurial and social enterprise communities.)

5.3.9.4. Capital

Tenecé employs bootstrap thinking both to its own business model and to its marketing techniques. It built itself up project-by-project from very little capital, but it also sells its student management systems to universities and colleges at zero cost to the client—money is made by retaining the right to charge each student a small annual fee of $20 for their use of the system.

The CEO has his own story that illustrates why many technology companies are reluctant to leverage formal financing to expand their operations. Tenecé once went through a tough year where it didn't

have enough cash to pay salaries, and discovered to its great disappointment that "the banks are not as supportive as we would want. Some five years ago we could ask for an overdraft. Now they ask for a property 'in a choice area' as collateral. But we're a start-up, we don't have such property. We started with nothing, bootstrapped everything, no venture capital." The director makes a virtue of its difficult birth, asserting that as a result of its times of scarcity "we have a better understanding of how to put a dollar to use than the average company around here."

5.3.9.5. Networking

Tenecé's CEO travels regularly to conferences such as those in Hanover and Barcelona, to search for emerging products that can offer the company a competitive advantage within Nigeria. It was through these activities that he has established supply partnerships with technology companies in cities like Moscow, Tel-Aviv and Edirne. For many global brands such as Cisco, Oracle or IBM, these companies have representatives in Nigeria who approach Tenecé, whereas smaller brands might only have a regional representative based in London, in which case Tenecé go to them.

When it came to setting up the real estate development company, the CEO made a point of "travelling", again to seek very specific expertise on the international market. He went to Dubai to meet with real estate professionals there, but everyone he met were "talking top dollar, and they don't understand Nigeria." Instead he turned to South Africa: "I'm really impressed with the quality of development in South Africa [...] the South Africans can give me close to Dubai quality without asking top dollar and they're happy to live in Nigeria for a couple of years."

The CEO also has a close friend (to whom he sublets office space in Lagos) from Kozhikode (Calicut) in India, and who has offices in Mumbai, Bangalore and Dubai, who he leans on for advice and contacts, and who he hopes will help him set up an office in Dubai in the future.

5.3.9.6. Themes

Tenecé is one of the most interesting companies encountered in the fieldwork because of the sophisticated strategic thinking employed by its CEO and the heritage of his training. It shares many similarities with other technology companies, including an emphasis on providing "solutions" rather than products, a dependence on networking globally to source new products overseas and an active programme to train its staff in their use, and a reluctance to call upon external financing.

But in each of these it goes one or two steps further than its peers. Its desire to provide solutions led to the creation of a specialist office focused on the development of those solutions, its global networking activities are transformed into an exercise in spotting new market niches ahead of the curve, its staff training extends to the provision of MBAs and other masters degrees, and its reluctance to use finance becomes a glorification of the bootstrapping approach to business growth.

However, geographically speaking it is rather conventional, basing itself in the most predictable cities of Lagos, Abuja, Port Harcourt and Enugu, and extending quite predictably into Accra as its first foray into the rest of West Africa. Its relationship to leading global IT cities such as San Francisco is also rather conventional, even if it does make an effort to find suppliers in more obscure locations, demonstrating that the canonical global city network does retain a role in the strategies of even this most intellectually agile of Lagos technology companies.

5.3.10. Global Corp Ltd

Global Corp Ltd (Global Corp) is a good example of a Nigerian tendency for a group of young entrepreneurs to register a company name, scratch around to see where they can make themselves useful, and then develop a few business models only as the first few prospects turn into clients. "People here tend to register their companies early, then things start percolating, and they start deciding to focus on a couple of things." It was registered in 1996, but "operations didn't start until 2000", from which point it has developed interests in construction, agricultural development consultancy, farming and, most recently, surveillance technology. The farm is currently trialling varieties of tomatoes, spinach and other vegetables which they have introduced from Italy.

Global Corp also operate a trading company, Broadstreet Traders, to which it delegates transactions whenever its consultancy and other activities involve the buying and selling of merchandise and equipment.

Table 5.21 Global Corp Ltd

Annual report	*2007*	*2008*	*2009*	*2010*	*2011*
Operating revenue				$1.98m	
Total assets				NA	
Number of employees				50	

Source: Bureau van Dijk (2013). Other years unavailable

5.3.10.1. Customers

Global Corp has a second office in Uyo to liaise with its two construction clients in the city, for whom it is building a hospital and a private mansion respectively. It is involved in speculative developments, building 6 duplexes for sale on the open market on land opposite its farm in Ibeju Lekki in Lagos' eastern suburbs.

Global Corp has large clusters of agricultural customers in Zamfara state (capital: Gusau) and Akwa Ibom state (capital: Uyo; home to a number of palm oil producers), to whom it sells machinery and various agricultural development consultancy services.

Apart from its head office in Lagos, its trading subsidiary, Broadstreet Traders, has representatives in Abuja, Port Harcourt, Uyo, Calabar and Warri, though most of these consist of friends or former partners of the business who have moved away from Lagos and maintain an amicable working relationship.

Global Corp is looking for its first customers for the surveillance solutions it has been developing, which include the provision of closed-circuit television cameras and video recording, storage and playback facilities familiar to governments and retail businesses throughout London. It is pursuing customers in two sectors: government and public infrastructure agencies, and hospitality (in particular large four- and five-star hotels, having installed a system in Lagos' well-known Federal Palace Hotel). It also wants to lobby the government to subsidise surveillance technology as part of its mandate of ensuring national security. The director observes that, "because of the security in Dubai, you can see a family come out at 4 o'clock in the morning and go to KFC," something he believes should be made possible in the occasionally violent streets of late-night Lagos.

5.3.10.2. Supply

Global Corp's major partner in its agricultural development consultancy business is Agricoma Italia, a consortium of about 20 Italian companies producing agricultural seed and starter crops as well as agricultural machinery. The director believes that "60% of European agricultural machinery exports come from Agricoma Italia." Their partners sourced through Agricoma Italia include Spedo, a manufacturer of potato planters and spreaders.

Global Corp has also established partnerships with suppliers of a Dutch water storage and treatment equipment supplier, a Mumbai-based fertiliser manufacturer, another based in Australia's Gold Coast, and a seed producer in Christchurch (New Zealand), all met through a conference in Dubai. Many of the materials for the construction projects are also sourced in Dubai, notably tiles, furnishings and electric fittings, though the contractors building the projects are local. Amongst the construction-related consultants only the structural engineer flies from Lagos to visit the sites in Uyo.

On the surveillance technology side, it has set up partnerships with Firetide in San Francisco via a distributor in Johannesburg, Streaks in Phoenix via an agent in Rotterdam, Axis Communications in Lund (Sweden), and Milestone in Copenhagen, among others.

5.3.10.3. Knowledge

Global Corp has sent many of its staff overseas to obtain training and certification at the headquarters of its technology providers, at least when such training is unavailable in Lagos. It also draws heavily on its extensive networking activities for new knowledge, described below.

Rather than think about itself as an importation business, which it arguably is, the director interviewed prefers to think that the business is engaged in technology transfer, since beyond sourcing the technology overseas, Global Corp invests heavily in building up its own capacities and those of its staff to use the technology and becoming experts in the eyes of its customers.

5.3.10.4. Capital

Despite its international dealings, Global Corp reports that it has no special relationships with any foreign banks, and relies on Nigerian banks only for letters of credit and similar interests. Like many others in Lagos, "the way we finance projects is with other projects." For example, "most of the money from the construction of the hospital sprinkles down into other projects."

5.3.10.5. Networking

This is where Global Corp proves one of the most interesting companies interviewed. Global Corp is engaged in two major international networks that provide it with rather complex business opportunities.

The first is its partnership with Agricoma Italia, an agricultural syndicate headquartered in Rome. Through this partnership it made contact with Spedo in Castagnaro. With Spedo it put together a bid to build greenhouses in the University of Maiduguri in eastern Nigeria, submitted it to the World Bank in Washington DC for funding, and organised a demonstration of Spedo's machinery in Abuja to promote the deal. Global Corp was approached by the Roche Group, based in Limerick (Ireland) predominantly involved in construction, and acting on behalf of another member of the Italian syndicate, to assist in purchasing palm plantations in western Nigeria for the production of palm oil. Global Corp was able to put them in touch with a palm oil farmer in Osun state, a farmer it was in touch with originally because Global Corp helped create the Southwest chapter of Alliance Farmers Association of Nigeria (AFAN), of which the farmer was a member. Another Agricoma Italia member, Caro, invited Global Corp to its own conference in Cesena in northern Italy, where it made further contacts.

Global Corp's directors attend the agricultural conference AgraMe that takes place in Dubai each year, and have become the conference's ticketing agents for the West African region, making them perfect gatekeepers for West African and global agricultural companies wishing to do business with each other. It is through this conference that it made its connections to suppliers in the Netherlands, India, Australia and New Zealand. With these connections it made a proposal to develop a cattle feeding station in Kwara state (capital: Ilorin), which it knew had invited 13 or so white farm managers expelled from Zimbabwe to apply their expertise to the state's cattle industry.

When the directors attend the conference or conduct other agriculture-related business in the Emirates, they also spend time sourcing materials for their construction projects. For example they

purchase the tiles, furniture and electrical fittings for the duplexes in Ibeju Lekki in Dubai and Sharjah, then ship it home themselves. “We just … every time we go we build more contacts.”

One of the directors lives part time in New York, where his wife and children remain. “Whenever I’m in the US I take the opportunity to network there. I even work harder there [than in Lagos].” Having seen the popularity of surveillance technology in the US and UK markets, the directors decided that this was a business opportunity in Nigeria. They enquired about Firetide, a San Francisco company producing secure wireless networks to which surveillance cameras and video recording equipment could be attached. Fireside directed them to its distributor in Johannesburg.

To market this new opportunity, Global Corp built a proof of concept on its own premises, a multi-storey office building in the northern suburbs, placing cameras around the car park, foyer, lift lobbies and stairwells. It approached Glo (the Nigerian telco taking Microspace across Central Africa), offering to do a proof of concept of Firetide’s technology in Glo’s headquarters. The proof of concept would have required using Glo’s new fibre optic network, and Glo wanted to charge an exorbitant rate for this usage, so it abandoned the idea. However six months later Glo realised that it didn’t want its competitors to know that wireless network technology was being marketed around Lagos, so Glo invited Global Corp back to do the proof of concept at Glo’s own expense. From Glo’s perspective, this was not so much about demonstrating the security potential of the technology as about demonstrating Glo’s ability (read Global Corp’s ability) to provide wifi technology throughout the streets of Lagos.

In this way Global Corp’s interest in surveillance technology has given it new lines of business in wireless internet service provision as well as video communications technology. It has since sought to solidify its hold on the latter by making itself the West African agent for video recording and storage hardware and software through the following encounters: One of the agents who represented Firetide (from Milan) moved to a video storage technology company named Direct Data Networks, enabling Global Corp to become its agent. On one of their trips to Abu Dhabi, the directors made contact with Milestone, a Danish company that produces the software that manages the surveillance video recording process. Milestone has partnerships with HP and Dell, placing Milestone’s software on their network video recording hardware [NVRs]. “Dell came up with one [an NVR] that has 64 channels—you can hook up 64 cameras to it.” Global Corp has become the agent for these technologies as well.

As for the cameras themselves, Global Corp has become the agent for Axis Communications, a Swedish manufacturer. The directors are thinking of setting up a retail shop in Lagos for the Axis brand, and have a local investor willing to inject capital into the company to achieve this, but this is still under discussion. If this goes ahead, the distribution itself will be managed by Global Corp’s Broadstreet subsidiary.

To return to the surveillance concept, Global Corp has promoted this idea by approaching the People's Democratic Party (PDP), the political party of Goodluck Jonathan, president of Nigeria at time of writing, offering to provide security for their party convention in Eagle Square in Abuja. It had prepared a whole network design laid out in the proposal—what facilities would be covered, what streets would be covered, where the cameras would be. ("We never got anything [in response] until we heard there was an explosion around the area!")

It has approached the National Security Agency, hoping for them to make the technology part of Nigeria's national security policy. It has argued that the crude oil pipelines running through the Niger delta cannot be patrolled by security guards alone: "they will sleep, they will eat; no, you need full time surveillance"—the kind provided only by security cameras. The Lebanese man who runs the supermarket next to Global Corp's head office is a friend of the Inspector-General, so it was able to make a proposal to him. It has sent other proposals to the State Security Service (Nigeria's national intelligence agency) and to major gated communities such as Parkview and Banana Island.

It has sent a proposal to the Lagos state government and to the Lekki Concession Company to place security cameras across the whole of the Lekki-Epe Expressway, the highway that stretches for 22 kilometres from the central business district of Victoria Island to the outer eastern suburbs. To do this it proposed partnering with Glo (again) to use their fibre optics to manage the entire surveillance system remotely. It has also proposed to the state to install cameras on their buses, to monitor "the driving habits of their drivers, if anything is happening in the cabins, the bus stations, the filling stations." If Tenecé's business model could be summed up in the one word "knowledge", then certainly Global Corp's can be summed up in the word "networking".

5.3.10.6. Themes

Like Tenecé and a few other companies interviewed, Global Corp exemplifies a Nigerian tendency to create a company and fill it with a business model only some years later after a period of networking has come to fruition. Like them it has diversified where it saw new market opportunities within Nigeria, draws upon networks of suppliers based in cities large and small strung across the globe, invests heavily in training its staff and improving its own capacity to deliver technical services to its customers, and does so without drawing on external financing. Its networking activities are similar in nature to other companies interviewed as well, but the aggressiveness of Global Corp's networking is clearly above and beyond that of its peers.

What is striking however is just how "global" its networking behaviour is when it comes to identifying suppliers, and how local it is when it comes to prospecting for customers, all of whom are to be found solely within Nigeria's borders. Thus despite the complexity of Global Corp's networking behaviours, it still follows the same geography as most other service-based businesses in Lagos, with Microspace remaining the big exception to this rule.

5.3.11. Common themes

Apart from DHL, the service-based companies in Lagos exhibit very similar geographies in most aspects of their operations, and the consistency of these geographies gives a high degree of confidence that theirs are typical experiences for businesses trying to grow and develop with Lagos as their base.

5.3.11.1. Customers

The geography of these companies' own offices reflects to a large extent the urban network of Nigeria, and certainly the regional geography of the country: a headquarters in Lagos, the largest business centre, with perhaps an office in Ibadan serving other parts of its hinterland; a regional office in Abuja, the federal capital and the second largest business centre; a regional office in Port Harcourt or one of the other growing centres of the south such as Enugu, Benin City or Calabar; and very little implantation in the restless north except perhaps for some presence in Maiduguri or Sokoto somewhat set apart from the violence in Jos, Kano and Kaduna.

When these companies expand outside Nigeria, either they go it alone and spread rather timidly into Accra or Monrovia, both English-speaking cities, and occasionally into a few other small capitals within West Africa, but rarely into Francophone cities, a marked difference from the banks. Or they expand through partnership with a much larger organisation, in which case they are more capable of expanding into several West and Central African cities at once. Both of these strategies have little to do with establishing customer bases in the world's leading "global cities", and as such exemplify Jacobs' "downward" pattern of networking in which "backward cities" rely on each other to develop. The only company bucking this trend is Microspace's desire to launch a global electronics brand "made in Germany", but it cannot yet be seen whether this will be successful, or whether it will fizzle out like Nigerian banks' expansion into European markets.

5.3.11.2. Supply

The role of "global cities" in the supply of service-based companies in Lagos is ultimately a limited one. Unlike the banks, all of which operate networks of subsidiaries, representative offices or correspondent banks in many of the world's leading financial centres, the service-based companies call upon the world's leading business centres only when necessary for the sectors they operate in. Information technology companies frequently source their inputs from leading information technology centres such as San Francisco, Los Angeles, London and Bangalore. Electronics distributors source their inputs from leading electronics manufacturing centres such as Guangzhou and Tokyo. This is much like saying that banks source their finance in leading financial centres such as London and New York, which is slightly less grandiose and certainly more precise a claim than saying that banks source their finance in the world's leading "global cities".

On the other hand an agricultural development consultancy sources its inputs from rural parts of Italy and smaller regional centres in the Netherlands, Australia and New Zealand. A civil explosives distributor and manufacturer sources its supplies and raw materials from manufacturers in small towns scattered across France, Germany and Sweden. A food and FMCG importer sources its products from rural parts of the UK, Spain and South Africa.

In the end it is more useful to say that the geography of companies' inputs, whether those companies be banks, technology companies, electronics distributors, food distributors or otherwise, is driven by the geography of their sector than to say that it is driven by the geography of the global city network. However it is still essential to note that for all service-based companies interviewed in Lagos, their inputs are sourced in regions with higher levels of development relative to Lagos rather than lower levels.

5.3.11.3. Knowledge

The geography of knowledge is naturally very similar to that of supply, since the knowledge required by service-based companies in Lagos is usually knowledge about the inputs themselves. However the role of "global cities" is markedly higher in these companies' knowledge-related activities. There are two reasons for this. The first is that learning about inputs is more important when those inputs are knowledge-intensive in the first place, and the production of knowledge-intensive inputs is a defining specialisation of "global cities", such as San Francisco and London. The second is that the training activities required to acquire and absorb knowledge necessitate the bringing together of large numbers of professionals in one office or training centre, and that this bringing together of large numbers of professionals is another defining specialisation of "global cities". Dubai features highly in the geography of knowledge for exactly this specialisation, despite not being an information technology production centre in the manner of San Francisco or Bangalore.

5.3.11.4. Capital

The role of external finance is limited in most service-based companies. Their use of banks is restricted to maintaining their cash reserves and purchasing financial instruments (such as letters of credit) when necessary for purchasing inputs from foreign suppliers. Their acceptance of other forms of investment capital is usually conditional upon that investor bringing in knowledge that the company can benefit from, such as a chairman with experience in a foreign company in the same sector, or a foreign joint venture partner contributing their experience gained in their native markets. This means that the geography of these investors has little to do with the geography of the global financial industry and the "global cities" that dominate it, and much more to do with the geography of the sector the company operates within.

5.3.11.5. Networking

The geography of most service-based companies' networking activities shifts slightly from the previous inputs. There is more emphasis on trade fairs, conferences and exhibitions, and the locations of these events often bears very little relationship to the geography of their sectors (for example, the agricultural conference AgraMe is held in Dubai, where certainly very little agriculture happens). This means that global cities, often somewhat secondary global cities such as Hamburg and Las Vegas, feature more often than in the geographies for supply, knowledge and financing. There is also more emphasis on sourcing agents, businesses who by nature must network heavily with a wide range of other businesses, and who are thus more often located in global cities than many of the companies that engage them, such as Dubai, Guangzhou, Beirut and London. But here again, the geography of these sourcing agents need have little relationship to the geography of the sectors they are contributing to; Lebanese-owned businesses in Lagos may choose to network through agents in Beirut because of cultural affiliation, not because it provides any advantage within their sector.

However as a result of these intermediations, geographies of networking activities can be more complex even than of geographies of supply, since companies may have to make contacts across a chain of cities to identify partners meeting their exact needs, or indeed to set up supply chains that had not previously existed.

5.3.11.6. A contemporary entrepreneurial culture

A few other themes emerge that help understand how businesses situate themselves within the local and regional economy. For one, Lagos features many small technology companies with very large ambitions. These companies usually have young executives who studied in specialised fields in the US or Europe, established a very solid base of professional experience in larger companies after their studies, spent three or four years building their personal business networks and investigating potential business models while still employed, then pushed off into their own enterprises once some of their ideas were coming to fruition. These businesspeople were the most entrepreneurial in that they actively sought new niches or missed opportunities for bringing new technology into the Nigerian marketplace, and travelled overseas incessantly to find those technologies and build exclusive relationships with distant suppliers. They could also be very progressive in how they structured their organisations, for example Tenecé's "centre of excellence" that drew on Enugu's university talent, or Microspace's effort to acquire a "Made in Germany" label in its desire to become Nigeria's first globally recognised electronics brand.

These global networking strategies are clearly vital to how the Lagosian economy as a whole develops, and it is interesting to see how the geographies of these networking activities created by these "bottom-up" business centres often circumvent the traditional "top-down" hierarchies of the global city network, avoiding the most central global cities like London and New York and going

straight to the more specialised cities like San Francisco and Guangzhou to assemble new opportunities.

5.3.11.7. Providing "solutions"

As a corollary to this, many companies make a distinction between "providing solutions" and merely "trading" or distributing equipment. This is an important part of economic transitioning, the microeconomic expression of the desire to move from "an economy based on importation" to an urban economy based on complex service delivery, where several layers of value are added to the manufactured goods and other inputs sourced overseas. This also helps a large city such as Lagos that desires to become a regional "gateway" to develop an economic specialisation of value to businesses in cities throughout neighbouring countries, as it capitalises on its large professional workforce to deliver services that cannot be produced in smaller, poorer cities.

5.3.11.8. Growing on the back of larger brands

A final theme is how some small companies grow on the back of larger brands, for example Penuel through Hitachi, Hunts through Shoprite, and Microspace through Glo. The geography of these partnerships is instructive: small companies do not join with larger companies in an effort to grow "upwards", to set up new customer bases in more highly developed cities around the world, but rather in an effort to grow sideways and "downwards" towards equally low or less developed cities within the region.

5.4. Manufacturing companies

Two manufacturing companies were interviewed, both established in the heyday of Nigeria's post-independence industrialisation efforts, and both recovering from the loss of productivity and stagnation brought on by the intervening decades of structural adjustment, corruption and mismanagement.

5.4.1. First Aluminium Nigeria Plc

First Aluminium Nigeria Plc (First Aluminium) was established in 1960 (in Port Harcourt) as a subsidiary of Alcan, the Canadian manufacturer. It began life as a single aluminium rolling mill, introducing aluminium sheet and roofing to the Nigerian market. In 1980 it was purchased by an Indian businessman, Indoo Shivdasani, at the time one of the largest importers in Nigeria who traded under the company name Inlaks. It expanded under Inlaks, opening an FMCG packaging division (seamless plastic tubes, plastic laminate tubes, collapsible aluminium tubes, etc.) in 1981. The company is now owned by the son, Azad Shivdasani, who was born and still lives in London, and was 20 years old when his father died, though it is held through holding companies in Monte Carlo and the Cayman Islands.

15 years ago the owner started hiring a succession of Indian managing directors sourced through family contacts, and according to the current CEO, "from that moment on, slowly, slowly, you see results going down." Production declined to around "20% of the capacity of the equipment", and the company was "losing money like that!" The company attempted to diversify, including "household utilities"--aluminium pots and pans, and aluminium windows and doors. The household utilities division was closed five years ago. (Another family company, Tower Group, has since cornered this particular market—"it's also an Indian group, but they don't speak to each other.") The windows and doors division was closed one or two years ago.

The owner intervened again, and promoted an Englishman (born in Sudan and who had lived his whole life in Africa) from the packaging division to CEO of the entire company. "He fought fraud in the company and he did a good job. Anyone involved in fraud was sent away, but as a result there was no middle management anymore, no production people anymore." He was "a good guy [...] but had no clue about aluminium—not the processes, not the market, not the industry." The current CEO, a Dutchman, was hired from a 30-year career within a leading Swedish aluminium company and contracted first for six months, then nine months, and then permanently, though his family remains in Belgium where he was previously.

When he arrived in Lagos, he spent a lot of time talking to potential customers and found that "the reputation was still strong", the brand associated with good quality, but most contacts in Lagos and Abuja had said "but we thought you stopped operations five years ago," so small had their impact in the market become, though it had remained active and well known in Port Harcourt. The CEO thus has two tasks: bringing the name back into the market, and bringing production back to full capacity.

First Aluminium operates seven business units. In Port Harcourt there is a production unit (the original rolling mill) in the Transamadi industrial estate, and a roofing unit in the Aba Road estate. In Lagos there is the head office and the FMCG packaging unit in the suburb of Ikeja, and a roofing unit in the suburb of Ilupeju. There is a coil sales unit but no production facilities in Abuja, and a roofing unit in Kaduna. All units report to the mill in Port Harcourt, which itself reports to the head office in Lagos, except for the FMCG packaging unit in Lagos which reports to head office directly.

Table 5.22 First Aluminium Nigeria Plc

Annual report	*31 Dec 2007*	*31 Dec 2008*	*31 Dec 2009*	*31 Dec 2010*	*31 Dec 2011*
Operating revenue	$75.1m	$61.5m	$56.0m	$58.7m	$55.9m
Total assets	$63.8m	$65.5m	$71.6m	$69.7m	$62.3m
Number of employees	NA	529	572	588	588

Source: Bureau van Dijk (2013)

5.4.1.1. Customers

Aluminium sheets are 90% of the business, and the biggest market for these products is the south—Port Harcourt, Enugu, Warri, etc. The company remained strong here because "Port Harcourt is a rich area, they have money to pay for roofing [...] but even there you saw a decline, because each year you lose one or two customers." However the fastest growing markets are Lagos and Abuja.

FMCG packaging is only "10% of the turnover, but [is] a nicely profitable business." 80% of its output, indeed 80% of all FMCG packaging produced in Lagos, is bought by Unilever's factories in the city. There are many other smaller factories who purchase packaging from First Aluminium, "but Unilever dictates the market."

The north of the country "is not a priority anymore." The insecurity caused by Boko Haram is dire enough that the CEO has never seen his factory in Kaduna. "Kaduna is a no go area. I go to Abuja, and my staff at Kaduna come to Abuja [to meet me]. Anything north of Abuja they don't allow me to go. Even Indians don't go north of Abuja anymore. Nigerians still do but [this is] very limited. Economic activity has decreased enormously in the area. When I see the guys from Kano and Kaduna [in Abuja], the guy from Kano will stay around [after dark], the guy from Kaduna will go [early] to make sure he is home before 6pm," that is, before nightfall.

Anywhere outside Nigeria is not an option either. The cost of energy in Nigeria is too high and the currency too inflated by oil exports for Nigerian manufacturing to be competitive amongst its neighbours. It is only "that we have this mill, which can give us a niche in the market," that allows it to remain competitive within Nigeria. The CEO also complains that "all the legislation is against [its] own manufacturing. ... No-one's investing in new production capacity, not anymore."

As an example of how Nigerian regulations work against the interests of Nigerian manufacturing, the CEO cites the import tax structure. "Import duties on the finished product is the same or lower on the base materials," meaning that customers are disincentivised from sourcing finished products from inside Nigeria, usually going to Chinese makers instead. "Each day I am getting between five to ten offers from all kinds of Chinese companies involved in aluminium. They just march an email to everybody [in Nigeria] involved in aluminium." He believes that a lot of illegal and substandard imports are coming into Nigeria via the port of Cotonou in the Benin Republic. Instead of the high import duties and the VAT that he has to pay, the merchants of these imports just "pay one or two million naira to the customs officer to bring it in."

5.4.1.2. Supply

The rolling mill in Port Harcourt is still the one imported by Alcan in the 1960s, but needn't ever be replaced. "A rolling mill can be 200 years old. It's only the control equipment that makes a difference—so we change [that] every five to ten years. It's an old line but it's a nice line." The paint

lines have been in Nigeria for five to ten years; one is from Sydney, the other from the Chinese company Li Tong. Much of the rest of the company's technology is procured in India (Mumbai) and China through a purchasing agent in the UK, owned by the same Indian family in London. Much of the shipping and clearing of goods is managed by GMT, an agent based in Lagos but again chaired by an Indian businessman.

In the CEO's opinion, "Europe is not a business partner for Nigerian companies. [...] I would say the number one business partner is China, the second business partner is India. Then you get a whole thing of nothing then perhaps the US and Europe. They're out of scope here. When you say I want to import something from Europe, everybody thinks 'he's crazy'!" In his view, Indian machinery is at 95% of the standard of European machinery, Chinese machinery at 60% to 70%. "In America the aluminium industry is really 20 years behind Europe in development."

It can be difficult to source plant and machinery from some companies, not because of the terms, but because of the perception of insecurity associated with Nigeria. Two-month delays had been experienced because engineers employed by UK and German suppliers refused to come to Lagos after security warnings from their respective foreign offices.

Sourcing aluminium is another area where Nigerian trade policy "hurts the local manufacturer". First Aluminium needs large quantities of scrap aluminium to "remill" into sheets, but the companies that collect scrap are encouraged to form it into ingots and export it to China, since the export of ingots attracts a 20% subsidy from the Nigerian government. The CEO is aware that his competitor imports aluminium scrap from India to meet their production needs.

5.4.1.3. Knowledge

The company largely depends on the industry knowledge of its CEO and senior engineers, many of whom have been working in aluminium for over twenty years, and have also come from various cities within India. It also relies on the contacts and relationships maintained by the purchasing company in London.

The CEO believes it is a problem that aluminium companies have to resort to hiring expatriates to find staff knowledgeable about the industry. "A lot of the knowledge is expats, but I think that's a big disadvantage. We should be trying to replace expats with Nigerians. That's getting easier as more Nigerians come back from the US."

5.4.1.4. Capital

When the current CEO arrived, the company was supporting a standing loan of 2 billion naira, paying 450 million naira per year in interest. He turned the company around and made it cash-positive, but all the cash goes into paying off the interest. "That will go on for a couple of years while

we lower this cash burden, then we can really start earning money." First Aluminium's situation is not typical: "Most companies who are doing well in Nigeria, they don't need money from banks to invest, they invest their own cash."

First Aluminium has benefited from a loan from the CBN's Bank of Industry, a facility intended to increase the technical capacities of Nigerian manufacturers. Companies apply through their commercial bank (Mainstreet) to the Bank of Industry in Abuja, who sends assessors to meet the company and determine its eligibility. A new furnace line is being purchased on these terms. They offer a loan at 7% interest, whereas commercial loans for similar needs would be 18% to 19%.

The CEO has been looking for potential investors amongst venture capitalists in San Francisco and New York, to help lower the company's interest burden. He is using Linkedin to find potential contacts there and across Europe, just as he was found on Linkedin by the owner of the company.

He has one final thing to say about the company's finances. "The other thing about Nigerians is that they have an unbelievable faith in the future. When I talk around here with the management staff or the employees about the challenges facing the company, they say, 'But sir, don't be so negative. God has built a fence around this company that will always protect it.' There is not this idea that you have to earn money in order to survive as a company."

5.4.1.5. Networking

To increase the company's customer base, the CEO participates in social events every week. "You can only sell due to networks, you can only sell when you know people personally. I started going to all kinds of events. Nigerians love events, award ceremonies, whatever. [I] went to three, four, five events a week, just handing out business cards, and that works."

Internationally, "I have my old contacts, I know those suppliers. I travel to meet them two or three times a year." He travels whenever large transactions are involved. "I went to Dusseldorf to look at some second-hand machinery. I've been to Cameroon for an aluminium ingot supplier." He and an engineer travelled to Mumbai before purchasing machinery there.

5.4.2. Nigerian Ropes Plc

Nigerian Ropes Plc (Nigerian Ropes) began as a subsidiary of British Ropes Ltd (now Bridon International Ltd) in 1960, producing as well as importing steel, nylon, polypropylene, fibre and manila hemp ropes for industrial purposes, including steel slings required for lifting containers and other heavy loads within the shipping and oil and gas industries. It is now almost entirely Nigerian-owned. Like First Aluminium, corruption and other mismanagement problems saw its production collapse to less than 20% of capacity, and its market share shrink to less than 10% of the Nigerian rope industry.

The previous managing director was an Italian, an accountant working for a construction firm in Lagos, and hired across to Nigerian Ropes. "My predecessor wanted to micromanage everything," says the current (Nigerian) managing director, "it suited him to keep it small—small volumes with big margins, which he succeeded in doing."

The MD reports that "undercapitalisation was the other reason for low profitability. Historically [Nigerian Ropes] has not had adequate funds for raw materials." There are also "exceptionally long lead times" on materials, most of which is shipped from a supplier in Korea. "We used to end up disappointing customers because of our lead times and lost out to competitors internationally."

In 2008, 60% of the company's shares were bought by a number of companies that make up the Shoreline group, headed by well-known investor Kola Karim. Shoreline's strategy is to buy up interrelated businesses within Nigeria, including a large construction company (Costain) and a paints company, and create synergies between them. "Their latest interests are infrastructure and oil and gas." Shoreline operates between Lagos and the UK: "it's wherever Kola is". Karim hired the current managing director in November 2008, originally as an executive director in support of his predecessor.

Nigerian Ropes has a factory in Lagos, a warehouse and sales office in Port Harcourt, and another smaller one in Warri. In theory the Warri office reports to Port Harcourt; in practice the Lagos headquarters "does most of the work" of managing the Warri location. Shoreline owns an old industrial site in Transamadi, the largest industrial area in Port Harcourt (where First Aluminium also has its factory). The site was an old Michelin plant, bought "when tyre manufacturing died in Nigeria." It has its own gas-fuelled power plant, which Shoreline is planning to restore. When that happens, Nigerian Ropes, like other companies in the group, plans to open a factory there to take advantage of the cheap power. "To make good quality stuff you need steady power, which is a problem in Nigeria."

The MD discusses the fact that most other Nigerian businesspeople tend to treat all enquiries, including those regarding research projects, with "massive suspicion. I ask, what is there to hide? We're manufacturing using foreign machinery and foreign materials," implying that nothing that any company is doing can be so innovative that it cannot already be known by other companies. He warns that other potential interviewees will be "scared of misrepresentation, especially people who've been interviewed by the press."

Table 5.23 Nigerian Ropes Plc

Annual report	*31 Dec 2007*	*31 Dec 2008*	*31 Dec 2009*	*31 Dec 2010*	*31 Dec 2011*
Operating revenue	$3.11m	$3.37m	$2.84m	$2.52m	$3.14m
Total assets	$5.36m	$5.81m	$4.48m	$4.22m	$4.55m
Number of employees	NA	NA	140	140	140

Source: Bureau van Dijk (2013)

5.4.2.1. Customers

Customers in the oil and gas sector account for 90% of the company's turnover, the rest is made up by customers in construction, fishing and trawling, and power transmission, for whom Nigerian Ropes make the aluminium core that gives strength to the conducting wires strung between transmission poles and towers. One of its largest clients is Chevron, with whom it has a two-year "blanket purchasing agreement"—anything Chevron needs in ropes and slings in that period it must buy from Nigerian Ropes.

A lot of the oil and gas business is concentrated in Port Harcourt, hence the warehouse and sales office. These facilities also do "a bit of value adding" by converting steel ropes into slings to order. "Most things that are being lifted are being lifted with slings of one sort or another." In the shipping and trucking industries, "containers take a four-legged sling and a master sling." In the oil and gas sector, "everything that's being loaded from the sea to the [offshore] rigs is done with slings [...] rather than long-length rope." The office in Warri is smaller, "because it's where all the militancy in the delta area started, but it's returning to normal now." Nevertheless "many of the oil and gas operating near Warri were operating through Port Harcourt and Lagos instead."

Oil and gas companies are good return customers because the sector is "strict on standards and safety." There are third-party inspections every six months, every rope and sling is tested and colour-coded, and any length that fails gets replaced. "Plus they're all operating in salty environments."

Nigerian Ropes also benefits from a recently introduced regulation requiring that oil and gas companies give local companies first preference when seeking new suppliers. As the only Nigerian-owned rope manufacturer in the country, indeed in all of Sub-Saharan Africa outside South Africa, "local content" laws like this have helped Nigerian Ropes increase its production and exports across the region.

With the arrival of oil production in Ghana, the company plans to expand, with an office in Accra and another warehouse and sales office in Takoradi, the city nearest the offshore oilfields, which may include another "service centre" to transform ropes into slings locally. It is also "talking with joint venture partners in Takoradi" to set up technical partnerships with oil services companies.

Otherwise, like First Aluminium, Nigerian Ropes' export potential suffers from the cost of securing energy supplies in Lagos, the high value of the naira, and the delays and corruption encountered in the country's ports.

Shipping is also extremely inefficient. "One of the problems with trade on the West African coast is logistics. Shipments to Angola are transhipped through Europe. It's almost [always] the same with

Cameroon; definitely the same with Ghana. So we are actually planning to ship to Ghana by road, which is a nightmare because you cross three borders."

5.4.2.2. Supply

With 90% of the business being steel ropes, most of Nigerian Ropes' raw materials consist of steel wire imported from DSR in South Korea. Sling fittings (such as ferrules to fix the ends of short lengths of rope) are sourced from Talurit Sahm Seilklemmen in Bremerhaven (Germany) and George Taylor & Company in Aldrich (West Midlands). It also distributes these products to other manufacturers in Nigeria. Ribbons in Treorchy (Wales) supplies webbing and webbing sling material. Nylon yarn comes from a factory in China contracted to a German company and manufactured to German standards. The yarn is procured through a procurement company in Amsterdam—"that's how all the supply businesses in Nigeria tend to work." The plant and machinery are largely part of the original installation by British Ropes in the 1960s. The newest machinery came from Spain "with all sorts of automation and everything else," but Nigeria's notorious "power supply has buggered everything up."

One raw material, polypropylene yarn, was a banned import for many years in an attempt to protect the local textile industry, meaning that Nigerian Ropes' production of polypropylene ropes was extremely limited. The ban was lifted very recently, and it has now received its first consignment from the same South Korean company, enabling it to relaunch production of ropes up to 52mm in diameter.

The MD is looking forward to "trying to do some backward integration into the manufacture of polypropylene yarn, with the development of a petrochemicals industry in Nigeria. Someone in Nigeria would start making pellets, which we extrude into sheets, then twist and shred to make into the yarn for ropemaking." Once this can be achieved, "then we can talk about [making] eight- and 12-strand mooring ropes. We would need one additional machine for this." But this would give Nigerian Ropes the capacity to make ropes strong enough to restrain container ships moored throughout West Africa's ports.

He mentions a consignment of steel wire that arrived from a new South African supplier. When it arrived, they were "horribly shocked to see that it was rusted up and we had already paid." This highlighted another problem for manufacturers in Nigeria: "to take legal recourse is almost impossible, even in South Africa. We would have to prove poor quality or carelessness on their part, which would actually be difficult."

Logistical challenges affect supply times as well. For the steel wire coming from South Korea, "shipping time alone is six weeks. Most of our shipments are transhipped through Europe. There's a minimum of three weeks' clearing. So a minimum of ten weeks' lead time from the opening of letters

of credit." This caused Nigerian Ropes to "end up disappointing customers" until it mastered this problem.

The MD makes similar comments to the CEO of First Aluminium regarding the quality of equipment from different parts of the world. "I wouldn't buy China material, I'm yet to be convinced by the [machinery] coming out of China. I would look at some of the Western rope making countries [instead]."

5.4.2.3. Knowledge

All staff are Nigerian with the exception of the chief production manager, originally from Kerala, who has 40 years of ropemaking experience including 11 at Nigerian Ropes. The MD was originally a medical practitioner working as a company doctor at a dairy company (Fan Milk), before switching over to business administration upon completing the Sloan Masters in Leadership and Strategy at the London Business School—a 12-month programme currently priced at £51,400 for the year.

While Nigerian Ropes has less need to send its staff to train with suppliers in the way that technology companies do, its training policies are much more similar to theirs than to First Aluminium's. For one thing, Nigerian Ropes has "upped the level of general training as a corporate social responsibility, apart from us gaining directly. We do try to set up annual training programmes." The trainers are usually experts from local industry groups such as the Manufacturers Association of Nigeria, or hired from local training companies explicitly set up to offer trade courses. "A lot of new training companies have been set up" in Lagos in the past few years. Nigerian Ropes can also claim back a lot of training expenses from an international training fund.

Technical staff—those who work the shop floor—are basic technicians trained in rope making on the job. They are trained either by the chief production manager, or by other senior staff originally trained during the British Ropes era. Supervisory staff are usually mechanical engineers with either Higher National Diplomas (HNDs—a two-year tertiary qualification) or Bachelors of Science in engineering. New salespeople are put through two courses, one on the ropemaking industry—the production of ropes, the finished products, their specifications, etc.—and the other is a basic sales training course. Accountants are given some in-house training, but since most have the ambition to become chartered at various levels with the Institute of Chartered Accountants, it chooses to support them throughout that process as well. The MD adds that "once things improve significantly I would like to send a lot of our staff abroad to visit other companies to update their knowledge on ropemaking."

5.4.2.4. Capital

One initiative the MD embarked upon when he arrived was to raise a "hybrid offer" on the Nigerian stock exchange—an issue of new shares with an offer of rights to existing shareholders. "We started work on this in late 2008 [but] just as we started finalising values, the world crashed. We thought, 'no, there's no point.'"

By late 2009, the government was starting a manufacturing revival scheme, having realised that manufacturing had sunk to less than 2% of Nigeria's GDP. "Realising that reasonably priced funds was a problem," the Bank of Industry began offering loans at 7% interest ("fixed, not fluctuating or indexed"), with tenures of three to seven years to "deserving companies". Nigerian Ropes was able to get some funds through this, but not without a fight from its commercial bank (Ecobank), who was required to make the application on its behalf. Ecobank "didn't feel we were distressed … they didn't want to give up their 23% to give us 7%."

Ecobank "later declined to renew our commercial facilities so we've gone back to UBA [United Bank for Africa], who have recently granted us overdraft and other facilities to import raw materials which is our major funding requirement." However, Nigerian Ropes cannot apply for further Bank of Industry funding through UBA, since "to reapply for that, we would have to pay off our existing debt to Ecobank. And UBA as a matter of principle does not buy out debt from other banks. So we're in negotiations with Unity Bank who think that they might well be prepared to do so."

5.4.2.5. Networking

Nigerian Ropes benefits from having become part of the Shoreline group, whose horizontally integrated investment strategy means it can create partnership opportunities more easily. The networking potential that comes with Shoreline "is one of the wonderful things with being part of a wider group." The other tactic the MD uses to develop new contacts is socialising professionally and personally. He is a member of golf clubs, the polo club, and other exclusive groups within Lagos. He is heavily involved in the Manufacturers Association of Nigeria, being both a council member of its Apapa branch and the vice chairman for manufacturing of its "Local Content Group", a sub-association of manufacturers affected by local content laws.

Figure 5.6 Steel cable production line in the Nigerian Ropes factory. Source: author.

5.4.3. Common themes

The two indigenous manufacturers interviewed told remarkably similar stories: beginnings in the post-independence era, years of mismanagement under inadequate or corrupt staff, a decline in production and loss of competitiveness, before being reinvigorated by a new generation of ownership and a new managing director or CEO, who is working hard to rebuild client confidence, restore production levels, and return the company to liquidity. Like most technology companies, they search for their plant, machinery and raw materials across the global economy, aided by procurement agents in major "global cities", but supply almost entirely to the Nigerian market. In the case of Nigerian Ropes, it also shares with most technology companies an active and varied training policy for its different types of staff.

Both are uncompetitive for customers elsewhere in West Africa, partly due to logistical problems involved in shipping between West African countries, and partly due to counterproductive industrial protection policies that disfavour the industries they operate in. But a large source of their lack of competitiveness is Nigeria's terrible electricity infrastructure, whose output is extremely irregular, with power cuts of a few hours hitting different suburbs randomly several times each day. This makes energy-intensive manufacturing especially difficult, since they must buy and burn up huge volumes of diesel or pause production at these times, increasing their costs and lead times compared to other cities in the region such as Accra.

First Aluminium is also an object lesson in why most service-based companies avoided commercial loans—the very high interest rates can act as a throttle on the company's profits for several years to come. On the other hand Nigerian Ropes is a good example of what can happen when investment

comes along with entrepreneurial expertise and the backing of a larger brand, in its case the Shoreline Group, which has opened up the possibility of access to cheaper energy as well as of expansion through vertical integration.

5.5. Themes common across sectors

There are remarkable similarities in the ways companies in different sectors interact within the global economy, in general by drawing on a wide range of global connections to source inputs and knowledge used to pursue customers within the narrower geography of Nigeria and West Africa. Within this broad pattern, the following points can be observed.

5.5.1. Customers

Most companies are Nigerian concerns with transnational activities rather than transnational concerns with Nigerian activities; the only West African company to be a real exception to this is Ecobank. Otherwise they are focused overwhelmingly on the Nigerian market; for some it is an explicit policy at least in the short term (Aiico, JNC).

Nevertheless most also have an interest in expanding into West and Central Africa to capture new markets in the region, whether these expansions be a legacy of past initiatives (Keystone), currently underway (First Bank, 'Lagos Bank', Penuel), in the pipeline (Microspace, Internet Solutions) dreams for the future (Mainstreet, JNC, Tenecé), or simple wishes frustrated by lack of competitiveness or regulatory conditions in Nigeria (Nigachem, First Aluminium, Nigerian Ropes). Others are multinationals using Lagos as a hub within the region (Citigroup, DHL).

Most companies tend to divide Nigeria into three poles: the southwest, dominated by Lagos but comprising also Ibadan, Abeokuta, and others; the south, a more dispersed pole typically focused on Port Harcourt but which may also be served through Enugu, Benin City, Aba, Calabar, Warri, or other cities; and the 'north' focused almost exclusively on Abuja in the centre of the country. Only some companies (Citibank Nigeria, Aiico, Internet Solutions, Mainstreet, First Aluminium) maintain a pole in the troubled far north of the country, where Kano and Kaduna dominate over other cities.

Almost no companies other than the larger banks maintain operations in any of the canonical global cities such as London and Paris, though some may have owners, agents or other representatives.

5.5.2. Supply

The service-based and industrial companies have similar geographies of supply, each drawing their plant, machinery, raw materials, technology and other inputs from a very wide range of locations strung across North America, Europe and East Asia. The role of global cities in these geographies is

limited but very specific. Some inputs will originate from global cities with the right specialisations, for example London for secondary finance, Zurich and Munich for reinsurance, San Francisco for IT, Mumbai for heavy machinery, Guangzhou and Tokyo for electronics. Some will be acquired through sourcing agents based in global cities, but again they are global cities specialised in providing networking opportunities for global business: London and Dubai, and to a lesser extent Guangzhou and Beirut. Otherwise, many companies source a lot of their inputs from a plethora of smaller cities and towns, without regard for the specific geography of the global city network.

The geography of the global city network does not appear to drive each company's geography of supply. Rather it is the global geography of each sector that determines whether a company's geography of supply matches that of the global city network or not. Banks source their inputs from global financial centres; technology companies from global technology centres; food, agricultural and chemicals companies from a mix of urban and rural locations where their inputs can be safely or efficiently produced, etc.

5.5.3. Knowledge

The acquisition and absorption of knowledge is an important activity for all sectors. Whether banking, service-based or industrial, most companies have a very active programme of staff training, whether that be delivered in-house or by sending staff overseas to suppliers or training centres. Some also offer support for staff to pursue advanced tertiary education or qualifications (Aiico, Microspace, Tenecé, Nigerian Ropes).

The next most common pattern is for senior staff to have had industry experience in more developed contexts (JNC, Nigachem, First Aluminium) or experience working in global management consultancies (Aiico, Tenecé). The hiring of such consultancies (e.g. McKinsey) is less common, as is the use of a large in-house research and development team; these strategies are usually only the province of the larger banks.

5.5.4. Capital

Finance is an area where companies in each sector behave somewhat differently. Many service-based companies try to avoid using external finance at all (Penuel, Commint, Hunts, Internet Solutions, Tenecé), while others have done so only on the basis that it is accompanied by an external investor with expertise to offer the company (JNC, Nigachem). The industrial companies have more active relationships with their banks, even if that gets them stuck with very high interest burdens (First Aluminium). The industrial companies interviewed, both publicly listed, are both able to pursue a source of financing that the service-based companies cannot, namely special public offerings, but this is not always a reliable source of capital (Nigerian Ropes).

One facility that companies in all sectors may consider is finance from a major government institution, such as the CBN's Bank of Industry (First Aluminium), the World Bank ('Lagos Bank', Global Corp), a development agency such as CIDA (First Bank), or an "export-import" bank ('Lagos Bank', Microspace).

5.5.5. Networking activities

As with their geographies of supply, companies in many different sectors exhibit similar geographies when it comes to their networking activities. Many staff participate in industry conferences (First Bank, Citibank Nigeria, Aiico, JNC, Microspace, Internet Solutions, Tenecé, Global Corp) or trade missions (Hunts, Global Corp) to discover potential business partners. The geography of the global city network again plays a limited but specific role. Many of these conferences are in second-tier global cities such as Hanover or Las Vegas, but this is because conferences place little demands on their host cities other than adequate exhibition and meeting facilities and good tourism infrastructure, which all second-tier global cities can provide. Global cities play a more critical role when it comes to sourcing agents and other representatives, which are more likely to be in key networking sites, namely London ('Lagos Bank', Aiico, First Aluminium), Dubai (Nigachem, Tenecé), Guangzhou (Penuel, Nigachem) and Beirut (Nigachem, Internet Solutions).

Chapter 6. The Lagos network

This chapter provides a description of the networks formed by the activities of businesses in Lagos, as yielded by the fieldwork data. It should be read in conjunction with Volume II: Appendix B of the atlas, whose figures it will refer to throughout.

Each relation between agents in different cities discovered for each firm interviewed in Lagos was encoded into a series of matrices representing the Lagos network and its various sectoral and functional components. While the analyses in Chapter 4 were conducted on wide networks pertaining to whole regions or sectors, the analyses in this chapter are conducted on an egonet—a network pertaining to a single node (labelled "ego"). Because of this, the various morphologies that emerge require a different vocabulary. Rather than talk about consolidated, transitional, fragmented or degenerate networks, here the main distinctions are between "egocentric", "asymmetric" and "altercentric" networks. An "egocentric" egonet is the default case in which most connections are centred on "ego" (herein Lagos), whether directly or indirectly through a number of minor intermediaries. An "altercentric" egonet is the opposite case in which a large number of connections is centred on a different city or "alter" (a case which never appears in the Lagos network). An "asymmetric" city is one in which most connections are centred on ego, but with a significant minority centred on an alter.

In the elevation views for this network, the "headquarter cities" and "foothold cities" refer to the senders and receivers of various flows, as the following tables outlines.

Table 6.1 Types of flows in the Lagos network

Relation	*"Headquarter city" (sender)*	*"Foothold city" (receiver)*	*Flow*
Operations	Head office	Branch or representative office	Organisational command
Suppliers	Supplier	Company	Products and services
Knowledge	Supplier, training centre, or university	Company staff worksite	Knowledge transfer
Capital	Investors, creditors	Company	Capital
	Company	Shareholders, creditors	Dividends, interest, etc.
	Banks, customers, counterparties, etc.	Banks, customers, counterparties, etc.	Trade finance
Networking	Company staff worksite	Conference or meeting location	Personnel

The Lagos network may be decomposed into its intrafirm and interfirm components, its three sectoral components, and five sets of relations pertaining to different types of activities or functions. The sectors are those identified in the fieldwork; manufacturing and finance are identical to the definitions used in the analysis of the global network, while the third sector, "services", comprises a miscellany of companies which self-identify with any sector other than manufacturing and finance but which were observed during the fieldwork to be concerned primarily with service delivery to business clients. In addition to these, there were enough data on some functions within individual

sectors to report networks for those data. The final list of networks available for this study is shown in the following table.

Table 6.2 Components of the Lagos network used in this study

Name	*Definition*
Lagos (overall)	The network comprising all relations pertaining to the activities of firms interviewed in Lagos
Intrafirm	A component comprising all such relations between two or more business units within the same firm
Interfirm	A component comprising all such relations between two or more business units in different firms
Finance	A sectoral network comprising all relations pertaining to interviewed finance firms
Services	A sectoral network comprising all relations pertaining to interviewed miscellaneous services firms
Manufacturing	A sectoral network comprising all relations pertaining to interviewed manufacturing firms
Operations	A functional network comprising all relations pertaining to the internal operations of interviewed firms
Supply	A functional network comprising all relations pertaining to the supply of interviewed firms
Knowledge	A functional network comprising all relations pertaining to the knowledge-related activities of interviewed firms
Capital	A functional network comprising all relations pertaining to the capital-raising activities of interviewed firms
Networking	A functional network comprising all relations pertaining to the networking activities of interviewed firms
Finance: operations	A functional network comprising all relations pertaining to the internal operations of interviewed finance firms
Finance: capital	A functional network comprising all relations pertaining to the capital-raising activities of interviewed finance firms
Services: operations	A functional network comprising all relations pertaining to the internal operations of interviewed services firms
Services: supply	A functional network comprising all relations pertaining to the supply of interviewed services firms
Services: knowledge	A functional network comprising all relations pertaining to the knowledge-related activities of interviewed service firms
Services: networking	A functional network comprising all relations pertaining to the networking activities of interviewed service firms

6.1. Morphology

Just as in the global network, the morphology of the various components of the Lagos network may be seen from their plan views. Many appear to be egocentric—centred entirely on Lagos, the ego—and many appear to be asymmetric—having a significant number of ties centred on an alter. These morphologies are presented in Table 6.3 below. The visual interpretation of the morphology of each component is confirmed by the catalogue of outlying cities constructed for each component. The full catalogues of outlying cities in the Lagos networks are shown later; for now it is important to note that each network that looks asymmetric in the plan views is matched by a catalogue of outlying cities where there is one city which stands as the only outlying city for one role or another. For example, in the overall Lagos network, London is the only outlying "specialised city"; in the networking component of the services sector network, Dubai is the only outlying "foothold city".

In the global network, the morphologies of the various regional and sectoral components formed a linear sequence determined by the scale of each component, where the smallest networks were fragmented if not degenerate, the largest networks were consolidated, and mid-sized networks were transitional (unless barriers to entry for the relevant region or sector are high, in which case they were fragmented).

Table 6.3 Morphologies of the Lagos networks

Network	*K*	*Morphology*	*Alter if any*	*Alter's outlying role*
Lagos (overall)	4	Asymmetric	London	Specialised city
Intrafirm	4	Egocentric		
Interfirm	4	Asymmetric	London	Specialised city
Finance	4	Asymmetric	London	Specialised city
Services	4	Egocentric		
Manufacturing	3	Asymmetric	Port Harcourt	Specialised city
Operations	4	Egocentric		
Supply	3	Egocentric		
Knowledge	2	Asymmetric	London	Headquarter city
Capital	2	Asymmetric	London	Specialised city
Networking	2	Egocentric		
Finance: operations	3	Asymmetric	Lomé	Headquarter city
Finance: capital	2	Asymmetric	London	Specialised city
Services: operations	2	Egocentric		
Services: supply	3	Egocentric		
Services: knowledge	2	Egocentric		
Services: networking	2	Asymmetric	Dubai	Foothold city

By contrast, the morphologies of the various components of the Lagos network do not form a linear sequence determined by scale. Rather, they differ by sector; for example, the services sector networks are usually egocentric, the finance sector networks usually asymmetric. They may also differ by function. Within the services sector networks, the functional subnetworks pertaining to operations, supply and knowledge are egocentric; the "networking" subnetwork is asymmetric. The morphologies generated by the different sectoral and functional features may be nested inside one another. For example, London's role as a "specialised city" in the overall Lagos network is ultimately generated by its role in the capital activities of finance sector firms, and the knowledge activities of firms across all sectors. The roles of other alters are interpreted in the table below.

Table 6.4 Alters in the Lagos network

City	*Role*	*Network*	*Interpretation*
London	Specialised city	Finance: capital	The world's most important centralised financial market
	Headquarter city	Knowledge	The source of much training related to tech and other products imported by services firms
Port Harcourt	Specialised city	Manufacturing	Industrial centre of similar importance to Lagos within the Nigerian economy
Lomé	Headquarter city	Finance: operations	Headquarter city for Ecobank
Dubai	Foothold city	Services: networking	An important conference, trade fair and contact-making city for tech and other services firms

6.2. Decomposition

The cities and towns in each of the sectoral and functional components of the Lagos networks are listed in the following tables, again best browsed in conjunction with the plan views in the atlas.

Table 6.5 Regional and k-shell decomposition of the Lagos network

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Latin America*	*Middle East*	*South Asia*	*Total*
4	Amsterdam, Brussels, London, Lyon, Paris (5)	New York, San Francisco (2)	Guangzhou, Tokyo (2)	Abidjan, Cotonou, Dakar, Enugu, Johannesburg, Lagos, Lomé, Monrovia, Port Harcourt, Sao Tomé (10)		Beirut (1)		20 (9.4%)
3	Castagnaro, Izmir, Rome (3)	Los Angeles, Washington (2)		Abuja, Accra, Maiduguri (3)		Dubai (1)	Bangalore, Mumbai (2)	11 (5.2%)
2	Alcantarilla, Barcelona, Belfiore, Cesena, Copenhagen, Cranfield, Frankfurt, Geneva, Getinge, Leipzig, Limerick, Luton, Madrid, Milan, Monaco, Montebello Vicentino, Moscow, Munich, Rastatt, Rotterdam, Stockholm, Tzummarum, Zurich (23)	Atlanta, Chicago, Denver, Phoenix, Schenectady, St Louis, Toronto (7)	Beijing, Gold Coast, Shenzhen, Taipei (4)	Bamako, Calabar, Cape Town, Douala, Freetown, Ilorin, Kaduna, Keffi, Kinshasa, Libreville, Osogbo, Takoradi, Uyo, Warri (14)		Abu Dhabi, Manama, Tel-Aviv (3)	Ahmedabad, Nagpur (2)	53 (25.0%)
1	Aabenraa, Abingdon, Aldridge, Ardeer, Baar, Betzdorf, Birmingham, Bonn, Bremerhaven, Brugges, Cardiff, Castle Donington, Donesk, Dublin, Dundee, Dusseldorf, Edirne, Eltmann, Fontainebleau, The Hague, Hamburg, Hanover, Helsinki, Istanbul, Karlstad, Kiev, Koping, Leeds, Lund, Luxembourg, Manchester, Marseille, Melsungen, Nice, Northwich, Riga, Selles-St-Denis, Southampton, Stavanger, St-Martin-de-Crau, Treorchy, Utrecht, Villaviciosa, Wietmarschen, Wuppertal, York (46)	Ann Arbor, Austin, Boston, Corning, Dallas, Hopkinton, Houston, Las Vegas, Lincoln, Montville, Ottawa, Raleigh, Rochester, Vancouver, Wilmington (15)	Melbourne, Osaka, Pingdingshan, Seoul, Shanghai, Sydney, Toowoomba (8)	Aba, Abeokuta, Akure, Antananarivo, Asaba, Bamenda, Bangui, Banjul, Benin, Blantyre, Brazzaville, Bujumbura, Cabinda, Conakry, Dar es Salaam, Ekiti, Goma, Gombe, Gusau, Ibadan Ikorodu, Jos, Kampala, Kano, Khartoum, Kigali, Kumasi, Lokoja, Lubumbashi, Lusaka, Makeni, Malabo, Maseru, Nairobi, N'Djamena, Niamey, Nnewi, Nouakchott, Ogbomosho, Onitsha, Ouagadougou, Owerri,, Owo, Pointe-Noire, Port-Gentil, Praia, Sapele, Sokoto, Stellenbosch, Umuahia, Victoria (51)	Nassau, Rio de Janeiro, Sao Paulo (3)	Amman, Cairo (2)	Calicut, Hyderabad, Kochi (3)	128 (60.4%)
Total	77 (36.3%)	26 (12.3%)	14 (6.6%)	78 (36.8%)	3 (1.4%)	7 (3.3%)	7 (3.3%)	212 (100.0%)

Table 6.6 Regional and k-shell decomposition of the Lagos intrafirm network

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Middle East*	*Total*
4				Abidjan, Cotonou, Dakar, Johannesburg, Lagos, Lomé (6)		6 (7.3%)
3	London (1)			Abuja, Accra, Enugu, Port Harcourt (4)		5 (6.1%)
2	Brussels, Leipzig, Paris (3)	New York (1)		Douala, Freetown, Kaduna, Kinshasa, Libreville, Monrovia, Warri (7)	Dubai, Manama (2)	13 (15.9%)
1	Amsterdam, Birmingham, Bonn, Cardiff, Castle Donington, Istanbul, Manchester, Northwich (8)	Wilmington (1)	Beijing, Tokyo (2)	Aba, Abeokuta, Akure, Antananarivo, Asaba, Bamako, Bamenda, Banjul, Benin, Bujumbura, Cabinda, Calabar, Conakry, Dar es Salaam, Goma, Gombe, Ibadan, Ikorodu, Ilorin, Jos, Kampala, Kano, Keffi, Kigali, Kumasi, Lokoja, Lubumbashi, Lusaka, Maiduguri, Makeni, Malabo, Nairobi, Niamey, Nnewi, Nouakchott, Onitsha, Ouagadougou, Owerri, Pointe-Noire, Port-Gentil, Praia, Sao Tomé, Sokoto, Uyo (44)	Abu Dhabi, Amman, Cairo (3)	58 (70.7%)
Total	12 (14.6%)	2 (2.4%)	2 (2.4%)	61 (74.4%)	5 (6.1%)	82 (100.0%)

Table 6.7 Regional and k-shell decomposition of the Lagos interfirm network

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Latin America*	*Middle East*	*South Asia*	*Total*
4	Amsterdam, Brussels, London, Lyon, Paris (5)	New York, San Francisco (2)	Guangzhou, Tokyo (2)	Enugu, Johannesburg, Lagos, Monrovia, Port Harcourt, Sao Tomé (6)		Beirut (1)		16 (8.9%)
3	Castagnaro, Izmir (2)	Los Angeles, Washington (2)		Lomé, Maiduguri (2)		Dubai (1)	Bangalore, Mumbai (2)	9 (5.0%)
2	Alcantarilla, Barcelona, Belfiore, Cesena, Copenhagen, Cranfield, Frankfurt, Geneva, Getinge, Limerick, Luton, Madrid, Milan, Monaco, Montebello Vicentino, Moscow, Munich, Rastatt, Rome, Rotterdam, Stockholm, Tzummarum, Zurich (23)	Atlanta, Chicago, Denver, Phoenix, Schenectady, St Louis, Toronto (7)	Beijing, Gold Coast, Shenzhen, Taipei (4)	Abidjan, Abuja, Accra, Calabar, Cape Town, Ilorin, Osogbo, Takoradi, Uyo (9)		Abu Dhabi, Tel-Aviv (2)	Ahmedabad, Nagpur (2)	47 (26.3%)
1	Aabenraa, Abingdon, Aldridge, Ardeer, Baar, Betzdorf, Birmingham, Bremerhaven, Brugges, Cardiff, Donesk, Dublin, Dundee, Dusseldorf, Edirne, Eltmann, Fontainebleau, The Hague, Hamburg, Hanover, Helsinki, Karlstad, Kiev, Koping, Leeds, Lund, Luxembourg, Manchester, Marseille, Melbourne, Melsungen, Nice, Riga, Selles-St-Denis, Southampton, Stavanger, St-Martin-de-Crau, Treorchy, Utrecht, Villaviciosa, Wietmarschen, Wuppertal, York (43)	Ann Arbor, Austin, Boston, Corning, Dallas, Hopkinton, Houston, Las Vegas, Lincoln, Montville, Ottawa, Raleigh, Rochester, Vancouver, Wilmington (15)	Christchurch, Osaka, Pingdingshan, Seoul, Shanghai, Sydney, Toowoomba (7)	Antananarivo, Bamako, Bangui, Blantyre, Brazzaville, Cotonou, Dakar, Dar es Salaam, Douala, Ekiti, Freetown, Gusau, Jos, Kaduna, Kampala, Kano, Keffi, Khartoum, Kigali, Kinshasa, Libreville, Lusaka, Maseru, Nairobi, N'Djamena, Niamey, Ogbomosho, Ouagadougou, Owerri, Owo, Sapele, Stellenbosch, Umuahia, Victoria, Warri (35)	Nassau, Rio de Janeiro, Sao Paulo (3)	Cairo (1)	Calicut, Hyderabad, Kochi (3)	107 (59.8%)
Total	73 (40.8%)	26 (14.5%)	13 (7.3%)	52 (29.1%)	3 (1.7%)	5 (2.8%)	7 (3.9%)	179 (100.0%)

Table 6.8 Regional and k-shell decomposition of the Lagos finance network

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Latin America*	*Middle East*	*South Asia*	*Total*
4	London, Paris (2)			Abidjan, Cotonou, Dakar, Johannesburg, Lagos, Lomé (6)				8 (9.5%)
3	Brussels (1)			Accra (1)				2 (2.4%)
2	Amsterdam, Frankfurt, Geneva, Stockholm, Zurich (5)	Denver, New York, San Francisco, St Louis, Washington (5)				Beirut, Dubai (2)		12 (14.3%)
1	Aabenraa, Barcelona, Copenhagen, Dublin, Dusseldorf, Eltmann, Helsinki, Istanbul, Moscow, Munich, Northwich, Stavanger, Utrecht (13)	Atlanta, Boston, Houston, Ottawa, Toronto, Wilmington (6)	Beijing, Guangzhou, Melbourne, Shanghai, Tokyo (5)	Aba, Abeokuta, Abuja, Akure, Bamenda, Banjul, Benin, Bujumbura, Cape Town, Douala, Enugu, Freetown, Goma, Ibadan, Ikorodu, Jos, Kaduna, Kampala, Kano, Kigali, Kinshasa, Kumasi, Lubumbashi, Lusaka, Maiduguri, Makeni, Monrovia, Nairobi, Nnewi, Onitsha, Owerri, Port Harcourt, Sokoto, Warri (34)	Nassau (1)	Abu Dhabi, Cairo (2)	Mumbai (1)	62 (73,8%)
Total	21 (25%)	11 (13.1%)	5 (6.0%)	41 (48.8%)	1 (1.2%)	4 (4.8%)	1 (1.2%)	84 (100.0%)

Table 6.9 Regional and k-shell decomposition of the Lagos services network

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Latin America*	*Middle East*	*South Asia*	*Total*
4	Amsterdam, London, Lyon (3)			Lagos, Sao Tomé, Monrovia (3)				6 (3.6%)
3	Castagnaro, Izmir, Paris, Rome (4)	Los Angeles, New York, San Francisco, Washington (4)	Guangzhou, Tokyo (2)	Abuja, Enugu, Johannesburg, Maiduguri (4)		Beirut, Dubai (2)		16 (9.5%)
2	Alcantarilla, Barcelona, Belfiore, Brussels, Cesena, Copenhagen, Cranfield, Getinge, Leipzig, Limerick, Luton, Madrid, Moscow, Munich, Rastatt, Rotterdam, Stockholm, Tzummarum (18)	Atlanta, Chicago, Phoenix, Schenectady (4)	Beijing, Gold Coast, Shenzhen, Taipei (4)	Abidjan, Bamako, Calabar, Cape Town, Douala, Freetown, Ilorin, Keffi, Kinshasa, Libreville, Osogbo, Port Harcourt, Uyo (13)		Abu Dhabi, Manama, Tel-Aviv (3)	Ahmedabad, Bangalore, Mumbai, Nagpur (4)	46 (27.2%)
1	Abingdon, Ardeer, Baar, Betzdorf, Birmingham, Bonn, Cardiff, Castle Donington, Donesk, Dundee, Edirne, Fontainebleau, The Hague, Hamburg, Hanover, Karlstad, Kiev, Koping, Leeds, Lund, Luxembourg, Manchester, Marseille, Melsungen, Milan, Nice, Riga, Selles-St-Denis, Southampton, St-Martin-de-Crau, Villaviciosa, Wietmarschen, York, Zurich (34)	Ann Arbor, Austin, Boston, Corning, Dallas, Hopkinton, Las Vegas, Lincoln, Montville, Raleigh, Rochester, Vancouver, Wilmington (13)	Christchurch, Osaka, Shanghai, Toowoomba (4)	Abeokuta, Accra, Antananarivo, Asaba, Bangui, Benin, Blantyre, Brazzaville, Cabinda, Conakry, Cotonou, Dakar, Dar es Salaam, Ekiti, Gombe, Gusau, Ibadan, Jos, Kampala, Kano, Kigali, Lokoja, Lomé, Lusaka, Malabo, Maseru, Nairobi, N'Djamena, Niamey, Nouakchott, Ogbomosho, Onitsha, Ouagadougou, Owerri, Owo, Pointe-Noire, Port-Gentil, Praia, Sapele, Sokoto, Stellenbosch, Takoradi, Umuahia, Victoria, Warri (45)	Rio de Janeiro, Sao Paulo (2)	Amman, Cairo (2)	Calicut (1)	101 (59.8%)
Total	59 (33.0%)	21 (12.4%)	10 (5.9%)	65 (38.5%)	2 (1.2%)	7 (4.1%)	5 (3.0%)	169 (100.0%)

Table 6.10 Regional and k-shell decomposition of the Lagos manufacturing network

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*South Asia*	*Total*
3	London (1)			Lagos, Port Harcourt (2)	Mumbai (1)	4 (12.1%)
2	Monaco (1)			Abuja, Warri (2)		3 (9.1%)
1	Aldridge, Amsterdam, Bremerhaven, Brugges, Dusseldorf, Luxembourg, Milan, Montebello-Vicentino, Moscow, Stockholm, Treorchy, Wuppertal (12)	Toronto (1)	Guangzhou, Pingdingshan, Seoul, Sydney (4)	Accra, Cape Town, Douala, Enugu, Kaduna, Khartoum, Takoradi (7)	Hyderabad, Kochi (2)	25 (75.8%)
Total	14 (42.4%)	1 (3.0%)	4 (12.1%)	11 (33.3%)	3 (9.1%)	33 (100.0%)

Table 6.11 Regional and k-shell decomposition of the Lagos operations network

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Middle East*	*South Asia*	*Total*
4				Abidjan, Cotonou, Dakar, Johannesburg, Lagos, Lomé (6)			6 (7.1%)
3	London (1)			Accra (1)			2 (2.4%)
2	Amsterdam, Brussels, Dublin, Leipzig, Munich, Paris (6)	New York (1)	Shenzhen (1)	Abuja, Douala, Freetown, Kaduna, Kinshasa, Libreville, Monrovia, Port Harcourt, Warri (9)	Manama (1)	Bangalore (1)	19 (22.6%)
1	Birmingham, Manchester, Northwich (3)		Beijing (1)	Aba, Abeokuta, Akure, Antananarivo, Asaba, Bamako, Bamenda, Banjul, Benin, Blantyre, Brazzaville, Bujumbura, Cabinda, Calabar, Conakry, Dar es Salaam, Enugu, Goma, Gombe, Ibadan, Ikorodu, Ilorin, Jos, Kampala, Kano, Keffi, Kigali, Kumasi, Lokoja, Lubumbashi, Lusaka, Maiduguri, Makeni, Malabo, Nairobi, N'Djamena, Niamey, Nnewi, Nouakchott, Onitsha, Ouagadougou, Owerri, Pointe-Noire, Port-Gentil, Praia, Sao Tomé, Sokoto, Takoradi, Uyo, Victoria (50)	Abu Dhabi, Dubai (2)	Nagpur (1)	57 (67.9%)
Total	10 (11.9%)	1 (1.2%)	2 (2.4%)	66 (78.6%)	3 (3.6%)	2 (2.4%)	84 (100%)

Table 6.12 Regional and k-shell decomposition of the Lagos supply network

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Middle East*	*South Asia*	*Total*
3	Amsterdam, Izmir, London, Lyon, Paris (5)	New York, San Francisco (2)	Guangzhou, Tokyo (2)	Johannesburg, Lagos, Monrovia, Port Harcourt, Sao Tomé (5)	Beirut (1)	Mumbai (1)	16 (16.3%)
2	Belfiore, Castagnaro, Copenhagen, Getinge, London, Luton, Rastatt, Rome, Stockholm (9)	Denver, Los Angeles, Schenectady, St Louis, Washington (5)	Taipei (1)	Abuja, Lomé, Maiduguri (3)	Dubai (1)	Bangalore (1)	20 (20.4%)
1	Abingdon, Alcantarilla, Aldridge, Ardeer, Baar, Barcelona, Betzdorf, Bremerhaven, Cesena, Dusseldorf, Edirne, The Hague, Karlstad, Kiev, Koping, Lund, Luxembourg, Marseille, Melsungen, Milan, Montebello Vicentino, Moscow, Munich, Nice, Riga, Rotterdam, Selles-St-Denis, St-Martin-de-Crau, Treorchy, Tzummarum, Villaviciosa, Wietmarschen, Wuppertal (33)	Ann Arbor, Atlanta, Austin, Boston, Chicago, Corning, Dallas, Hopkinton, Montville, Phoenix, Raleigh, Rochester, Toronto, Vancouver (14)	Beijing, Christchurch, Gold Coast, Osaka, Pingdingshan, Seoul, Shenzhen, Sydney (8)	Cape Town, Douala, Nairobi, Stellenbosch, Uyo (5)	Tel-Aviv (1)	Nagpur (1)	62 (63.3%)
Total	47 (48.0%)	21 (21.4%)	11 (11.2%)	13 (13.3%)	3 (3.1%)	3 (3.1%)	98 (100%)

Table 6.13 Regional and k-shell decomposition of the Lagos knowledge network

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Middle East*	*South Asia*	*Total*
2	Cranfield, London (2)			Abuja, Accra, Calabar, Enugu, Johannesburg, Lagos, Lomé, Port Harcourt, Sao Tomé (9)			11 (18.6%)
1	Ardeer, Barcelona, Birmingham, Brugges, Brussels, Cardiff, Castle Donington, Donesk, Dundee, Fontainebleau, Istanbul, Leeds, Lund, Luxembourg, Manchester, Paris, Southampton, Stockholm (18)	Atlanta, Boston, Chicago, Lincoln, Montville, New York, Phoenix, San Francisco, Toronto, Wilmington (10)	Shanghai, Tokyo, Toowoomba (3)	Aba, Jos, Khartoum, Maseru, Monrovia, Ogbomosho, Owerri, Owo (8)	Amman, Cairo, Dubai (3)	Bangalore, Calicut, Hyderabad, Kochi, Mumbai, Nagpur (6)	48 (81.6%)
Total	20 (33.9%)	10 (16.9%)	3 (5.1%)	17 (28.8%)	3 (5.1%)	6 (10.2%)	59 (100%)

Table 6.14 Regional and k-shell decomposition of the Lagos capital network

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Latin America*	*Middle East*	*South Asia*	*Total*
2	Amsterdam, Brussels, Frankfurt, Geneva, London, Monaco, Paris, Stockholm (8)	New York, Washington (2)		Johannesburg, Lagos, Lomé (3)		Beirut (1)	Nagpur (1)	15 (33.3%)
1	Aabenraa, Bonn, Copenhagen, Dublin, Dusseldorf, Eltmann, Helsinki, Munich, Stavanger, Utrecht, Zurich (11)	Boston, Ottawa, San Francisco Toronto, Wilmington (5)	Beijing, Melbourne, Tokyo (3)	Abidjan, Abuja, Accra, Cape Town, Kaduna (5)	Nassau (1)	Abu Dhabi, Cairo, Dubai, Jeddah (4)	Bangalore (1)	30 (66.7%)
Total	19 (42.2%)	7 (15.6%)	3 (6.7%)	8 (17.8%)	1 (2.2%)	5 (11.1%)	2 (5.4%)	45 (100%)

Table 6.15 Regional and k-shell decomposition of the Lagos networking network

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Latin America*	*Middle East*	*South Asia*	*Total*
2	Barcelona, Cesena, Limerick, London, Madrid, Rome, Zurich (7)			Cape Town, Ilorin, Johannesburg, Lagos, Osogbo (5)		Dubai, Tel-Aviv (2)	Bangalore, Mumbai (2)	16 (28.6%)
1	Alcantarilla, Birmingham, Copenhagen, Dusseldorf, Fontainebleau, Hamburg, Hanover, Manchester, Moscow, Munich, Paris, Tzummarum, York (13)	Houston, Las Vegas, New York, Phoenix, San Francisco, Washington (6)	Beijing, Gold Coast, Shenzhen, Taipei (4)	Abuja, Accra, Bamako, Bangui, Douala, Ekiti, Lomé, N'Djamena, Port Harcourt, Takoradi (10)	Rio de Janeiro, Sao Paulo (2)	Abu Dhabi, Beirut, Cairo (3)	Calicut, Nagpur (2)	40 (71.4%)
Total	20 (35.7%)	6 (10.7%)	4 (7.1%)	15 (26.8%)	2 (4.6%)	5 (8.9%)	4 (7.1%)	56 (100%)

Table 6.16 Regional and k-shell decomposition of the Lagos finance operations network

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Middle East*	*Total*
3	London (1)			Abidjan, Accra, Cotonou, Dakar, Johannesburg, Lagos, Lomé (7)		8 (16.7%)
2	Amsterdam, Dublin, Paris (3)					3 (6.3%)
1	Northwich (1)	New York (1)	Beijing (1)	Aba, Abeokuta, Abuja, Akure, Bamenda, Banjul, Benin, Bujumbura, Douala, Enugu, Freetown, Goma, Ibadan, Ikorodu, Jos, Kaduna, Kampala, Kano, Kigali, Kinshasa, Kumasi, Lubumbashi, Lusaka, Maiduguri, Makeni, Monrovia, Nnewi, Onitsha, Owerri, Port Harcourt, Sokoto, Warri (32)	Abu Dhabi , Dubai (2)	37 (77.1%)
Total	5 (10.4%)	1 (2.1%)	1 (2.1%)	39 (81.3%)	2 (4.2%)	48 (100.0%)

Table 6.17 Regional and k-shell decomposition of the Lagos finance capital network

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Latin America*	*Middle East*	*Total*
2	Brussels, Frankfurt, Geneva, London, Paris, Stockholm (6)	New York, Washington (2)		Johannesburg, Lagos; Lomé (3)		Beirut (1)	12 (29.3%)
1	Aabenraa, Amsterdam, Copenhagen, Dublin, Dusseldorf, Eltmann, Helsinki, Munich, Stavanger, Utrecht, Zurich (11)	Boston, Ottawa, San Francisco, Toronto, Wilmington (5)	Beijing, Melbourne, Tokyo (3)	Abidjan, Abuja, Accra, Cape Town, Kaduna (5)	Nassau (1)	Abu Dhabi, Cairo, Dubai, Jeddah (4)	29 (70.7%)
Total	17 (41.5%)	7 (17.1%)	3 (7.3%)	8 (19.5%)	1 (2.4%)	5 (12.2%)	41 (100.0%)

Table 6.18 Regional and k-shell decomposition of the Lagos services operations network

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Middle East*	*South Asia*	*Total*
2	Brussels, Leipzig, Munich (3)		Shenzhen (1)	Abidjan, Johannesburg, Kinshasa, Lagos, Libreville, Monrovia (6)	Manama (1)	Bangalore (1)	12 (19.7%)
1	Birmingham, London, Manchester (3)	New York (1)		Abeokuta, Abuja, Accra, Antananarivo, Asaba, Bamako, Benin, Blantyre, Cabinda, Calabar, Conakry, Cotonou, Dakar, Dar es Salaam, Douala, Enugu, Freetown, Gombe, Ibadan, Ilorin, Kampala, Kano, Keffi, Kigali, Lokoja, Lomé, Lusaka, Malabo, Nairobi, N'Djamena, Niamey, Nouakchott, Onitsha, Ouagadougou, Pointe-Noire, Port-Gentil, Port Harcourt, Praia, Sao Tomé, Sokoto, Uyo, Victoria, Warri (44)		Nagpur (1)	49 (80.3%)
Total	6 (9.8%)	1 (1.6%)	1 (1.6%)	50 (82.0%)	1 (1.6%)	2 (3.3%)	61 (100.0%)

Table 6.19 Regional and k-shell decomposition of the Lagos services supply network

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Middle East*	*South Asia*	*Total*
3	Amsterdam, Izmir, London, Lyon, Paris (5)	New York, San Francisco (2)	Guangzhou, Tokyo (2)	Johannesburg, Lagos, Monrovia, Sao Tomé (4)	Beirut (1)		14 (17.3%)
2	Belfiore, Castagnaro, Copenhagen, Getinge, Luton, Rastatt, Rome, Stockholm (8)	Los Angeles, Schenectady, Washington (3)	Taipei (1)	Abuja, Maiduguri (2)	Dubai (1)	Ahmedabad, Bangalore (2)	17 (21.0%)
1	Abingdon, Alcantarilla, Ardeer, Baar, Barclona, Betzdorf, Cesena, Edirne, The Hague, Karlstad, Kiev, Koping, Lund, Luxembourg, Marseille, Melsungen, Moscow, Munich, Nice, Riga, Rotterdam, Selles-St-Denis, St-Martin-de-Crau, Tzummarum, Villaviciosa, Wietmarschen (26)	Ann Arbor, Atlanta, Austin, Boston, Chicago, Corning, Dallas, Hopkinton, Montville, Phoenix, Raleigh, Rochester, Vancouver (13)	Beijing, Christchurch, Gold Coast, Osaka, Shenzhen (5)	Nairobi, Stellenbosch, Uyo (3)	Tel-Aviv (1)	Mumbai, Nagpur (2)	50 (61.7%)
Total	39 (41.1%)	18 (22.2%)	8 (9.9%)	9 (11.1%)	3 (3.7%)	4 (4.9%)	81 (100.0%)

Table 6.20 Regional and k-shell decomposition of the Lagos services knowledge network

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Middle East*	*South Asia*	*Total*
2	Cranfield, London (2)			Calabar, Enugu, Johannesburg, Lagos, Port Harcourt, Sao Tomé (6)			8 (17.8%)
1	Ardeer, Birmingham, Brussels, Cardiff, Castle Donington, Donesk, Dundee, Fontainebleau, Leeds, Lund, Manchester, Southampton (12)	Boston, Chicago, Lincoln, Montville, New York, Phoenix, San Francisco, Wilmington (8)	Shanghai, Tokyo, Toowoomba (3)	Abuja, Accra, Jos, Maseru, Monrovia, Ogbomosho, Owo (7)	Amman, Cairo, Dubai (3)	Bangalore, Calicut, Mumbai, Nagpur (4)	37 (82.2%)
Total	14 (31.1%)	8 (17.8%)	3 (6.7%)	13 (28.9%)	3 (6.7%)	4 (8.9%)	45 (100.0%)

Table 6.21 Regional and k-shell decomposition of the Lagos services networking network

k	*Europe*	*North America*	*East Asia*	*Sub-Saharan Africa*	*Latin America*	*Middle East*	*South Asia*	*Total*
2	Barcelona, Cesena, Limerick, Madrid, Rome (5)			Cape Town, Ilorin, Johannesburg, Lagos, Osogbo (5)		Dubai, Tel-Aviv (2)	Bangalore (1)	13
1	Alcantarilla, Birmingham, Copenhagen, Fontainebleau, Hamburg, Hanover, London, Manchester, Moscow, Munich, Paris, Tzummarum, York, Zurich (14)	Las Vegas, New York, Phoenix, San Francisco, Washington (5)	Beijing, Gold Coast, Shenzhen, Taipei (4)	Abuja, Accra, Bamako, Bangui, Douala, Ekiti, Lomé, N'Djamena, Takoradi (9)	Rio de Janeiro, Sao Paulo (2)	Abu Dhabi, Beirut (2)	Calicut, Mumbai, Nagpur (3)	39
Total	19	5	4	14	2	4	4	52 (100.0%)

6.3. Outlying cities

The outlying cities for each component of the Lagos network has been calculated in the same manner as components of the global network. The difference here is that the values for Lagos have been excluded, partly because Lagos is an outlier on almost every single value within its own egonetwork and it is tautological to refer to it as such, and partly to focus on the geography of the surrounding economy as seen from Lagos. Instead of values representing millions of dollars in annual turnover, the scores used to calculate the outlying cities are simple counts of the number of times each city was revealed to play a specific functional role for each company interviewed.

Table 6.22 Outlying cities in the Lagos network

City	*Outlying attribute*	*Score*	*Largest non-outlier*	*Margin*	*Role indicated*
London (k = 4)	Total degree	91	39	52	Specialised city
London (k = 4)	Outdegree	43	21	22	Headquarter city
Abuja (k = 3)	Net degree (negative)	28	10	18	Foothold city
Port Harcourt (k = 4)	Net degree (negative)	18	10	8	Foothold city
Lomé (k = 4)	Net degree (positive)	9	4	5	Headquarter city
San Francisco (k = 4)	Net degree (positive)	9	4	5	Headquarter city
Tokyo (k = 4)	Net degree (positive)	9	4	5	Headquarter city
Paris (k = 4)	Net degree (positive)	6	4	2	Headquarter city
Bangalore (k = 3)	Net degree (positive)	6	4	2	Headquarter city
Nagpur (k = 2)	Net degree (positive)	5	4	1	Headquarter city

Table 6.23 Outlying cities in the Lagos intrafirm network

City	*Outlying attribute*	*Score*	*Largest non-outlier*	*Margin*	*Role indicated*
Abuja (k = 3)	Total degree	23	9	14	Specialised city
Abuja (k = 3)	Net degree (negative)	21	8	13	Foothold city
Abuja (k = 3)	Indegree	22	10	12	Foothold city
Port Harcourt (k = 3)	Total degree	20	9	11	Specialised city
Lomé (k = 4)	Outdegree	13	6	7	Headquarter city
Lomé (k = 4)	Total degree	16	9	7	Specialised city
Port Harcourt (k = 3)	Indegree	16	10	6	Foothold city
Lomé (k = 4)	Net degree (positive)	10	4	6	Headquarter city
London (k = 3)	Total degree	14	9	5	Specialised city
Abidjan (k = 4)	Total degree	13	9	4	Specialised city
Port Harcourt (k = 3)	Net degree (negative)	12	8	4	Foothold city
Accra (k = 3)	Total degree	12	9	3	Specialised city
London (k = 3)	Outdegree	8	6	2	Headquarter city

Table 6.24 Outlying cities in the Lagos interfirm network

City	*Outlying attribute*	*Score*	*Largest non-outlier*	*Margin*	*Role indicated*
London (k = 4)	Total degree	77	30	47	Specialised city
London (k = 4)	Indegree	42	14	28	Foothold city
London (k = 4)	Outdegree	35	16	19	Headquarter city
San Francisco (k = 4)	Net degree (positive)	9	4	5	Headquarter city
Paris (k = 4)	Net degree (positive)	8	4	4	Headquarter city
Tokyo (k = 4)	Net degree (positive)	8	4	4	Headquarter city
London (k = 4)	Net degree (negative)	7	3	4	Foothold city
Abuja (k = 2)	Net degree (negative)	7	3	4	Foothold city
Port Harcourt (k = 4)	Net degree (negative)	6	3	3	Foothold city
Guangzhou (k = 4)	Net degree (negative)	6	3	3	Foothold city
Bangalore (k = 3)	Net degree (positive)	6	4	2	Headquarter city
Amsterdam (k = 4)	Net degree (positive)	5	4	1	Headquarter city
Nagpur (k = 2)	Net degree (positive)	5	4	1	Headquarter city
Enugu (k = 4)	Net degree (negative)	4	3	1	Foothold city
Lyon (k = 4)	Net degree (negative)	4	3	1	Foothold city

Table 6.25 Outlying cities in the Lagos finance network

City	*Outlying attribute*	*Score*	*Largest non-outlier*	*Margin*	*Role indicated*
London (k = 4)	Total degree	62	23	39	Specialised city
London (k = 4)	Indegree	35	14	21	Foothold city
London (k = 4)	Outdegree	27	10	17	Headquarter city
Abuja (k = 1)	Net degree (negative)	11	4	7	Foothold city
Lomé (k = 4)	Outdegree	16	10	6	Headquarter city
Port Harcourt (k = 1)	Net degree (negative)	10	4	6	Foothold city
Lomé (k = 4)	Net degree (positive)	9	4	5	Headquarter city
London (k = 4)	Net degree (negative)	8	4	4	Foothold city
Abidjan (k = 4)	Net degree (negative)	8	4	4	Foothold city
Accra (k = 3)	Net degree (negative)	6	4	2	Foothold city
Paris (k = 4)	Net degree (positive)	5	4	1	Headquarter city

Table 6.26 Outlying cities in the Lagos services network

City	*Outlying attribute*	*Score*	*Largest non-outlier*	*Margin*	*Role indicated*
London (k = 4)	Total degree	21	10	11	Specialised city
Johannesburg (k = 3)	Total degree	21	10	11	Specialised city
Dubai (k = 3)	Total degree	20	10	10	Specialised city
Abuja (k = 3)	Net degree (negative)	16	6	10	Foothold city
San Francisco (k = 3)	Outdegree	14	6	8	Headquarter city
Abuja (k = 3)	Indegree	16	8	8	Foothold city
San Francisco (k = 3)	Total degree	18	10	8	Specialised city
Johannesburg (k = 3)	Outdegree	12	6	6	Headquarter city
Abuja (k = 3)	Total degree	16	10	6	Specialised city
San Francisco (k = 3)	Net degree (positive)	10	5	5	Headquarter city
London (k = 4)	Indegree	12	8	4	Foothold city
Dubai (k = 3)	Indegree	12	8	4	Foothold city
Bangalore (k = 2)	Outdegree	9	6	3	Headquarter city
London (k = 4)	Outdegree	9	6	3	Headquarter city
Enugu (k = 3)	Total degree	13	10	3	Specialised city
Dubai (k = 3)	Outdegree	8	6	2	Headquarter city
Tokyo (k = 3)	Outdegree	8	6	2	Headquarter city
Bangalore (k = 2)	Total degree	12	10	2	Specialised city
Tokyo (k = 3)	Net degree (positive)	7	5	2	Headquarter city
Johannesburg (k = 3)	Indegree	9	8	1	Foothold city
Monrovia (k = 4)	Total degree	11	10	1	Specialised city
Bangalore (k = 2)	Net degree (positive)	6	5	1	Headquarter city

Table 6.27 Outlying cities in the Lagos manufacturing network

City	*Outlying attribute*	*Score*	*Largest non-outlier*	*Margin*	*Role indicated*
Port Harcourt (k = 3)	Total degree	18	8	10	Specialised city
Port Harcourt (k = 3)	Indegree	10	3	7	Foothold city
Port Harcourt (k = 3)	Outdegree	8	2	6	Headquarter city
London (k = 3)	Outdegree	7	2	5	Headquarter city
London (k = 3)	Net degree (positive)	6	2	4	Headquarter city
Warri (k = 2)	Net degree (negative)	3	1	2	Foothold city
Port Harcourt (k = 3)	Net degree (negative)	2	1	1	Foothold city

Table 6.28 Outlying cities in the Lagos operations network

City	*Outlying attribute*	*Score*	*Largest non-outlier*	*Margin*	*Role indicated*
Abuja (k = 2)	Indegree	22	8	14	Foothold city
Abuja (k = 2)	Total degree	22	11	11	Specialised city
Abuja (k = 2)	Net degree (negative)	22	11	11	Foothold city
Port Harcourt (k = 2)	Total degree	20	11	9	Specialised city
Port Harcourt (k = 2)	Indegree	16	8	8	Foothold city
Lomé (k = 4)	Outdegree	11	5	6	Headquarter city
Lomé (k = 4)	Net degree (positive)	9	3	6	Headquarter city
Accra (k = 3)	Indegree	13	8	5	Foothold city
Accra (k = 3)	Total degree	15	11	4	Specialised city
Abidjan (k = 4)	Total degree	13	11	2	Specialised city
Lomé (k = 4)	Total degree	13	11	2	Specialised city
Abidjan (k = 4)	Outdegree	6	5	1	Headquarter city
Port Harcourt (k = 2)	Net degree (negative)	12	11	1	Foothold city

Table 6.29 Outlying cities in the Lagos supply network

City	*Outlying attribute*	*Score*	*Largest non-outlier*	*Margin*	*Role indicated*
San Francisco (k = 3)	Total degree	16	8	8	Specialised city
San Francisco (k = 3)	Outdegree	13	6	7	Headquarter city
London (k = 3)	Total degree	15	8	7	Specialised city
San Francisco (k = 3)	Net degree (positive)	10	3	7	Headquarter city
Johannesburg (k = 3)	Total degree	13	8	5	Specialised city
Guangzhou (k = 3)	Indegree	8	4	4	Foothold city
London (k = 3)	Outdegree	9	6	3	Headquarter city
Guangzhou (k = 3)	Total degree	11	8	3	Specialised city
Tokyo (k = 3)	Net degree (positive)	6	3	3	Headquarter city
Guangzhou (k = 3)	Net degree (negative)	5	2	3	Foothold city
Johannesburg (k = 3)	Outdegree	8	6	2	Headquarter city
London (k = 3)	Indegree	6	4	2	Foothold city
Lyon (k = 3)	Net degree (negative)	4	2	2	Foothold city
Tokyo (k = 3)	Outdegree	7	6	1	Headquarter city
Johannesburg (k = 3)	Indegree	5	4	1	Foothold city
Lyon (k = 3)	Indegree	5	4	1	Foothold city
Amsterdam (k = 3)	Total degree	9	8	1	Specialised city
Port Harcourt (k = 3)	Net degree (negative)	3	2	1	Foothold city
Lomé (k = 2)	Net degree (negative)	3	2	1	Foothold city
Maiduguri (k = 2)	Net degree (negative)	3	2	1	Foothold city

Table 6.30 Outlying cities in the Lagos knowledge network

City	*Outlying attribute*	*Score*	*Largest non-outlier*	*Margin*	*Role indicated*
London (k = 2)	Total degree	13	5	8	Specialised city
London (k = 2)	Outdegree	12	5	7	Headquarter city
London (k = 2)	Net degree (positive)	11	5	6	Headquarter city
Enugu (k = 2)	Total degree	8	5	3	Specialised city
Port Harcourt (k = 2)	Indegree	4	2	2	Foothold city
Port Harcourt (k = 2)	Net degree (negative)	4	2	2	Foothold city
Enugu (k = 2)	Indegree	3	2	1	Foothold city

Table 6.31 Outlying cities in the Lagos capital network

City	*Outlying attribute*	*Score*	*Largest non-outlier*	*Margin*	*Role indicated*
London (k = 2)	Total degree	40	13	27	Specialised city
London (k = 2)	Indegree	24	6	18	Foothold city
London (k = 2)	Outdegree	16	7	9	Headquarter city
London (k = 2)	Net degree (negative)	8	2	6	Foothold city
Boston (k = 1)	Net degree (negative)	6	2	4	Foothold city
Beirut (k = 2)	Net degree (positive)	5	2	3	Headquarter city
Frankfurt (k = 2)	Net degree (positive)	4	2	2	Headquarter city
Zurich (k = 1)	Net degree (positive)	4	2	2	Headquarter city
Dubai (k = 1)	Net degree (positive)	4	2	2	Headquarter city
Stockholm (k = 2)	Net degree (positive)	4	2	2	Headquarter city
Johannesburg (k = 2)	Net degree (positive)	3	2	1	Headquarter city
Paris (k = 2)	Net degree (positive)	3	2	1	Headquarter city
Washington (k = 2)	Net degree (positive)	3	2	1	Headquarter city

Table 6.32 Outlying cities in the Lagos networking network

City	*Outlying attribute*	*Score*	*Largest non-outlier*	*Margin*	*Role indicated*
Dubai (k = 2)	Total degree	10	5	5	Specialised city
Dubai (k = 2)	Indegree	9	5	4	Foothold city
London (k = 2)	Total degree	9	5	4	Specialised city
Dubai (k = 2)	Net degree (positive)	8	4	4	Headquarter city
Rome (k = 2)	Outdegree	4	2	2	Headquarter city
London (k = 2)	Indegree	7	5	2	Foothold city
Rome (k = 2)	Net degree (negative)	3	1	2	Foothold city
Bangalore (k = 2)	Outdegree	3	2	1	Headquarter city
Johannesburg (k = 2)	Total degree	6	5	1	Specialised city
London (k = 2)	Net degree (positive)	5	4	1	Headquarter city
Bangalore (k = 2)	Net degree (negative)	2	1	1	Foothold city
Tel-Aviv (k = 2)	Net degree (negative)	2	1	1	Foothold city

Table 6.33 Outlying cities in the Lagos finance operations network

City	*Outlying attribute*	*Score*	*Largest non-outlier*	*Margin*	*Role indicated*
Lomé (k = 3)	Net degree (positive)	10	2	8	Headquarter city
Lomé (k = 3)	Outdegree	11	5	6	Headquarter city
Abuja (k = 1)	Indegree	12	6	6	Foothold city
Abuja (k = 1)	Total degree	12	6	6	Specialised city
Lomé (k = 3)	Total degree	12	6	6	Specialised city
Abuja (k = 1)	Net degree (negative)	12	6	6	Foothold city
Port Harcourt (k = 1)	Indegree	10	6	4	Foothold city
Port Harcourt (k = 1)	Total degree	10	6	4	Specialised city
London (k = 3)	Total degree	10	6	4	Specialised city
Port Harcourt (k = 1)	Net degree (negative)	10	6	4	Foothold city
Accra (k = 3)	Total degree	7	6	1	Specialised city

Table 6.34 Outlying cities in the Lagos finance capital network

City	*Outlying attribute*	*Score*	*Largest non-outlier*	*Margin*	*Role indicated*
London (k = 2)	Total degree	35	13	22	Specialised city
London (k = 2)	Indegree	22	6	16	Foothold city
London (k = 2)	Outdegree	13	5	8	Headquarter city
London (k = 2)	Net degree (negative)	9	2	7	Foothold city
Boston (k = 1)	Net degree (negative)	6	2	4	Foothold city
Beirut (k = 2)	Net degree (positive)	5	2	3	Headquarter city
Frankfurt (k = 2)	Outdegree	7	5	2	Headquarter city
New York (k = 2)	Outdegree	7	5	2	Headquarter city
Frankfurt (k = 2)	Net degree (positive)	4	2	2	Headquarter city
Zurich (k = 1)	Net degree (positive)	4	2	2	Headquarter city
Stockholm (k = 2)	Net degree (positive)	4	2	2	Headquarter city
Johannesburg (k = 2)	Net degree (positive)	3	2	1	Headquarter city
Dubai (k = 1)	Net degree (positive)	3	2	1	Headquarter city
Paris (k = 2)	Net degree (positive)	3	2	1	Headquarter city
Washington (k = 2)	Net degree (positive)	3	2	1	Headquarter city

Table 6.35 Outlying cities in the Lagos services operations network

City	*Outlying attribute*	*Score*	*Largest non-outlier*	*Margin*	*Role indicated*
Abuja (k = 1)	Indegree	9	4	5	Foothold city
Abuja (k = 1)	Total degree	9	4	5	Specialised city
Abuja (k = 1)	Net degree (negative)	9	4	5	Foothold city
Abidjan (k = 2)	Net degree (positive)	5	1	4	Headquarter city
Abidjan (k = 2)	Outdegree	6	3	3	Headquarter city
Libreville (k = 2)	Total degree	7	4	3	Specialised city
Abidjan (k = 2)	Total degree	7	4	3	Specialised city
Libreville (k = 2)	Outdegree	5	3	2	Headquarter city
Accra (k = 1)	Indegree	6	4	2	Foothold city
Accra (k = 1)	Total degree	6	4	2	Specialised city
Libreville (k = 2)	Net degree (positive)	3	1	2	Headquarter city
Leipzig (k = 2)	Net degree (positive)	3	1	2	Headquarter city
Accra (k = 1)	Net degree (negative)	6	4	2	Foothold city

Table 6.36 Outlying cities in the Lagos services supply network

City	*Outlying attribute*	*Score*	*Largest non-outlier*	*Margin*	*Role indicated*
San Francisco (k = 3)	Outdegree	12	4	8	Headquarter city
San Francisco (k = 3)	Total degree	15	7	8	Specialised city
San Francisco (k = 3)	Net degree (positive)	9	3	6	Headquarter city
Guangzhou (k = 3)	Indegree	8	4	4	Foothold city
Johannesburg (k = 3)	Total degree	11	7	4	Specialised city
Johannesburg (k = 3)	Outdegree	7	4	3	Headquarter city
Tokyo (k = 3)	Outdegree	7	4	3	Headquarter city
Guangzhou (k = 3)	Total degree	10	7	3	Specialised city
Tokyo (k = 3)	Net degree (positive)	6	3	3	Headquarter city
Guangzhou (k = 3)	Net degree (negative)	6	3	3	Foothold city
London (k = 3)	Total degree	9	7	2	Specialised city
London (k = 3)	Indegree	5	4	1	Foothold city
Lyon (k = 3)	Indegree	5	4	1	Foothold city
Tokyo (k = 3)	Total degree	8	7	1	Specialised city
Lyon (k = 3)	Net degree (negative)	4	3	1	Foothold city

Table 6.37 Outlying cities in the Lagos services knowledge network

City	*Outlying attribute*	*Score*	*Largest non-outlier*	*Margin*	*Role indicated*
Enugu (k = 2)	Total degree	8	3	5	Specialised city
Enugu (k = 2)	Outdegree	5	2	3	Headquarter city
London (k = 2)	Outdegree	4	2	2	Headquarter city
Enugu (k = 2)	Indegree	3	1	2	Foothold city
London (k = 2)	Total degree	5	3	2	Specialised city
London (k = 2)	Net degree (positive)	3	1	2	Headquarter city
Dundee (k = 1)	Net degree (positive)	3	1	2	Headquarter city
Johannesburg (k = 2)	Net degree (positive)	3	1	2	Headquarter city
Dundee (k = 1)	Outdegree	3	2	1	Headquarter city
Johannesburg (k = 2)	Outdegree	3	2	1	Headquarter city
Port Harcourt (k = 2)	Indegree	2	1	1	Foothold city
Sao Tomé (k = 2)	Indegree	2	1	1	Foothold city
Enugu (k = 2)	Net degree (positive)	2	1	1	Headquarter city
Bangalore (k = 1)	Net degree (positive)	2	1	1	Headquarter city
Calabar (k = 2)	Net degree (positive)	2	1	1	Headquarter city
Cardiff (k = 1)	Net degree (positive)	2	1	1	Headquarter city
Cranfield (k = 2)	Net degree (positive)	2	1	1	Headquarter city
Dubai (k = 1)	Net degree (positive)	2	1	1	Headquarter city
Mumbai (k = 1)	Net degree (positive)	2	1	1	Headquarter city
Nagpur (k = 1)	Net degree (positive)	2	1	1	Headquarter city
New York (k = 1)	Net degree (positive)	2	1	1	Headquarter city
Ogbomosho (k = 1)	Net degree (positive)	2	1	1	Headquarter city
Port Harcourt (k = 2)	Net degree (negative)	2	1	1	Foothold city
Sao Tomé (k = 2)	Net degree (negative)	2	1	1	Foothold city

Table 6.38 Outlying cities in the Lagos services networking network

City	*Outlying attribute*	*Score*	*Largest non-outlier*	*Margin*	*Role indicated*
Dubai (k = 2)	Indegree	9	3	6	Foothold city
Dubai (k = 2)	Total degree	10	5	5	Specialised city
Dubai (k = 2)	Net degree (negative)	8	3	5	Foothold city
Rome (k = 2)	Outdegree	4	2	2	Headquarter city
Rome (k = 2)	Net degree (positive)	3	1	2	Headquarter city
Bangalore (k = 2)	Outdegree	3	2	1	Headquarter city
Bangalore (k = 2)	Net degree (positive)	2	1	1	Headquarter city
Tel-Aviv (k = 2)	Net degree (positive)	2	1	1	Headquarter city

Like the various components of the global network, these may be collapsed into a single list of significant outlying cities. (Apart from the same procedure used to discard less significant outlying cities for the global network, here I also discard cities where the largest non-outlier or the margin is a score of only 1.) This results in the following list of significant outlying cities.

Table 6.39 Significant outlying cities in the Lagos network

City	*k*	*Role*	*Sectoral networks*	*Functional networks*
London	4	Headquarter city	Manufacturing	
		Specialised city	Finance, services	Supply
Abuja	3	Foothold city	Services	
Port Harcourt	4	Foothold city	(Lagos overall)	
		Specialised city	Manufacturing	
Lomé	4	Headquarter city	Finance	
San Francisco	4	Headquarter city	Services	Supply
Johannesburg	4	Headquarter city	Services	Supply
Accra	3	Foothold city	Finance	Operations
Tokyo	4	Headquarter city	Services	Supply
Abidjan	4	Foothold city	Finance	
Dubai	3	Foothold city	Services	
Guangzhou	4	Foothold city	Services	Supply
Paris	4	Headquarter city	Finance	
Enugu	4	Specialised city	Services	
Bangalore	3	Headquarter city	(Lagos overall)	
Lyon	4	Foothold city	Services	Supply

How does this geography of the global economy seen from the perspective of Lagos correspond to the geography of the global network produced in this study? The following table matches each city having a significant outlying role in sectoral components of the Lagos network with its significant outlying roles in sectoral components of the global network (if they exist), along with an indication of each city's position within the Lagos network (given by its k-shell) and within the global network (given by its core-periphery type: A, B, C or D).

A few expected patterns emerge. First, roles can be very easily matched for most A cities: London, San Francisco, Tokyo and Paris. The only exception is Guangzhou, though perhaps Guangzhou's outlying role in the Lagos network is best understood as represented by Hong Kong's outlying role in the global network, in which case it too is easily matched. All the D cities having outlying roles in the Lagos network—Abuja, Port Harcourt, Lomé, Accra, Abidjan, Enugu and Bangalore—have no outlying role in the global network (whether related to their role in Lagos or not). This leaves two C cities: Johannesburg and Dubai. Johannesburg's role in Lagos may be understood as a reflection of its functional role in the global network as a foothold city for companies entering African markets.

Dubai's role is less obvious, and quite interesting. Dubai's outlying role in the global network is as a foothold ciy for global companies entering Middle Eastern markets. But no companies interviewed in Lagos are trying to break into Middle Eastern markets. Rather, Dubai's outlying role in the Lagos network is as a place for networking—for conferences, trade shows, and making new contacts generally. Thus Dubai has a role which has gone unnoticed in the analysis of the global network, namely in creating the "temporary geographic proximity" that Torre and Rallet (Rallet & Torre, 1999;

Torre, 2008) argue plays a key part in establishing "nonlocal relations" and thus in innovation generally.

Table 6.40 Significant outlying roles—the Lagos and global networks compared

City	*Component of Lagos network*	*Role*	*k (Lagos)*	*Component of global network*	*Role*	*Type (global)*
London	Manufacturing	Headquarter city	4	Manufacturing	Headquarter city	A
	Finance	Specialised city	4	Finance	Headquarter city	A
	Services	Specialised city	4	Finance; Admin, commerce	Headquarter city; Specialised city	A
Abuja	Services	Foothold city	3			D
Port Harcourt	Manufacturing	Specialised city	4			D
Lomé	Finance	Headquarter city	4			D
San Francisco	Services	Headquarter city	4	Commerce, ICT	Headquarter city	A
Johannesburg	Services	Headquarter city	4			C
Accra	Finance	Foothold city	3			D
Tokyo	Services	Headquarter city	4	Commerce, ICT; Manufacturing	Headquarter city; Foothold city	A
Abidjan	Finance	Foothold city	4			D
Dubai	Services	Foothold city	3			C
Guangzhou	Services	Foothold city	4	(Hong Kong: commerce, manufacturing, technical)	(Foothold city)	A
Paris	Finance	Headquarter city	4	Finance	Headquarter city	A
Enugu	Services	Specialised city	4			D
Bangalore	(Lagos overall)	Headquarter city	3			D
Lyon	Services	Foothold city	4			A

We can codify this into a few key statements. First, "A" and "C cities"—cities that comprise the core of the global network as identified through "interlocking world city network models" (IWCNM) (Hennemann & Derudder, 2012; Parnreiter, 2013) such as Alderson and Beckfield's (2004)—do indeed play a role in articulating the activities of non-MNE firms in a peripheral city such as Lagos. Second, "C cities"—core cities in peripheral regions of the global network such as Johannesburg—do indeed play a role as "regional articulator" (Beaverstock, Taylor, & Smith, 1999b, p. 1872) or "semi-periphery primary city" (Friedmann, 1986) in articulating the activities of non-MNE firms in a peripheral city such as Lagos. Third, and absent from the suppositions of the "world city hypothesis" (Friedmann, 1986), a significant role is played by cities (such as Dubai) in acting not as permanent "global cities" or "regional articulators" but as temporary "networking cities", and there need not be any relationship between a city's role as a networking city and its role as an A or C city.

6.4. Global outreach versus global flows

However another level of analysis offers a different interpretation. First, if we count the numbers of each type of city in each component of the Lagos network, we discover that B cities (cities in the periphery of the global network but in core regions of the global network) play a role so far undescribed. In the table below, D cities—especially smaller cities in West and Central Africa—are

the most numerous in the Lagos network overall, and especially in the intrafirm (operations) components. A cities are just as numerous or more numerous in the interfirm components: supply, knowledge, capital and networking. This reflects what has just been said above, which is that cities classified as A cities by the IWCNM do indeed play a role in the economies of firms in other cities beyond the MNEs used in the method.

Table 6.41 Global cores and peripheries in Lagos networks

Network	*A (core cities in core regions)*	*B (peripheral cities in core regions)*	*C (core cities in peripheral regions)*	*D (peripheral cities in peripheral regions)*	*Total*
Lagos (overall)	65	55	9	90	219
Intrafirm	12	4	5	61	82
Interfirm	60	52	9	59	180
Finance	33	4	6	41	84
Services	46	44	9	71	170
Manufacturing	12	7	2	12	33
Operations	11	2	4	67	84
Supply	41	37	6	14	98
Knowledge	20	13	4	22	59
Capital	25	4	3	13	45
Networking	23	7	8	18	56
Finance: operations	6	1	3	38	48
Finance: capital	24	3	3	11	41
Services: operations	7	1	3	50	61
Services: supply	33	32	5	11	81
Services: knowledge	13	12	4	16	45
Services: networking	21	7	7	17	52

However, after this, it is very clear that B cities are more numerous than C cities in the supply and knowledge components (and as a result in the services and interfirm components), by orders of six-to-one and three-to-one respectively. There are a few possible interpretations. The first is that we are witnessing the "regional articulator" function of C cities, and that they are fewer in number because they are bundling together larger numbers of connections than the equivalent B cities. A second interpretation is that B cities are more numerous in Lagos' supply and knowledge networks simply because B cities are more numerous and more scattered in the world. A third interpretation is that B cities are more numerous because B cities are more important to the businesses of Lagos.

One way to discern between them is to count the types of ties between different types of cities present in the various components of the Lagos network, as is done in the following table. The most important rows and columns for this discussion are extracted in a smaller table below.

Table 6.42 Global flows in Lagos networks

Network	*A-A*	*A-B*	*A-C*	*A-D*	*B-A*	*B-B*	*B-C*	*B-D*	*C-A*	*C-B*	*C-C*	*C-D*	*D-A*	*D-B*	*D-C*	*D-D*	*Total*
Lagos (overall)	42	4	10	159	7	2	3	61	3			43	124	8	31	277	774
Intrafirm	2		1	14	1		1	3				7	10	1	6	168	214
Interfirm	40	4	9	145	6	2	2	58	3			36	114	7	25	109	560
Finance	21		2	72				1	1			12	64	3	13	104	293
Services	21	2	8	70	6	2	3	54	1			29	59	5	15	152	427
Manufacturing		2		17	1			6	1			2	1		3	21	54
Operations	4		1	5	1		1	1				4	16	1	7	178	217
Supply	20	1	8	63	5	2		39	1			18	15	1		10	183
Knowledge				35				17				10	3			35	100
Capital	16	1		50				2	1			8	37	2	1	17	135
Networking	3	2	1	8	1		2	2	1			5	31	4	17	20	97
Finance: operations	3		1	3								3	9	1	4	83	97
Finance: capital	16			44				1	1			7	34	2	1	14	120
Services: operations	1			2	1		1	1				1	7		3	86	103
Services: supply	19		7	43	4	2		35				14	15	1		8	148
Services: knowledge				15				16				8	3			21	63
Services: networking	1	2	1	5	1		2	2	1			5	22	4	11	18	75

The following table extracts the components (the rows) where B cities are more numerous than C cities, and extracts all ties (the columns) representing flows of supply and knowledge into Lagos and other D cities.

Table 6.43 Global flows in Lagos networks—extract

Network	*A-D*	*B-D*	*C-D*	*D-D*	*Total*
Lagos (overall)	159	61	43	277	774
Interfirm	145	58	36	109	560
Services	70	54	29	152	427
Supply	63	39	18	10	183
Knowledge	35	17	10	35	100
Services: supply	43	35	14	8	148
Services: knowledge	15	16	8	21	63

Here we can see that flows from A cities to D cities are still the most numerous, but we can also see that flows from B cities to D cities outnumber flows from C cities to D cities by an order of two-to-one. This tells us that all of our interpretations of why B cities were more numerous than C cities are correct to some degree. The full story in rough terms is that each C city bundles together about three times as many flows of supply as each B city, and about 1.5 times as many flows of knowledge as each B city, but taken together, the total flows of supply and knowledge coming through B cities is twice as large as those coming through C cities. So, each C city is on average more important than each B city, but B cities taken together are more important than C cities taken together. We may say that B cities taken together have more resources to offer than C cities taken together, but that there

are gains in efficiency in reaching out to C cities in preference to B cities. This is supported by comparing the D-C and D-B ties for the networking components: these figures show that firms in Lagos are reaching out to C cities roughly between three and four times more often than to B cities. But again, recall that the C cities with significant outlying roles in the Lagos network were Johannesburg and Dubai. From the interview data, we can see that this reaching out is predominantly to the "networking city" of Dubai, as well as to C cities with specific commercial opportunities such as Mumbai and Bangalore, not the "regional articulator" of Johannesburg. We can say that the firms in Lagos are really reaching out to B cities via Dubai, not to C cities such as Johannesburg and Dubai for their own sakes, whereas they do reach out to C cities such as Mumbai and Bangalore for their own sakes. In the case of B cities and C cities such as Mumbai and Bangalore they are reaching out for the specific commercial opportunities they offer—specific products they can supply to the West African market, and specific types of knowledge they can offer alongside.

We can codify this interpretation into three new statements. First, A cities play a role in articulating the activities of firms in a peripheral city such as Lagos. Second, several types of cities: A cities, B cities, and C cities, in that order, play a role as sources of new products and new knowledge for firms in a peripheral city such as Lagos. Second, "networking cities" such as Dubai play a role in connecting firms in a peripheral city such as Lagos to those sources of new products and new knowledge, creating the "temporary geographic proximity" (Rallet & Torre, 1999; Torre, 2008) required for them to establish and maintain new partnerships.

6.5. Intrafirm versus interfirm ties

We can illustrate this further by exploring the distinct geographies of intrafirm and interfirm ties. As discussed in section 2.2, one key assumption underpinning the typical IWCNM methodologies discussed in Chapter 2 is that intrafirm ties may stand as a proxy for interfirm ties, but the warning was given that this may create a bias in the way the global network of cities is identified. As Figure 6.1 and Figure 6.2 show, many distinctions can be made between the two types of ties.

The first thing to notice is that interfirm ties vastly outnumber intrafirm ties in the Lagos network overall, as well as in each sector, and almost every type of activity. The only exception is operations. This is not necessarily a source of bias; intrafirm ties may stand as a proxy for interfirm ties of greater number where their geographic and sectoral patterns remain similar.

So the second thing to notice is that these patterns are not very similar, as the geographic views on the following pages show. In the interfirm networks there are many more nodes in the core regions Europe, North America and East Asia. There are also many more ties between the different regions, especially between these three core regions; this is also to say that there are many more ties between two regions external to Sub-Saharan Africa itself in the interfirm component compared to the intrafirm component. This is a source of bias, but not necessarily one that contradicts the findings of the standard IWCNM methods, since all this bias implies is that the role of "global cities" and

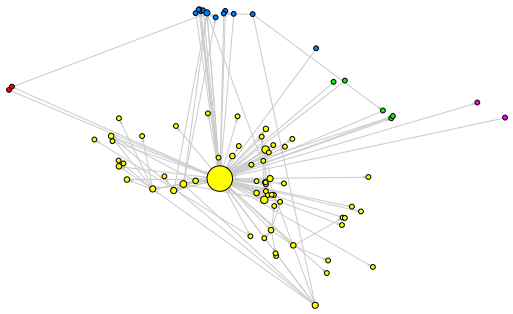
connections between cities in the core of the global network may simply be even greater than those methodologies already identify.

In the finance sector, the differences between intrafirm and interfirm ties are slight and reflect the "positive" bias mentioned above. This does little to upset intrafirm methods that emphasise the role of the financial and other producer services, since here the slight differences simply reinforce the role of "global cities" in this sector.

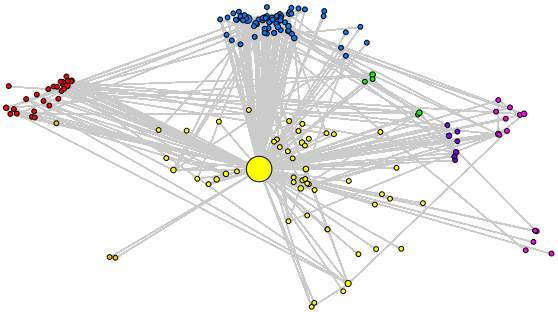
In the services sector the differences are much more dramatic, responsible for most of the variation between intrafirm and interfirm ties in the Lagos network overall. This is attributable to the complex organisation of supply chains feeding companies in this sector. This is a greater upset to Taylor's (2001) version of the IWCNM which emphasises the role of financial and other producer services, because it shows that the greatest potential source of bias comes from a sector that is absent from the data used in his method. But it is also a greater upset to the intrafirm method overall, in a way that is slightly confusing. What the services sector shows is that the role of European, North American and East Asian cities and connections between them is perhaps even greater than one should expect from the intrafirm method, and at first glance this reinforces the findings of that method. But more careful observation notices the role of small firms in Lagos in shaping very complex interfirm supply chains in other, supposedly wealthier and more powerful regions. A lot of activity within the Lagos economy is directed by small firms coordinating with foreign firms (small and large) to create these interfirm supply chains. Even though most of them may be routed through European, North American and East Asian cities, they are nevertheless coordinated from Lagos itself.

This means two things. The first point is that potentially a lot of power and influence is generated through interfirm supply chains, raising a significant challenge to the primacy of intrafirm supply chains, which the intrafirm methods presuppose. This is not necessarily a bias in itself if interfirm supply chains follow similar geographic patterns to intrafirm supply chains. However the second point is that given Lagos as an example, these interfirm supply chains are likely coordinated by agents in a much wider array of cities, including many more large developing-world cities, than intrafirm supply chains. So while the geography of the supply chains themselves may be similar, the geography of their command and control may be very different. This may be a significant bias in the intrafirm methods which tilt their identification of the cities that "control" the global network towards "global cities" and away from secondary and developing-world cities.

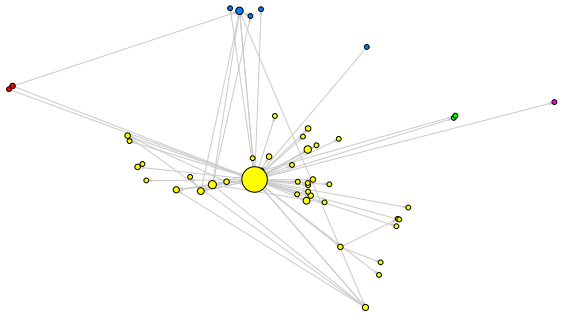
To clarify, these sources of bias are of concern only if one intends the sampling of the global network to represent the population of firms that constitute that network, as is the intention in this study. It is not necessarily of concern if one is selectively exploring a specific geography, as Taylor (2006) intends when his method draws only upon producer services firms. Nevertheless Storper's (1997) warning not to elide between the two intentions remains.



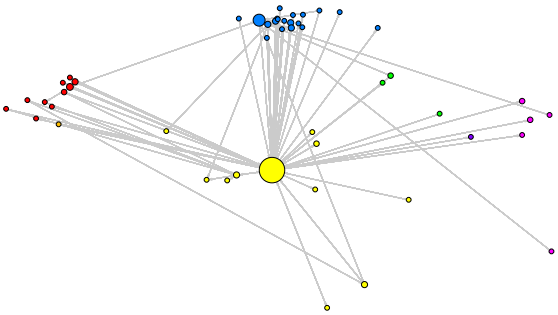
Lagos: intrafirm ties



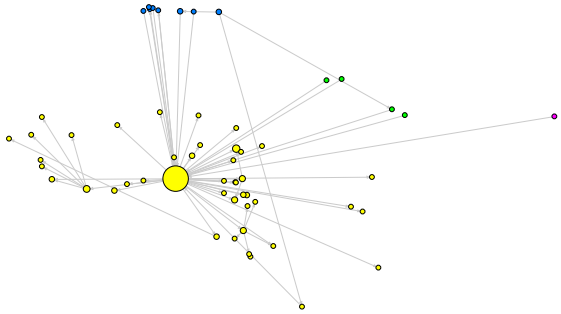
Lagos: interfirm ties



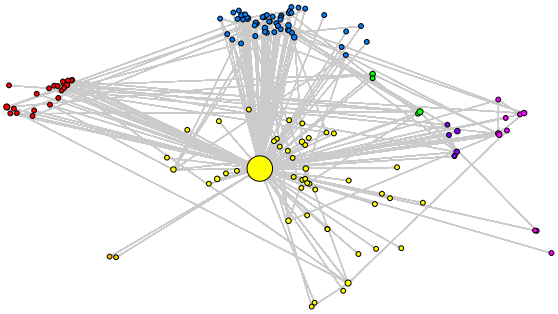
Finance sector: intrafirm ties



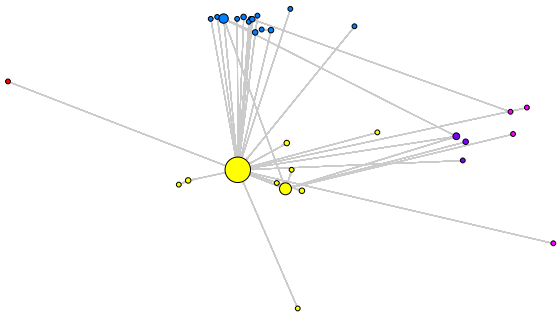
Finance sector: interfirm ties



Services sector: intrafirm ties

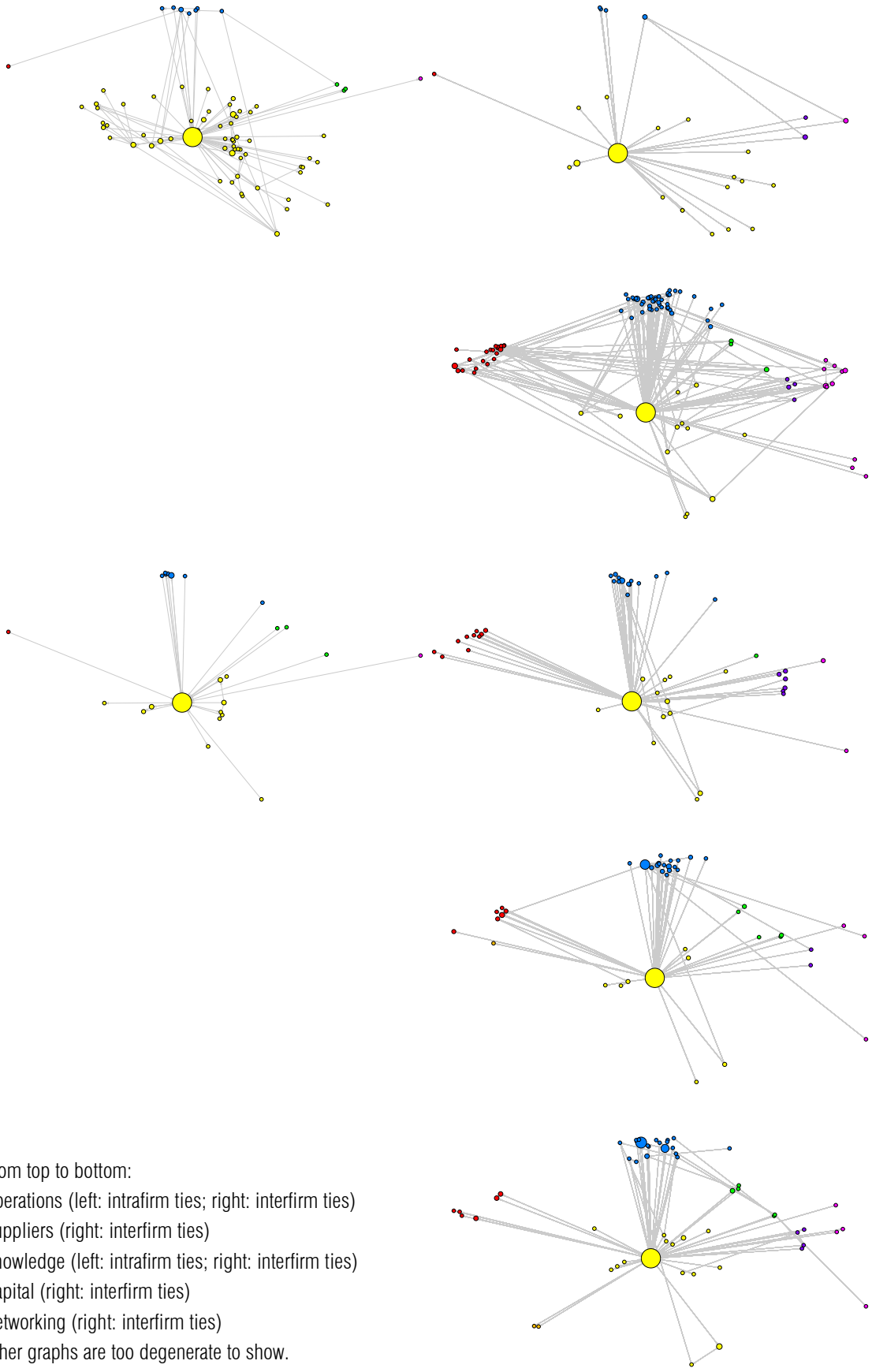


Services sector: interfirm ties



Manufacturing sector: interfirm ties

Figure 6.1 Geographic views of intrafirm and interfirm ties in different sectors in the Lagos network
Manufacturing sector intrafirm graph is too degenerate to show (and consists of no interregional ties).



From top to bottom:
Operations (left: intrafirm ties; right: interfirm ties)
Suppliers (right: interfirm ties)
Knowledge (left: intrafirm ties; right: interfirm ties)
Capital (right: interfirm ties)
Networking (right: interfirm ties)
Other graphs are too degenerate to show.

Figure 6.2 Geographic views of intrafirm and interfirm ties in different functions in the Lagos network

We have observed that in a city such as Lagos, interfirm ties vastly outnumber intrafirm ties. It may be that as one moves through successively smaller regional economies, the relative importance of intrafirm to interfirm ties changes, that in larger regional economies (such as Europe) intrafirm ties are more important for command and control of the economy, and in smaller regional economies (such as Sub-Saharan Africa) interfirm ties grow more important for command and control of the economy. This would mean that the intrafirm method may be fine for identifying the "heights" of the global network, i.e. the "global cities" at its peak, but that it would need to be complemented by interfirm methods to accurately identify the geography of the global network and its control within low-income regions or regions with smaller economies.

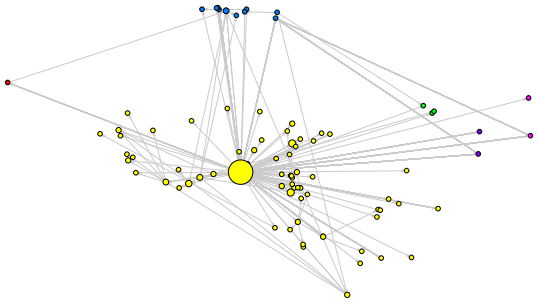
6.6. Factors

Looking at the geography of Lagos firms' networking and supply activities, we may say that Lagos acts somewhat like a funnel. Its companies search for inputs from across a wide number wealthier cities around the globe, synthesise them into new financial products and other services in Lagos, and sell these across a narrower number of poorer locations across West and Central Africa. A review of the components in Figure 6.3 confirms this geography. Supply, knowledge, capital and networking activities engage few West African locations outside of Lagos, but thoroughly engage European, North American and East Asian locations, as well as a smattering of Middle Eastern locations. As has been said, supply even demands complex coordination between multiple regions, not simply between other regions and Lagos; and networking activities for many companies and their suppliers are conducted in conferences in places like Dubai, Hamburg and Barcelona. Capital largely flows directly between Lagos and cities in wealthy regions, but many route their flows through the financial industry in London. These explain the bulk of the interregional ties visible in each component.

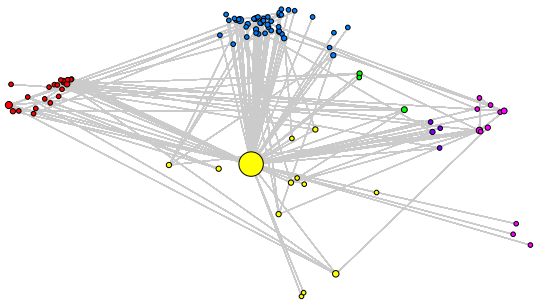
Operations are very different. Here there are much fewer locations in Europe, only one city in North America (New York), two in East Asia (Beijing and Shenzhen), three in the Middle East (Abu Dhabi, Dubai and Manama). But there are many more locations in West and Central Africa—the Atlantic coast of West Africa is rather well defined in the geographic view of Lagos' operations.

This is a direct illustration of Jacobs' theory that economic opportunity for "backward cities" comes by pursuing markets in "even more backward cities".

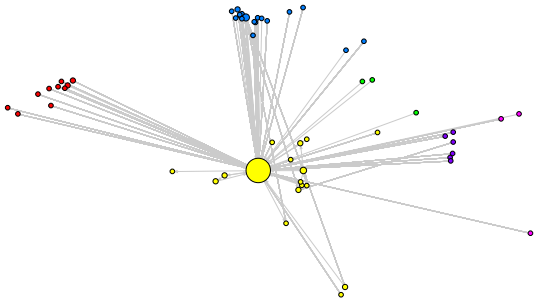
Operations



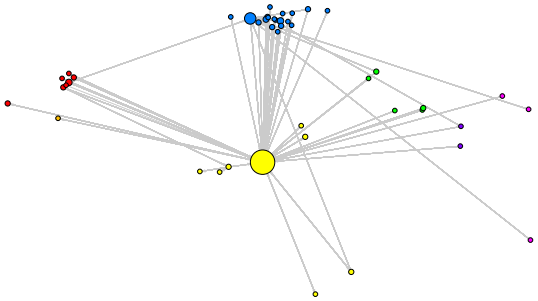
Suppliers



Knowledge



Funds



Networking activities

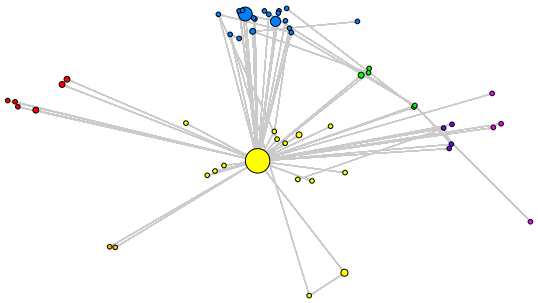


Figure 6.3 Components of the Lagos network

6.7. Implications

In the end, we cannot dismiss the geography of the world's A or "global" cities as identified by the IWCNM methods as having no relevance for the pursuit of economic opportunity in peripheral cities such as Lagos. The significant outlying roles that the world's leading "global cities" fulfil for the world's largest MNEs are matched by the roles they fulfil for the smaller firms in Lagos.

What is different is the nature of the "semi-periphery" that the global and Lagos networks imply. The geography of the world's MNEs includes a number of C cities or "regional articulators" such as Johannesburg, Sao Paulo and Mumbai, which facilitate the entry of MNEs into peripheral regions. However, the geography of the Lagos network places greater importance on the partnership opportunities offered by firms in the much wider panoply of B cities and towns, from overlooked metropolises such as Izmir (Turkey; 4 million) and Pingdingshan (China; 5 million) to out-of-the-way villages such as Selles-St-Denis (France; 1,200) and Tzummarum (Netherlands; 1,300), which have products and knowledge that Lagosian firms can turn to new markets in West and Central Africa. The geography of the Lagos network also places greater importance on the role of "networking cities" which bring Lagosian firms together with these potential partners to forge these new partnerships.

The task now is to try to assemble all of these various observations regarding the geography of the global network and the geography of the Lagos network into a single framework, which is the work of the following chapter. Once such a framework is established, the full implications of this research for the growth and development of an economy such as Lagos' may be sketched out.

Chapter 7. A model of the global network

This chapter builds a model of the global network and works towards an understanding of how peripheral cities such as Lagos ought to pursue economic development specifically through the process of business growth and expansion within the context of this network. This model has concerns at the micro, meso and macro levels, so to clarify how these terms are used here: Micro refers to the level of an individual firm, the networks that form between its individual business units in different locations, and the networks that form between it and other individual firms, whether in the same location or different locations. Meso refers to sectoral, functional or urban formations of large numbers of firms. That is, it may refer to clusters of firms forming within individual cities (whether sectoral or functional or not), or long sectoral or functional aggregations of firms forming across several cities. Macro refers to the structure of the global network as a whole, especially the relationship between its core and periphery.

7.1. Microeconomic foundations

Like the "new economic geography" literature, the model laid out here derives from the balance between "centripetal" and "centrifugal forces" (Fujita, Krugman, & Venables, 1999) or "forces of attraction" and "repulsion", with the tension between them contributing to the specific nature of uneven spatial distribution witnessed in the world. Unlike them however, it does not proceed with a discussion of distance[25], transport costs or costs of location, but through the centripetal forces of proximity (especially cognitive and institutional) and agglomeration, and a centrifugal force herein called "monopoly-seeking" (used in a positive sense rather than its negative sense in the "rent-seeking" literature).

7.1.1. Cognitive and institutional proximity

The first of these forces is proximity, especially cognitive and institutional proximity. As discussed in Chapter 2, Boschma (2005) recalls five types of proximity: cognitive, organisational, social, institutional and geographic. Rallet and Torre (1999) indicate that geographic proximity is something that allows the other types of proximity to take effect, rather than being a sufficient form of proximity on its own. Being of a different class, this form of proximity is discussed in the next section. Between the remaining four there is a lot of overlap and confusion, both terminological and conceptual, so to reiterate, this discussion begins by following Boschma (2005) in defining these as follows: cognitive proximity refers to similarity in knowledge bases, organisational proximity refers to prior familiarity between organisations, social proximity refers to social relations within which actors are embedded, and institutional proximity refers to participation in or adoption of common institutions and norms, including language blocs and regulatory environments.

[25] Specifically geodesic distance, or distance as measured over the face of the Earth.

As outlined in Table 7.1, the companies interviewed in Lagos engaged in networking activity that exploited many of these forms of proximity.

Table 7.1 Non-geographic proximity amongst Lagos companies

Company	*Key activities related to non-geographic proximity*	*Key dimensions of proximity*
First Bank	Acquisition of the largest bank in DRC (Kinshasa); seeking clients in the US (Houston) oil and gas sector based on experience in the Nigerian oil and gas sector	Cognitive
	Acquiring FSA licensing and British accreditations to assure potential clients of the quality of its operations	Institutional
	Using a London office to serve Anglophone African clients and a Paris office to serve Francophone African clients	Cognitive, institutional
	Maintenance of connections with Commonwealth governments (British, Canadian and South African high commissions and trade ministries)	Cognitive, organisational, institutional
Access/ Intercontinental	Acquiring FSA licensing to facilitate entry into other remote financial markets	Institutional
Keystone	Possession of subsidiaries in small Anglophone African countries	Cognitive, institutional
Citibank	Foreign clients entering Africa preferring to liaise with Johannesburg because of its better infrastructure and institutions compared to Lagos	Institutional
Aiico	Will only accept foreign capital from investors with foreign experience in insurance to share ; insurance broker playing role of disseminator of knowledge about reinsurers' new products; software; uses software developed in Nairobi after recommendation of Kenyan insurer	Cognitive
JNC	Seeks supply partners only within its own sector (medical equipment)	Cognitive
Penuel	Seeks supply partners only within its own or related sectors	Cognitive
	Launching into Cape Verde based on experience in Sao Tomé and Principe	Cognitive, institutional
Nigachem	Suppliers all draw from the same sector	Cognitive
	Joint venture established with a more technologically advanced partner in the same sector	Cognitive
Hunts	Suppliers identified through their upstream and downstream partners; partnership with a very large downstream client (Shoprite)	Cognitive, organisational
Microspace	Partnership with much larger clients in related sectors (GE India, Glo)	Cognitive
Internet Solutions	Lebanese directors' reliance on Beirut as their gateway to global networks; new contacts accepted only based on very strong personal referrals	Social, institutional
	Seeks supply partners only within its own sector	Cognitive
Tenecé	Seeks supply partners within its own or related sectors	Cognitive
	Seeks professionals with related experience when breaking into new sectors	Cognitive
Global Corp	Seeks partners and suppliers within its own or related sectors; networks aggressively amongst upstream and downstream companies	Cognitive, organisational

Cognitive proximity emerges as the most important, both for networking "upstream" to identify new suppliers and partners, and for expanding "downstream" into new territorial markets. Institutional proximity proves important in two ways: many banks participate in regulatory institutions such as FSA licensing to signal their readiness to serve prospective clients and partner with other financial institutions, while many firms across the different sectors in Lagos expand into new markets based on their familiarity with other markets possessing similar regulatory and linguistic institutions (which resonates with arguments found in trade decomposition studies (Evenett & Venables, 2002; Zahler, 2011)). Organisational proximity was not very important, something which speaks to the third force to be discussed below—monopoly-seeking. That is, Lagos firms do not simply use their existing organisational contacts to discover new opportunities; they diligently go quite a long way

beyond their immediate circles to meet new firms, and seek to monopolise relations with these new partners. Social proximity was also not very important amongst the firms interviewed, though no immediate explanation for this emerges from the interview data other than that given for organisational proximity, i.e. that firms choose to go quite far beyond their immediate circles in their efforts to build new connections.

We may thus identify at least cognitive and institutional proximity as a major "force" in the formation of the global network, responsible for the creation of large numbers of interfirm ties between firms with similar knowledge bases or institutional groundings in the absence of prior organisational or social connections between them. But this may be expressed in various ways: cognitive and institutional proximity can generate large numbers of interfirm ties between firms in the same or similar sectors, between firms executing the same or similar functions albeit in different sectors, or between firms targeting the same or similar markets or market segments, etc. This means that sectoral clusters of ties, functional clusters of ties, vertically converging chains of ties, assemblages of relations between markets with common histories and languages, etc., all form important meso-level components of the global network. Prior to any discussion of geographic proximity, it might be possible to imagine a global network in which firms are dispersed arbitrarily across space, but even here it must be seen that the ties between them are not dispersed arbitrarily across space; rather these ties are bundled together in identifiable sectoral, functional and institutional structures.

7.1.2. Agglomeration

The second force to consider is agglomeration, but this force does not necessarily act here as it does in other literatures. The model outlined here has not adopted geodesic distance, the cost of location or transport costs as the instrumental factors. This is in contrast to mathematical models such as Christaller's (1966) central place theory or Fujita, Krugman and Venable's (1999) "hierarchical urban system" model[26], where the tension between the cost of location and transport costs creates sites of economic concentration at regularly spaced intervals, with cities of similar economic size dominating territories of similar geodesic area (Christaller, 1966; Fujita, Krugman, & Venables, 1999). This may be appropriate for explaining the distribution of a hierarchy of small and midsized towns across a continuous territory such as a subnational region, as Christaller does in southern Germany or as Fujita, Krugman and Venables do for the American Midwest. But this does not make as much sense at the global scale or for large cities. For one thing, it is empirically untrue that the most important "global cities" are distributed at regularly spaced intervals across the globe dominating similar portions of the world's inhabited land mass, even taking into account large uninhabitable areas such as oceans and deserts. The two most important "global cities", London and Paris, are separated by less than 400 kilometres, where the models would surely argue for them to

[26] This is not to repudiate all models presented in *The Spatial Economy* (Fujita, Krugman, & Venables, 1999), only those which insist upon agglomeration economies sited at regularly spaced intervals.

be on opposite sides of the globe, and half of the cities constituting the global core are packed into Europe, with very few in East Asia or South Asia where half the world's population lies and where half of the world's core cities should be according to the regular-interval models.

Rather, it is another application of agglomeration that is more appropriate here. In various literatures, including the geographical economic literature that Fujita, Krugman and Venables are a part of, an important role that agglomerations play is to increase opportunities for fruitful exchange between actors, particularly enabled by the possibility of face-to-face interaction (Storper & Venables, 2004). But this phenomenon has little to do with the geodesic distances between such sites or the uniformity of their distribution across the globe. We may say that agglomeration creates sites within which space and time are compressed, where firms are drawn together into geographic proximity (spatial compression) so as to increase the frequency of their interaction (temporal compression), which would appear to be a more convincing set of motives than the weighing of transport versus rent costs. This also puts the emphasis on time more than on space: agglomeration reduces the amount of time required for and between interactions, whereas reducing the amount of space between agents is merely a means to that end. Likewise, the sites where agglomeration occurs appear to be chosen much more by time than by space, or in other words they are determined by historical path dependencies rather than by the geodesic distances between them. For example, the two largest "global cities"—London and Paris—arise partly because they are both long-established capital cities of early-industrialising nations and of major former empires. And once again, the fact that even the smallest companies in Lagos are extremely global in their movements is another piece of evidence for the notion that geodesic distance per se is not terribly important, at least in the current phase of globalisation.

What matters is that at various points around the globe, several of the actors that constitute the global network are congregated in extremely small geographic areas, particularly in cities or city regions. If not distance and transport costs, what else may determine the distribution of these sites? This is where we refer back to cognitive and other forms of proximity. While agglomeration by itself is a "force" that attracts all firms towards each other, combined with cognitive, institutional, and other forms of proximity it becomes a force that specifically attracts firms with similar cognitive and institutional groundings towards each other more than firms with very different groundings. Sites of agglomeration therefore are the sites for several of the sectoral, functional and vertically integrated structures produced by the "force" of cognitive and institutional proximity and mentioned above.

The interviews conducted in Lagos help to qualify this picture. Table 7.2 shows the various ways that the different companies have benefited from agglomeration.

Table 7.2 Agglomeration amongst Lagos companies

Company	*Key activities related to agglomeration*	*Key aspect of agglomeration*
First Bank	Creation of subsidiaries and representative offices in major banking centres, including Beijing, Johannesburg and Abu Dhabi, and especially London and Paris	Sectoral cluster
Ecobank	Creation of subsidiaries and correspondent offices in London, Paris, Shanghai and Dubai	Sectoral cluster
Access/ Intercontinental	Creation of subsidiaries in London	Sectoral cluster
"Lagos Bank"	Interaction with correspondent banks through the London offices of each	Sectoral cluster
Citibank	Despite its global nature, interbank lending still overwhelmingly in London	Sectoral cluster
Mainstreet Bank	Liaison with correspondent banks through London	Sectoral cluster
	Majority of trade finance related to manufacturing imports from Guangzhou	Sectoral cluster
Penuel	Uses a representative in Guangzhou to network with manufacturers throughout East Asia also represented in Guangzhou	Sectoral cluster, networking city
Nigachem	Maintains sourcing agents in Guangzhou, Beirut and Dubai scanning international markets for suppliers	Networking cities
Microspace	Microspace's large partner, Glo, could have worked with any company in Africa to launch its expansion across the continent, but partnered with Microspace in Lagos, facilitating communication despite the geographic scale of the project.	Face-to-face interaction
	Division of labour for its electronics brand: components built in Shenzhen, software written in Bangalore, assembly in Munich and Lagos	Sectoral clusters
Tenecé	Location of innovation centre in major university town	Local endowment
Global Corp	Regular conferencing and travel to Dubai and Abu Dhabi to make new contacts	Networking cities
Nigerian Ropes	Integration within the Shoreline Group of companies to create synergies between complimentary sectors	Intersectoral clusters

The majority of these are indeed sectoral—many banks make use of the (huge) cluster of finance sector companies in London, just as some technology companies make use of the cluster of manufacturing sector companies in Guangzhou (also huge). But for some actors, the sectors that dominate the cities they travel to are not the reason they travel there; rather it is because they expect many other actors from other cities to travel there and to meet them at conferences and fairs or simply in passing, in what is here called "networking cities". This accords perfectly with the proximity literature's thinking on "temporary geographic proximity": "The need for geographical proximity (or better, face-to-face interactions) may be realized by temporary co-location (bringing agents together by means of fairs, conferences, business meetings, et cetera), instead of permanent co-location" (Boschma & Frenken, 2010, pp. 123-124; Rallet & Torre, 1999; Torre, 2008). Indeed it also accords with Jacobs' (1969) reading of the role played by the medieval fairs of Europe.

From the perspective of network analysis, this creates an interesting level of complexity. While the sample of activities shown in the table above refer to representatives permanently stationed in key "networking cities", the phenomenon described here alludes to "networking cities" of a much more transient nature. These cities would appear and disappear as nodes in the network at very short order, not necessarily impacting much on the long-term morphology of the network, yet they have played a decisive role in its formation.

7.1.3. Monopoly-seeking

Yet it is very different to talk about networking in sites host to permanent agglomeration economies and in sites which may come and go from one season to the next. The latter phenomenon need not necessarily arise but for a third, centrifugal force pulling firms away from the very attractive efficiencies and opportunities made available in large, permanent sites of agglomeration.

A number of methodological extensions applied in this study have led to this argument for monopoly-seeking as the third force animating the global network of cities. An emphasis on visual methods of analysis rather than on computational methods alone has revealed a family of roles played by cities within the network beyond their simple level of centrality or other measures of importance. Breaking the Lagos network down into a number of sectors (manufacturing, finance, etc.) and relations (operations, suppliers, etc.) helps understand the motives that drive network formation and reveals something of the sequence of this activity.

But perhaps most fruitful is the adding of interfirm ties to the network of intrafirm ties usually relied upon in interlocking world city network models (IWCNMs), revealing a number of features of the Lagos network (and likely of many other peripheral cities) that deserve reiteration. The first is the greater number and diversity of locations connected to Lagos via its interfirm relations compared to its intrafirm relations (at a ratio of two to one); the second is the remarkable directness of these connections (i.e. the lack of intermediaries); and together these produce the third: the overall egocentricity of the Lagos network (Figure B.1). The literature suggests that an economy such as Lagos will likely be oriented around a "regional articulator" (Beaverstock, Taylor, & Smith, 1999b, p. 1872; Friedmann, 1986) such as Johannesburg, or other "global cities" in the core of the network. Here that proves not to be the case at all except in the area of financial markets (Figure B.19, Figure B.25). A fourth feature is the remarkable "globalness" of Lagos' connections (Figure B.3). The small size of firms in Lagos is no impediment to their making connections throughout the world; indeed the smallest firms in the sample exhibit some of the geographically broadest networking patterns (Hunts, Microspace, Tenecé, Global Corp).

This shows that "the tyranny of distance" is not a major factor in the networking activities of small firms even in peripheral regions. The number and diversity of locations connected to Lagos is an important clue; some very specific motive must be driving Lagos firms actively to seek this extraordinary diversity, otherwise why would they engage in what looks like rather inefficient behaviour? In the theoretical review it was posited that an economic theory of the global network of cities must begin with the interactions of economic agents at the microeconomic scale. It should also correctly identify the motives of those agents. The interviews recorded in this study offer one such motive that can be responsible for the scattering of ties observed in the Lagos network. This is that firms are monopoly-seekers, striving to find and occupy new market niches. The majority of companies interviewed had engaged in activities that can be described as monopoly-seeking, including attempting to enter neighbouring countries before their competitors, travelling

internationally to identify new products for the Nigerian market of which they alone would be the distributor, or developing a "solutions"-based sales approach that offers unique sets of products to each client. These are identified in Table 7.3.

Table 7.3 Monopoly-seeking activity amongst Lagos companies

Company	*Key activities related to monopoly-seeking*	*Form of monopoly sought*
First Bank	Attempting to enter specific neighbouring countries before its Nigerian competitors; acquisition of a subsidiary in the DRC	Unique markets
Ecobank	Attempting to become a pan-African bank before its Nigerian competitors	Unique markets
Keystone	Moving into secondary Anglophone countries (Liberia and Uganda) rather than larger markets (Ghana and Kenya)	Unique markets
"Lagos Bank"	Moving into Francophone rather than Anglophone countries	Unique markets
Aiico	Introducing "terrorism insurance" and other new forms of policies to the Nigerian market	Unique products
JNC	Introducing new forms of medical equipment to the Nigerian market	Unique products
Penuel	Becoming a licensed distributor for Hitachi	Unique products
	Entering one Lusophone country after another	Unique markets
Hunts	Introducing new food products to the Nigerian market; attempting to introduce new furniture lines from Brazil	Unique products
Microspace	Focus on "solutions"—different product packages tailored to different clients; pivoting from fleet management to power management technology; attendance at conferences to identify new technology products to bring to Nigeria	Unique products
Internet Solutions	Focus on "solutions"; pivoting from conventional internet service provision to high-end business clients and satellite-based solutions; attendance at conferences to find new technology products for Nigeria	Unique products
Tenecé	Focus on "solutions"; creation of a "centre of excellence" to develop new technology products; attendance at conferences to find new products overseas	Unique products
Global Corp	Organisation of and participation in trade tours to identify new partners and products overseas, pivoting from agricultural consultancy to surveillance technology and efforts to create a market for it in Nigeria	Unique products
Nigerian Ropes	Exploitation of local content rules	Unique products

The table shows that two prominent types of monopoly-seeking activity (among others) can be identified: the seeking of unique products to sell within one's home market, and the seeking of new markets for products already sold to one's home market. These are equivalent to the strategies of diversification and internationalisation discussed in the literature on the growth of the firm (Penrose, 1959; Cantwell & Piscitello, 2000). At the beginning of the life of a firm, the former must happen before the latter, and over time, it is natural that larger companies will be more likely to be seeking unique geographic markets than smaller companies, which are more likely to still be seeking unique products for the home market, as is the case amongst the companies interviewed.

In essence, firms seek to bring together new forms of supply with new forms of demand. Both sides of this equation may have a geographic component. New forms of supply—i.e. new products—may be developed within one's home market through local innovation, but they may also be found by importing existing products from other geographic territories. New forms of demand may be developed within one's home market by identifying and exploiting a need not already satisfied, but they may also be found by exporting existing products into new geographic territories.

This is to say nothing of where those other geographic territories are. All firms may be global in their geographic activity from their very beginning, seeking ties in all regions of the world. As has been said, amongst the companies interviewed the smallest firms were the most global in their networking activities. This also says nothing of whether firms internalise these new opportunities within their corporate structure or not. The geographic ties that may result from these activities may be intrafirm, through the creation of new subsidiaries or branches, or through mergers and acquisitions; or they may be interfirm, through the establishment of partnerships with suppliers, distributors, joint ventures or spin-off enterprises. Once again, larger companies will often be more interested in achieving this through intrafirm ties, while smaller companies will more often be satisfied with achieving this through interfirm ties, as is the case in Lagos.

Apart from its basis in the empirical evidence yielded through the interviews, the monopoly-seeker theory offers an elegant explanation both for the diversity and the directness of most connections observed in the Lagos network. Because firms are monopoly-seekers, they are likely to differentiate themselves from their competitors by pursuing different geographies of connections. This is the "centrifugal force" creating the extraordinary number and diversity of connections observed. And, because firms are monopoly-seekers, they are likely to want to monopolise even their relationships with their connections, to the extent that they aim to eliminate any intermediaries, creating the resolute directness that characterises the vast majority of the connections in the Lagos network, even where both partners are in seemingly inaccessible locations. Thus the monopoly-seeker theory speaks to the most important morphological feature of the periphery observed in this study, which is the overall egocentricity of a city such as Lagos.

If we can believe that the egocentricity and the vast number and diversity of interfirm ties observed of Lagos is true of most other cities also usually considered peripheral to the global network, then it is possible that they are not really peripheral at all, or rather, that they are peripheral when considering the global intrafirm network alone, but may no longer be considered peripheral once the interfirm network is added. However, as the rest of this chapter suggests, there is a reinforcing relationship between intrafirm and interfirm ties, leading one to believe that if there is a core-periphery structure in the intrafirm component, there is likely a similar structure in the interfirm component as well, even if it is less pronounced.

7.2. The growth of the firm

The monopoly-seeking motive drives firms to expand in either or both of two directions—new products and new markets (Penrose, 1959; Cantwell & Piscitello, 2000)—two strategies that are increasingly interrelated in the case of multinational enterprises (Cantwell & Piscitello, 2000). Firms will naturally test a product in one market before attempting to sell it in others; failure to sell a product in one market will likely make a company seek to introduce a new product rather than risk prolonging failure by attempting to export the existing weak product abroad. This resonates with a finding amongst the smallest firms interviewed in Lagos, which is the number of very small firms

that pivot from one product to another (Microspace, Internet Solutions, Global Corp), before settling on one or two product lines with growth potential.

Also, to repeat an earlier line of argument, firms may choose whether to internalise these new opportunities within their corporate structure or not, that is, whether to pursue these directions in such ways as to produce new interfirm or new intrafirm ties. Both types of ties may imply the creation of entirely new business units; both may also imply the exploitation of existing business units only. New intrafirm ties may be created by launching subsidiaries or branch operations; they may also be created by merging or acquiring another company. Likewise, new interfirm ties may be created by launching an independent offshoot enterprise, but may also be created by partnering with an existing firm.

The directions that firms choose produce the different types of firms visible in the data. We may say that firms that concentrate on new products become conglomerates if they internalise these new products. If they do not internalise the production of these new offerings, they become in a sense "importers", bringing in products from external partners and delivering them into their home markets. Likewise we may say that firms that concentrate on new markets become multilocational firms (MLFs)[27] if they internalise these new markets (by launching or acquiring operations further afield), and "exporters" if they do not.

Typically, small firms will have less capacity to pursue new opportunity through internal means. Therefore we should expect small firms to rely more on interfirm ties than intrafirm ties in pursuing new products and markets. This suggests that in the periphery of the global network, interfirm relations play the greater role, whereas at the higher levels intrafirm relations play an increasingly important role. The amount of bias incurred by studying intrafirm relations without simultaneously studying interfirm relations thus decreases as one moves towards the largest scales of the global network, making it more understandable that the IWCNM for the most part chooses to omit interfirm ties when identifying the "peaks" of the global network, and to focus on MNEs to the exclusion of most domestic firms, but less excusable to do so when studying the periphery of the global network. Studying the networks formed by MNEs alone are an expedient way to analyse the core of the global network, but not the periphery, though even in the core this still risks overlooking the largest bundles of interfirm ties in the global network.

Nevertheless MLFs and MNEs, the large families of intrafirm relations they contain, and the even larger webs of interfirm relations that they cast out, are largely responsible for the increasing consolidation of the global network seen through its intrafirm component. There is an interesting combination of the three "forces" at work here. As the network consolidates, the role of the agglomeration force becomes increasingly strong. The various clusters in the network become larger,

[27] The distinction between MLFs and MNEs is not theoretically significant in this model; accordingly the term MLF may be used to include MNEs as well.

more sophisticated, and more specialised, making them increasingly unavoidable as sources of innovation and new product opportunities. The possibilities for obtaining new monopolies by outflanking one's competitors geographically become fewer; MLFs and MNEs must either venture further into peripheral regions (typically known to them as "emerging markets") or must seek monopolies in the creation of increasingly sophisticated and specialised product lines.

These complexities trigger a transformation in firms as they grow. To return to other terms in the literature, MLFs and MNEs begin to separate their Level III, Level II and eventually Level I functions across different locations (Hymer, 1970; Iammarino & McCann, 2013), and the intrafirm networks created by these arrangements become increasingly complex. As suggested below, this increasingly complexity, rather than the capacity for command and control which it implies, is the salient factor placing MLFs and MNEs at the core of the global network.

7.3. Micronetwork formations

It is proposed that the combination of the three "forces" described above offers a relatively simple explanation for the morphology of the global network of cities founded upon microeconomic motives and behaviours, in a way that may be operationalised for further economic research, and, as shall be shown, in a way that generates most of the features identified in this study. But for the purposes of network analysis, this morphology must also be reconstituted from the micro*networks* that these three microeconomic forces imply.

The building blocks of the network are the different geometric configurations or polyads that connect business units within and between firms across different cities. These polyads include dyads (connections between two nodes), triads (three nodes), tetrads (four nodes), and so on.

The simplest and most common polyad is the interfirm dyad between two firms engaged in exchange or partnership. But an enormous amount of energy must be expended just to get to this point. Firms must invest heavily in networking, i.e. discovering, meeting and socialising with the representatives of other firms, gaining introductions into new markets, etc. This often takes place through intermediary firms or in intermediary locations and it is usually vastly more efficient to do so. However, since firms are monopoly seekers, they ultimately seek to engage with those discovered partners directly, without permanent intermediation. Once exploited, the intermediaries are set aside. This is true of any city network: many of the ties observed in the Lagos network formed with the use of intermediaries. This means that the overall egocentricity and diversity in the connections surrounding Lagos conceals a number of intermediaries that have since disappeared. Many will recognise that these intermediaries contribute the "weak ties" responsible for new opportunities in many kinds of networks (Granovetter, 1973). But depending on the method used to describe the network, these intermediaries and the "weak ties" they provide (which are usually interfirm ties almost by definition) may not be captured.

Larger numbers of individual firms may form common partnerships, leading to more permanent interfirm triads, tetrads, pentads (five nodes), etc. As discussed, the various interfirm polyads are most likely to form where a good level of cognitive or institutional proximity exists between firms, leading eventually at the meso level to long chains and large clusters construed along sectoral or functional commonalities.

After the various forms of interfirm polyad is the intrafirm dyad. However the intrafirm dyad is formed, it will still likely be built upon a preceding set of interfirm relations. A new subsidiary or branch may be launched, in which case many interfirm relations will have been called upon to identify the new market opportunity and facilitate entry into it. Or a merger or acquisition may take place between two existing businesses, in which case the intrafirm dyad is likely replacing a prior interfirm dyad between the same pair. But in general we may say that intrafirm ties are typically preceded by interfirm ties. In the global network, businesses scattered across thousands of locations engage in networking geographically to discover partners and new market opportunities, and over time increasing proportions of these interfirm ties coalesce or routinise into intrafirm ties.

Firms comprising intrafirm polyads spanning several cities are by definition MLFs. More complex intrafirm polyads—triads, tetrads, etc.—are possible as MLFs grow. Returning to Hymer (1970), MLFs that have begun to split their Level I and II functions into different cities tend to generate dense networks of interaction between the various Level I and Level II sites, giving rise to these more complex intrafirm structures.

After these purely interfirm or intrafirm polyads, it is possible to have hybrid triads, tetrads or higher polyads that combine interfirm and intrafirm ties, However these are necessarily formed by adjoining one or more intrafirm polyads via any number of interfirm polyads. These arise where two or more separate firms enter into partnership, where one or more of them are MLFs distributing their administration of the partnership over more than one site. For example, a hybrid triad may exist comprising one intrafirm dyad and two interfirm dyads (two intrafirm and one interfirm is not possible), representing one company operating from one site interacting with another company operating from two sites. A hybrid tetrad with one intrafirm dyad may be a hybrid triad with a third independent firm added to the relationship; a hybrid tetrad comprising two intrafirm dyads may represent two firms operating from two sites each, or one company at one site with another company at three sites, etc. The largest polyad encountered in the Lagos network is a heptad (seven nodes) representing Penuel's licensed distributor relationship with Hitachi, where four of Hitachi's European offices (Amsterdam, London, Lyon and Paris) coordinate on ordering and payment processes to supply Penuel's three locations (Lagos, Monrovia and Sao Tomé). Yet even this relationship was originally formed through intermediary agents in New York and Beijing.

To return to some of the terminology of the previous chapter, each polyad has its own measure of degeneracy, that is to say it has its own internal K-value, and the maximum possible K value is one less than the number of nodes in the polyad. A dyad can only have a K-value of one; a triad can have

a K-value of one or two; a tetrad a K-value of one, two or three, etc. The K-values of individual polyads inform the k-values of the cities involved. This has direct significance at the macro level. As firms and their polyads are aggregated together, the geography of the overall global network forms. The k-values of each city inform the K-value of the overall network. Thus complex firm relationships with large K-values (as are witnessed within and between MLFs) produce cities with large k-values, which produce networks with large K values. Thus the higher the K-value of the polyad, the closer the polyad is to the core of the overall network.

This implies that the core of the global network is established by and participated in by the firms that produce the most complex sets of relations, not necessarily by those that exert the most power and control. Thus the k-shell decomposition used in this study identifies cities engaged in relationships of increasing complexity, but not the cities having increasing power and control. This is perhaps better indicated by the roles that individual cities play within the network, roles that are explored in the next section.

7.4. Mesonetwork formations

Overall, the network arises as these various polyads are aggregated at larger and larger scales. This produces the mesonetwork formations mentioned earlier: individual supply chains and value chains that cut across several cities, and clusters of activity within individual cities. This study has not attempted to trace supply chains and value chains, but it has identified a number of types of cities and the clusters they contain, which are laid out here.

7.4.1. Specialised cities

The forces of cognitive and other forms of proximity and agglomeration result in many polyads accumulating within individual cities along sectoral and functional lines. These result in sectoral and functional urban clusters, on which a very rich literature already exists. The largest clusters in a city contribute to the reputed specialisations of that city. And clusters in one city are connected to related clusters in other cities, resulting in a global network which can appear to be composed of several sectoral or functional subnetworks superposed upon each other, as with those discussed in section 4.2. The most prominent clusters in Lagos are in banking, IT and manufacturing; the most prominent clusters to which these are connected are London, San Francisco and Port Harcourt respectively.

7.4.2. Networking cities

As has been indicated, an important role is played by nodes that make the process of networking and discovering other actors for potential partnership more efficient. This has produced actors specialising in introducing firms to each other, and cities specialised in bringing firms together for the purposes of networking. These “networking cities” are thus where large numbers of interfirm

ties are forged, and which therefore may be responsible for a significant proportion of all ties in any network. This is inherently a functional rather than sectoral specialisation, though cities can also specialise in fulfilling this function within individual sectors. Of these networking cities, at least four have been revealed amongst Lagos' connections: London, Dubai, Guangzhou and Beirut. However, if we include cities that are sites for temporary fairs and conferences, we may include several more: Copenhagen, Hamburg, Hanover, Houston, Johannesburg, Khartoum, Las Vegas, Munich, Paris, Taipei, Zurich, and Lagos itself. Cities for which this is their only role in the global network tend to be concealed from IWCNM methods relying on intrafirm data alone for two reasons: first because their role is almost exclusively to catalyse new interfirm polyads, not intrafirm polyads; and second because their role is to catalyse these new polyads and then be removed from the relationship. Those "networking cities" that do feature prominently in the intrafirm IWCNM studies do so because of activity occurring in other clusters and other sectors within those cities. But those that do not feature prominently remain critical for the development of peripheral city economies because they may be wellsprings for some of the most novel, fruitful and innovative relationships between peripheral-city firms.

As was said, the emergence of "networking cities" of a transient nature accords with the proximity literature (Rallet & Torre, 1999; Torre, 2008; Boschma & Frenken, 2010), but it also accords with Jacobs' reading of medieval Europe, where a number of small towns host to famous seasonal trade fairs were instrumental in the growth of trade across the region:

> *"The great medieval fairs of the twelfth century were, of course, immense centers of trade where great numbers of merchants gathered. But the fairs did not become manufacturing centers and they did not become* [centres of innovation] *either. They proved to be ephemeral."*
> (Jacobs, 1969, p. 131)

7.4.3. "Independent hubs" or "lone star cities"

Of the previous two features, "specialised cities" may entail both interfirm and intrafirm relations, while "networking cities" are concerned primarily with interfirm relations. The remaining city types discussed here may also entail both interfirm and intrafirm relations, but because they draw primarily from the first half of this study which like many others has had to rely on intrafirm data alone, they will be discussed primarily in the context of their intrafirm manifestations.

As certain clusters and "specialised cities" grow in their entrepreneurial and productive capacities, they naturally grow very large numbers of ties with the outside world. However, the destinations of these ties are "diffracted" through the monopoly-seeking motive: all the firms in the cluster extend ties to other cities, but each firm tends towards different sets of cities to its colleagues and competitors. The growth of the cluster or specialisation is thus expressed not simply in the number of ties or the value of each tie but in their geographic diversity. This makes of each growing city a "headquarter" or "star city".

But here we encounter a problem of identification. Given the egocentricity observed of Lagos, one may surmise that in fact all cities are “headquarter” or “star cities”, since there is good reason to believe that all cities are as egocentric and as diverse in their connections as Lagos. Further comparative research may ascertain that this is not the case, but on the basis of this study, we cannot speculate further on this issue.

Figure 7.1 The “real estate activities” component of the global network

Figure 7.2 The “human health and social work activities” component of the global network
These graphs are not reported in the atlas because of their low degeneracy (K = 1) but are shown here to illustrate the appearance of embryonic “headquarter cities”.

What we can do is examine this type of formation in the intrafirm component of the network. As the capacity to internalise new opportunities grows amongst certain firms, those firms begin to form intrafirm ties, and some amongst them become capable of forming intrafirm ties across several locations, becoming hubs in overt hub-and-spoke formations, examples of what Markusen calls "hub-and-spoke industrial districts" (Markusen, 1996, p. 303). Figure 7.2 and Figure 7.3 show several of these formations appearing in the midst of sectors whose global intrafirm components are otherwise completely "degenerate" and unreportable, and others are visible in the less degenerate sectoral networks reported in the atlas (for example, Figure A.27, Figure A.33 and Figure A.36).

We can see that to begin with, neither the hubs nor the spokes (or the stars and the "rays") of these networks overlap, which suggests that they are conforming to the implications of the "monopoly-seeking" notion, namely that firms seek out geographically different sets of ties to each other. We may remember this property by referring to cities that host such formations by such terms as "independent hubs" or "lone star cities". Such formations have K values of one, meaning that they have no intrinsic power over their sector (at least none that is apparent from intrafirm data alone), but they set the scene for later and larger formations.

Given that intrafirm polyads are typically produced from prior interfirm polyads, we can surmise that these formations have grown on the backs of interfirm relations between related firms in different cities, or between related clusters in different cities. It may be the case that a "hub-and-spoke" or "lone star" structure typically exists in the bundles of interfirm ties emanating from the cities that become host to intrafirm hubs, though this may not be essential.

However these formations tell us something important about the growth of MLFs generally. It is fairly trivial to say that some intrafirm dyads must exist before intrafirm triads form. But the fact that such hub-and-spoke or "lone star" formations comprising several intrafirm dyads seem to exist before the emergence of any intrafirm triads or higher polyads suggests that such higher polyads form only after these formations have undergone a long period of gestation. MLFs may accumulate large numbers of subsidiary locations or intrafirm ties while retaining this formation, and only then do they become so unwieldy that some of these ties need to be reorganised into more complex intrafirm formations containing triads or larger polyads at the firm level.

7.4.4. "Foothold cities"

Recall that the fundamental tension is between the desire to create monopolies for oneself and the desire to benefit from the economies pertaining to existing sectoral and functional agglomerations. In some sectors or at certain points in their growth, the efficiencies and the economies that have accrued in certain sites of agglomeration begin to win over. These sites begin to attract the attentions of two or more "lone star" firms or clusters, perhaps because those sites are home to large domestic markets that can accommodate two or more competing MLFs, they begin to specialise in

some peculiar function that two or more MLFs wish to internalise, or for other reasons. These may be called "foothold cities", since this is how such firms treat them.

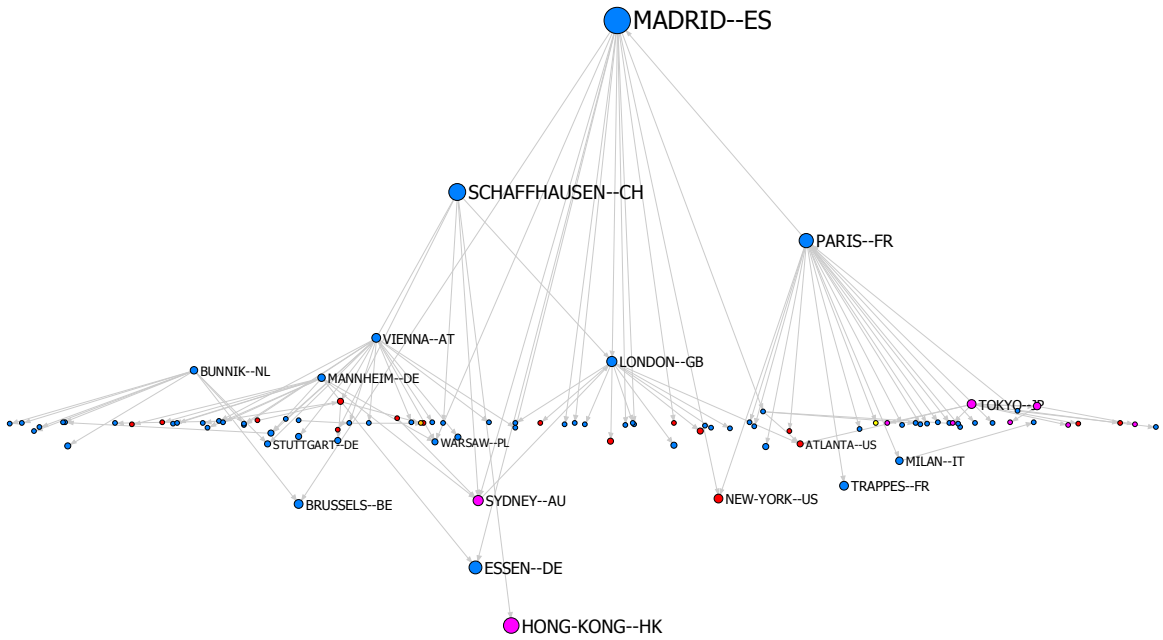


Figure 7.3 "Foothold cities" and "emissary ties" in the construction sector

To illustrate, consider Figure 7.3 (adapted from Figure B.22), in which eight "headquarter cities" and seven "foothold cities" are visible. The eight headquarter cities are Madrid, Schaffhausen, Paris, Vienna, London, Bunnik, Mannheim and Tokyo. It is easy to imagine that each of these were independent hubs or "lone star cities" in the past, though this need not have been strictly true in reality. Several of these headquarter cities have developed subsidiaries in the same cities as other headquarter cities; these are the seven "foothold cities": Essen, Brussels, Sydney, New York, Stuttgart, Atlanta and Warsaw[28]. Ignoring the connections visible between the headquarter cities in the above figure for a moment, it should be noted that the emergence of a "foothold city" between two or more otherwise independent hubs does not result in the creation of an intrafirm triad, and therefore does not increase the level of degeneracy in the network above a K value of one. This means that foothold cities do not by themselves cause the creation of significant power structures across a network, and are not intrinsically powerful places, despite the economies that evidently exist within them.

7.4.5. Emissary ties and "well-connected" cities

In addition to the emergence of foothold cities, Figure 7.3 also shows that some headquarter cities are responsible for subsidiaries in other headquarter cities, for example Madrid has a subsidiary in

[28] Three other cities appearing in the bottom of this graph—Hong Kong, Trappes and Milan—are not foothold cities but simply the sites of prominent subsidiaries.

Paris which has a subsidiary in Tokyo, Schaffhausen has a subsidiary in Vienna, and both Madrid and Schaffhausen have subsidiaries in London. We may call these "emissary ties" since they involve the head office of one large company in a sector locating an "emissary" close to the head office of another large company in the same sector. Emissary ties may exist for any number of reasons. For example two large firms may specialise in different functions within the one sector, and one locates a subsidiary near the other so as to provide it with a specialist service, or avail of such from the other. Perhaps a large pool of talented workers may have formed in the same city as the head office of one company (with causality running any which way), and another company wishes to locate a department there to benefit from that pool, etc. Or perhaps the city has developed such a large domestic market that it can accommodate competition launched against the main company headquartered there.

Like foothold cities, in the absence of more complex connections the creation of emissary ties between two headquarter cities does not result in the creation of an intrafirm triad, and therefore does not increase the level of degeneracy in the network above a K value of one. However a soft form of power may nevertheless be obtained between two headquarter cities with large bundles of "emissary ties" between them, simply due to the size of the operations at their command. And unlike foothold cities, the creation of a ring of emissary ties between *three* headquarter cities *does* result in the creation of an intrafirm triad and therefore does increase the degeneracy of the polyad to K = 2. So does the creation of an emissary tie *and* a foothold city between two headquarter cities. In these cases, these "well-connected hubs" and "well-connected footholds" start to have some observable degree of power. However the power denoted by a K value of two is not significant from the perspective of the whole network, and thus it may be of limited range beyond the immediate purview of these cities.

7.4.6. Core cities

As firms grow, and as MLFs generate increasingly complex internal networks, their location decisions begin to coalesce into the geographies described in the MNE literature, in which different cities begin to specialise in different functions of importance to large cohorts of MLFs or MLEs (Hymer, 1972; Cohen, 1981; Brenner & Keil, 2006). These are effectively the core cities identified in this study. Within this framework, they are essentially a particular category of specialised city, wherein the specialisation is a functional one pertaining especially to one class of firms: MLFs. In a sense, these core cities are merely the sum of their parts, emerging as they do from the simple accumulation of intrafirm polyads. In terms of the three forces, these are places where the agglomeration and cognitive (etc.) proximity forces create efficiencies that overwhelm any desire on the part of MLFs to avoid each other's geographic footprints.

Table 6.41 and Table 6.43 show that these cities are not merely the sum of their parts however. These tables show that core cities, especially in core regions (A cities), contribute a significant proportion of the interfirm component of the Lagos network. It must be imagined then that while

core cities have been identified here by their intrafirm ties, they stand also at the centre of large networks of interfirm ties, directed in and out of peripheral cities worldwide, including Lagos.

Thus, in the background of the MLFs and the core cities their intrafirm networks create, is a vast web of interfirm ties not only between MLFs but also involving single-location firms across a much broader spectrum of cities and towns throughout the world. Whether or not the emergence of an identifiable core in the intrafirm component of the global network is shadowed by a similar core in the interfirm component of the global network has not been ascertained in this study but cannot be taken for granted either way. The comparison of interfirm and intrafirm data available for the Lagos network suggests that a significant component of interfirm activity goes on without regard for the geography of the intrafirm component. On the other hand, several discussions in this chapter suggest that intrafirm ties have been prefaced in the past and are accompanied in the present by a wider ecosystem of interfirm ties. The likelihood then is that the interfirm component of the global network shares a similar core-periphery structure to the intrafirm component, but that this structure is flatter and broader and stretches much further into the periphery of the global economy in the interfirm component.

Thus core cities prove to be important to the MLFs that constitute the intrafirm component of the global network, but important also to smaller firms that populate the interfirm component of the global network, especially in the periphery. On the other hand, the sectoral or functional roles that core cities play for smaller firms is often easily matched to the sectoral or functional roles they play for the larger MLFs. How then should we think of the cities that constitute the global core? First, they are a type of specialised city providing important functions to large MLFs (especially the large MNEs amongst them) especially within given sectors. Second, their specialisations in various sectors and functions attract the interests of smaller firms throughout the periphery, who seek to exploit the opportunities and efficiencies these specialisations create. But third, while these cities are involved in the command and control of the large MLFs, they are not necessarily involved in the command and control of the smaller peripheral firms, which are largely acting on their own volition, as has been observed amongst firms in Lagos.

7.4.7. Outlier cities

Does this do justice to the extraordinary outlying positions of London and Paris in the elevation views of the global network (Figure A.2)? If we continue the line of thinking that "core cities" are simply "specialised cities" host to clusters specialised in providing various functions for large MLFs, then we may also say that the outlier cities who stand at the top of the intrafirm component of the global network (as London and Paris do) are simply "specialised cities" whose clusters specialise in supporting the top-level strategy activities (Hymer's (1970) Level I functions) of MLFs. Likewise, outliers at the bottoms of the elevation views, such as Hong Kong in the global network or Johannesburg in the Sub-Saharan network, are simply specialised cities whose clusters fulfil the

function of enabling MLFs' entry into specific markets, while at the same time being ill-suited to supporting top-level functions themselves.

If this interpretation is accepted, there is in a sense only one type of city in the global network: the specialised city. The specialisations involved may be sectoral or functional; the argument is that all other types of cities identified above are different expressions of these. Headquarter cities are specialised cities from which one or more MLFs have emerged to place footholds in a number of surrounding territories. "Foothold cities" are specialised cities with services of sufficient value to MLFs that they overcome their aversion to overlapping geographically with potential competitors and come to place a foothold. Core cities are specialised cities exhibiting the properties of both headquarter cities and footholds in varying proportion. And outliers specialise in very high-level functions within the hierarchy of the management of MLFs.

Thus the global network may really be just as flat and as broad as the interfirm component implied by the Lagos data, composed of nothing more than specialised cities in the foreground laid across a broad hinterland of relatively unspecialised cities in the background. The graphs of the intrafirm components showing an extraordinary topography of outlying "mountains" and "valleys" (again, as in Figure A.2) might simply be the graphs of each city's propensity for supporting Level I functions, regardless of all the other functions such cities may possess.

We end up with something close to the basic model we started with: the global network is composed of vast numbers of ties between different business units, many of which are bundled together along sectoral and functional lines and clustered in sites of agglomeration (i.e. cities). These sectoral and functional clusters produce the specialisations associated with their cities. Some such specialised cities (such as "networking cities") play roles in the interfirm component; some of them (such as "foothold cities" and "core cities") play roles in the intrafirm component. Yet between the two, a handful of core cities emerge where several clusters in various sectors and functions are hosted alongside each other, largely to serve the large MLFs that dominate the network. Some of these clusters are of value to other actors in the periphery; on other occasions these peripheral actors pursue opportunities in other peripheral locations instead.

7.5. Development at the meso level

Within the context of the model laid out thus far, how should peripheral cities such as Lagos pursue economic development? Or rather, returning to the narrower question posed by this research project, how can they encourage their businesses to grow and expand within the context of such a network? The question can be answered at two levels, with one response based on meso-level features of the network, and another based on an analysis of the macronetwork. At the meso level, the different types of specialised cities catalogued in this chapter present a "menu" of structural roles within the global economy that a peripheral city might choose to aspire towards. On the other hand, the discussions of the different types also suggest that there is a sequence to these roles, for

example, that a city tends to develop a specialisation before it can be of value to MLFs and thus become part of the core of the global network. The recommendations explored in the theoretical review, in which writers such as Borja et al. (1997) propose that peripheral cities should simply aim to insinuate themselves within the flow of global capital and make themselves part of the core that way seems to put the cart a long way before the horse.

At the meso level then, the answer is for a peripheral city to pursue some branch of the family of roles presented here in the sequence in which they have been presented. Using the cognitive base of the city and those of its remote connections, several of the firms within the city must form clusters and develop innovations and efficiencies within some sector or function, creating one or two specialisations for the city. These specialisations may give rise to the city's first indigenous MLFs, whose profits earned from the innovations and efficiencies produced within the city enable it to place footholds in other urban economies. They may also attract the attention of "foreign" firms which come to place footholds within it, not simply to skim profits from the local market but to benefit and perhaps learn from the innovations and efficiencies being produced there. Through these innovation- and efficiency-driven interactions the city begins to secure its role within global value chains, first within its original sector or function, and then in other sectors and functions as its cognitive base and those of its partners grow. Its indigenous MLFs grow into MNEs in every sense of the word. As its innovations and efficiencies grow to enjoy ubiquity in the global economy, generating more and more connections to other cities, the city moves closer to the core of the global network, say, as the San Francisco Bay area has done through the innovations of its IT clusters, or as Guangzhou is doing through the efficiencies of its manufacturing clusters. The important thing in this hypothetical sequence is that local innovation and local efficiencies come first; entry into the global core comes *last*. In effect, what this meso-level analysis is asking cities to do is to become monopoly-seekers themselves, just as their firms are doing, rather than simply seek to replicate economic functions already monopolised by other cities.

7.6. Development at the macro level

If we look at this as a question about a transformation of the network at the macro level, a very different set of possibilities comes into view. These can initially be explained through an abstract block model analysis. The most significant macro-level feature of the network is the core-periphery structure that emerges as the global economy grows very large. Consider the simplest possible block model of this core-periphery structure, as per the following matrix:

$$\begin{array}{cc} & \begin{array}{cc} C & P \end{array} \\ \begin{array}{c} C \\ P \end{array} & \begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix} \end{array} \qquad (1)$$

(Borgatti & Everett, 1999)

Within this notation, C represents the core of the network, P represents the periphery, and the numbers indicate the presence or absence of ties between them. As per the conventional definition of a core-periphery system, peripheral locations are connected to core locations, core locations are connected to each other, but peripheral locations are not connected to each other. Since it helps to unpack this a bit, we can finesse this by introducing values to indicate the relative strength or number of ties within and between each block in a typical core-periphery system, as follows:

$$\begin{array}{cc} & \begin{array}{cc} C & P \end{array} \\ \begin{array}{c} C \\ P \end{array} & \begin{array}{cc} 1.0 & 0.5 \\ 0.5 & 0.0 \end{array} \end{array} \tag{2}$$

The question is: how may the network evolve from this point? And which forces are responsible for what kinds of evolution? From the perspective of the core, these questions are answered very easily. The core is by definition relatively saturated with connections, so geographically the best place for actors in the core to seek new monopolies is in the periphery. Creating additional core-periphery ties produces this block model—

$$\begin{array}{cc} & \begin{array}{cc} C & P \end{array} \\ \begin{array}{c} C \\ P \end{array} & \begin{array}{cc} 1.0 & 1.0 \\ 1.0 & 0.0 \end{array} \end{array} \tag{3}$$

—which reverts to matrix (1) above. Here the actors in the core have engaged in monopoly-seeking. Ostensibly both the core and the periphery may have benefited from this development, though the core-periphery structure is preserved, as is the inequality within the system.

From the perspective of the periphery, the questions should also be answered very easily. Starting again from matrix (2), peripheral locations have two main options for seeking new monopolies geographically. They may form new ties with core locations, in which case they are largely attracted by the agglomeration efficiencies in core locations, though the force of monopoly-seeking may cause them to pursue a slightly different geography of core locations to their peers. If they do, the additional core-periphery ties lead straight back to matrix (3) and thus to matrix (1). Once again, both the core and the periphery may benefit from this development, but both the core-periphery structure and the inequality within the economy remain. Alternatively, actors in peripheral locations may form new ties to other peripheral locations, where opportunities for new monopolies based on new geographic connections are wide open. Here the force of monopoly-seeking is the main driver. These new periphery-periphery ties lead to this model:

$$\begin{array}{cc} & \begin{array}{cc} C & P \end{array} \\ \begin{array}{c} C \\ P \end{array} & \begin{array}{cc} 1.0 & 0.5 \\ 0.5 & 1.0 \end{array} \end{array} \tag{4}$$

Note that core-core ties and periphery-periphery ties now share the same value. This hints at an exciting possibility, which is that as ties form between peripheral locations, these locations as a set

begin to constitute a new, separate network core (Figure 7.4). In this arrangement, the periphery has benefited greatly; the core has not. The core-periphery structure has been eliminated, so too the inequality within the economy. The "periphery" is no longer peripheral at all.

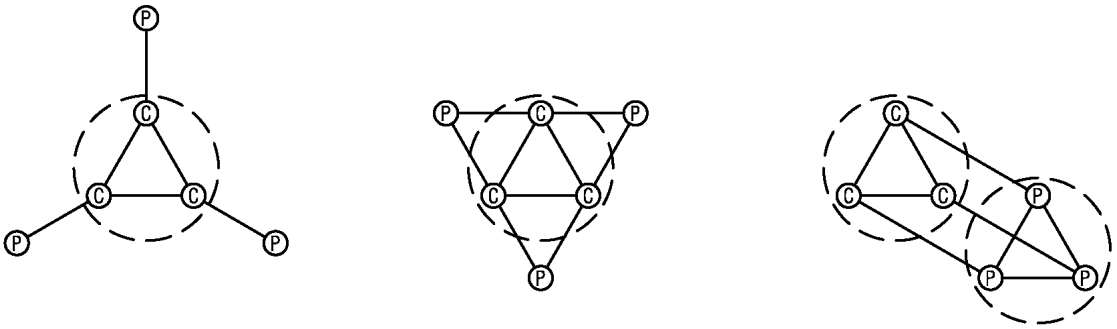


Figure 7.4 Possibilities for network evolution from the perspective of the periphery
Left: A basic network, with three core nodes ("C") shown grouped, with three peripheral nodes ("P") outside them
Centre: The same network with additional core-periphery ties, showing the core of the network unchanged
Right: The same network with additional periphery-periphery ties, showing the emergence of a new, separate core

There are thus two ways for peripheral locations to come into the core. They may seek increasing connections with the existing core, which they must somehow do in such a way that inequality is reduced, which the meso-level analysis suggests is achieved by developing specialisations of great value to firms in the core. Or they may simply circumvent the existing core completely, and by doing so create a new core of themselves, which over time "merges" with the existing core simply by eliminating the difference in status between the two. At the meso level the intraurban processes are likely the same—cities must still develop specialisations—but these will intend to be of value to firms in the periphery rather than to firms in the core.

If the possibility of periphery-periphery connections seems at odds with some two-region trade models, for example some two-region models of comparative advantage, one reason may be that a particular tacit assumption is in play that obscures this possibility from view. Models that concern themselves only with the nature of trade *between* two regions tend not to explore the possibilities for trade *within* each region at the same time. The network implied by this approach is as follows:

$$\begin{array}{cc} & P \\ C & 1 \end{array} \tag{5}$$

Without even the possibility that trade may exist between peripheral locations on the table, the idea that the periphery may join the core *precisely by circumventing it* is unimaginable.

7.6.1. Peripheral cities versus peripheral regions

It was left unsaid whether the previous discussion was arguing for increased interaction between peripheral cities as distinct from core cities, or for increased interaction between peripheral regions

(which the literature sometimes calls “South-South” interaction) as distinct from core regions. In the extremely abstract block models presented here, either might have been the case. However, the data collected in Lagos suggest that it is a subtle combination of both that is at play. To recall, this study has distinguished between four types of cities that compose the global network:

A. Core cities in core regions;
B. Peripheral cities and towns in core regions;
C. Core cities in peripheral regions;
D. Peripheral cities and towns in peripheral regions.

The Friedmann (1986) “world city hypothesis” proposes that the hierarchy of the global economy is thus: peripheral cities and towns in peripheral regions are attached to core cities in peripheral regions (D cities such as Lagos are linked to C cities such as Johannesburg), and they are in turn attached to core cities in core regions (C cities such as Johannesburg are linked to A cities such as London). We may call this an A-C-D model for now.

Table 6.43 showed that overall, and especially with regards to interfirm connections (including supply and knowledge), ties from C cities make up a smaller proportion of Lagos’ connections than ties from A cities and B cities. Instead of the A-C-D model proposed by Friedmann (1986) and Wallerstein (1984), we are perhaps looking at an A-B-D model.

We may imagine this to be true of the global economy overall, that in general D cities tend not to be greatly connected to C cities. Instead, they tend to be connected much more often directly to core regions, both to core cities (A cities) and peripheral cities (B cities) within them. They also tend to be very well connected to other D cities within their own region. When we break this down into the various functions, we see that D cities connect “upstream” to A and B cities (especially for supply and knowledge) and “downstream” to other D cities (operations). Thus a city such as Lagos tends to act as a funnel: through its businesses it identifies value either in core cities or in peripheral cities and towns in core regions, and funnels them into value for peripheral cities and towns within its own region.

The Friedmann (1986) hypothesis has proven to be incorrect. But why should this be? Table 4.11 makes one possible reason very clear. B cities are far and away the most numerous category of city in the global network; C cities are the least numerous. C cities simply do not present sufficient opportunities to the D cities (peripheral cities and towns) within their own regions. It is more valuable for agents in D cities to go straight to A cities than to C cities because A cities present much greater concentrations of opportunity. It is also more common for agents in D cities to go straight to B cities than to C cities because B cities present a greater number of opportunities than C cities.

The simple truth is that there is most likely vastly more interaction going on between peripheral cities (whether in core or peripheral regions) worldwide than we commonly think, and furthermore

that there is most likely vastly more opportunity in encouraging these interactions than we think. If this is so, then the block models presented in the previous discussion are really arguing for increased interaction between peripheral cities as distinct from core cities, not between peripheral regions as distinct from core regions.

Effectively, this is asking peripheral cities and the communities of businesses within them to become monopoly-seekers not just in terms of the role they play within the network as a *node*, but to become monopoly-seekers in terms of the family of *ties* they disperse across the globe, and in terms of the geographic diversity and sheer number of those ties. Since this has already been witnessed in Lagos, this is something that the firms within every peripheral city likely already do; the implication for policy is that this is something city leaders should be encouraging to emerge at the macroeconomic level as well, rather than simply seek to become yet another foothold city in the global economy.

7.7. Evolution of the network

Thus at the macro level, the network is transformed not by the increasing reinforcement of the existing core, but by its destabilisation. The network evolves when actors in different peripheral cities choose to eschew existing core locations and seek to form dense networks of connections between themselves; by doing so, they become the core of a new component of the global network. As these components increase in strength, they become part of the core of overall network by default. In theoretical terms the cities in these new components become part of the existing core simply by emerging adjacent to it, rather than by insinuating themselves within it. In reality, such an occurrence would cause severe disruption throughout the network as actors in the existing core scramble to adjust to the emergence of a competing centre of gravity. Arguably this is what the global economy has experienced in the rise of East Asian economies since the Second World War.

It is over decades rather than years that one should think of these new cores emerging. A number of places in some part of the global periphery must become sites of agglomeration, and develop the social and economic institutions to benefit from their own demographic mass. Within them must form clusters of like-minded enterprises, hives of improvisation and innovation, which gradually produce their specialisations. Their firms must develop the confidence and the capacity to expand into other peripheral territories. They will begin to beckon each other's largest firms to place footholds within them. Over the long term, the sum of innovation occurring in a large number of interconnected peripheral cities has the capacity to drive the next generation of technological revolution, to produce the "leading sectors" of the next wave of the global economy. Here finally is a model of the global network as Wallerstein and Jacobs imagined it—a dynamic and unstable system in which teams of "backward cities" innovate and develop together, in circumvention of the existing core, growing "strong enough to impose themselves as new core powers" (Wallerstein, 1984, p. 7), and enjoy a brief moment of hegemony before the next team of "backward cities" emerges from the periphery.

Chapter 8. Conclusion

What is the role of the global network of cities in the growth and expansion of firms in peripheral cities in peripheral regions, such as the case of Lagos? To answer this has required us to go so far as to build a model of the formation and evolution of the global network. This theory has three pillars, or in other terms is composed of three countervailing "forces", one "centrifugal", the other "centripetal". The "centripetal forces" are cognitive (and other forms of) proximity, which causes firms to connect along sectoral and functional lines, and agglomeration, which causes firms to cluster in cities (especially firms already connecting along sectoral and functional lines). The "centrifugal force" is the motive of monopoly-seeking, which acts to disperse not the firms nor the cities but rather the ties pertaining to each firm and city (whether in the core or the periphery) across an extremely diverse geography of other core and periphery locations.

These forces produce a global network punctuated by five types of cities: specialised cities, networking cities, headquarter cities, foothold cities, and core cities. In reality four of these are just particular types of specialised cities: networking cities are cities specialised in facilitating introductions between firms, headquarter cities are specialised cities that generate large numbers of outgoing ties, foothold cities are specialised cities that attract large numbers of incoming ties, and core cities are cities that specialise in various sectoral and functional inputs of value to MLFs, MNEs and related firms. In this framework, what the literature usually calls "global cities" are here understood to be core cities, i.e. cities specialised in inputs of value to MLFs and MNEs, and the most "vertiginous" of these, such as London, Paris, Tokyo, Dallas, San Francisco and New York, are understood simply as cities specialised in inputs related to their top-level strategic direction.

The network is governed by the tension between the desire to seek new monopolies in new territorial markets and the desire to benefit from the efficiencies and the concentration of opportunities provided by existing sites of agglomeration. It is in the context of this tension that the role of the global network of cities in the development of peripheral cities and regions should be understood. On the one hand the global network provides peripheral actors with access to networking cities and other specialised cities through which they may meet new partners, acquire new knowledge, and discover new products and suppliers to bring to new markets. On the other hand the global network is also a source of competition, through which firms may seek to invade and disrupt each other's markets with new and better products.

The opportunities for the growth of peripheral cities and regions are also understood within this framework. On the one hand and at the meso level, a peripheral region or the cities within it may seek to benefit from participation in the core of the existing global network by establishing city specialisations which create value for MLFs, MNEs and other firms reaching them through the network—in micro terms by creating new core-periphery connections—though it is unclear that this will significantly reduce the regional inequalities inherent in the existing network. This is an improvement on the recommendations made by Borja et al. (1997) in which peripheral regions and

the cities within them should seek to attract MNEs but do so not by providing them with valuable inputs but by providing them with the physical and commercial infrastructure necessary for them to relocate some of their functions to those cities.

On the other hand and at the macro level, a peripheral region or the cities within it may seek to circumvent the core of the existing global network by establishing urban hubs or "headquarter cities" that dominate peripheral areas beyond the purview of existing MNEs—in micro terms by creating new periphery-periphery connections—a path which is consistent with Jacobs' (1984) thesis on the development of "backward cities" and theoretically more likely to reduce regional inequalities inherent in the existing network.

This latter path is also more consistent with the evolution of the global network over the *longue durée* as proposed by Braudel (2002) and especially Wallerstein (1984) (despite the A-B-D geography described here differing from the A-C-D model Wallerstein theorised), in which existing core cities become locked into existing forms of production, while new centres of innovation and new industrial sectors emerge in peripheral and semi-peripheral regions of the network, in time becoming the core cities and regions for the next generation of the global economy.

8.1. Original contribution

The main original contribution to knowledge comes about through the discovery of the number, the diversity, the globalness and the directness of Lagos' intra- and interfirm connections, especially to other peripheral cities both in core regions and peripheral regions. This produces the realisation that the hierarchy of cities predicted for the world's peripheral regions by Friedmann's (1986) "world city hypothesis" is incorrect. Peripheral cities in peripheral regions are not simply articulated into the global economy through the core cities within their own regions, such as Johannesburg in Sub-Saharan Africa, Mumbai in South Asia, or Sao Paulo in Latin America, even if MNEs tend to use such cities as gateways into those regions. Rather, peripheral cities in peripheral regions are articulated into the world economy in part by their great number of direct connections to core regions, both core cities in those regions such as London and New York and peripheral cities and towns in those regions such as Pingdingshan or Izmir. Peripheral cities and towns in peripheral regions are also highly connected with each other.

From these empirical facts and theoretical deductions, other observations flow. One is the general egocentricity of the Lagos network, the fact that it is largely centred on Lagos itself rather than any other city, for example a "global city" such as London or a "regional articulator" such as Johannesburg, except where relevant for individual sectors or functions related to individual firms in Lagos. Another is that the role "global cities" play in the global economy is real, but somewhat limited to the roles they play in the management of multinational business, and to the sectoral and functional specialisations they develop in relation to those roles. The opportunities and efficiencies they offer within those sectors and functions are sought by actors in peripheral cities in peripheral

regions, but this does not give actors in the "global cities" themselves undue control over their counterparts in these peripheral locations.

Going in another direction, the diversity of connections observed around a city such as Lagos leads to a search for what motivates such behaviour, which leads to the identification of monopoly-seeking as an important "centrifugal force" driving firms to seek geographically differentiated sets of ties to other core and periphery locations. In another direction is confirmation that periphery-periphery ties, as opposed to core-periphery ties, are an important component of economic activity and economic development in peripheral cities and regions overall. And this begins to provide evidence for Jacobs' (1984) thesis that economic development or rather the specific process of business growth and expansion within it is driven by the formation of connections between peripheral cities in peripheral regions, and ultimately for Braudel (2002) and Wallerstein's (1984) thesis that new core cities emerge in the periphery and semi-periphery at the expense of, rather than to the benefit of, existing core cities.

8.2. Limitations

A number of limitations arise in the design of this research project and the acceptance of its findings. The first major limitation is the inability to count the different types of ties between different types of cities in the global network (A-D ties, B-D ties, C-D ties, etc.). To explain: one of the key findings is that in the Lagos network, B-D ties—ties from peripheral cities in core regions to peripheral cities in peripheral regions—proved to play a larger role in providing cities such as Lagos with new supply and knowledge opportunities than C-D ties—ties from core cities in peripheral regions to peripheral cities in peripheral regions. This could be established by counting the different types of ties in the Lagos network data, which could be done because the different types of relations had been encoded by hand. However this was done only after several months of analysis of the Lagos network data had finally pointed the research effort in the direction of this particular exercise.

The ideal approach would have been to go back to the global network data and count the different types of ties in those matrices. However, not being able to predict the future, the global network matrices had been constructed two years earlier according to other imperatives, notably relating to the limitations of the *Ucinet* (Borgatti, Everett, & Freeman, 2002) software, and the limitations imposed by the construction of the *Orbis* (Bureau van Dijk, 2011) database, as discussed in the methodology). These imposed limitations caused the global network matrices to be constructed in a manner that precluded the differentiation of the various types of ties. Specifically, in an effort to pare down the number of relations that the software had to handle, and because of the fact that the explicit hierarchy of subsidiaries pertaining to each independent company were not efficiently accessible through the database, the intermediary relationships between different levels of subsidiaries within each corporate hierarchy were flattened. All subsidiaries, whether one, two or three steps removed from their ultimate parent, were attributed to the ultimate parent alone. At the time, simplifying the datasets in this way allowed them to extend further into the periphery of the

network, another important imperative. By the time that the significance of this error in the design of the global network matrices had been realised, it was no longer practical to go back and reconstruct the global network datasets in a more appropriate manner, with all the iterative and exhaustive testing that this would have required as described in the methodology.

To be clear, this limitation does not apply to the construction of the Lagos network data, and the findings with regard to the different types of ties and their role in the activities of Lagos firms are unaffected by this limitation. What it limits is the ability to determine to what extent the geography of the global network (whether as determined by intrafirm ties as done here or by intrafirm and interfirm ties together) corresponds to or contrasts with the geography of these different types of ties within the Lagos network. Also, while it is clear that this limitation may have biased the findings of the global network analysis, one cannot presume to know in which direction this bias may have fallen. One may imagine from the "global cities" literature that the failure to sufficiently capture intermediary cities caused the role of C cities—core cities in peripheral regions, such as Johannesburg—to be underestimated. Yet from the outcomes of the Lagos data which was not affected by this limitation, one may now also imagine that this failure caused the role of B cities—peripheral cities in core regions, such as Pingdingshan—to be underestimated.

Another limitation in the construction of the global network datasets that did not become clear until the Lagos network analysis had neared completion was the inability to differentiate between different types of themes or functions (supply, knowledge, capital, etc.) in the global network data, which would have allowed for more finely resolved comparison between the various functional roles played by cities in the Lagos network and those played by cities in the global network.

Another limitation was clearer at the time the global network data was constructed, namely the inability to capture interfirm ties as extensively and as efficiently as intrafirm ties. It has been theorised based on an analysis of the literature and of the qualitative findings that interfirm ties and intrafirm ties impact upon the geography of control in the global network in different proportions in the periphery compared to the core. Further research that can incorporate interfirm ties much more extensively will be able to test this proposition much more satisfactorily.

Subsequent phases of research produced other major limitations. The small number of firms interviewed in Lagos limits the significance of the qualitative findings and the findings of the Lagos network analysis. To be fair, there was a lot of consistency in the themes arising in the interviews across most companies in each sector, which offers a degree of confidence in the findings relating to the geographies of these sectors. But further probing into other sectors whose actors did not make themselves for interview, in particular oil services and distribution and fast-moving consumer goods manufacturing, may have produced a geography far more dependent on the functions carried out by agents in core cities, whether in core regions (e.g. London) or peripheral regions (e.g. Johannesburg). Further research is required to determine whether or not other sectors emphasise the same geographies as the sectors successfully investigated here.

Finally, the propositions relating to peripheral cities in peripheral regions have been made on the basis of one city alone: Lagos. At the beginning of this study it was felt necessary to conduct a rich, intensive enquiry into a single city; in further research it will be more appropriate to turn this into an extensive enquiry into a wider number of cities, now that the research question can be more narrowly confined to the specific themes emerging in this study. But for now the proposition that B-D ties play a larger role than C-D ties in the economies of D cities must be treated as a hypothesis for further cross-sectional investigation.

8.3. Implications for future research

A number of areas where the methods used in this study can be improved in subsequent research have been indicated above. It will be necessary to expand the interlocking world city network model (IWCNM) methodological toolkit to include the various parameters that this study has begun to include: interfirm relations, smaller firms, domestic firms, firms of all sectors, datasets using different threshold criteria to investigate the periphery of the network, and datasets differentiating various types of geographically patterned activities or functions including those relating to operations, supply, demand, technology, knowledge, capital and trade finance, and networking. It will be necessary to replicate in several other cities the qualitative research undertaken in Lagos to identify whether the number and diversity of periphery-periphery ties and the resulting egocentricity of the Lagos network, upon which much of these conclusions are founded, really are typical of peripheral cities in peripheral regions, or whether Lagos is something of an exception.

Another observation made in the course of this study deserves much more attention in future research than could be given to it here. It was suggested that the intrafirm and interfirm components of the global network will exhibit significantly different geographies, in particular that intrafirm ties are increasingly important towards the core of the global network, while interfirm ties are increasingly important towards the periphery. This goes beyond the mere geometry of ties, to the question of control and coordination. The manner in which small and medium enterprises in Lagos organise lines of supply throughout core and peripheral cities in core regions in their efforts to bring products to market in West and Central Africa suggest that much more activity throughout both the core and the periphery may be driven by such firms in peripheral cities than we currently imagine. Future research will need to extend existing methods and data sources to determine the truth of these propositions.

If this work progresses and the findings put forward in this study gain greater acceptance, it should become fairly easy to integrate these and subsequent findings with the literatures on innovation, industrial clusters and regional science, from which these findings draw much inspiration and with which they share a common language in concepts such as domestic firms and MNEs, intrafirm and interfirm relations, cognitive and other forms of proximity, clustering, agglomeration, city specialisations, and the diversification and internationalisation strategies of firms.

However it will be much more difficult to integrate these and subsequent findings with various mainstream economic models of trade, including many models of comparative advantage, which demand that peripheral or "global south" cities and regions seek economic development specifically by pursuing further connections with core or "global north" cities and regions, especially two-region models constructed so as to be unable even to imagine the possibility of periphery-periphery or "south-south" ties. One way in which these two positions might be reconciled (and indeed learn to speak the same languages of network and matrix analysis) is by advancing research efforts involving the decomposition of trade matrix data, which can be used to identify patterns in the chronological and geographic expansion of trade emanating from low- and middle-income countries (and cities) as they develop. Two studies which hint at this possibility are Evenett and Venables (2002) and Zahler (2011), which suggest that cognitive and geographic proximity play a role in the spread of developing countries' exports from one destination country to another. Further studies along these lines may demonstrate that developing countries grow through trade amongst each other in a similar manner to that predicted by Jacobs (1984) and in contrast to the manner predicted by two-region and other comparative advantage models. It may also be useful to retain the insight that while developing countries may eventually arrive at a geography of trade which matches that predicted by comparative advantage models, they may in the meantime progress through geographies of trade that appear to be in conflict with those predictions. General equilibria of trade—if one believes that such phenomena exist in the real economic world—may be found to be reached by very indirect means.

Finally, an area where the technical aspect of city network research can be advanced in the future is in marrying purely descriptive network analyses with spatial econometric techniques (involving the use of weighting matrices derived directly from the network matrices rather than estimated or assumed) to test hypotheses of the economic impacts of specific geographies arising within the network on the wider global economy, within an experimental paradigm.

8.4. Implications for policy

It would seem that the model of the global network described in this study sets out clear policy recommendations on how peripheral cities and regions might pursue economic development through opportunities for business growth and expansion. Drawing from the meso-level analysis of the network, peripheral cities in peripheral regions ought to encourage interaction amongst its firms, especially those with significant cognitive and institutional proximities, but should also encourage them to interact with other firms (again, especially those with significant cognitive and institutional proximities) in other peripheral cities (both in core and peripheral regions), through the networking opportunities presented by conferences, trade fairs and trade missions, among other activities. This is in line with Rallet and Torre's finding that "nonlocal relations appear as a key factor to develop innovation [sic] [and] should be encouraged by local development policies in the same way as local relations" (Rallet & Torre, 1999, p. 373). The hope is that they will introduce new knowledge to the city's actors, stimulate local processes of innovation and allow the city to develop some area of

specialisation in one sector or function or another that will be of value to other actors in the global economy. Drawing from the macro-level analysis of the network, cities ought to encourage their firms to interact upstream further with firms in peripheral cities in core regions, and to operate downstream further in other peripheral cities and towns in peripheral regions, in order to monopolise the most novel and the most unexploited opportunities around them.

With regards to the current composition of the Lagos economy, the best avenues for these opportunities would seem to be by supporting the banking and IT services sectors in their drive to innovate new forms of financial and technical solutions appropriate to the needs of customers within Nigeria and elsewhere in the region, and encouraging them in their continued push to acquire or launch subsidiaries in other parts of West and Central Africa.

In reality, these recommendations would prove a challenge to much that authorities of cities such as Lagos do policy-wise in pursuit of economic development, often operating under a neoclassical paradigm of seeking growth by securing foreign direct investment, pursued through city branding and image-making, and investments in infrastructure, regeneration and gentrification programmes thought to be attractive to foreign multinationals and the professionals who associate with them. Storper calls this the "playground" model of local economic development wherein economic actors are thought to be attracted by the amenities (or crudely put the opportunities for "play") a city offers, which he calls "misguided" in contrast to the "workshop" model of local economic development wherein economic actors are attracted by the opportunities for innovation and specialisation (Storper, 2013, p. 224), which this study has sought to reinforce.

In Lagos (as in many similar cities) the "playground" approach is manifested by street cleaning and beautification programmes and the forced (and often brutal) eviction of the informally housed on the one hand, and by megaprojects such as the Eko Atlantic land reclamation project on the other. This policy paradigm is reinforced by the advice given by representatives of wealthier nations and their representatives—multilateral organisations such as the World Bank and the Organisation for Economic Cooperation and Development (OECD), development agencies such as the US Agency for International Development (USAID) and the UK Department for International Development (DFID), ambassadors, ministers for trade and economic cooperation, and other miscellaneous economic advisers—often acting under a conflict of interest created by the demands of their own corporations and lobbyists in the real estate, construction and infrastructure industries, that to replicate the wealth of these nations cities such as Lagos must effectively lay down the red carpet for foreign business. It is difficult to imagine the various protagonists of this "development-industrial complex" (Breyman, 2010) coming to tell authorities in cities such as Lagos essentially to ignore the demands of MNEs and other agents that constitute the existing core of the global network, and to seek to create MNEs indigenous to their own regions through the hard graft of innovation and entrepreneurialism (as opposed to other forms of "graft"!). Nevertheless that is the main implication of this research for policy.

It should be mentioned that the policy recommendations made here are not in conflict with the principle—derived from mainstream models of economic growth—that increased inputs of capital from foreign sources will improve productivity in the local economy. The difference is that in the mainstream economic paradigm, MNEs and other firms in wealthy economies are the ones who seek to move capital into developing regions in search of investment and entrepreneurial opportunities, whereas in the policy recommendations made here it is firms indigenous to the peripheral economy who should be responsible for sourcing capital from wealthy economies as need arises to improve their own productivity or to pursue investment and entrepreneurial opportunities that they have identified for themselves. In the end it is not by reinforcing the hegemony of the existing core that peripheral cities and regions shall reduce the economic inequalities present in the global economy, but by finding innovative ways to join together entrepreneurially and circumscribe this hegemony.

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Appendix A. The global network

The following graphs should be browsed in conjunction with Chapter 4.

A.1. The global network (K = 15)

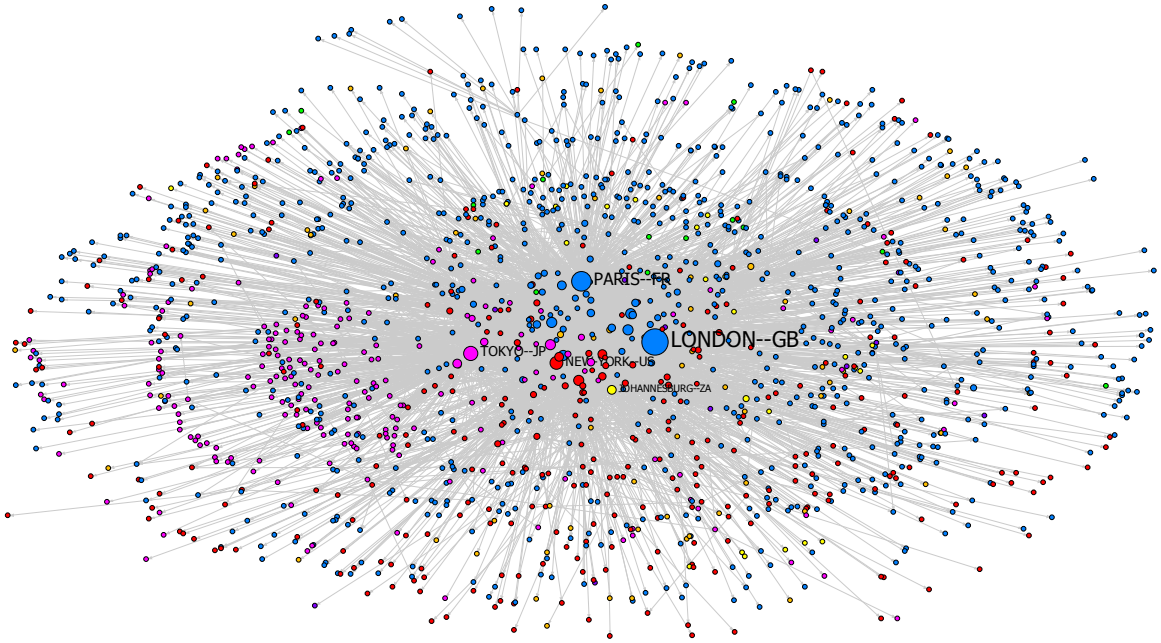

Figure A.1 The global network: plan view

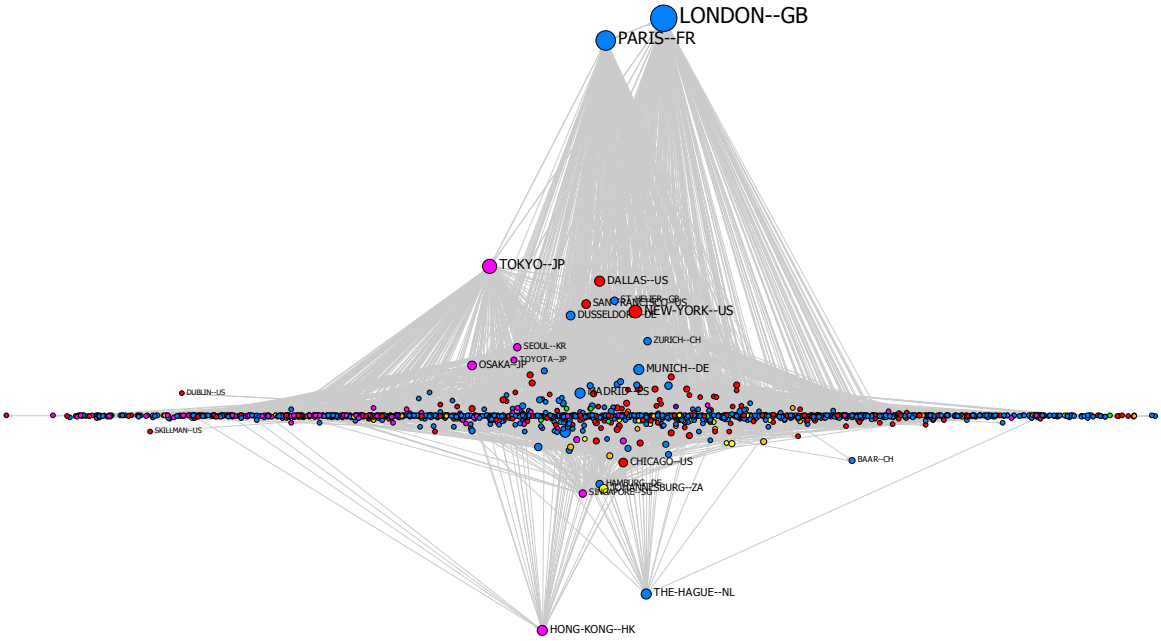

Figure A.2 The global network: elevation view

A.2. Regional networks

A.2.1. Europe and Central Asia (ECS; K = 12)

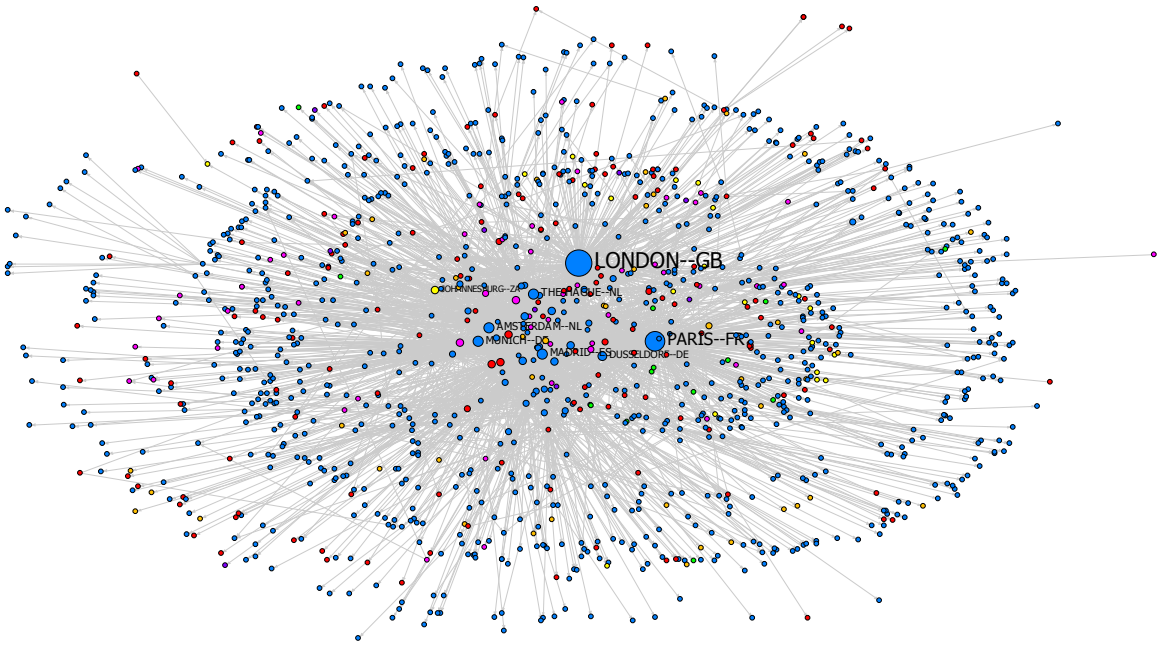

Figure A.3 The ECS network: plan view

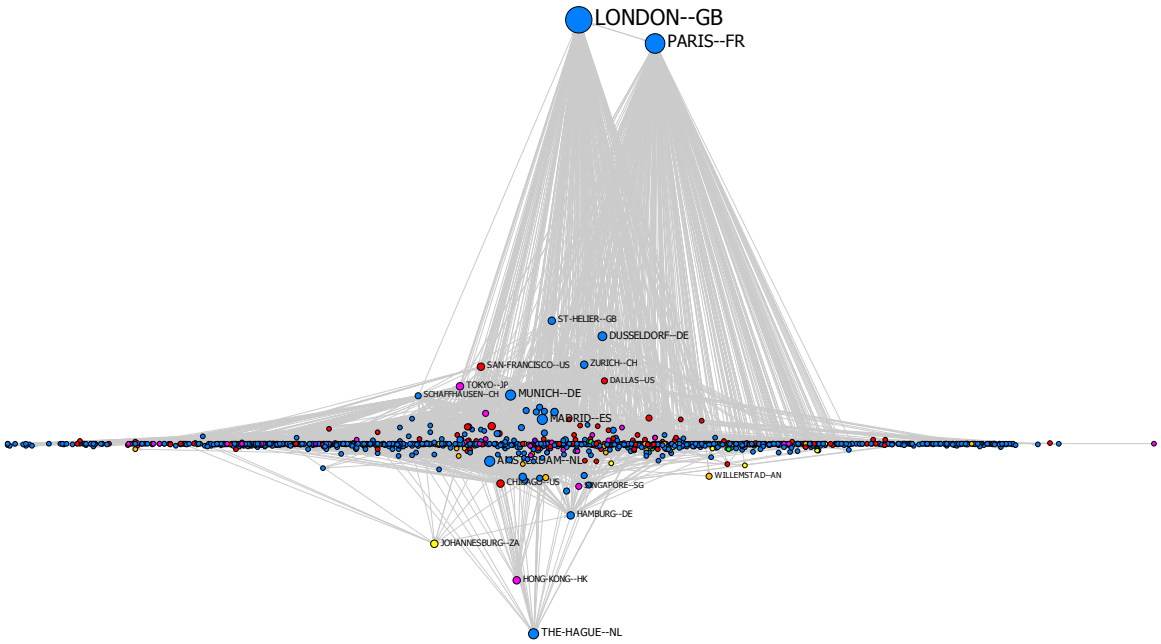

Figure A.4 The ECS network: elevation view

Regional networks (continued)

A.2.2. North America (NAC; K = 9)

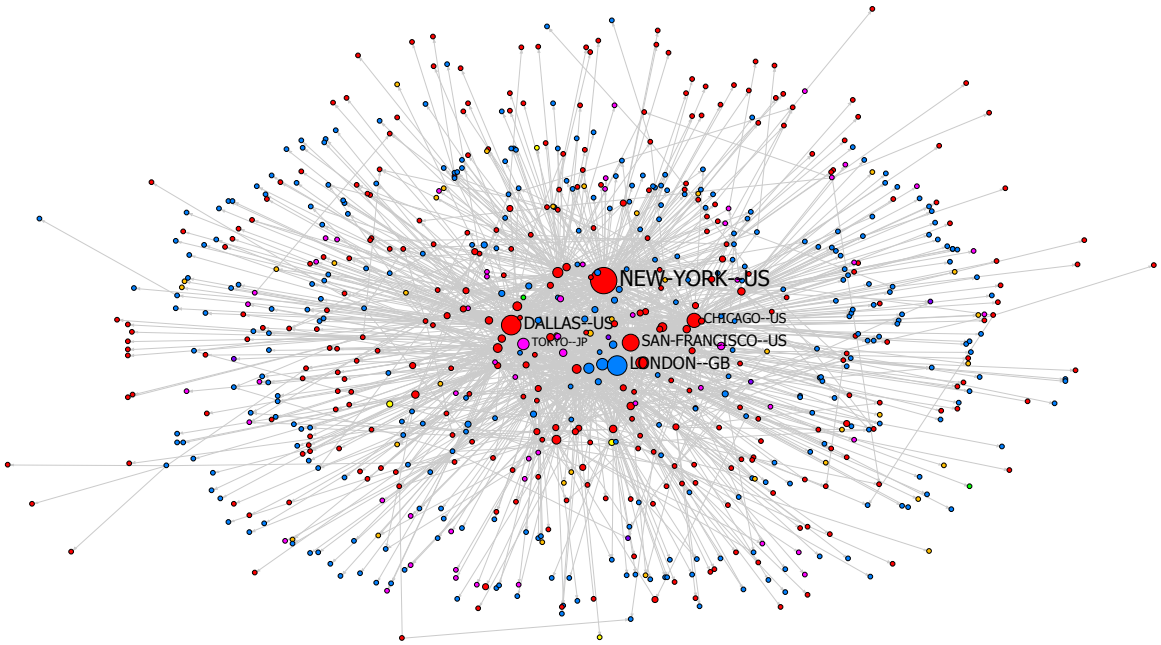

Figure A.5 The NAC network: plan view

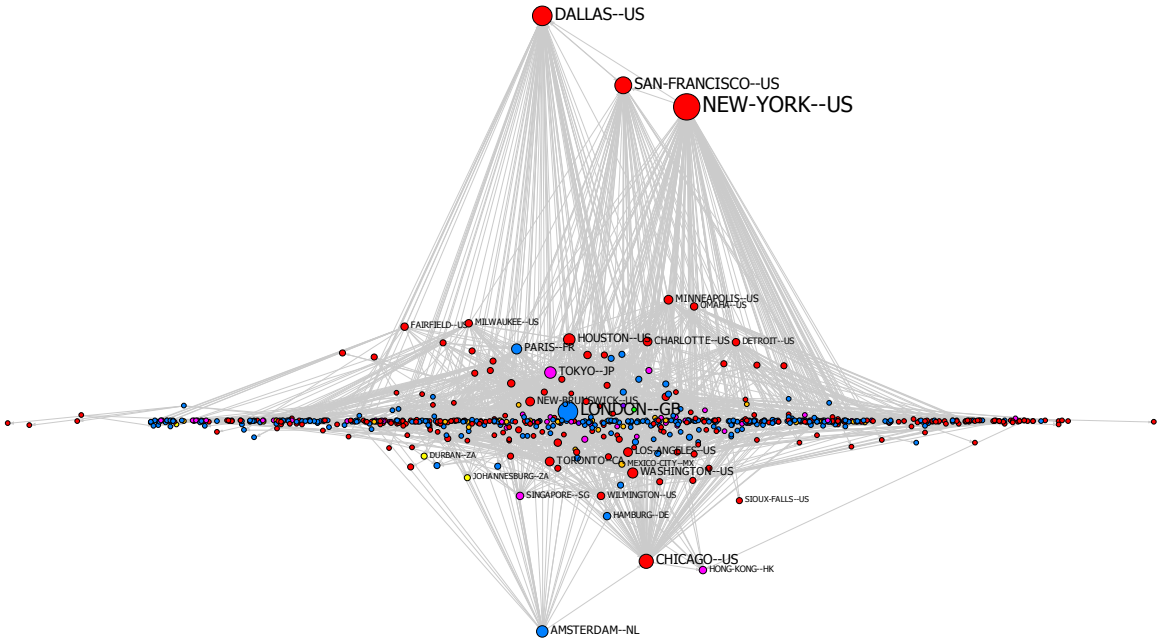

Figure A.6 The NAC network: elevation view

Regional networks (continued)

A.2.3. East Asia and the Pacific (EAS; K = 7)

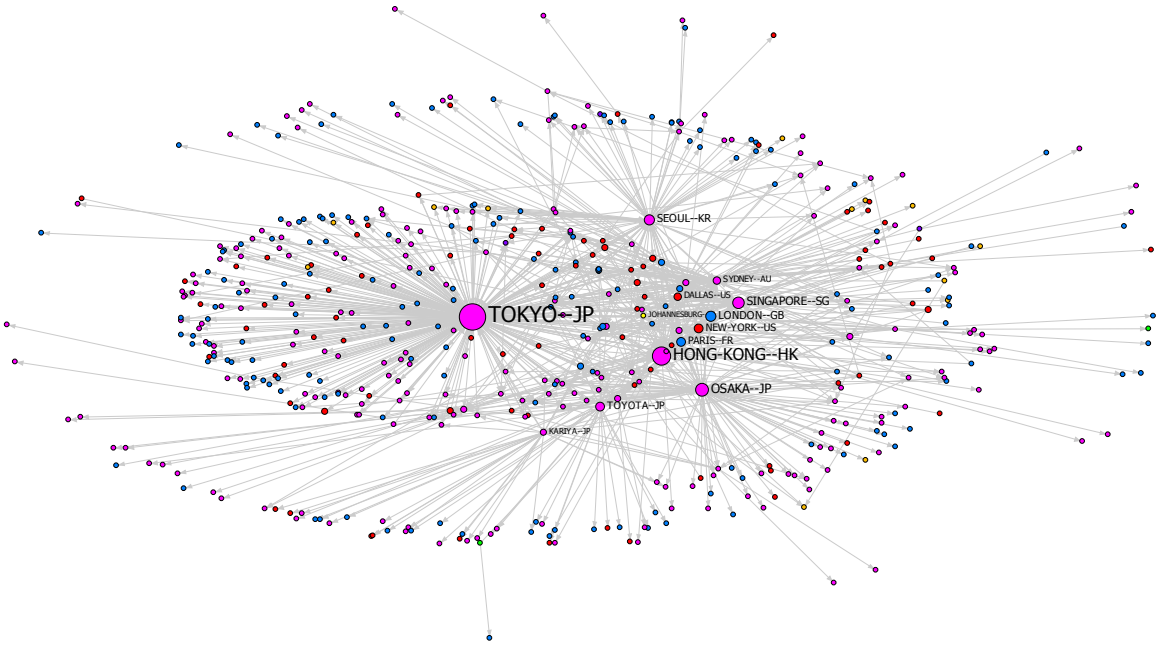

Figure A.7 The EAS network: plan view

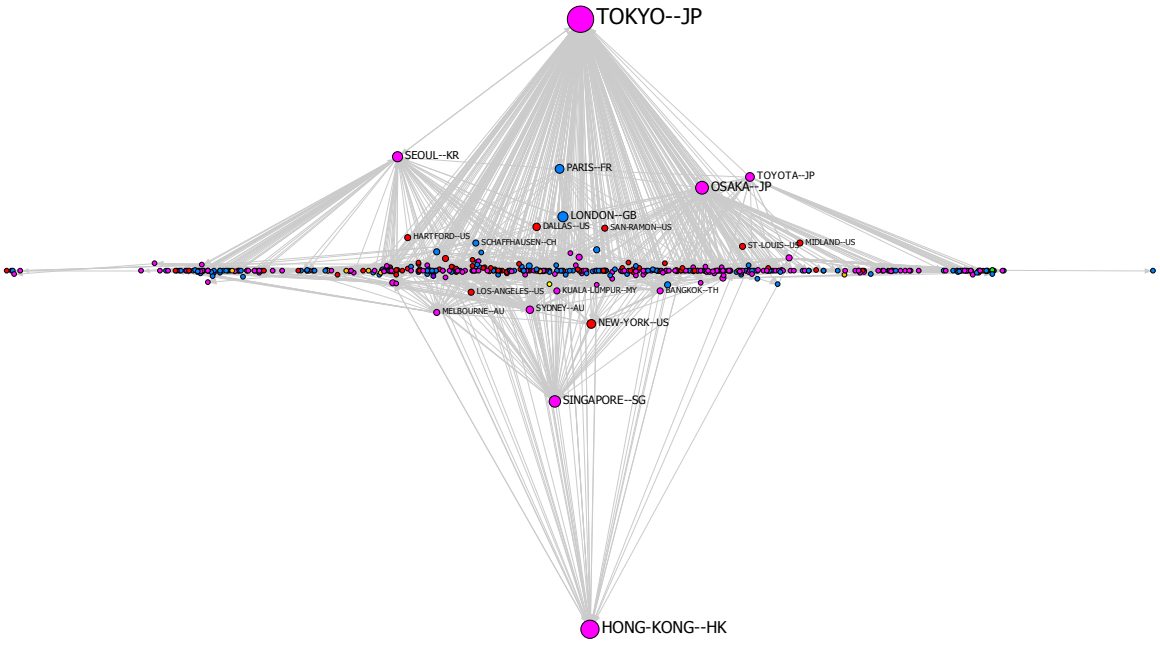

Figure A.8 The EAS network: elevation view

A.2.4. Sub-Saharan Africa (SSF; K = 2)

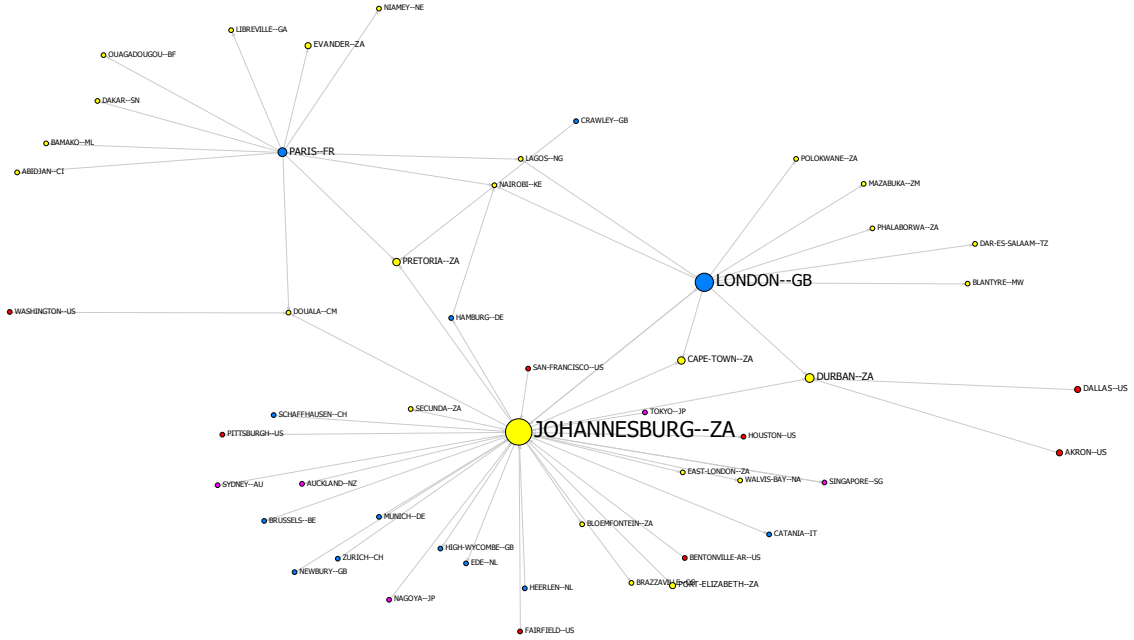

Figure A.9 The SSF network: plan view

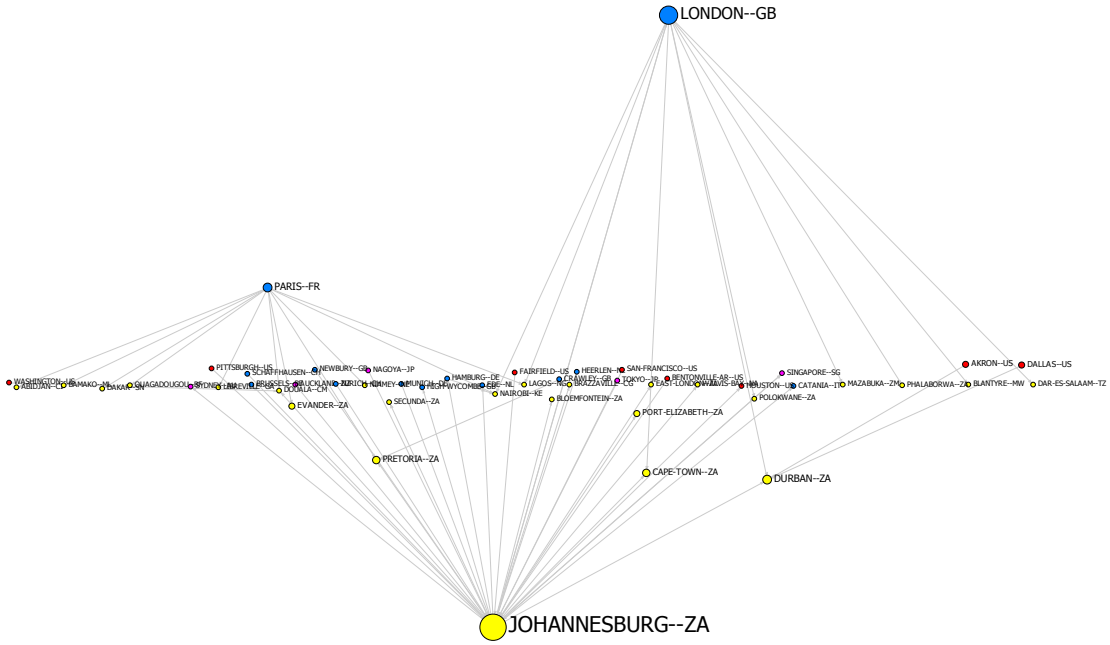

Figure A.10 The SSF network: elevation view

A.2.5. Latin America and the Caribbean (LCN; K = 5)

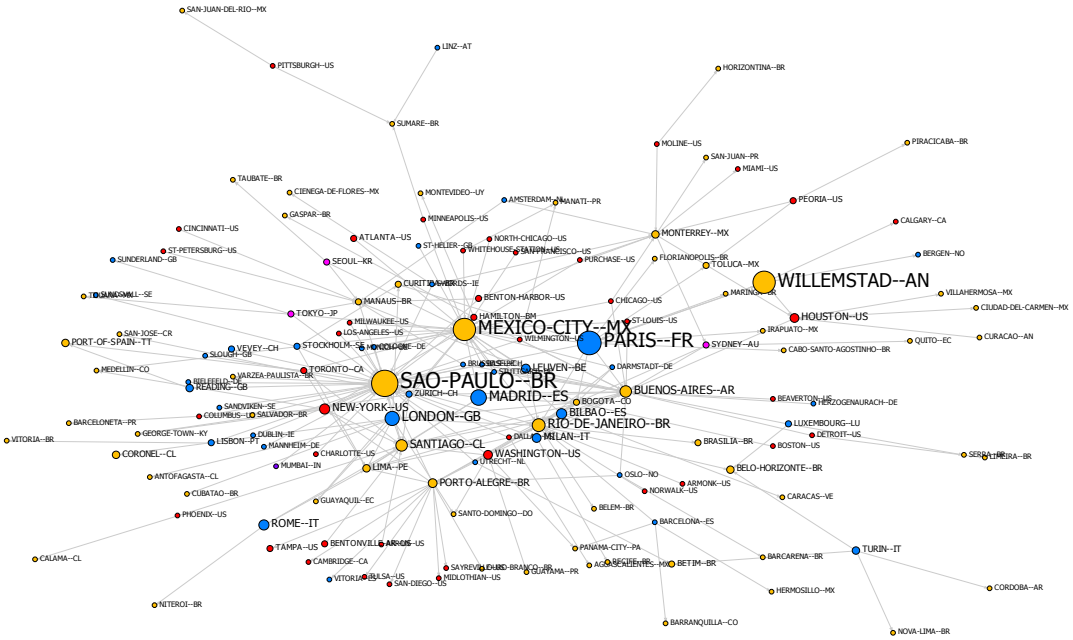

Figure A.11 The LCN network: plan view

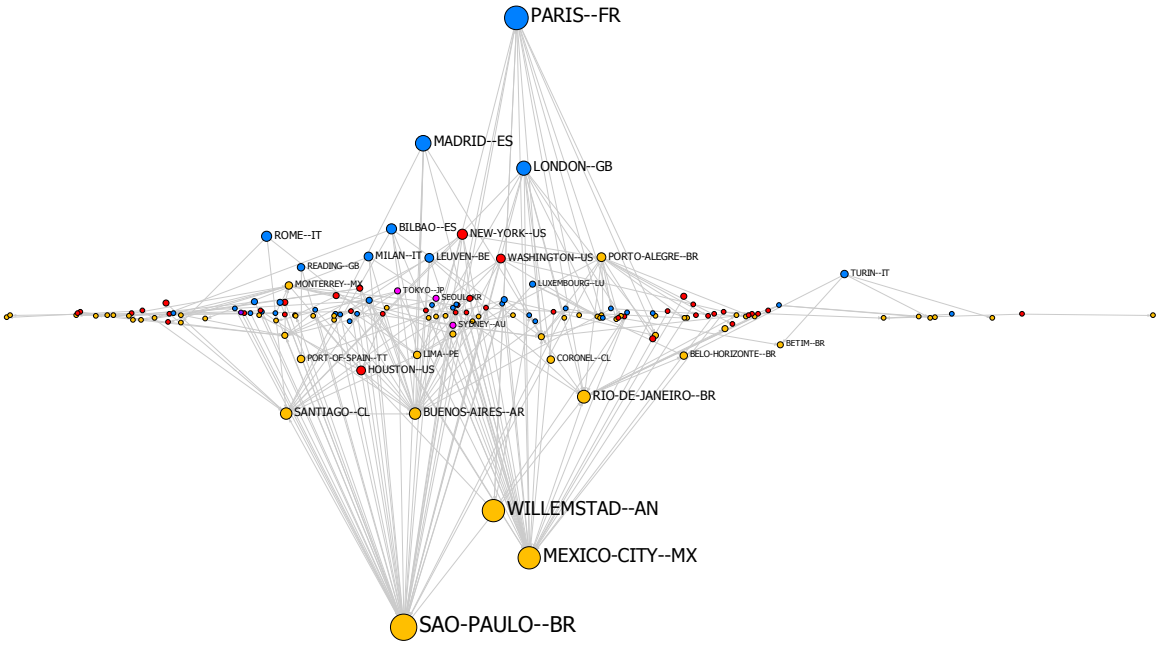

Figure A.12 The LCN network: elevation view

Regional networks (continued)

A.2.6. Middle East and North Africa (MEA; K = 2)

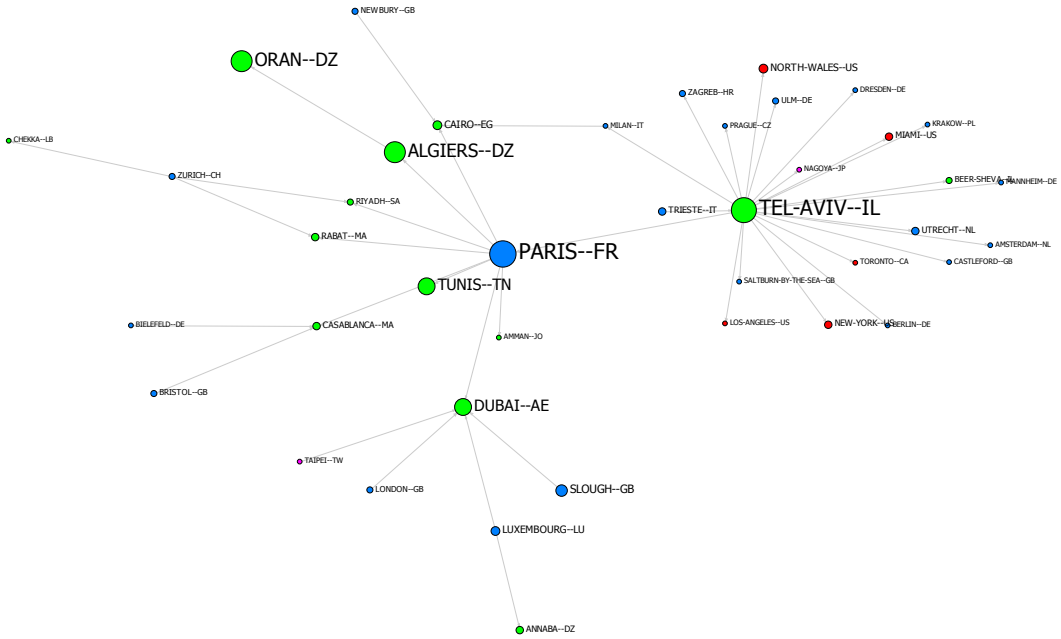

Figure A.13 The MEA network: plan view

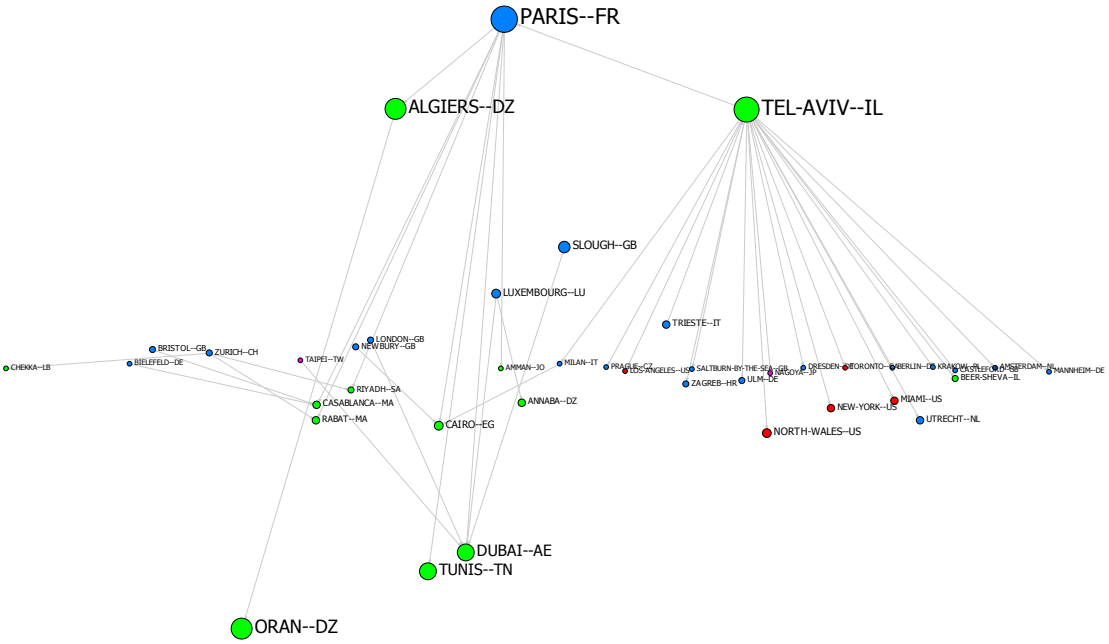

Figure A.14 The MEA network: elevation view

Regional networks (continued)

A.2.7. South Asia (SAS; K = 2)

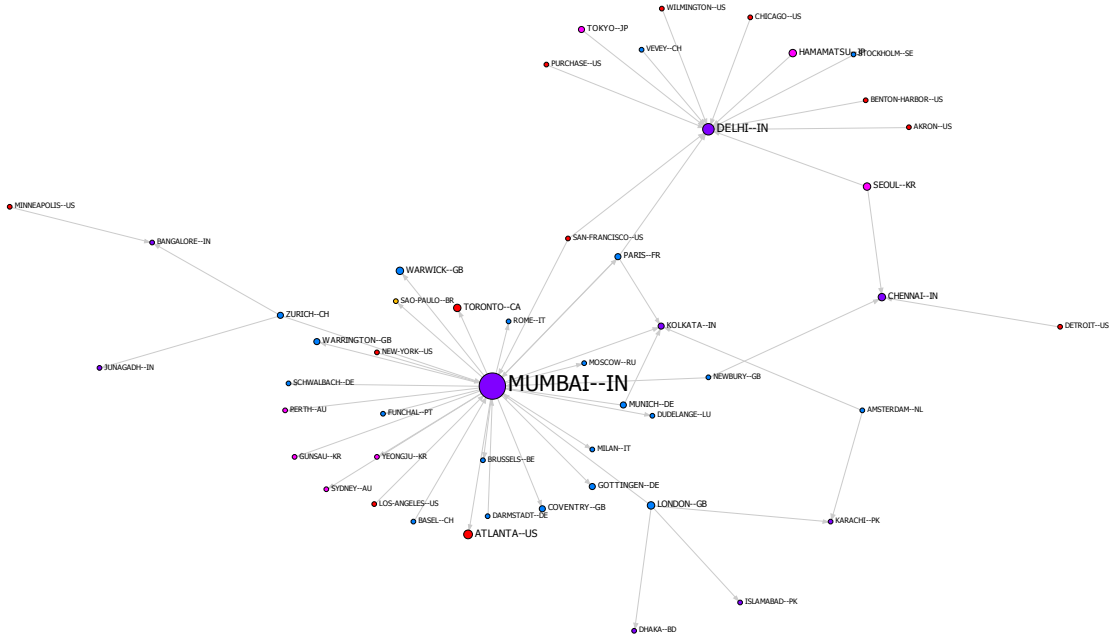

Figure A.15 The SAS network: plan view

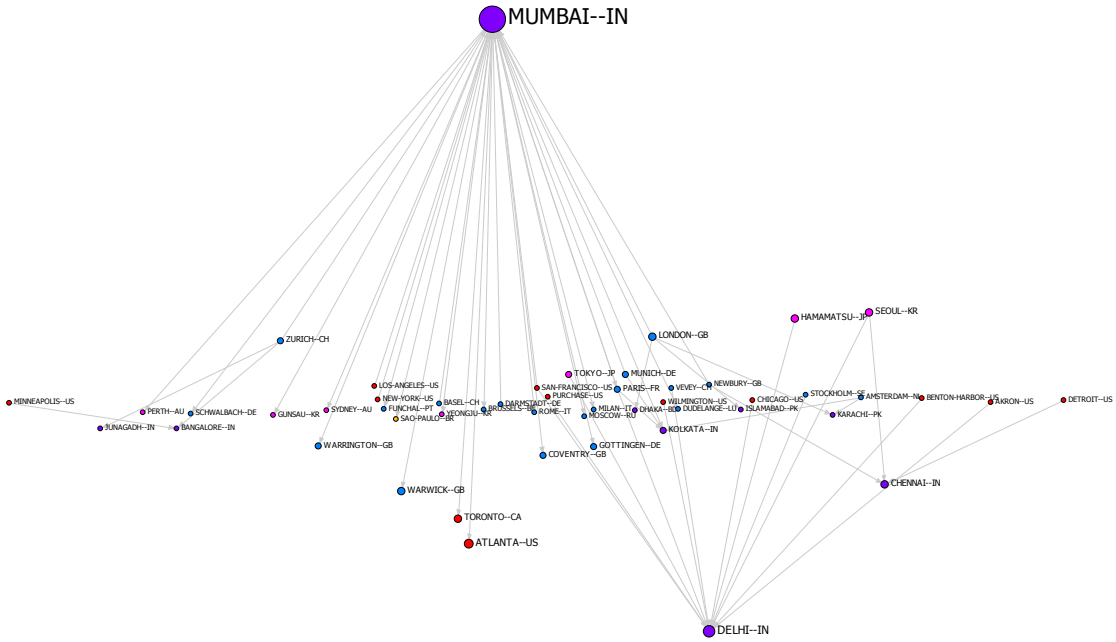

Figure A.16 The SAS network: elevation view

A.3. Sectoral networks

A.3.1. Manufacturing (K = 7)

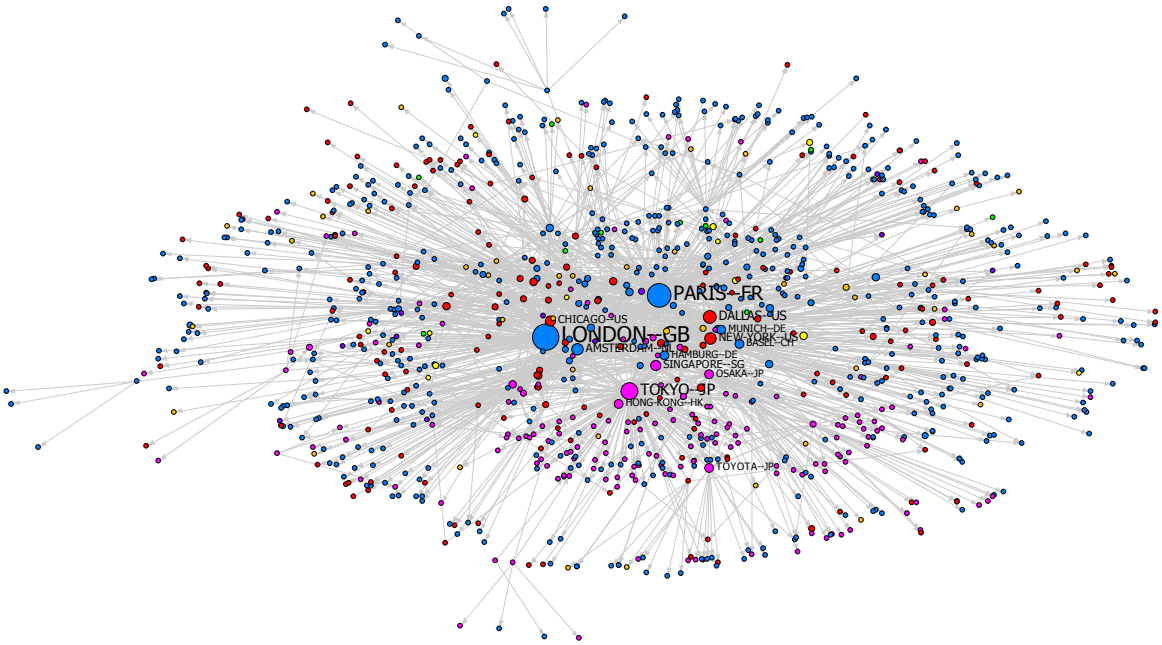

Figure A.17 The manufacturing network: plan view

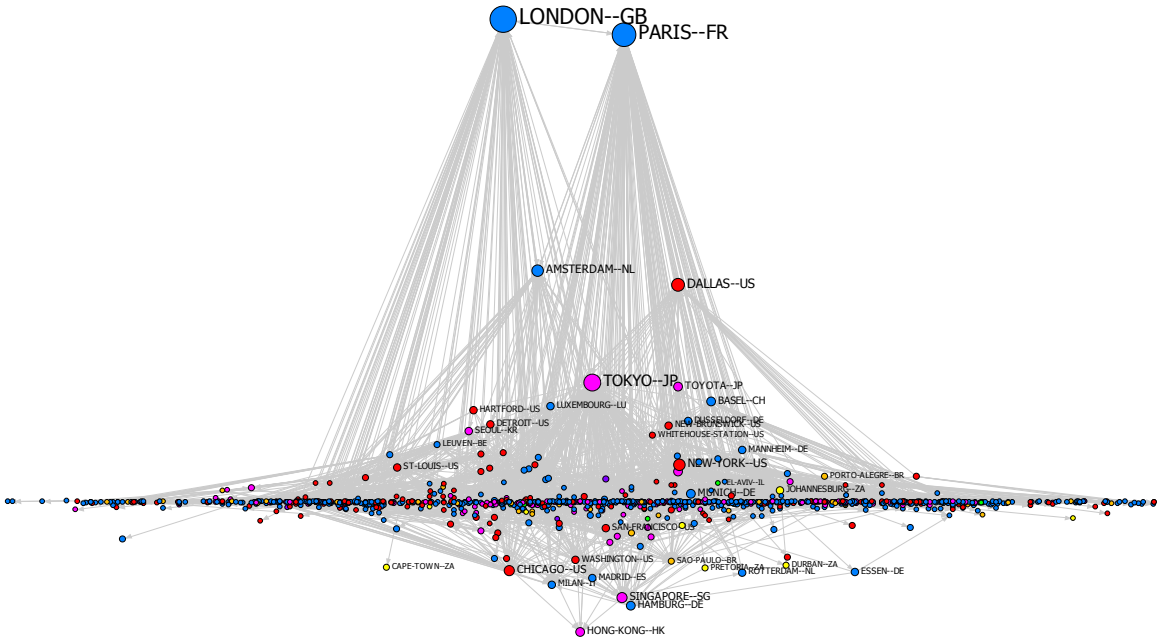

Figure A.18 The manufacturing network: elevation view

Sectoral networks (continued)

A.3.2. Finance (K = 6)

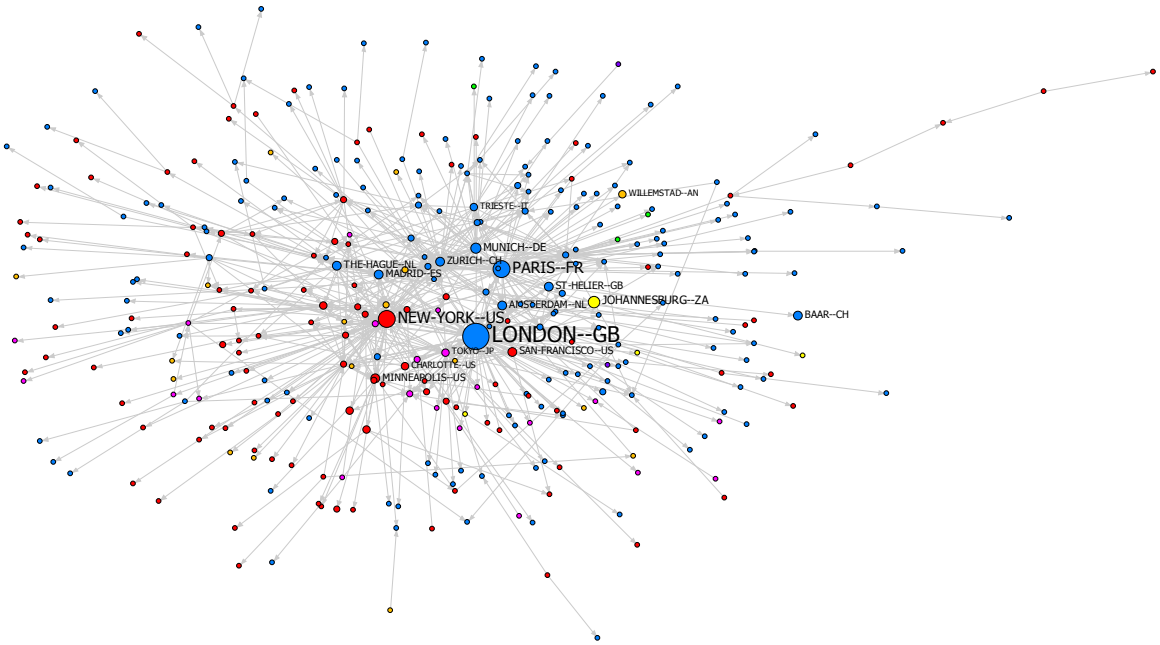

Figure A.19 The finance network: plan view

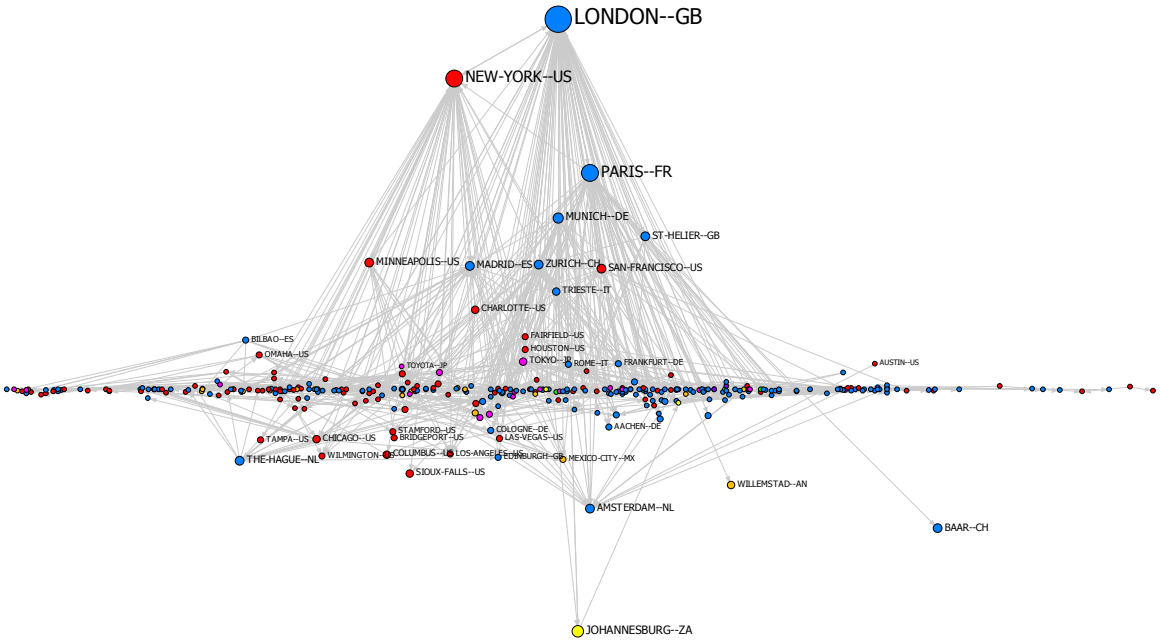

Figure A.20 The finance network: elevation view

Sectoral networks (continued)

A.3.3. Commerce (K = 7)

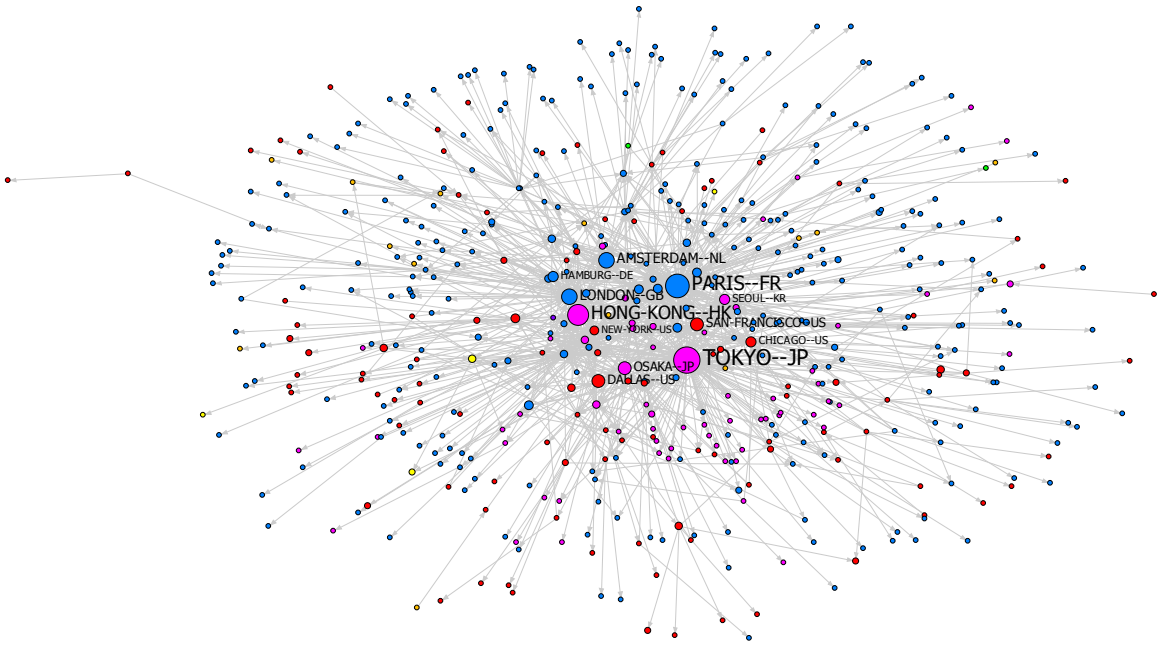

Figure A.21 The commerce network: plan view

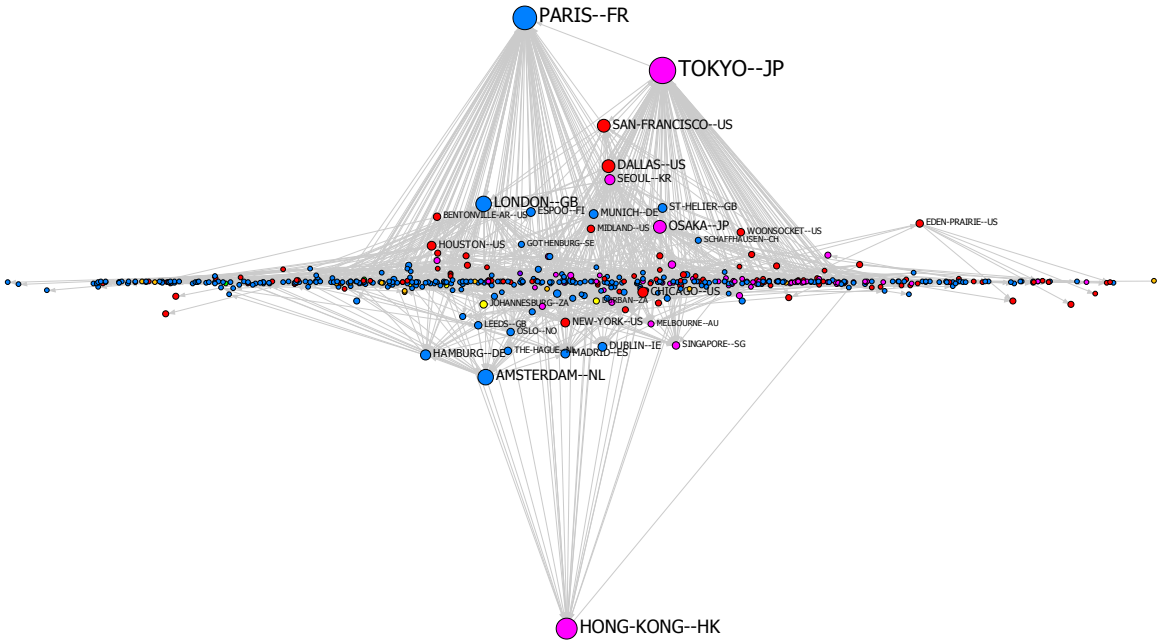

Figure A.22 The commerce network: elevation view

Sectoral networks (continued)

A.3.4. Mining (K = 2)

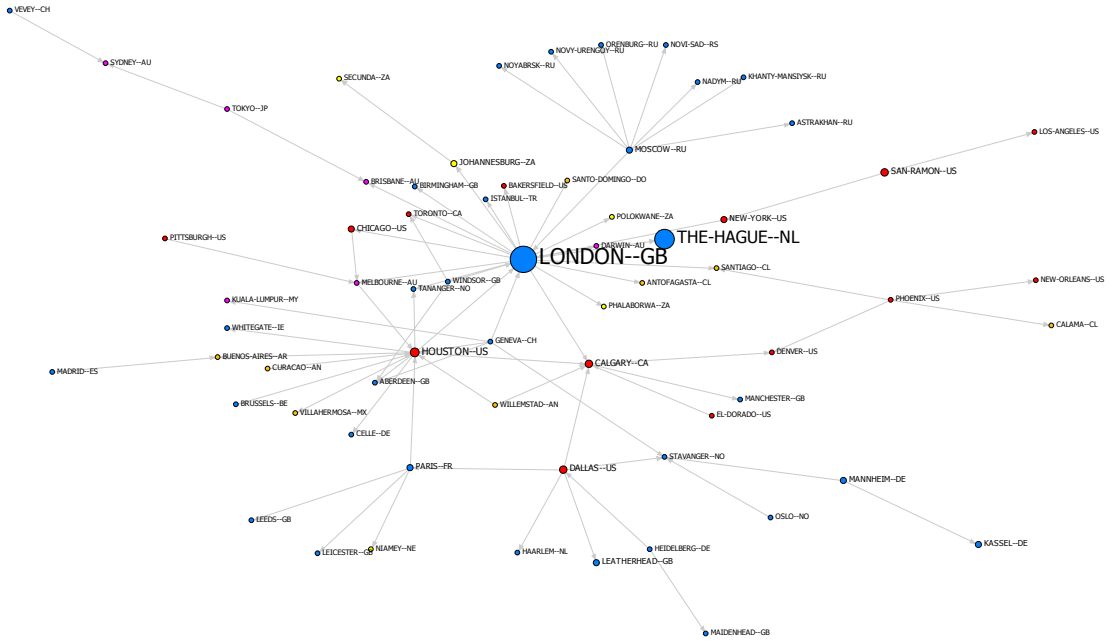

Figure A.23 The mining network: plan view

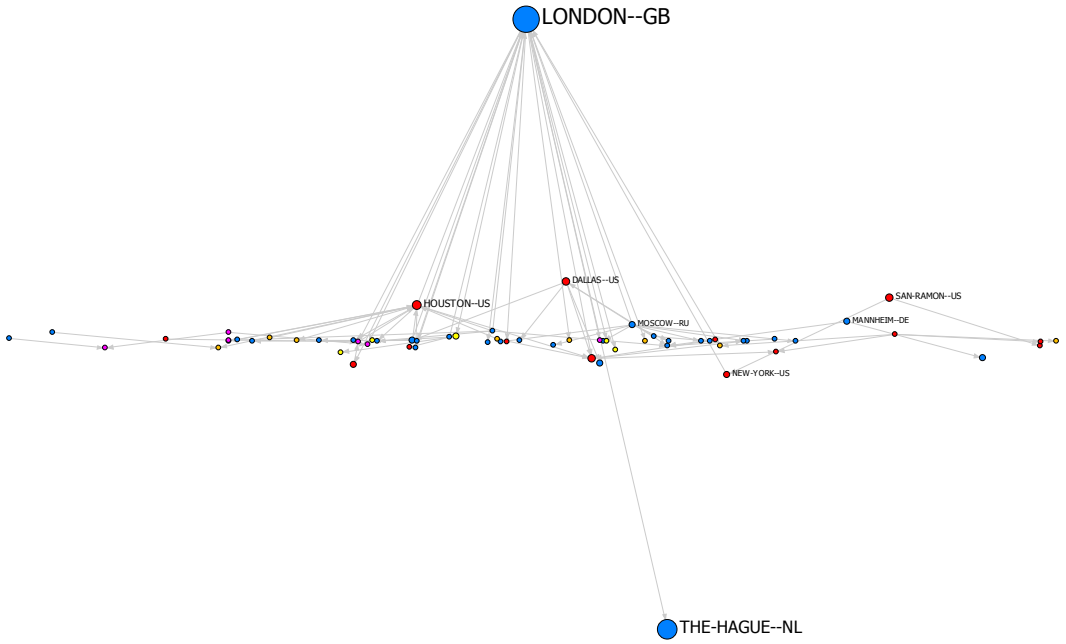

Figure A.24 The mining network: elevation view

Sectoral networks (continued)

A.3.5. ICT (K = 4)

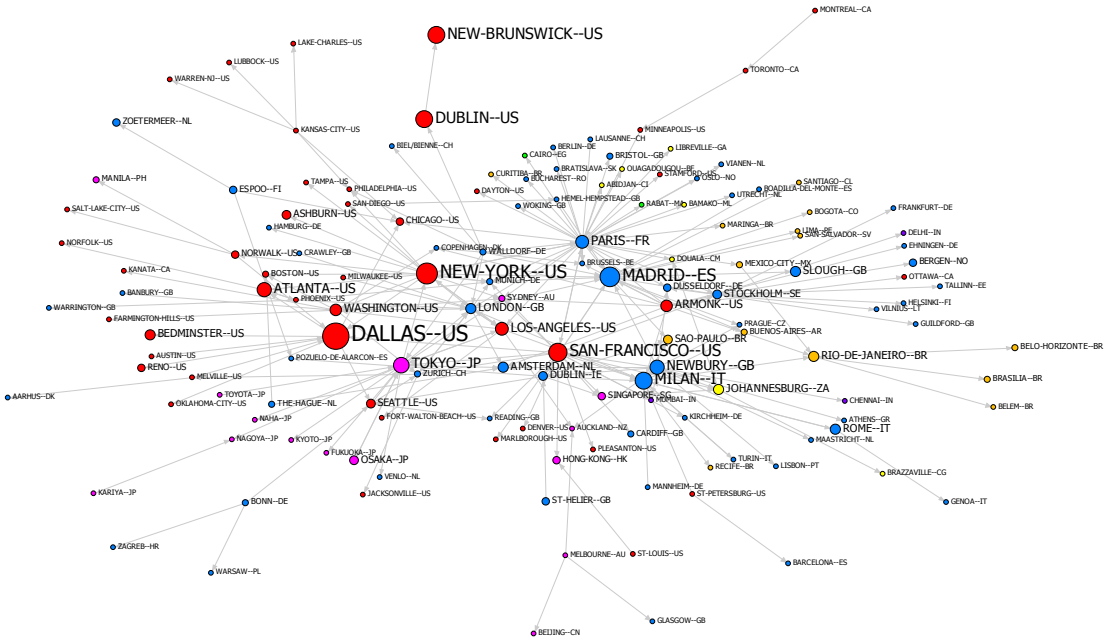

Figure A.25 The ICT network: plan view

Figure A.26 The ICT network: elevation view

A.3.6. Utilities (K = 2)

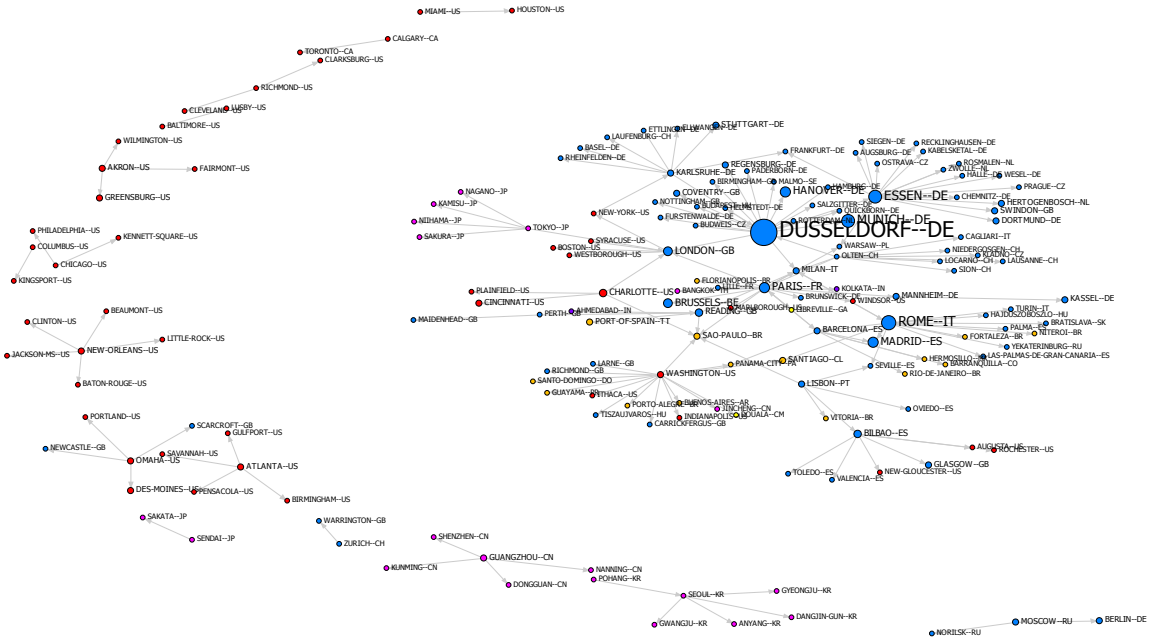

Figure A.27 The utilities network: plan view

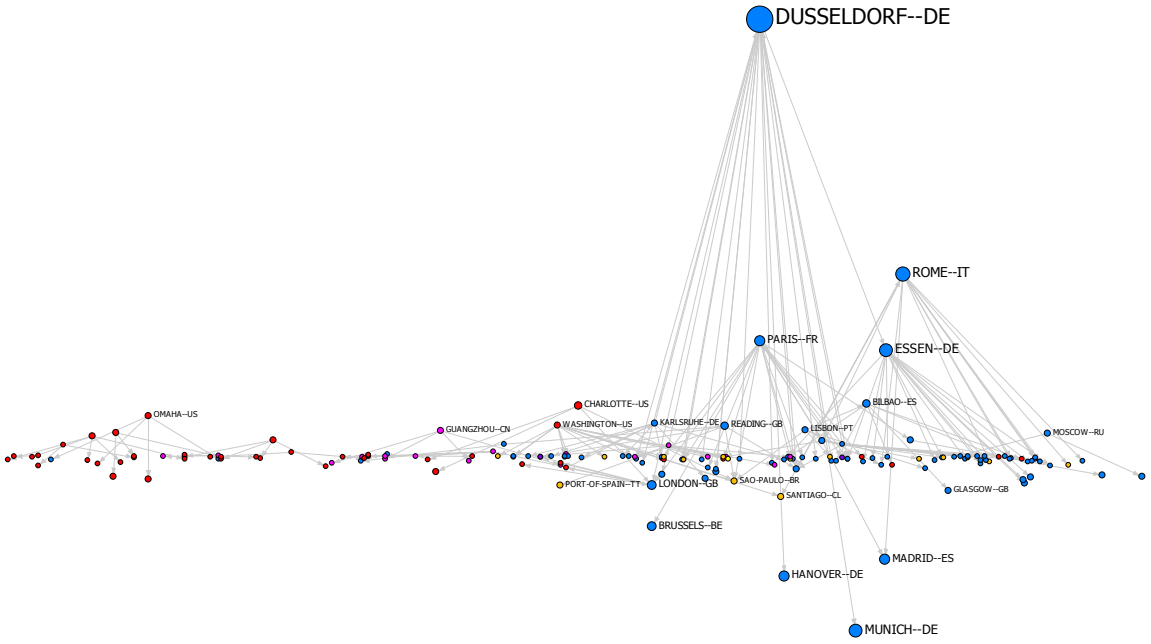

Figure A.28 The utilities network: elevation view

Sectoral networks (continued)

A.3.7. Technical (K = 3)

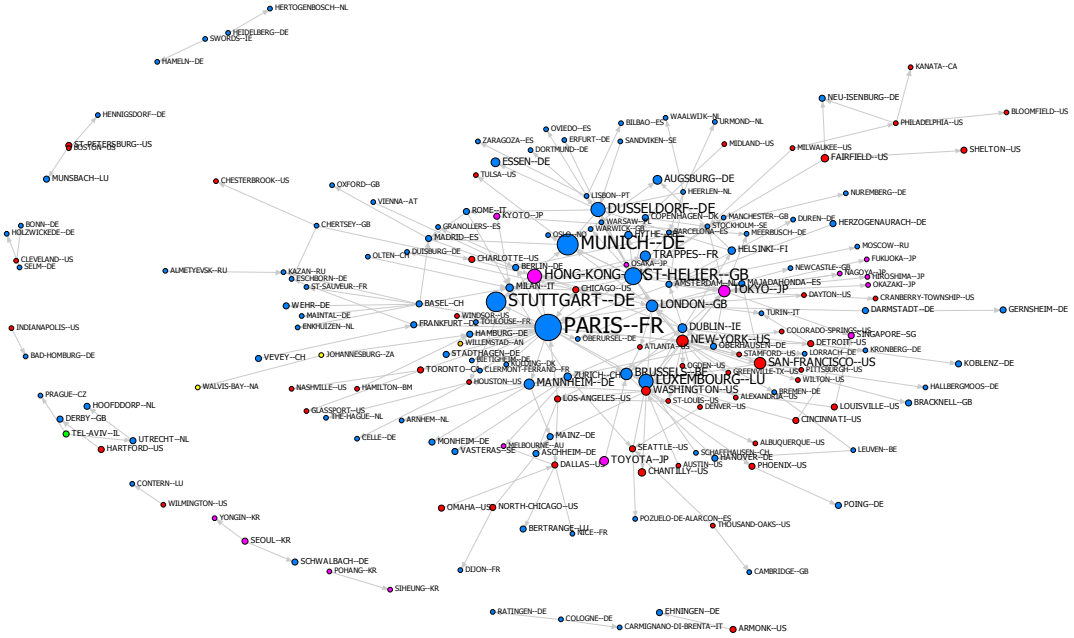

Figure A.29 The technical network: plan view

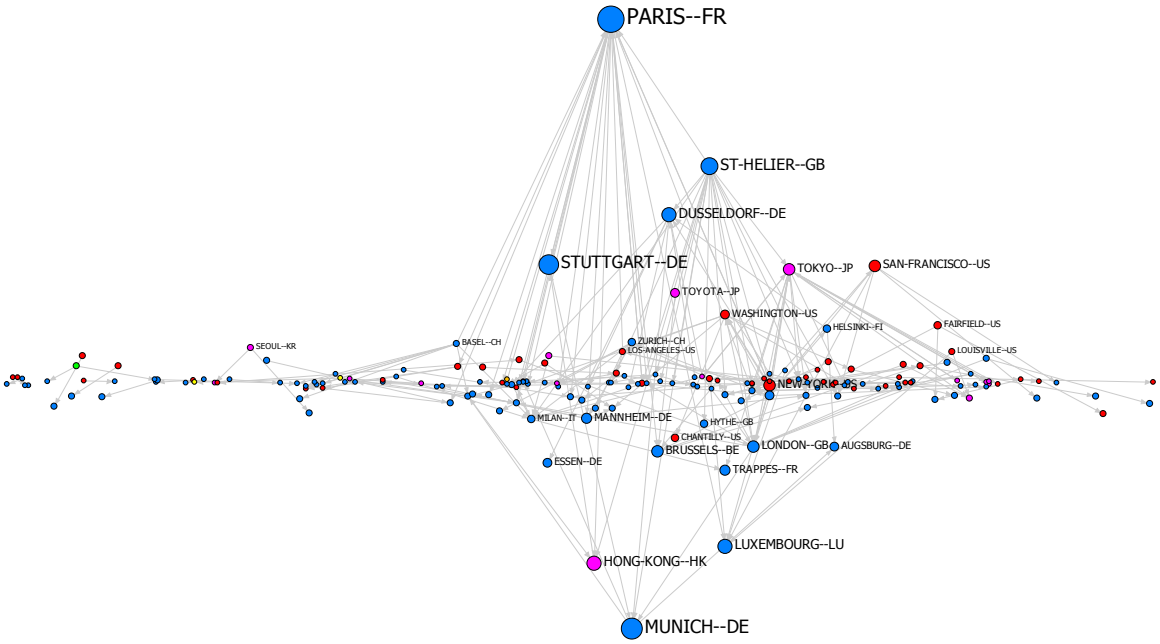

Figure A.30 The technical network: elevation view

Sectoral networks (continued)

A.3.8. Admin (K = 4)

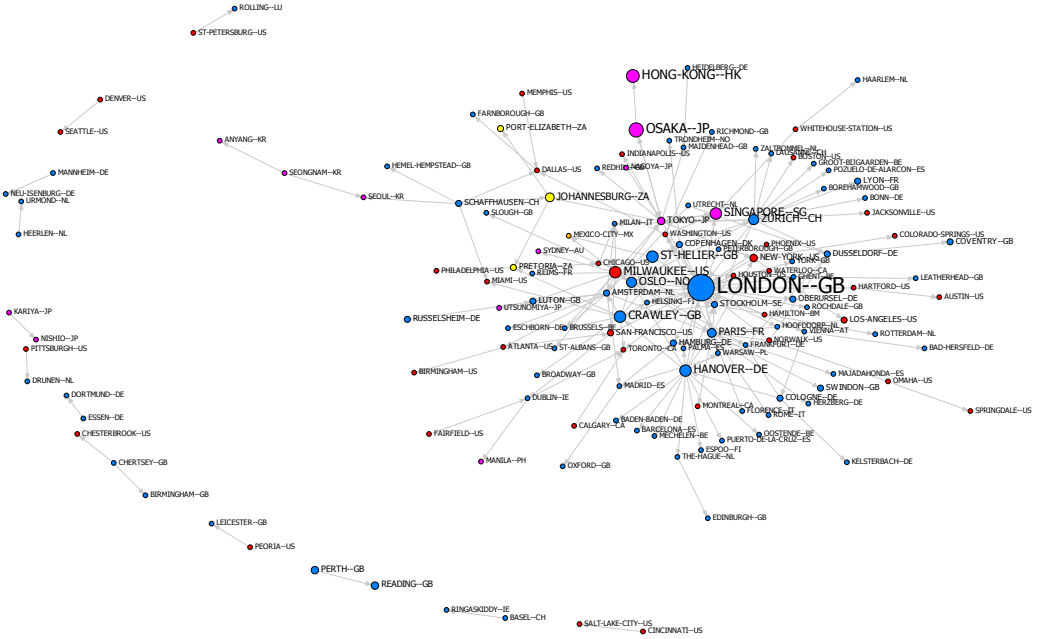

Figure A.31 The admin network: plan view

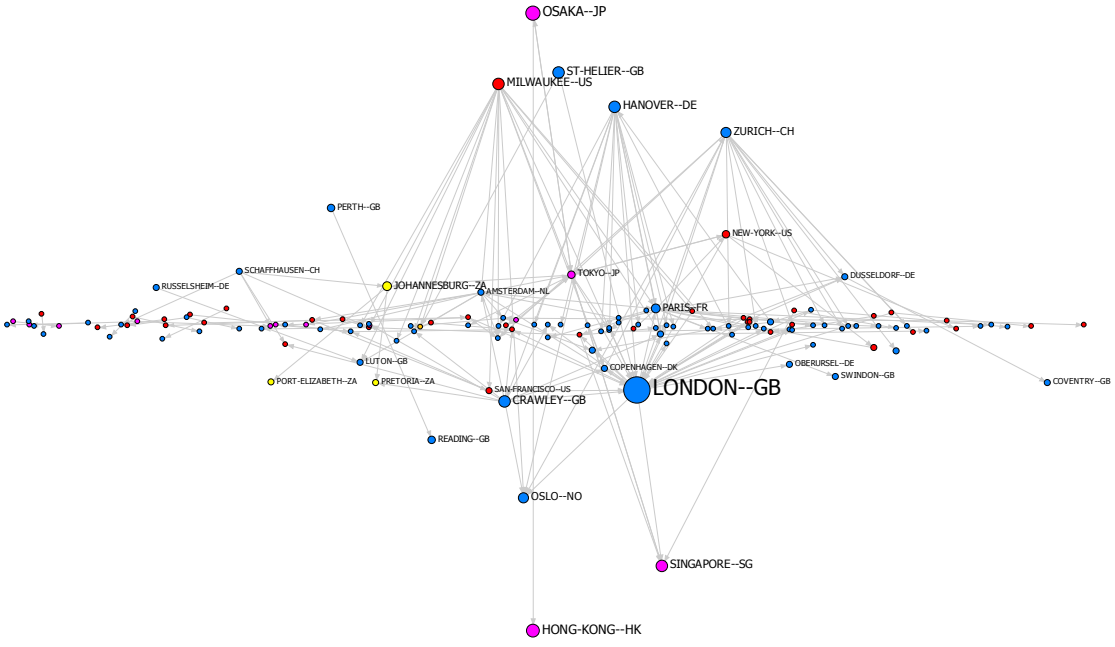

Figure A.32 The admin network: elevation view

A.3.9. Logistics (K = 2)

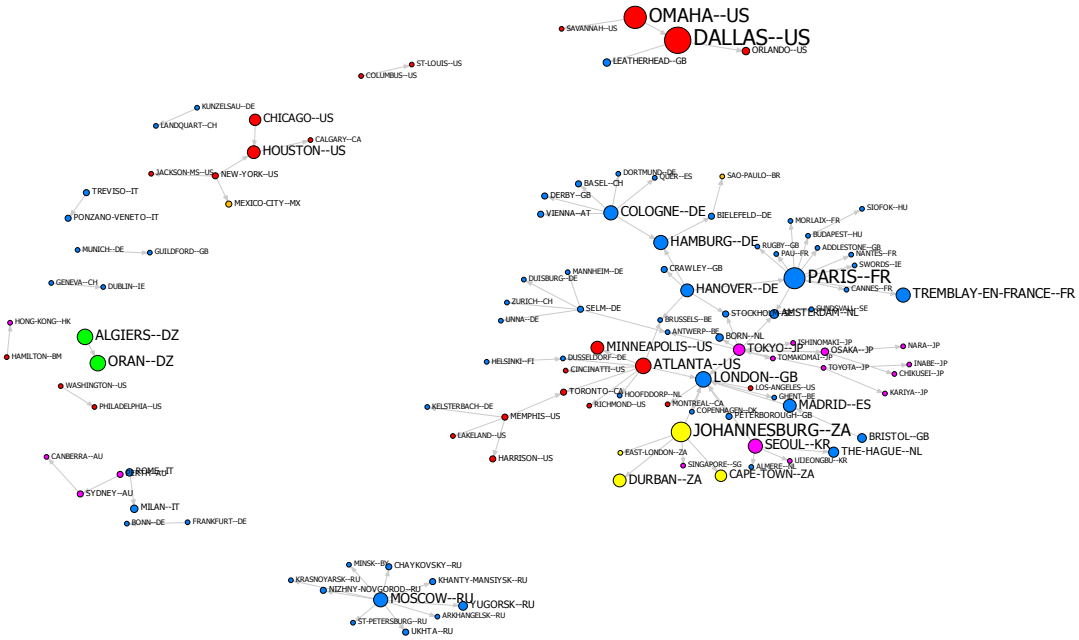

Figure A.33 The logistics network: plan view

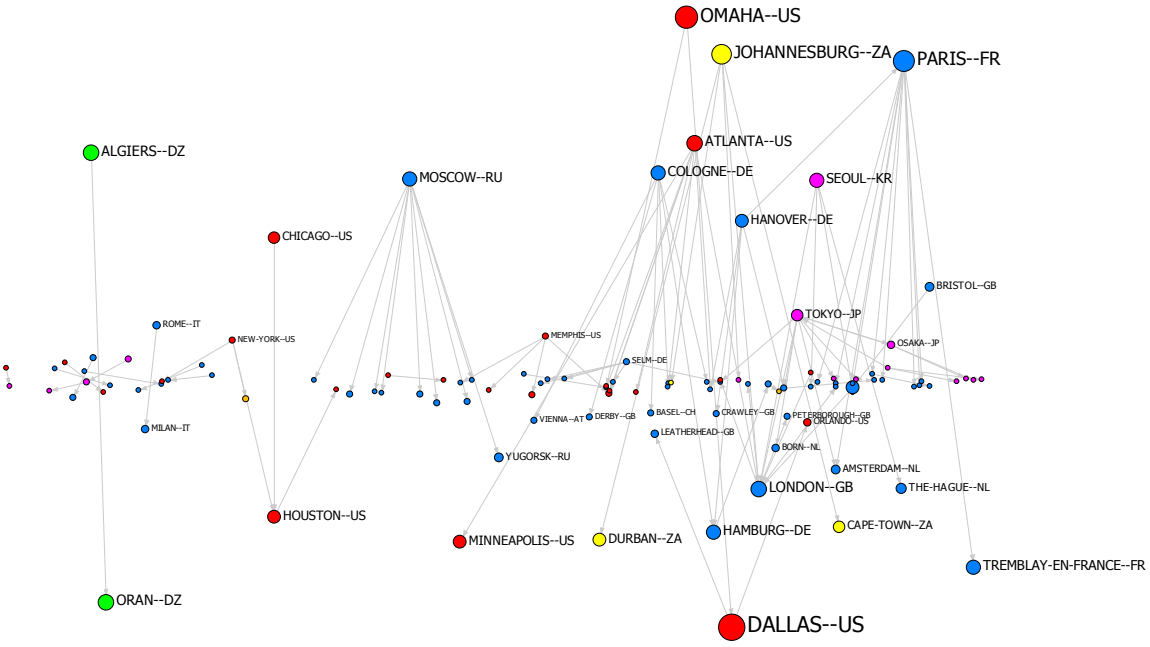

Figure A.34 The logistics network: elevation view

Sectoral networks (continued)

A.3.10. Construction (K = 2)

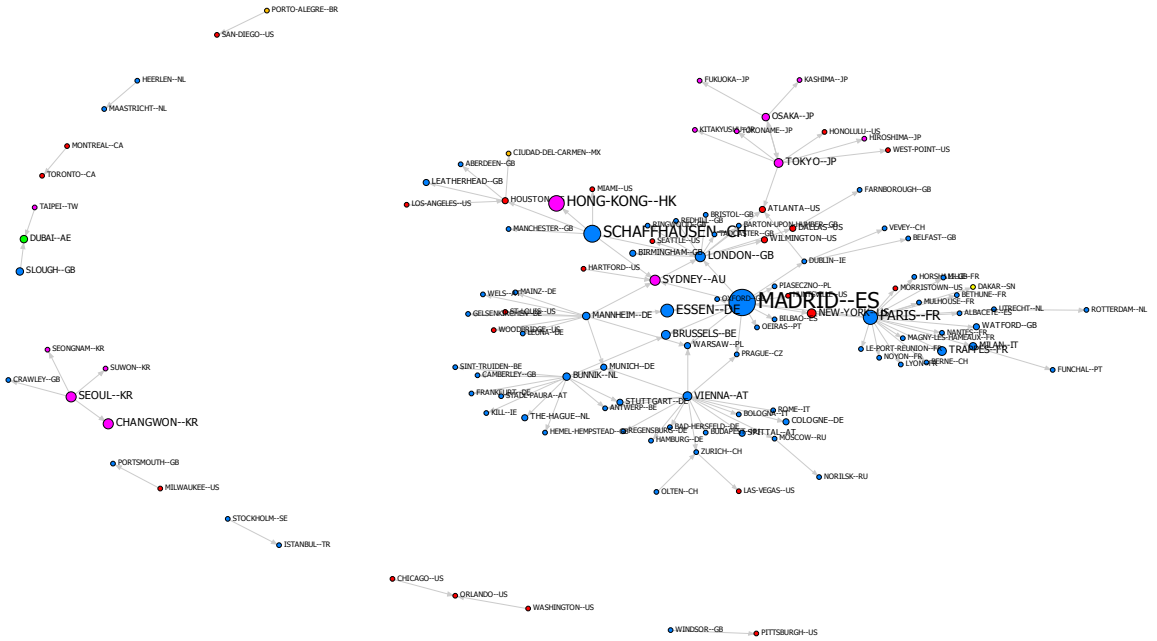

Figure A.35 The construction network: plan view

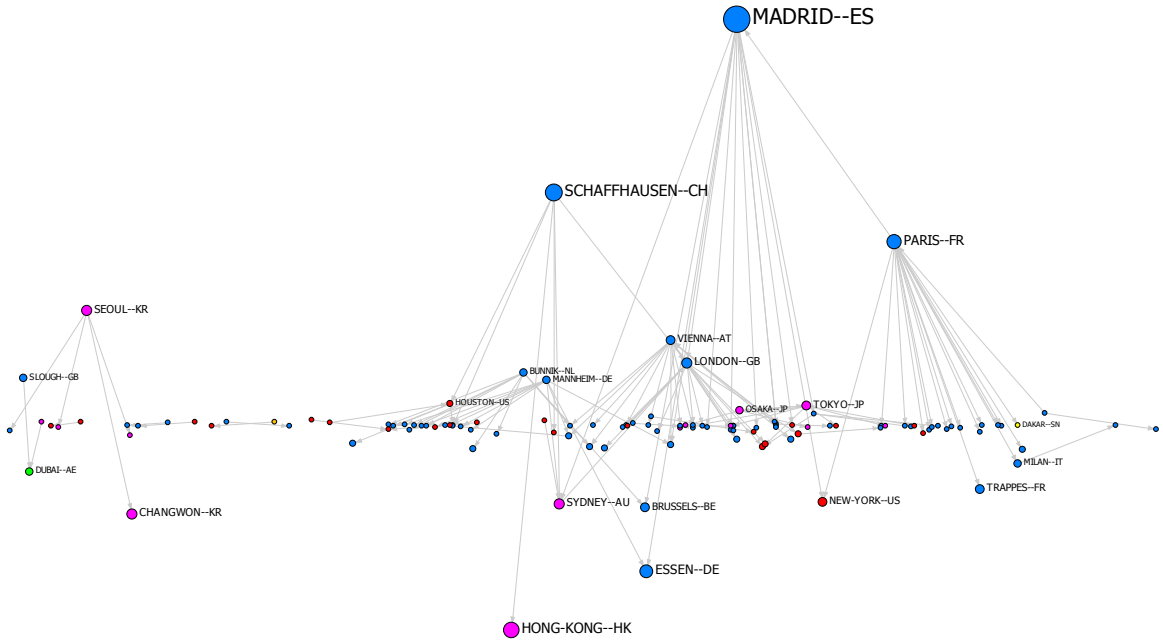

Figure A.36 The construction network: elevation view

Sectoral networks (continued)

A.3.11. Hospitality (K = 2)

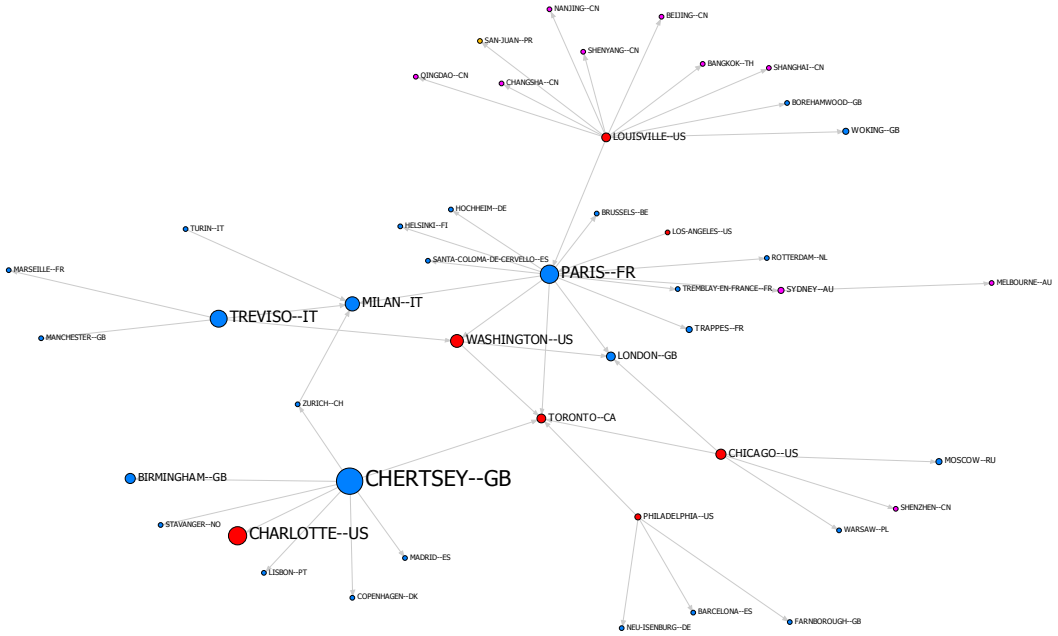

Figure A.37 The hospitality network: plan view

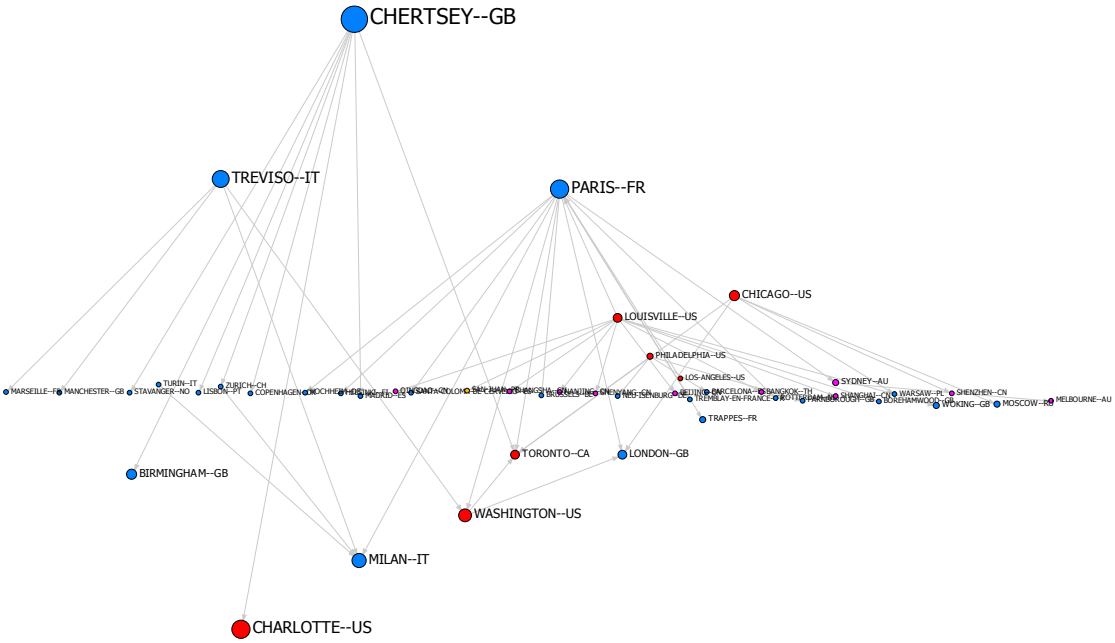

Figure A.38 The hospitality network: elevation view

Appendix B. The Lagos network

The following graphs should be browsed in conjunction with Chapter 6.

B.1. The Lagos network (K = 4)

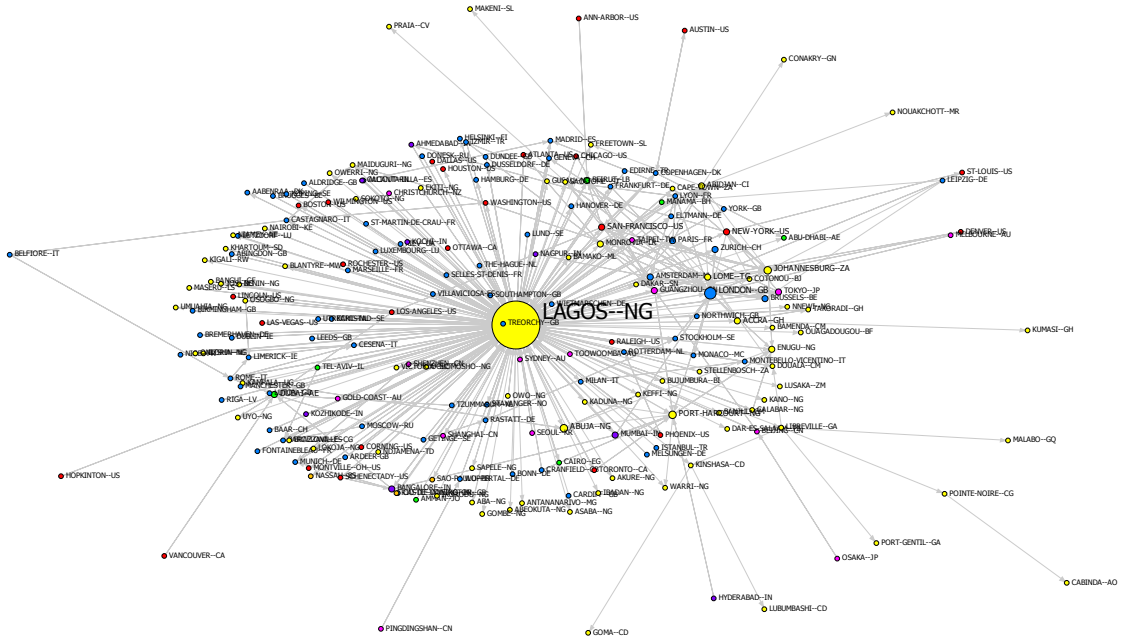

Figure B.1 The Lagos network: plan view

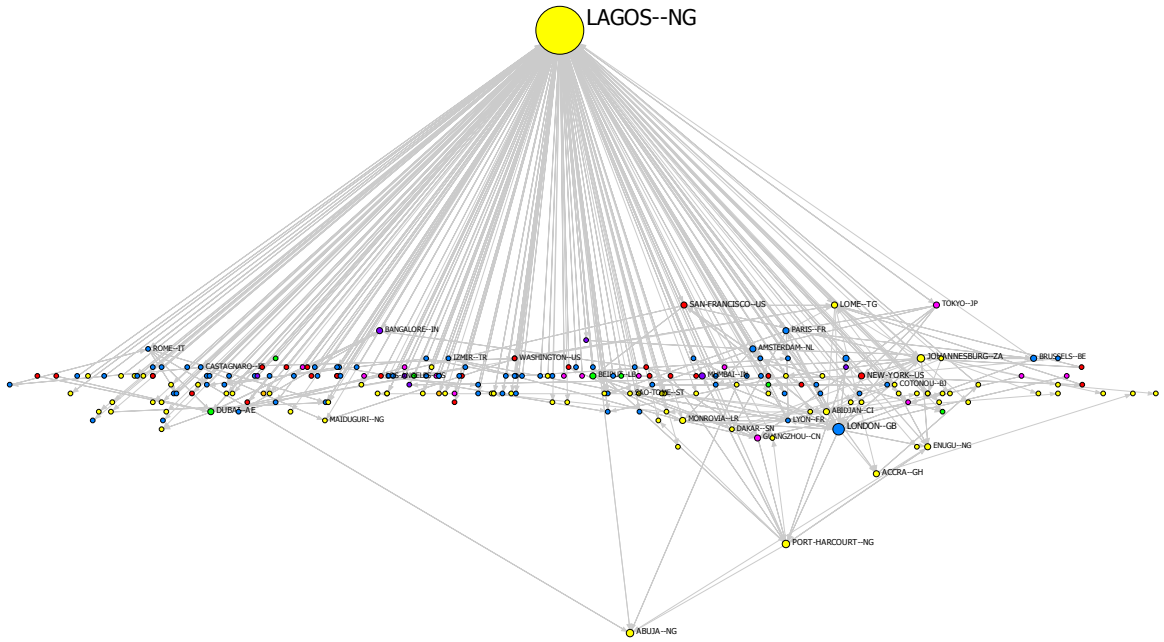

Figure B.2 The Lagos network: elevation view

The Lagos network (continued)

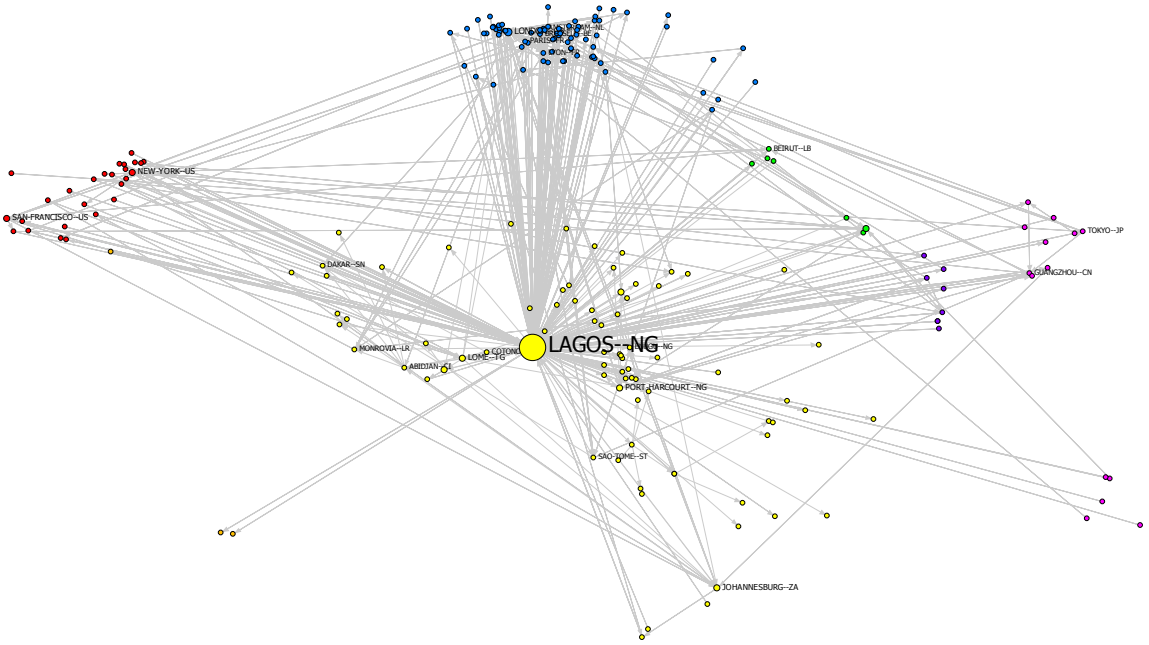

Figure B.3 The Lagos network: geographic view

The Lagos network (continued)

B.1.1. Intrafirm ties (K = 4)

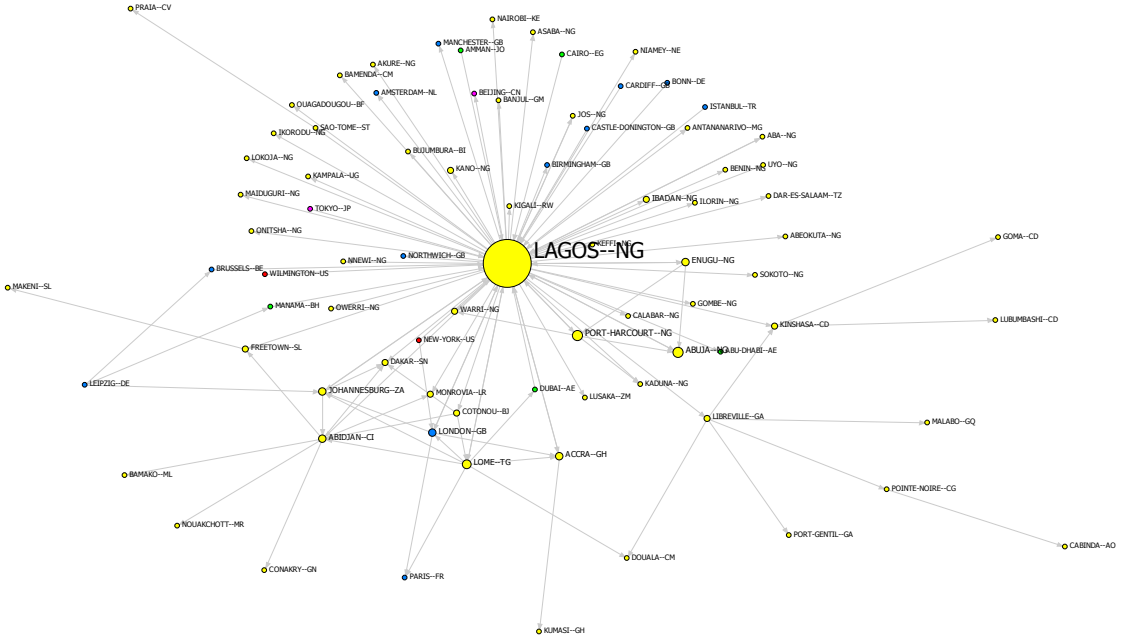

Figure B.4 The Lagos intrafirm network: plan view

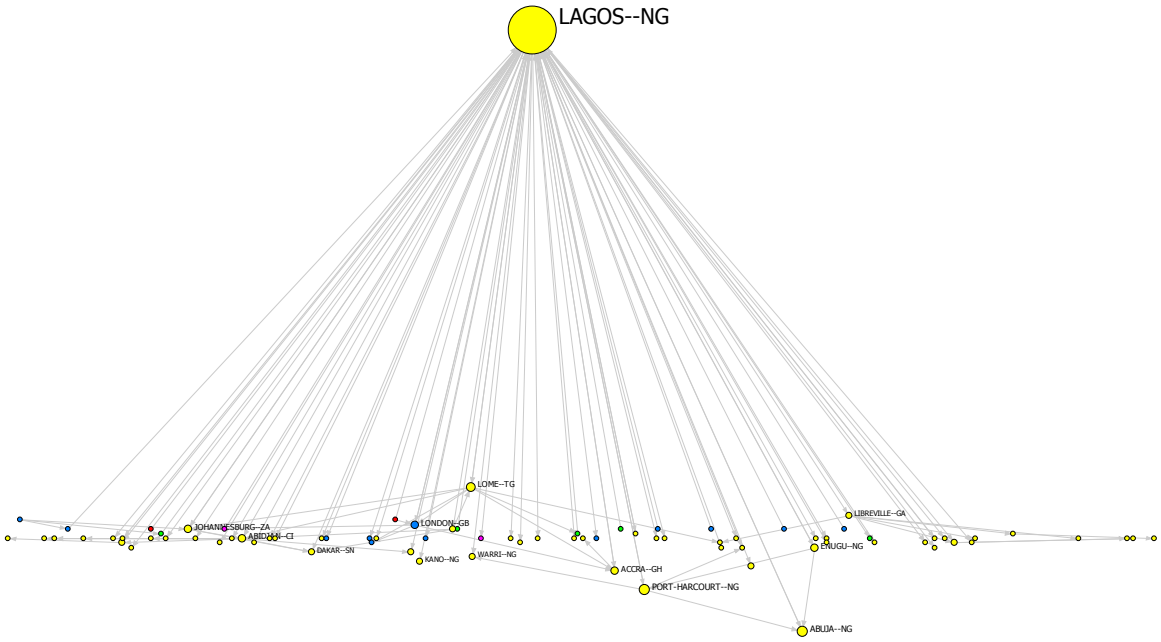

Figure B.5 The Lagos intrafirm network: elevation view

The Lagos network (continued)

Intrafirm ties (continued)

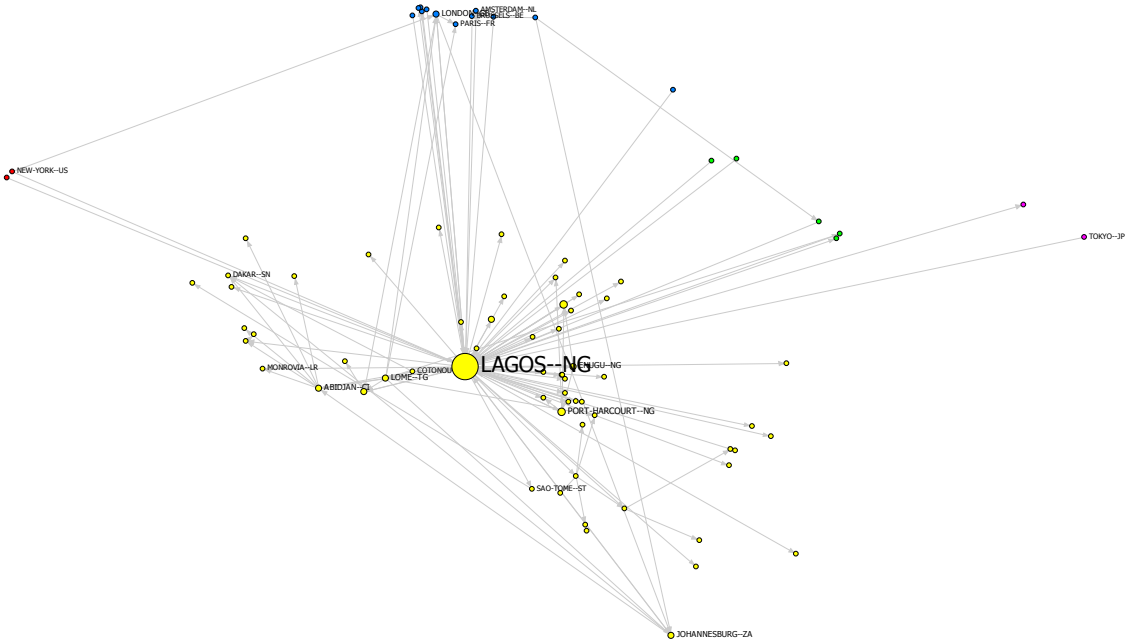

Figure B.6 The Lagos intrafirm network: geographic view

The Lagos network (continued)

B.1.2. Interfirm ties (K = 4)

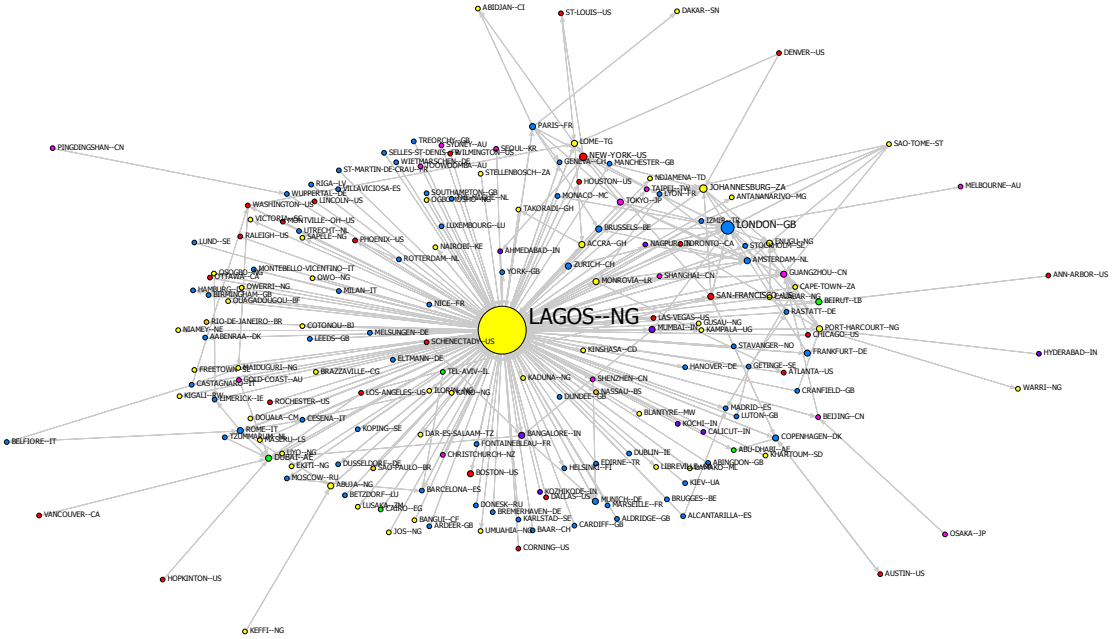

Figure B.7 The Lagos interfirm network: plan view

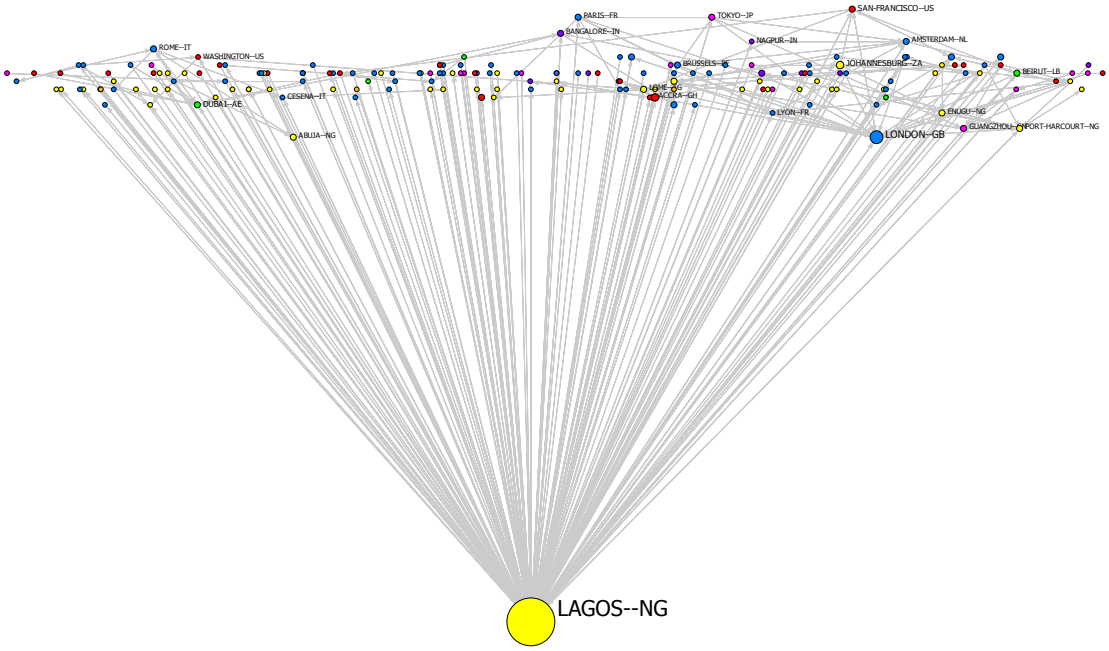

Figure B.8 The Lagos interfirm network: elevation view

The Lagos network (continued)

Interfirm ties (continued)

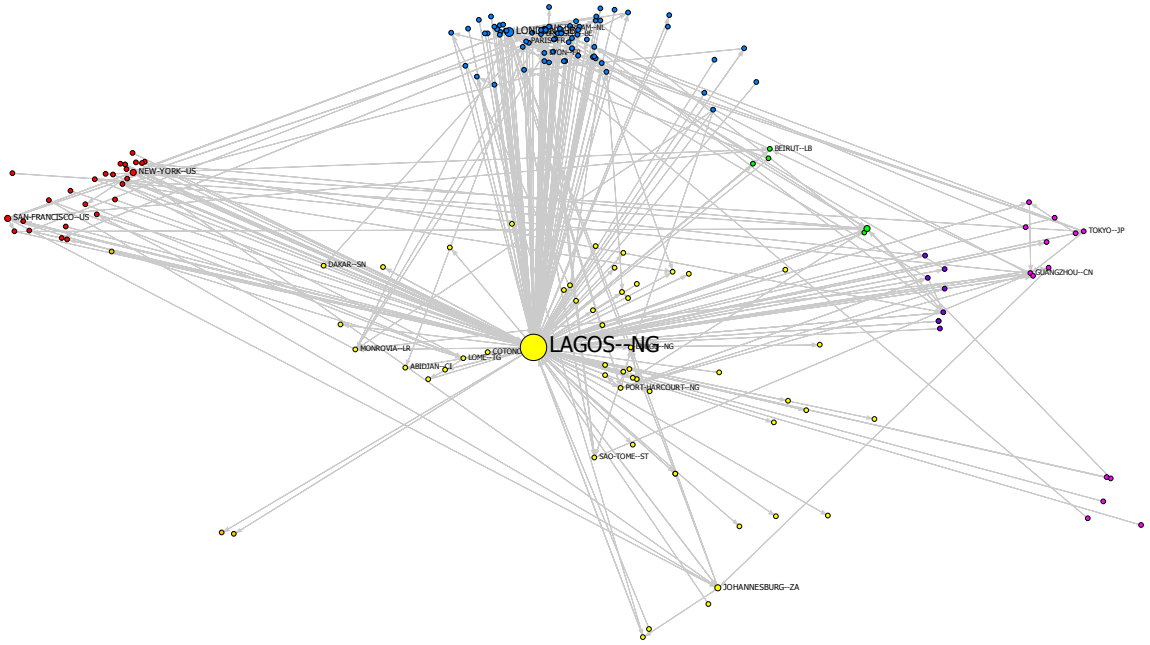

Figure B.9 The Lagos interfirm network: geographic view

The Lagos network (continued)

B.1.3. Operations (K = 4)

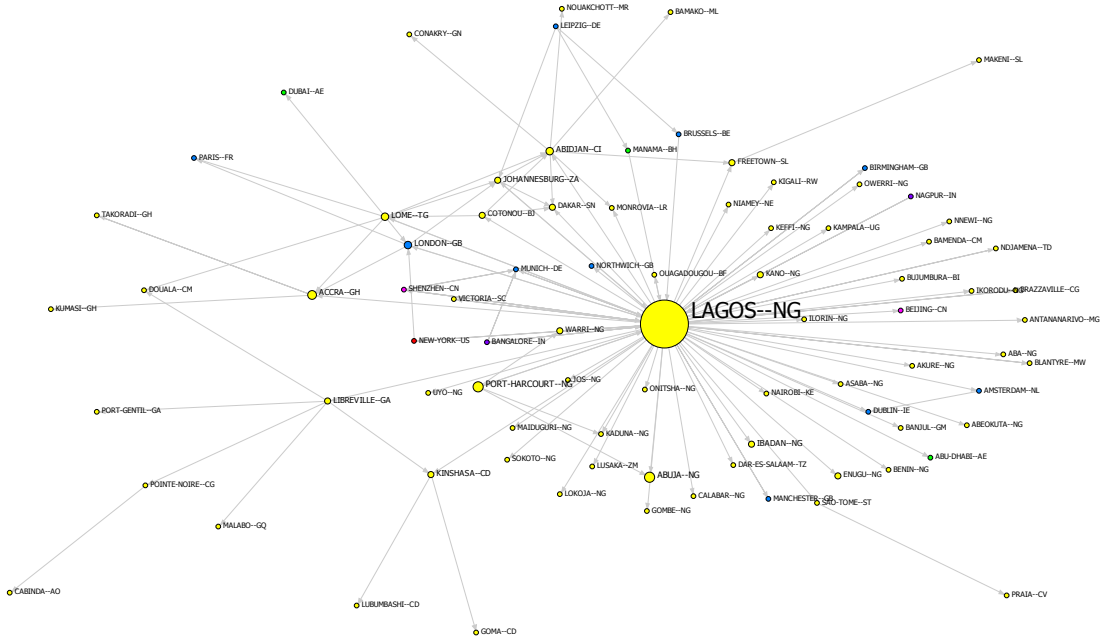

Figure B.10 The Lagos operations network: plan view

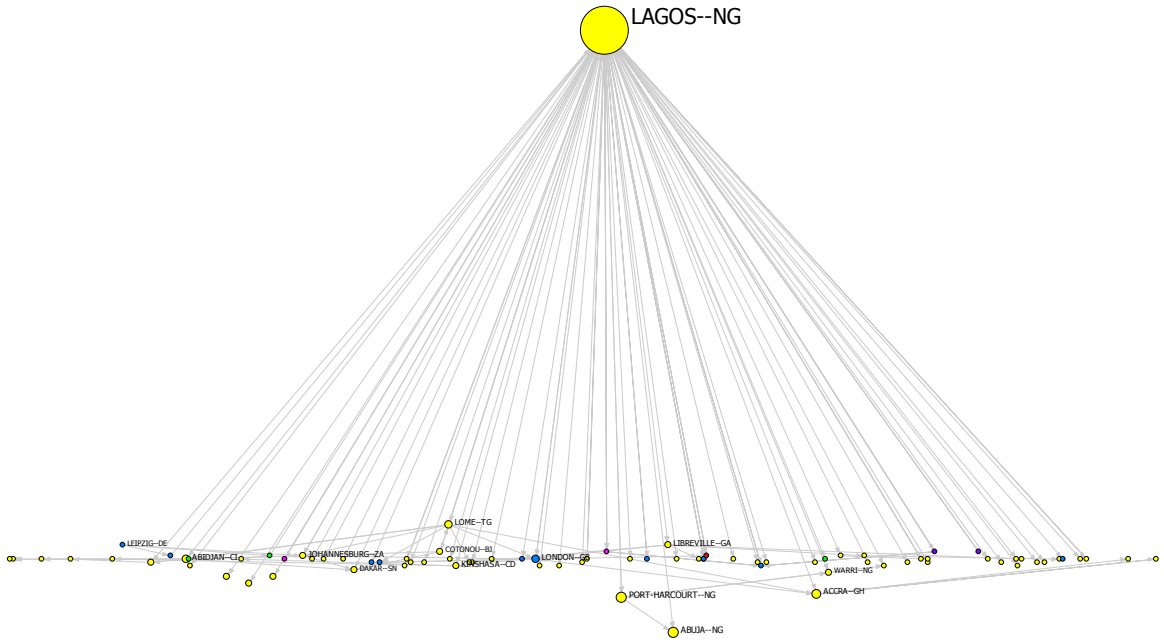

Figure B.11 The Lagos operations network: elevation view

The Lagos network (continued)

Operations (continued)

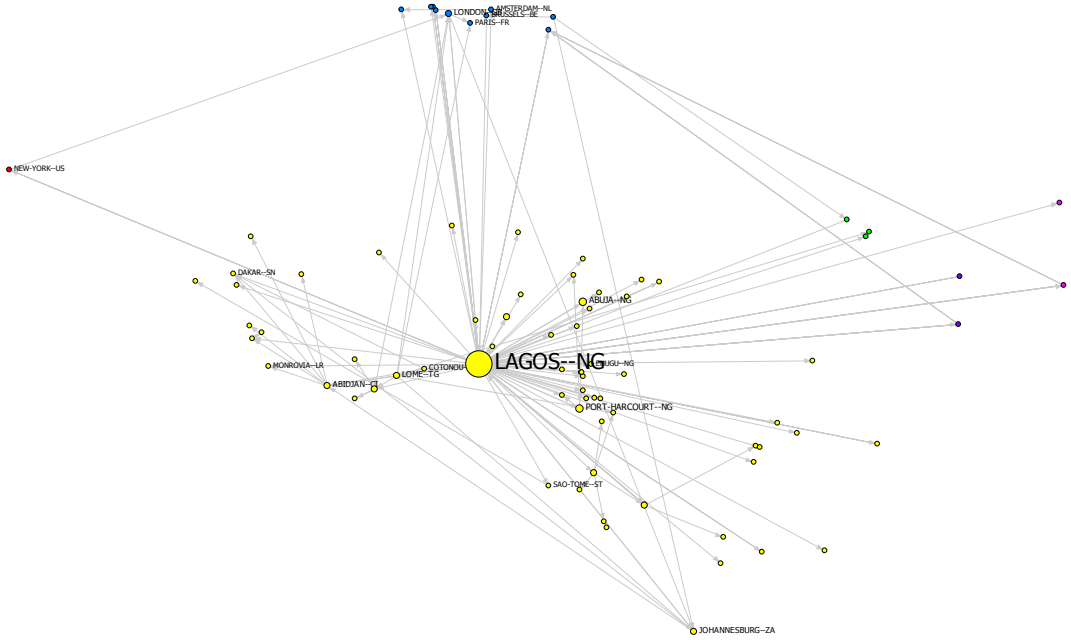

Figure B.12 The Lagos operations network: geographic view

The Lagos network (continued)

B.1.4. Supply (K = 3)

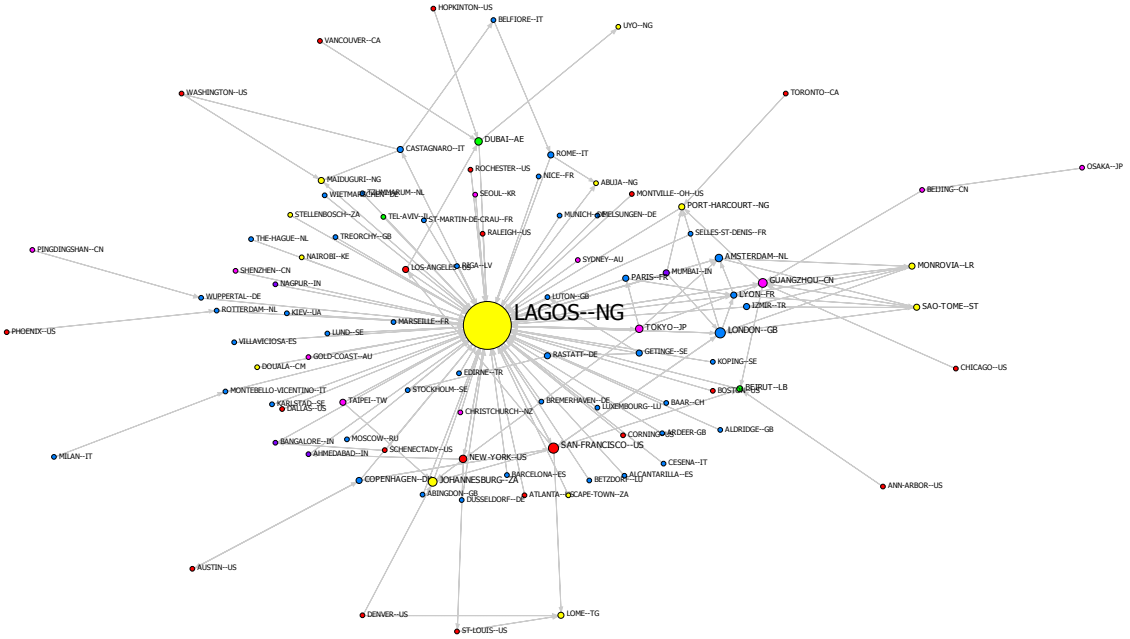

Figure B.13 The Lagos supply network: plan view

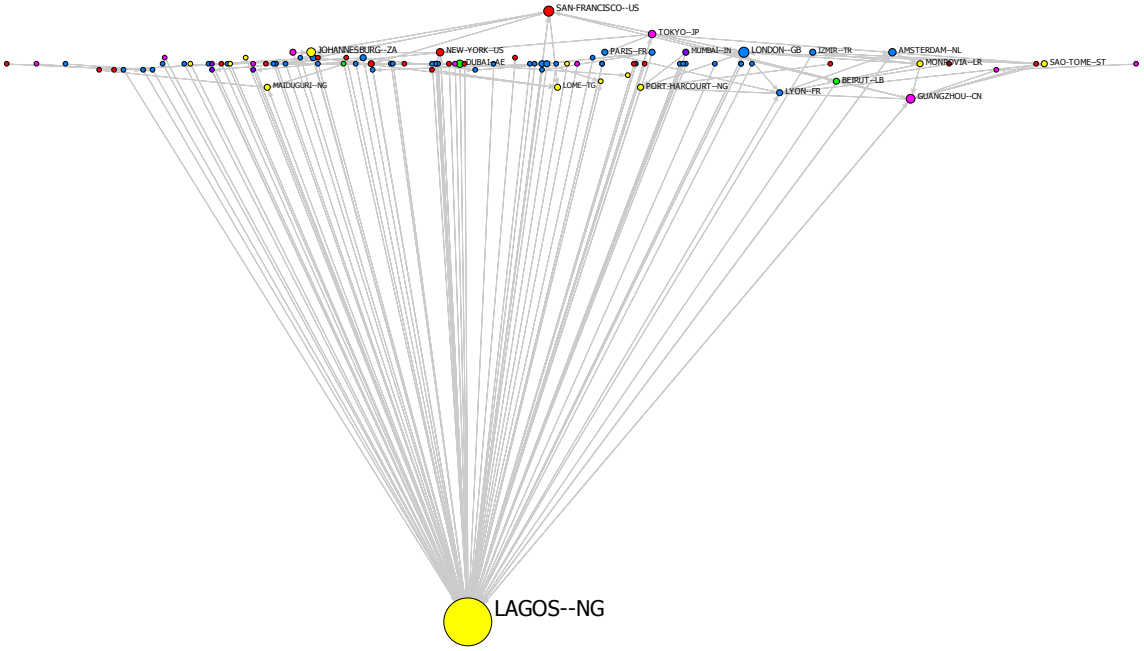

Figure B.14 The Lagos supply network: elevation view

The Lagos network (continued)

Supply (continued)

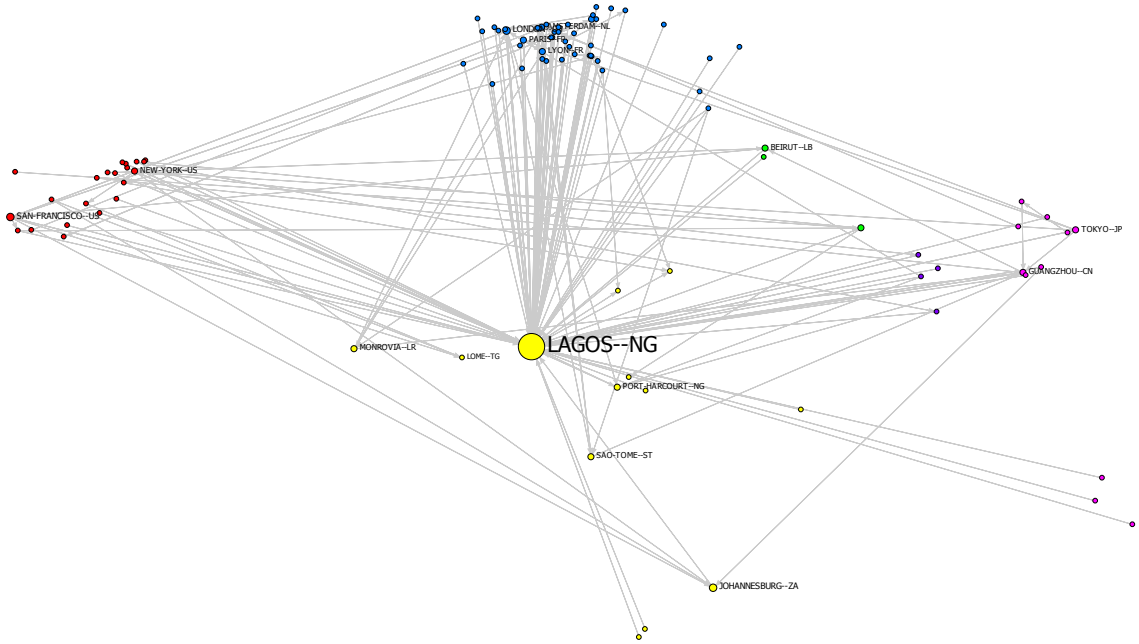

Figure B.15 The Lagos supply network: geographic view

The Lagos network (continued)

B.1.5. Knowledge (K = 2)

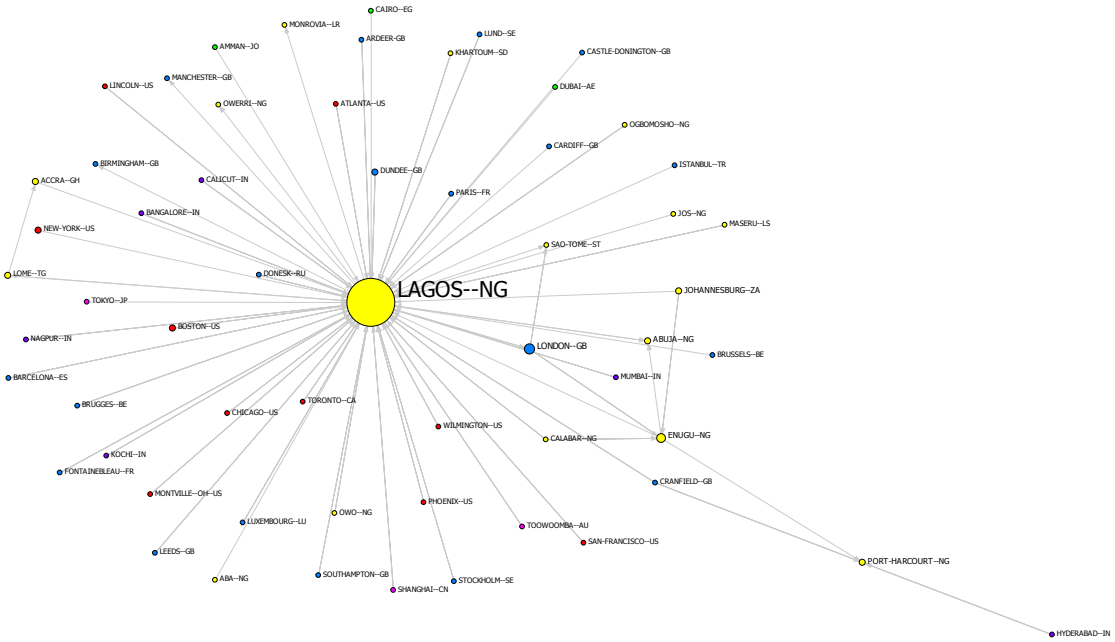

Figure B.16 The Lagos knowledge network: plan view

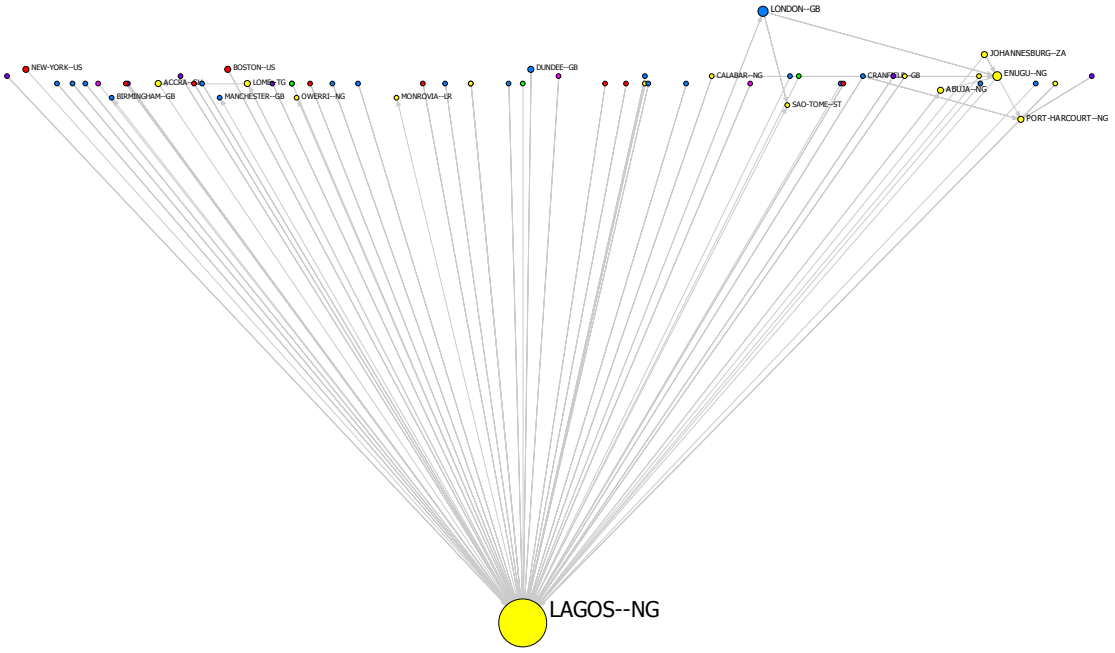

Figure B.17 The Lagos knowledge network: elevation view

The Lagos network (continued)

Knowledge (continued)

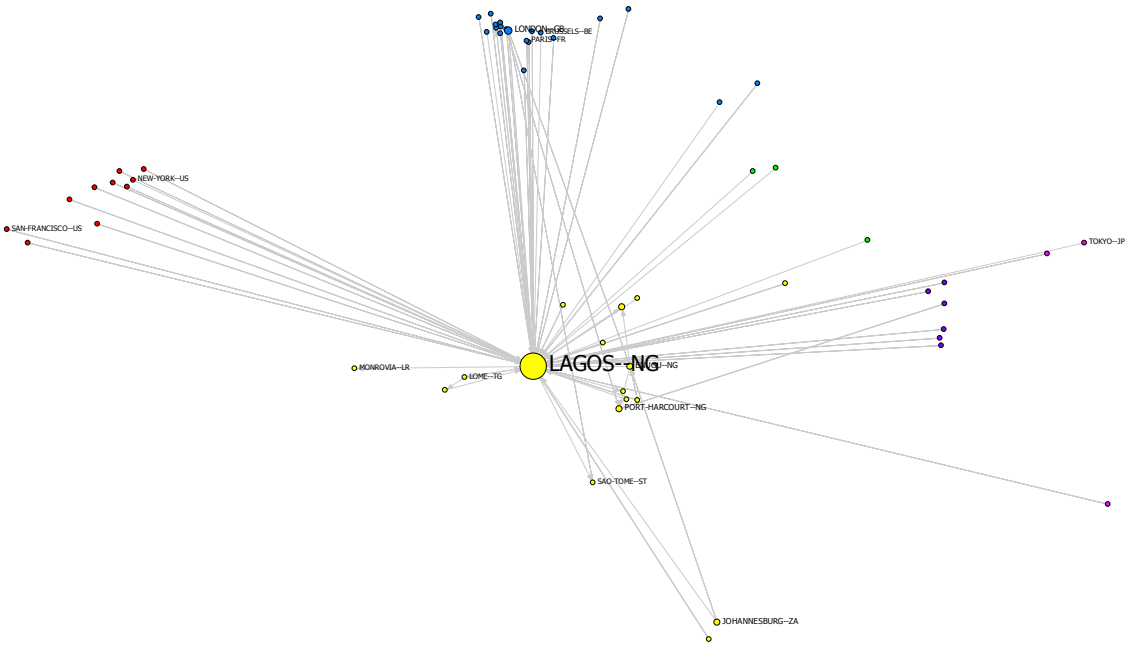

Figure B.18 The Lagos knowledge network: geographic view

The Lagos network (continued)

B.1.6. Capital (K = 2)

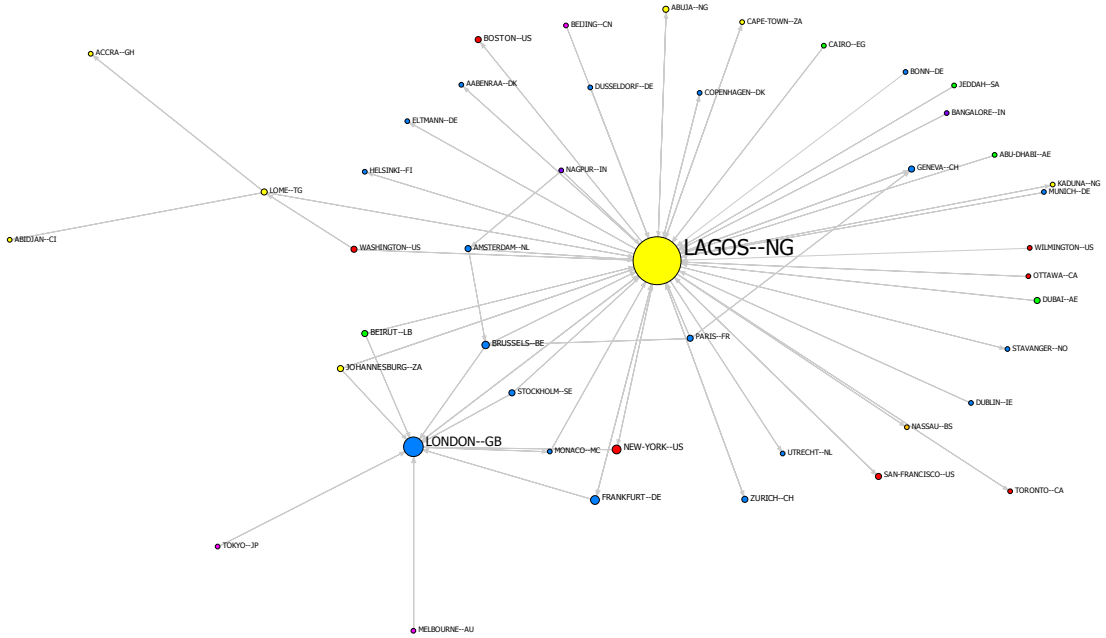

Figure B.19 The Lagos capital network: plan view

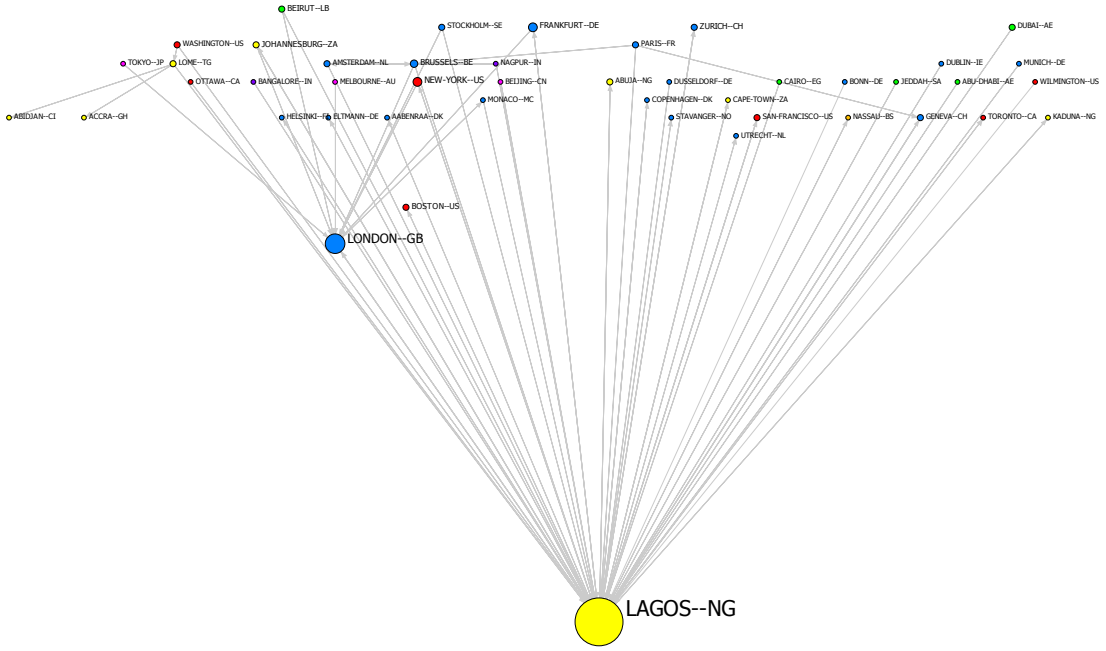

Figure B.20 The Lagos capital network: elevation view

The Lagos network (continued)

Capital (continued)

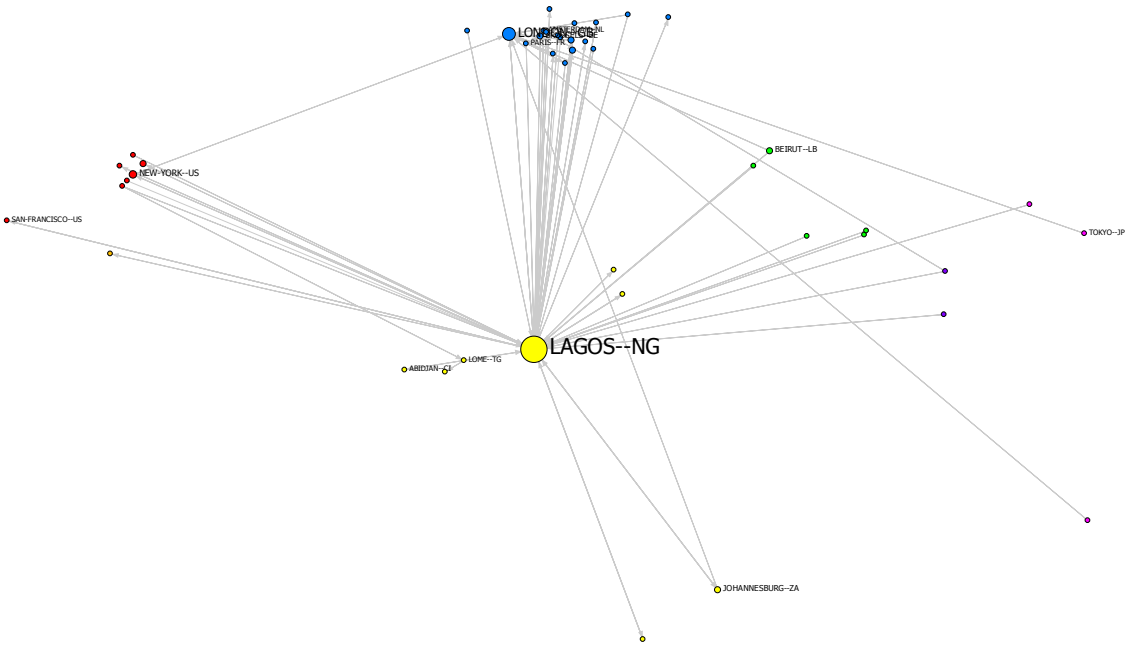

Figure B.21 The Lagos capital network: geographic view

The Lagos network (continued)

B.1.7. Networking (K = 2)

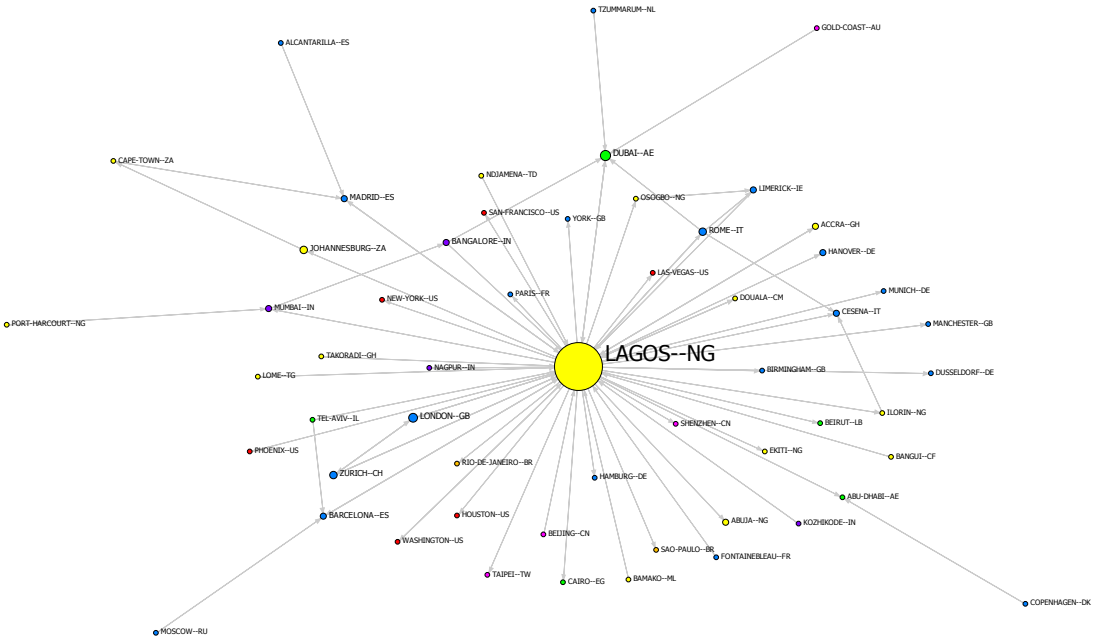

Figure B.22 The Lagos "networking" network: pan view

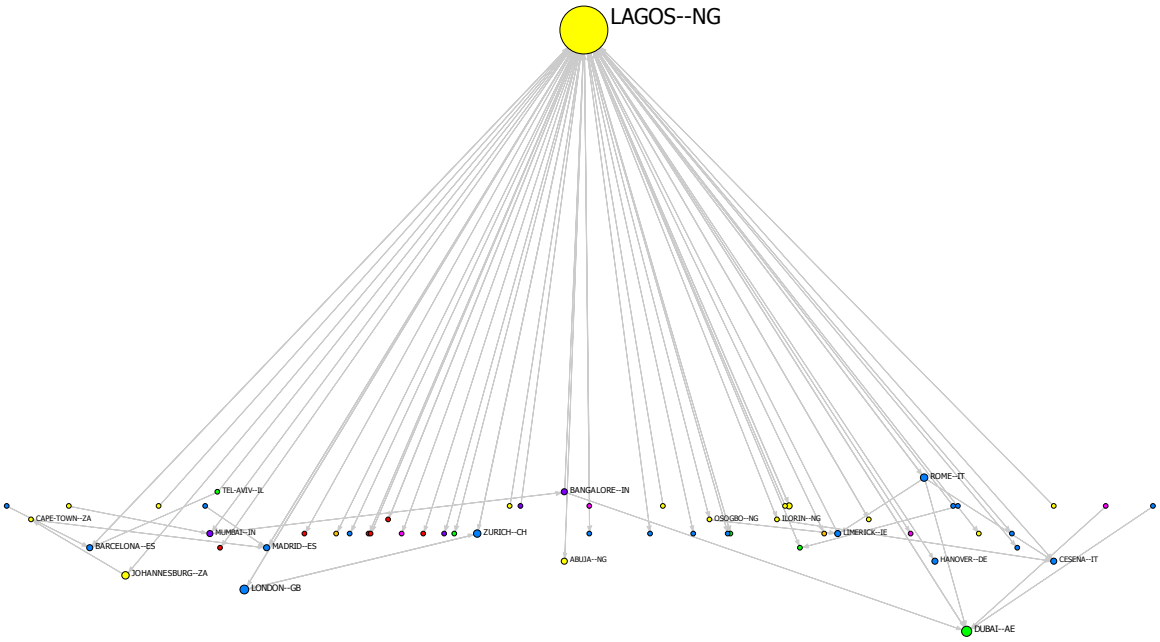

Figure B.23 The Lagos "networking" network: elevation view

The Lagos network (continued)

Networking (continued)

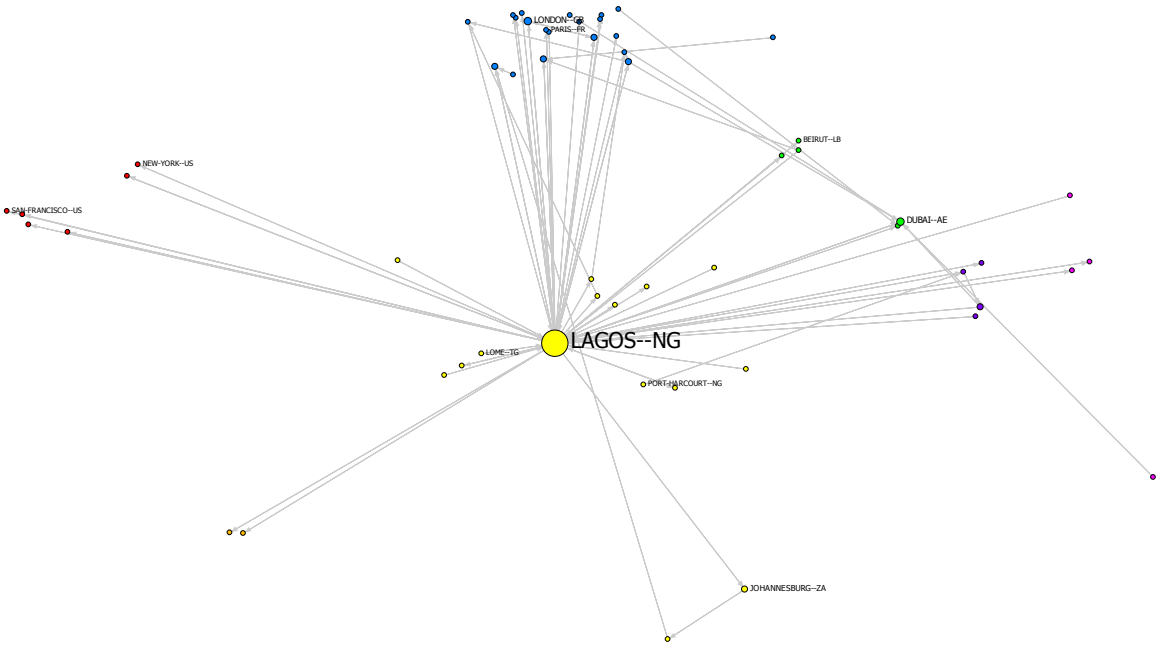

Figure B.24 The Lagos “networking” network: geographic view

B.2. The Lagos finance sector (K = 4)

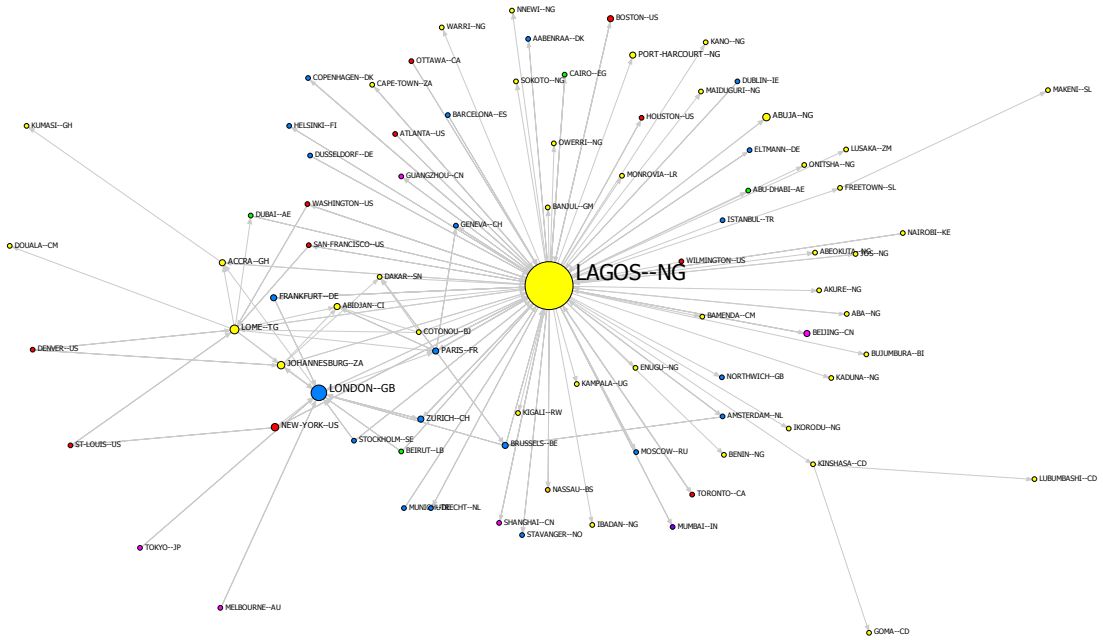

Figure B.25 The Lagos finance network: plan view

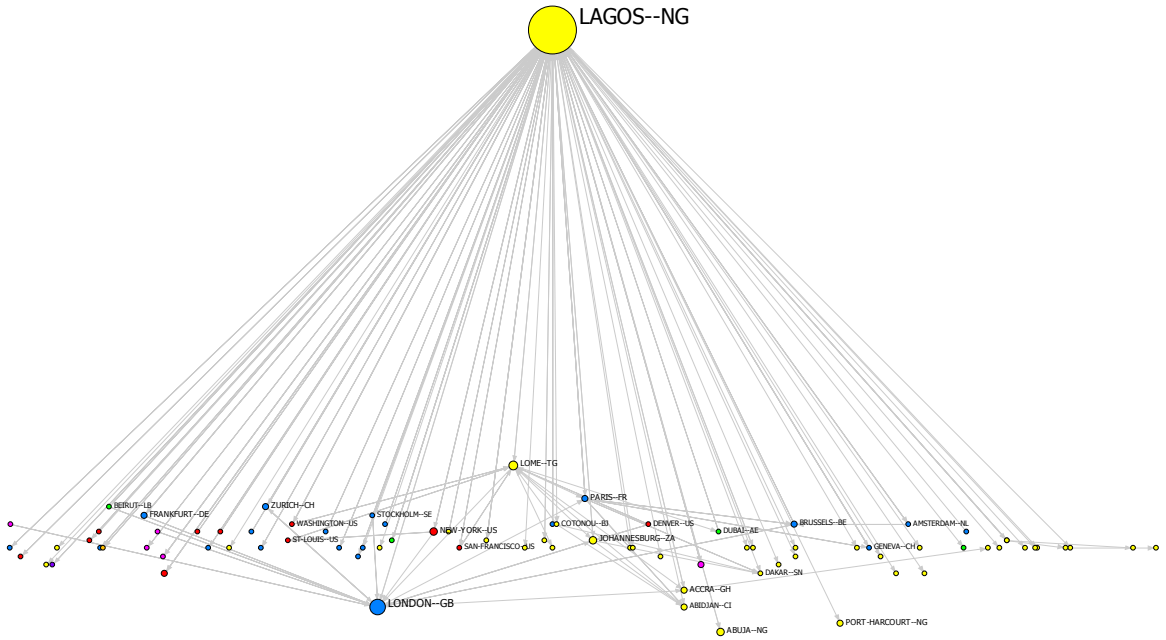

Figure B.26 The Lagos finance network: elevation view

The Lagos finance sector (continued)

B.2.1. Operations (K = 3)

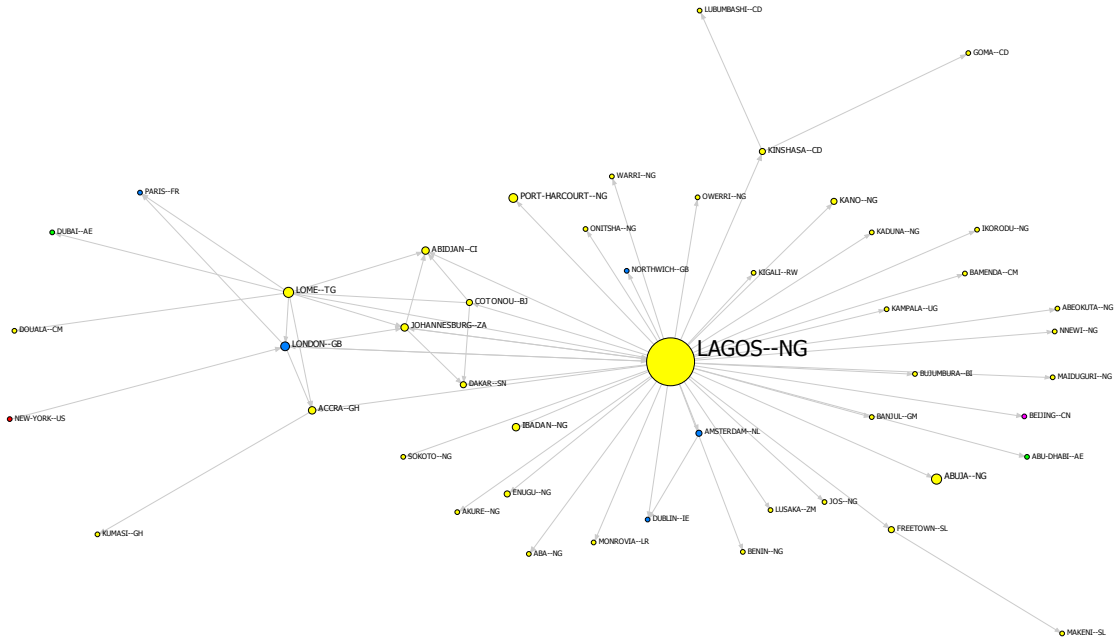

Figure B.27 The Lagos finance operations network: plan view

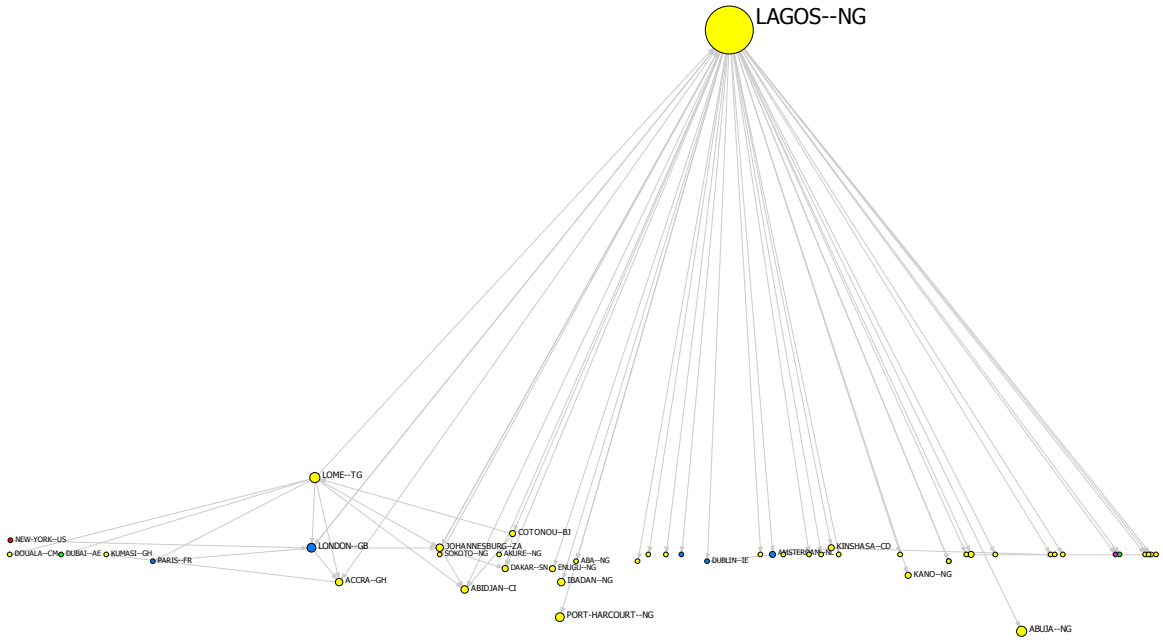

Figure B.28 The Lagos finance operations network: elevation view

B.2.2. Capital (K = 2)

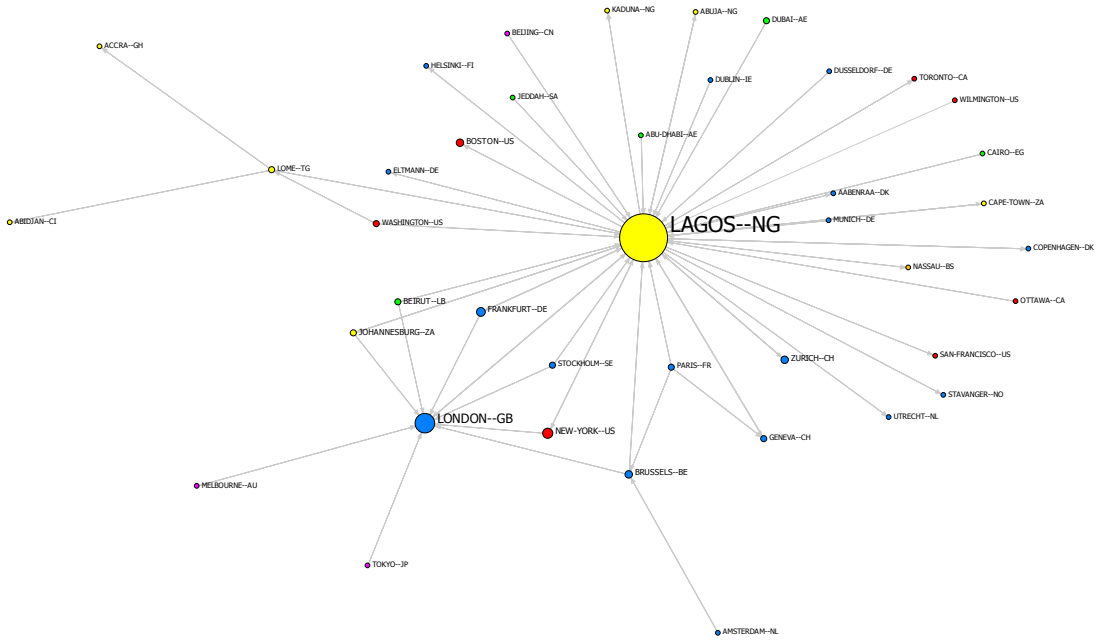

Figure B.29 The Lagos finance capital network: plan view

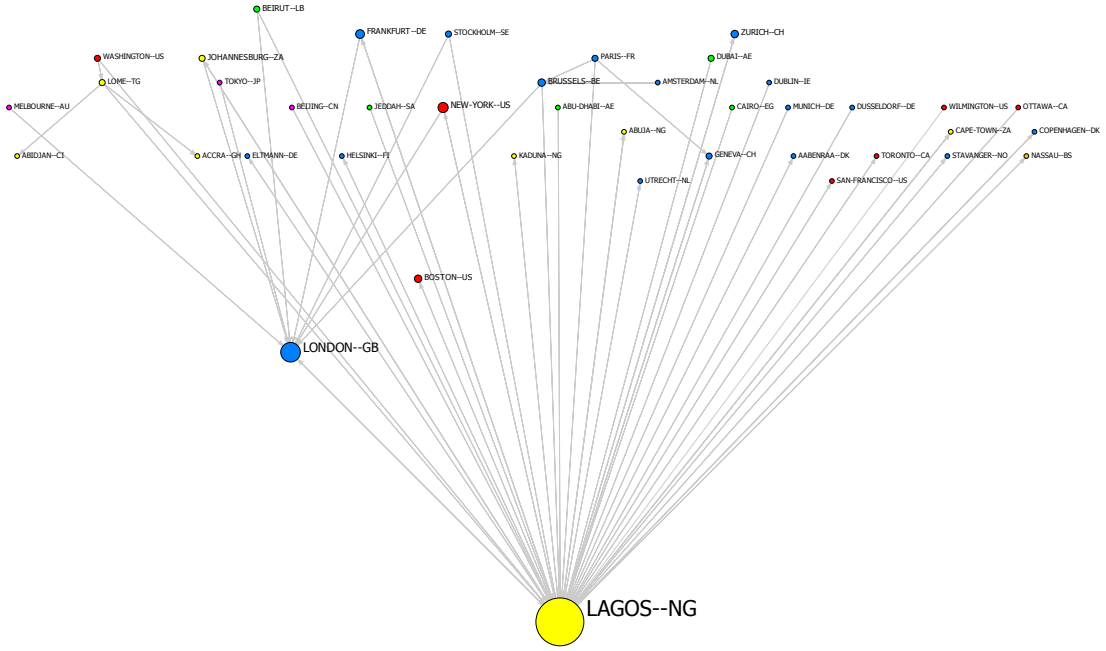

Figure B.30 The Lagos finance capital network: elevation view

B.3. The Lagos services sector (K = 4)

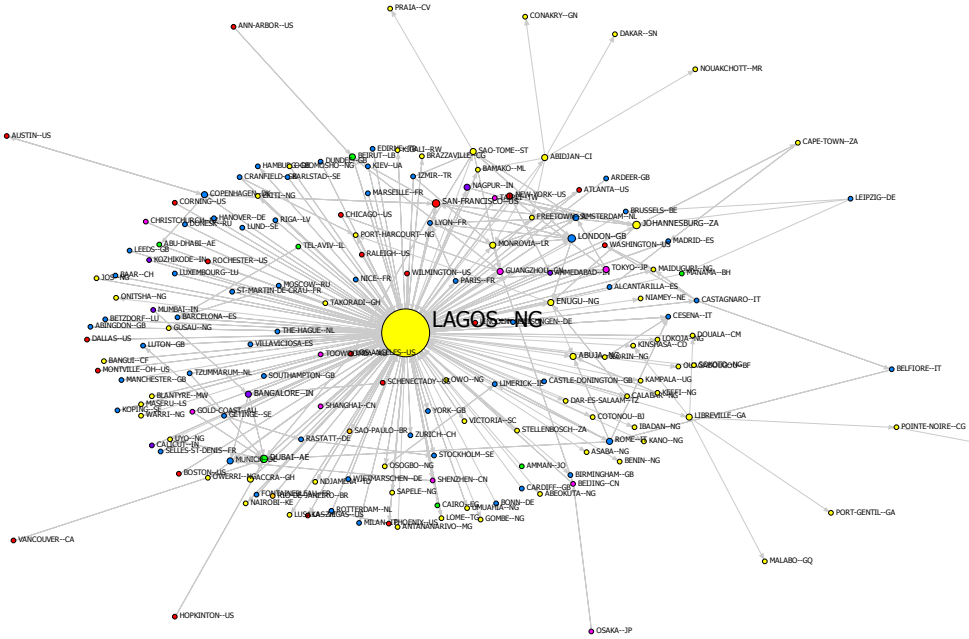

Figure B.31 The Lagos services network: plan view

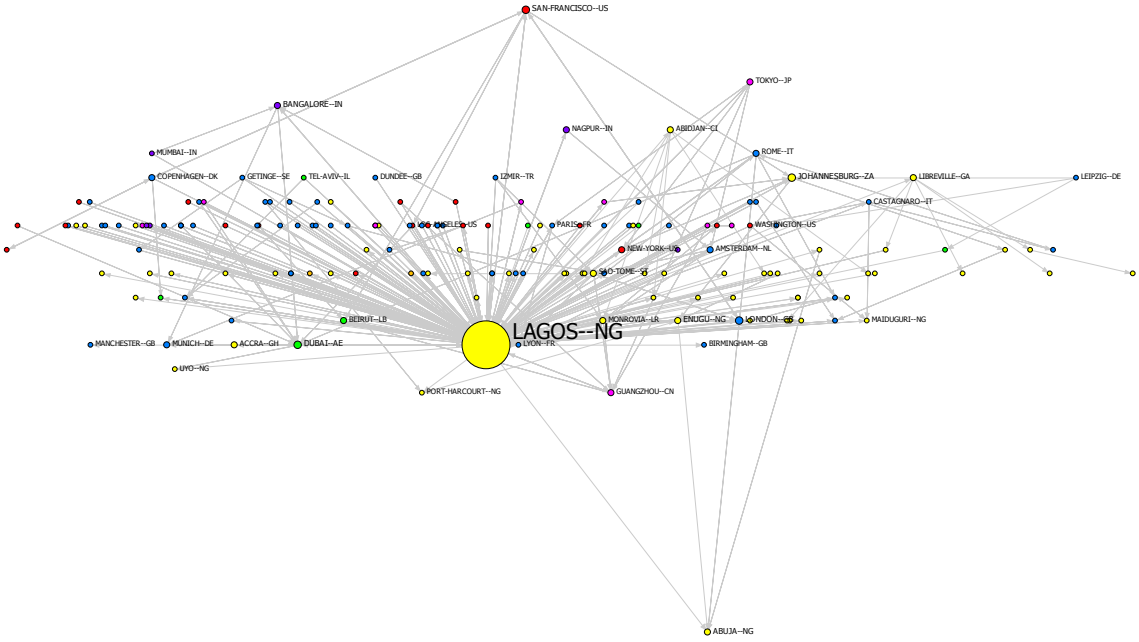

Figure B.32 The Lagos services network: elevation view

The Lagos services sector (continued)

B.3.1. Operations (K = 2)

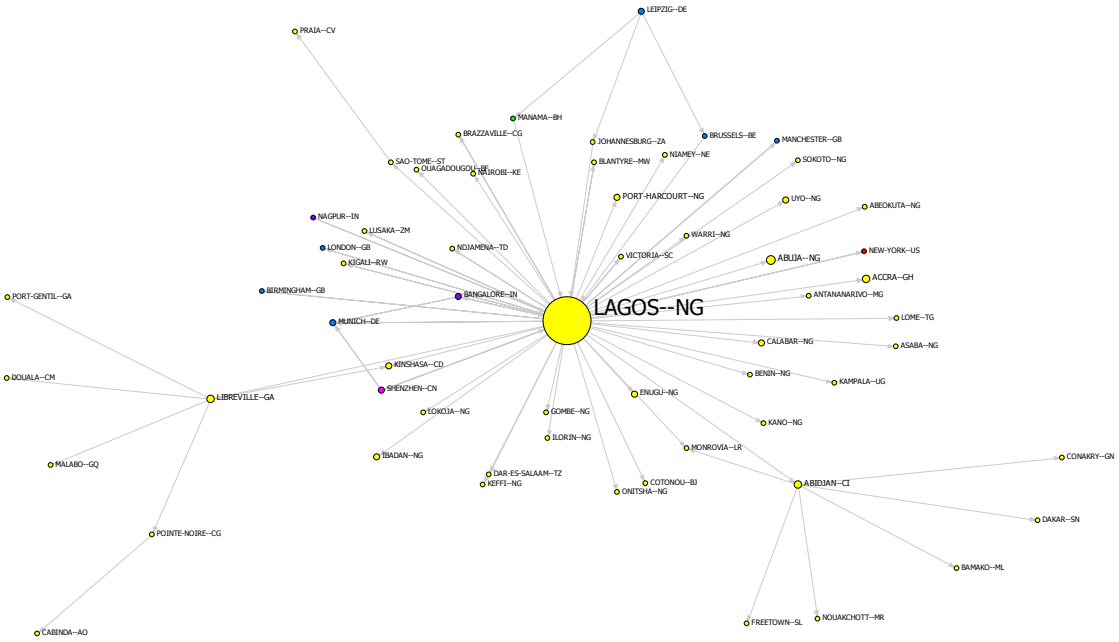

Figure B.33 The Lagos services operations network: plan view

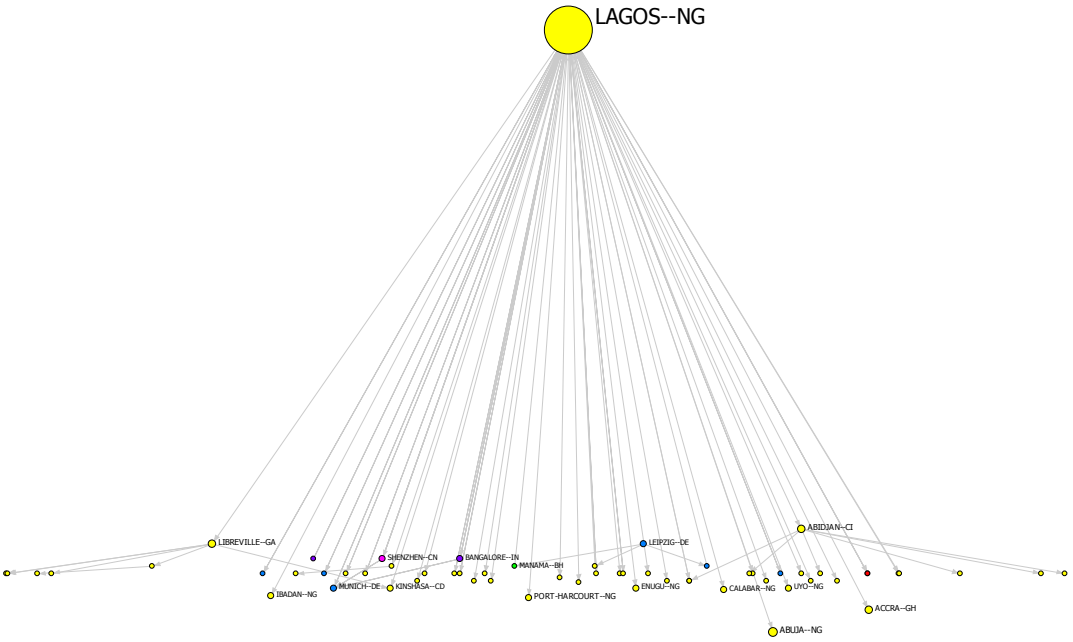

Figure B.34 The Lagos services operations network: elevation view

B.3.2. Supply (K = 3)

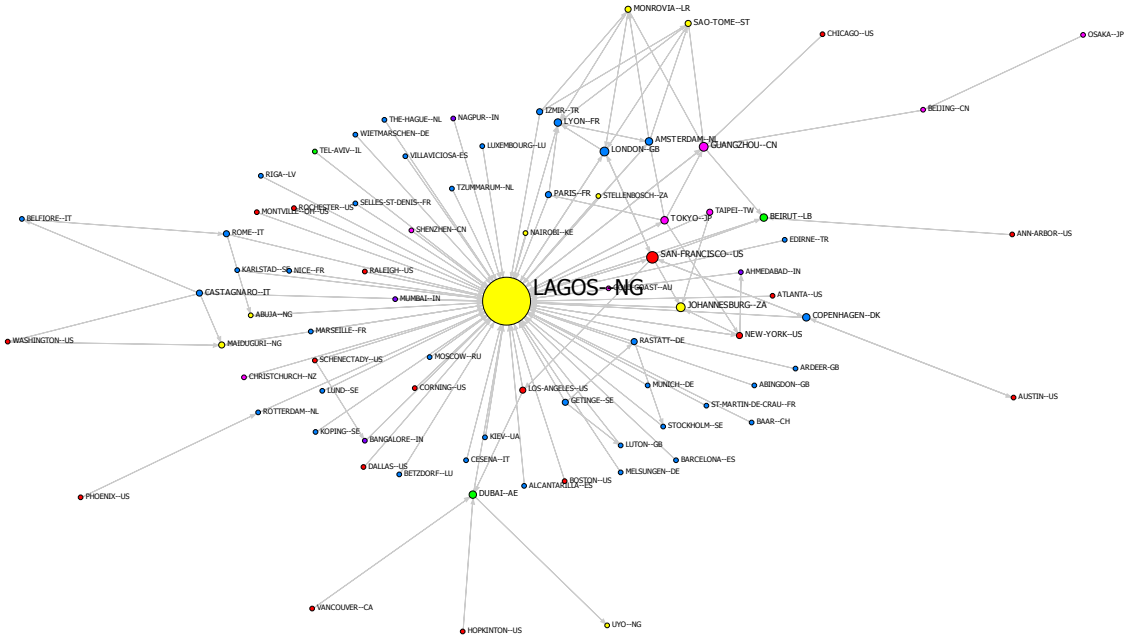

Figure B.35 The Lagos services supply network: plan view

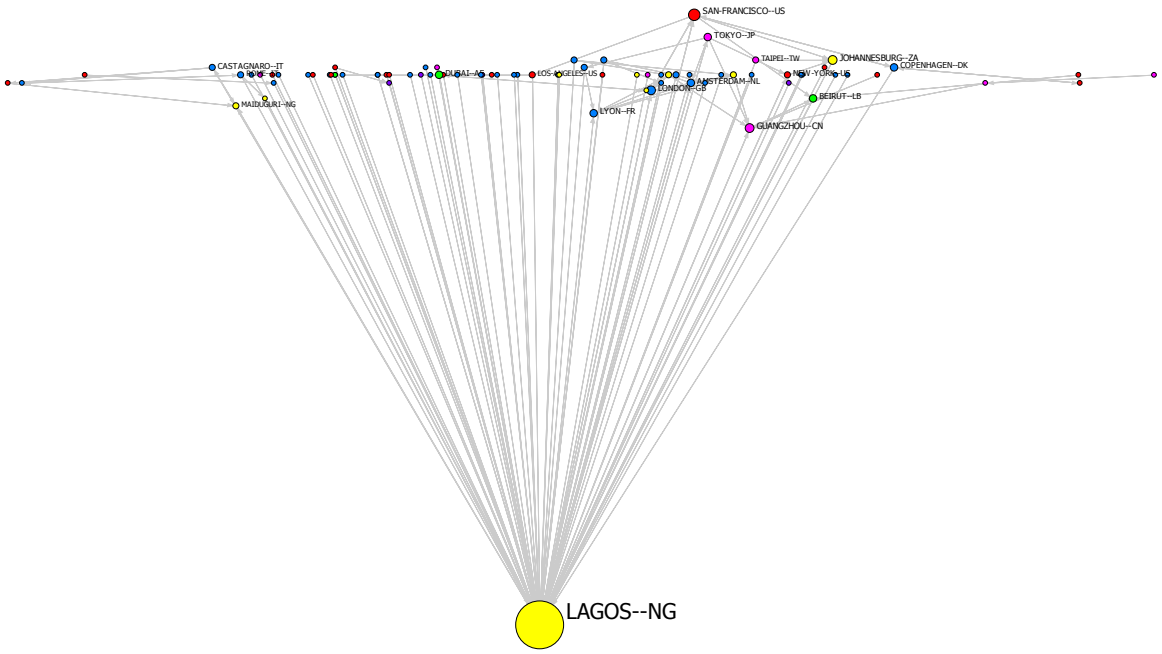

Figure B.36 The Lagos services supply network: elevation view

B.3.3. Knowledge (K = 2)

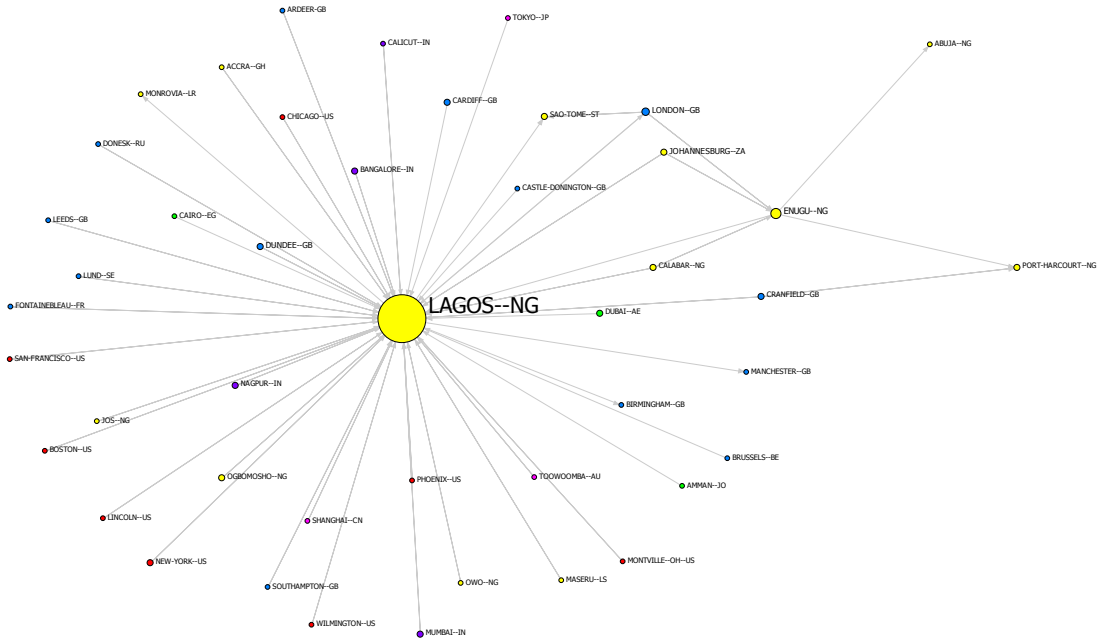

Figure B.37 The Lagos services knowledge network: plan view

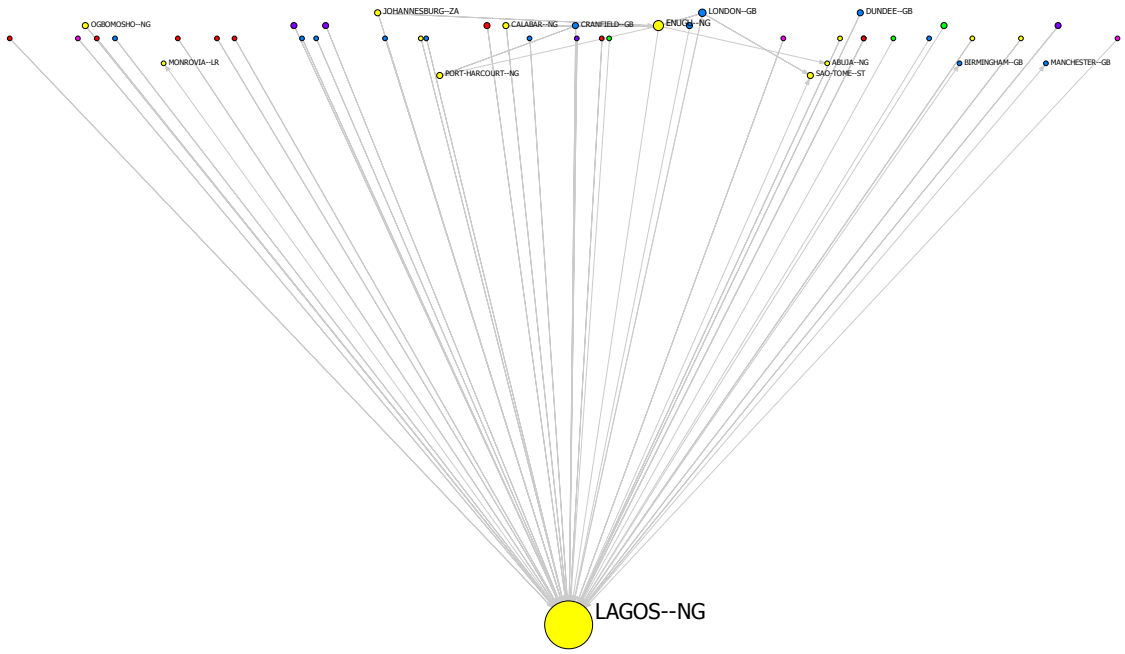

Figure B.38 The Lagos services knowledge network: elevation view

B.3.4. Networking (K = 2)

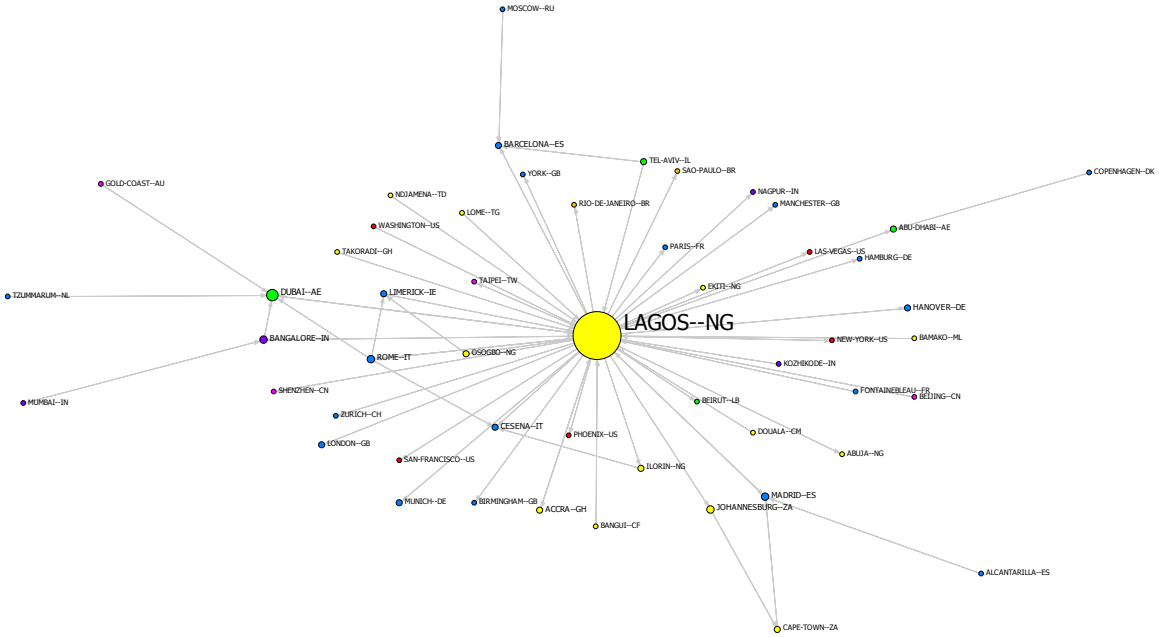

Figure B.39 The Lagos services "networking" network: plan view

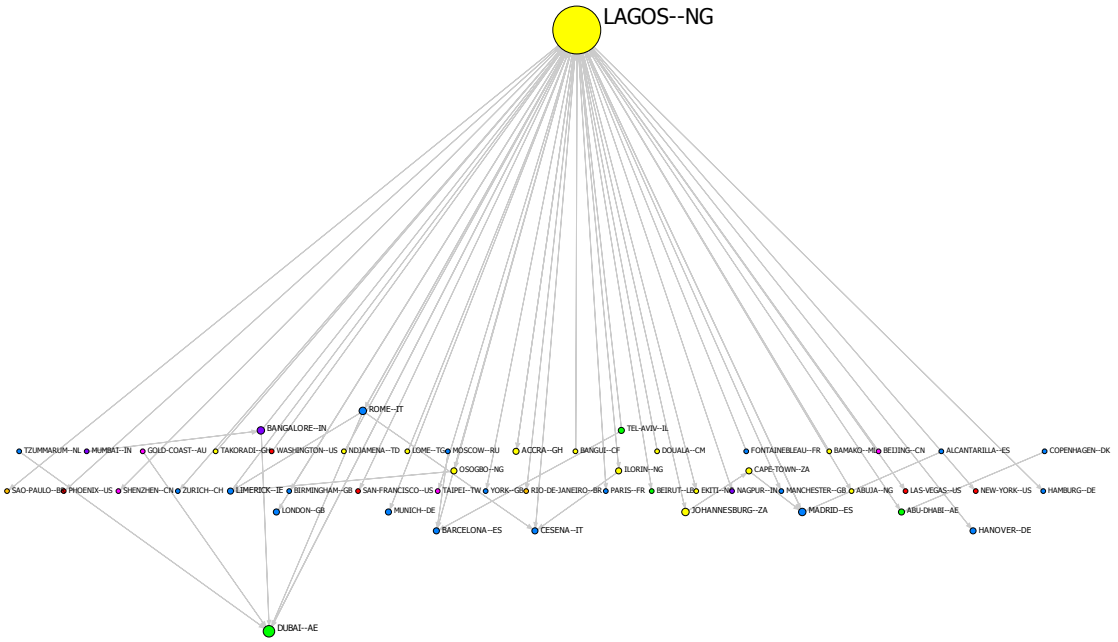

Figure B.40 The Lagos services "networking" network: elevation view

B.4. The Lagos manufacturing sector (K = 3)

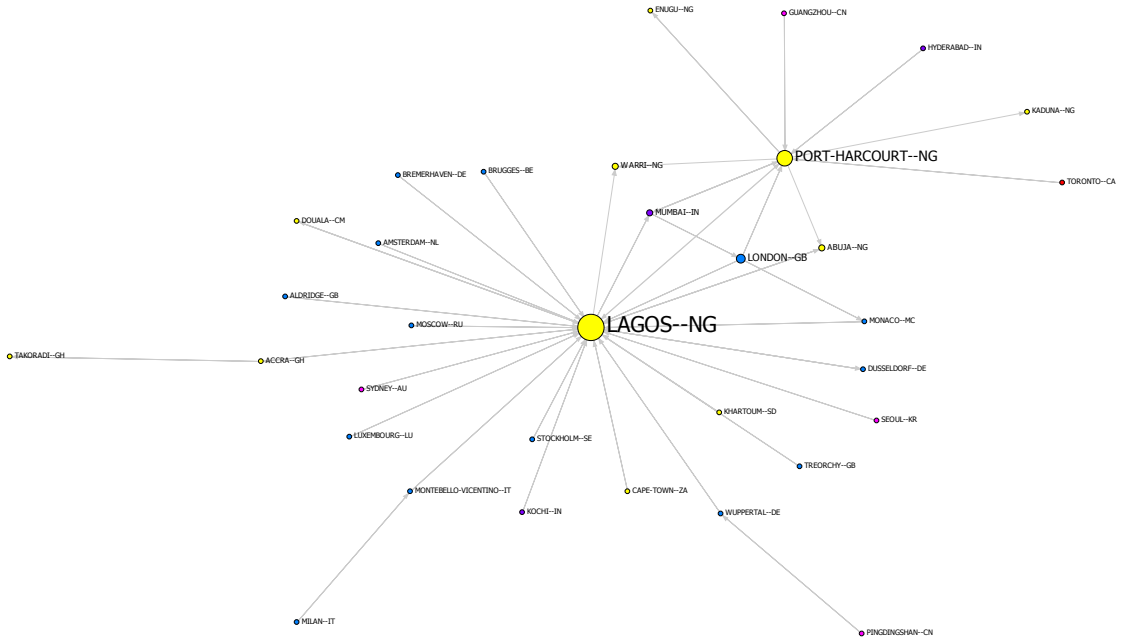

Figure B.41 The Lagos manufacturing sector: plan view

Figure B.42 The Lagos manufacturing sector: elevation view