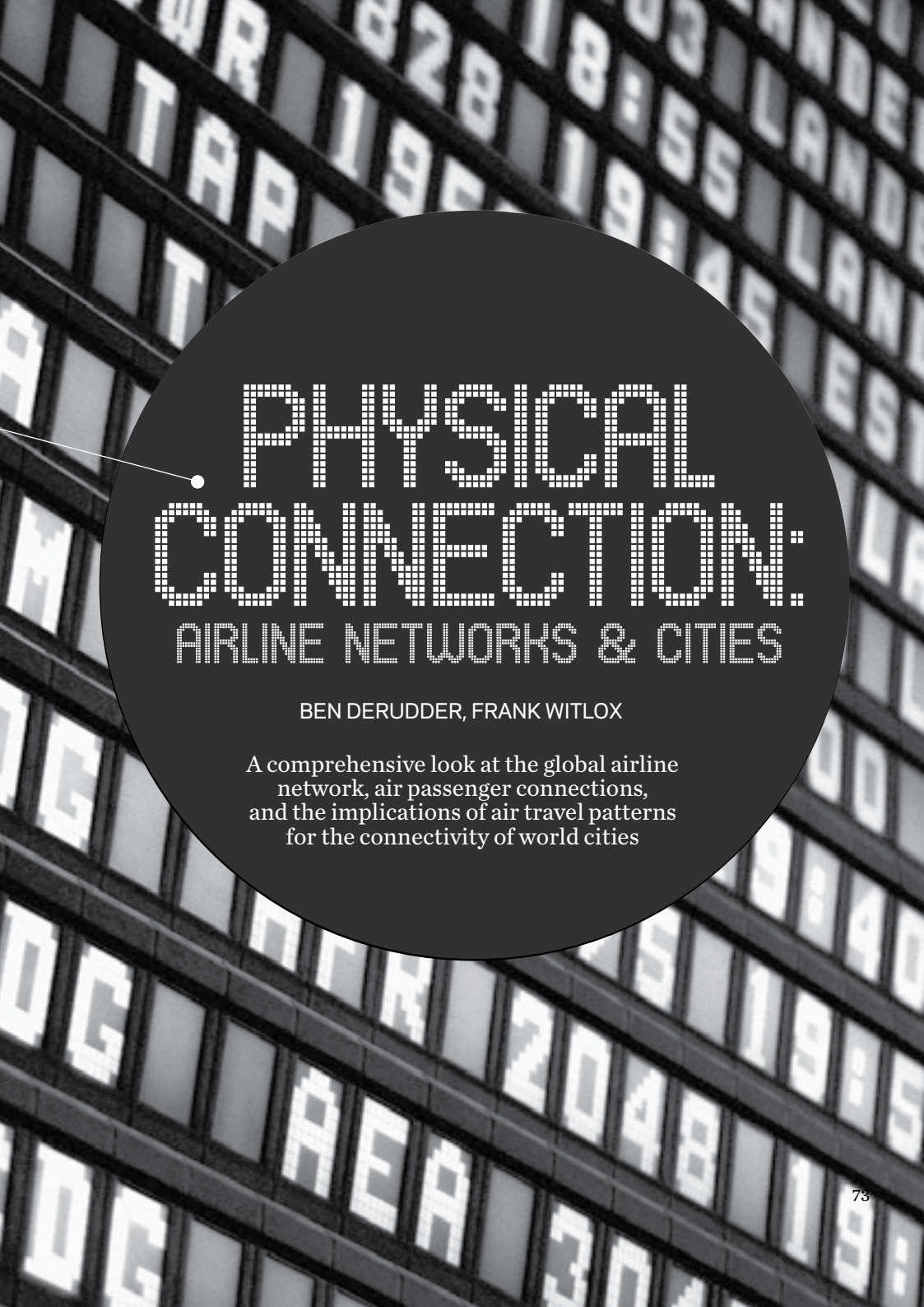




3







PHYSICAL CONNECTION:

AIRLINE NETWORKS & CITIES

BEN DERUDDER, FRANK WITLOX

A comprehensive look at the global airline network, air passenger connections, and the implications of air travel patterns for the connectivity of world cities



**THE GLOBAL AIRLINE NETWORK IS
A PRINCIPAL CHANNEL FOR THE
FLOWS THAT DEFINE THE ARCHITECTURE
OF URBAN CONNECTIONS**

A COMPREHENSIVE ANALYSIS OF the connectivity of the world's major cities would not be complete without a chapter examining the worldwide urban geography of air transportation. There are a number of important reasons to include such an analysis. First, information on a city's connectivity in airline networks is comparatively easy to interpret in comparison with other forms of urban connectivity. Second, airline links and their associated infrastructures are at the same time an important component and the most visible manifestation of a city's aspiration to world city status. And third, air transport is the preferred mode of inter-city movement for the transnational business class, migrants, tourists, and high-value goods that together underpin contemporary globalisation. Taken together, then, connectivity in airline networks can clearly be thought of as a significant determinant of

the 'network potential' of urban agglomerations, and this chapter therefore presents an assessment of global urban connectivity under the form of a large-scale analysis of the geography of airline networks.

The global airline network is thus a principal channel for the flows that define the architecture of urban connections, and by discussing the spatial organisation of the global airline network in more detail, this chapter attempts to contribute to a better understanding of the connectivity of key cities. To this end, this chapter consists of two main sections. First, we briefly discuss general trends and patterns in worldwide air transportation. This overview of the industry's major characteristics is then further elaborated in the second section, in which we present an analysis of urban connectivity in worldwide air transport networks.

MAJOR TRENDS IN GLOBAL AIR TRANSPORT

Origins and Aggregate Trends

ALTHOUGH THE WORLD'S AIR TRANSPORT NETWORKS WERE LARGELY pioneered before the Second World War, the origins of mass air travel date back to no earlier than around 1960. Aggregate growth rates since then have been quite dramatic, although there seems to be an ever-present sense of volatility in the industry. The long-term aggregate growth in demand for air transport has largely been driven by growing gross domestic product (GDP) per capita and disposable incomes. This growing demand for air transport has, however, been further fuelled by radical changes in the geopolitics of air transport, as government regulation and control have increasingly been replaced by an ethos of deregulation, liberalisation, privatisation and increased competition. Cumulatively, the result has been a steep change in the supply and pricing of air transport. Both the rising demand and supply of air transport have led to ever-increasing urban connectivity at a variety of scales.

5.1%
.....
**FORECAST
ANNUAL
GROWTH AIR
PASSENGER
2007-2011**

In spite of some intermittent falls in this aggregate growth pattern (such as the industry's slump after '9/11' and the SARS outbreak in Asia) and structural constraints on the development towards evermore connectivity (such as rising fuel costs, negative environmental impacts and congestion around key metropolises), the aviation industry remains confident about long-term growth. The International Air Transport Association (IATA), for instance, has recently stated that—in spite of seemingly ever-worsening predictions about global economic conditions—growth in air transport will remain strong, albeit that international passenger volume growth has passed its peak level for the current growth cycle. Indeed, IATA expects that international air passenger numbers will continue to grow at an average annual growth rate (AAGR) of 5.1% between 2007 and 2011, which is only slightly lower than the average rate of 7.4% seen between 2002 and 2006. These predictions are based

FIGURE 1
ANNUAL GROWTH RATE AVERAGE PER REGION
 For the period 2007 to 2011 Source: IATA 2007

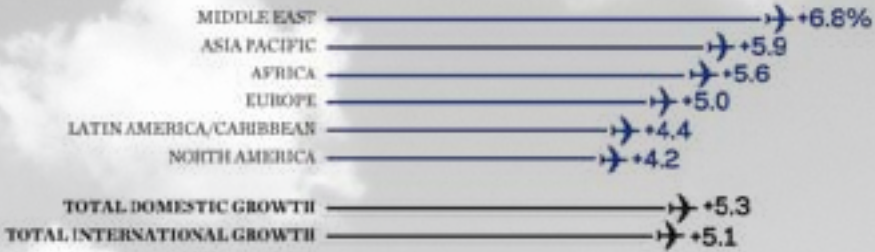


FIGURE 2
AVERAGE ANNUAL GROWTH RATE PER INTER-CONNECTED PAIR OF REGIONS
 For the period 2007 to 2011 Source: IATA 2007



on the assumption that demand growth will be weakened by slower global economic growth, but at the same time boosted by the further liberalisation of markets and the emergence of new routes and services. Furthermore, a significant growth in national connectivity is expected in the Chinese and Indian domestic markets: in these markets domestic passenger numbers are forecast to grow at an AAGR of 5.3% between 2007 and 2011, higher than the average rate of 4.4% seen between 2002 and 2006.

These aggregate growth trends obfuscate major regional differences in expected growth rates (FIGURES 1 AND 2). The latter will largely reflect differences in regional economic growth and the structure of each regional market. According to a recent IATA report,

the Middle East, developing economies in Asia and, to a lesser extent, Africa will be boosted by strong GDP growth, along with significant new capacity and new routes. European growth will be close to the average, though Eastern Europe will see a more rapid expansion. Relatively low Latin American growth reflects lower demand growth on key markets to North America and within the region itself. North America is expected to be the slowest growing region, reflecting both mature markets and cyclically slower growth in the US economy. Strong growth in Asia Pacific will see its share of global passenger traffic increase from 23% in 2006 to 27% of the global total of 2.75 billion passengers in 2011. This is equivalent to a 279 million increase in annual passengers within the Asia Pacific region over the five years. It will have a higher share of the global market than the US domestic market, though it will still be slightly smaller than the North American market as a whole. Taken together, over the next five years, developing economies will make a greater contribution towards air traffic growth. The increase in disposable incomes for a large population within China and India will boost the demand for air travel. However, because incomes are growing from relatively low levels, air traffic growth may initially be focused on domestic and short-haul travel with long-haul travel developing over the medium to long-term.

Major Contemporary Processes: Deregulation and Environmental Sustainability

MOST RECENT ACADEMIC AND PUBLIC DEBATE CONCERNING AIR transport has been centred on the consequences of two intertwined issues, i.e. (i) questions surrounding the environmental sustainability of the air transport industry at large, and (ii) the consequences of globalisation and the associated deregulation of worldwide air transport. Recent research into the issue of ‘environmentally sustainable aviation’ suggests that this may well be a contradiction in terms. The main environmental problems created by air transport are noise from aircraft engines, atmospheric pollution and the excessive fuel use. Technological improvements to reduce both noise and emissions have been implemented, but they are being offset by growth trends of the industry at large. More recently, the growing awareness of the significant environmental problems associated with air transport has led to a set of schemes that seek ‘carbon-neutral’ air transport through internalising the environmental externalities associated with this mode of transport.

For the present discussion, however, the most important feature of contemporary changes is that air transport networks are being reshaped dramatically by myriad globalisation processes. This is, of course, essentially a two-way relationship, in that globalisation results in dramatic increases in air transport, while at the same time being facilitated by the possibilities offered by worldwide airline networks. The most dramatic feature of the globalisation of the airline industry is the continuous deregulation of the worldwide marketplace for aviation. Historically, at the international scale, air service provision between countries was controlled by bilateral agreements negotiated by pairs of governments which governed the so-called ‘freedoms’ of civil aviation. Since domestic airline deregulation in 1978, however, the US government has pursued a global policy to liberalise international bilateral agreements. Most recently, it has sought so-called ‘open skies’ agreements, allowing unrestricted market entry for every carrier. The logical outcome of full open skies will be the replacement of bilateral with multilateral agreements, in which groups of like-minded countries permit any airline virtually unlimited access to any market within their boundaries. In this context, deregulation involves the exposure of air transport to free-market forces achieved through the removal of most regulatory controls over pricing, while permitting carriers to enter and leave markets at will. While this has occurred within regional markets such as the EU and the North American Free Trade Area (NAFTA), the provision of both passenger and freight air transport between these blocs and many individual countries still remains constrained by bilateral agreements.

This trend towards evermore deregulation has significant impacts on the industry at large. For instance, to circumvent remaining regulatory constraints, airlines have sought to establish strategic global alliances (such as Star Alliance, OneWorld and SkyTeam), while the need for efficiency and economies of scale in a global marketplace have led to new rounds of mergers and acquisitions. Deregulation, in turn, has led to new forms of air transport such as the well-known low-cost carriers. In the context of the present discussion, however, the most interesting trend induced by recent changes in the airline industry is a series of shifts in the organisational geography of airline networks, a process that will be discussed in the next paragraph.

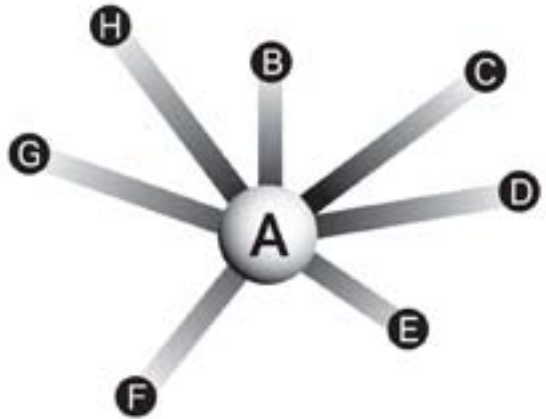
Point-to-Point vs. Hub-and-Spoke Models

THE INTERPRETATION OF URBAN

connectivity in terms of airline networks may seem obvious: after all, the (inherently plausible) assumption is that the connectivity of a major city is directly reflected in its ability to attract a lot of passengers. However, it should be noted that while airline passenger networks have indeed traditionally been oriented towards major cities, there is a continuous shift towards a more complex organisation. This is because some cities are gaining prominence in air transport networks through their role as ‘hubs’ rather than as origins and/or destinations in their own right. Hubs are hereby defined

as places where passengers requiring multiple flights to get to their final destination change planes. While hub functions have always been important to connect distant and/or less important cities, it has become even more important in recent years. More specifically, the mounting importance of specific switching points in global airline networks can be traced back to the adoption of the hub-and-spoke model as primary strategy for organising route structures. The hub-and-spoke model hereby refers to the image of a bicycle wheel with a core component (the hub) and many subcomponents (the spokes). When airlines adopt this model, they establish one or more central switching points where passengers can change planes. Spoke flights via the hub take passengers to their final destinations. **FIGURE 3** presents an example of an ‘ideal’ hub-and-spoke network and an ‘ideal’ point-to-point network.

Although the hub-and-spoke model may involve the disadvantage of a longer overall travel time, its benefits are obvious: there are fewer routes to service, which in turn yields the possibility of higher flight frequencies, higher loadfactors and the possibility to create economies of scale using bigger aircraft. The reason for the mounting success of



FEWER ROUTES TO SERVICE & HIGHER FLIGHT FREQUENCY

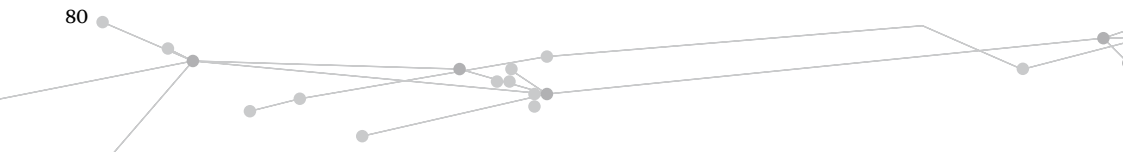
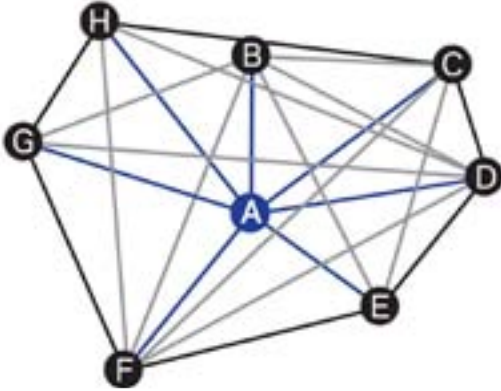


FIGURE 3
HUB-AND-SPOKE VS.
POINT-TO-POINT NETWORKS

www.lboro.ac.uk/GaWC/rb/rb187.html



the hub-and-spoke model, therefore, is that it allows airlines to exploit important productive efficiencies due to the presence of economies of traffic density. The growing relevance of the hub-and-spoke model has, however, equally been fuelled by 'external' trends. For instance, the previously described deregulation pacts in Europe and the US were a major force in the transition towards hub-and-spoke models. Indeed, most major US carriers have adopted the hub-and-spoke model after the *Airline Deregulation Act* in 1978, while major European airlines have increasingly been moving in the same direction

since the deregulation of the European market in the period 1988–1997. Although it can be expected that the further liberalisation of air traffic will once again reinforce the trend towards hub-and-spoke networks, there are at the same time some powerful countertendencies at work. The most important countertendency is the mounting success of low-cost carriers, which are notorious for their use of a point-to-point organisation. The ensuing reinstatement of large-scale point-to-point models challenges the gradual shift towards hub-and-spoke networks, and this is likely to gain further pace as low-cost carriers continue to increase their market shares. It is difficult at this stage to predict how the total share of both organisational networks will evolve, but it is obvious that both schemes will continue to co-exist: in practice, the route structures of major airlines exhibit a mixture of both organisation forms, with (i) direct connections between major cities, and (ii) a hub-and-spoke network to ensure that every city is connected to the overall network. In the context of this chapter, the most important point is that we should be able to make the distinction between the 'real' origin/destination connectivity of a city and its connectivity due its role as switching point for air traffic between other pairs of cities.

HIGHER LOAD FACTORS & ECONOMIES OF SCALE

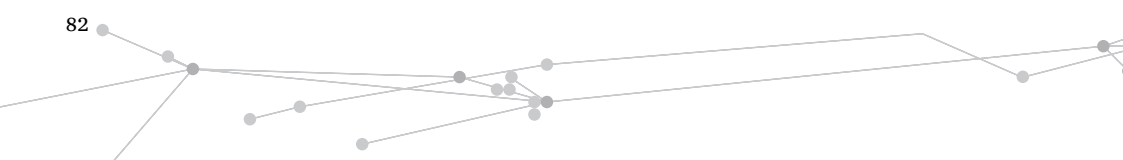
CONNECTIVITY OF CITIES

Beyond Standard Airline Statistics

THE ANALYSIS OF THE WORLDWIDE CONNECTIVITY OF MAJOR CITIES based on air transport statistics is centred on the idea that air traffic provides us with a pertinent indicator in this context. However, we have equally stressed that because of the widespread adoption of hub-and-spoke models, one has to distinguish ‘real’ origin/destination connectivity from ‘hub connectivity’. Although standard airline statistics, such as those provided by IATA and other air transport agencies, may well provide a basic insight into the urban geography of air transport networks, they cannot be used for our specific purposes for two main reasons. First, standard statistics lack information on the *actual* origin/destination of passengers. This is because these statistics record the individual legs of trips rather than the trip as a whole. Thus, in the case of a stopover, a significant number of ‘real’ inter-city links are replaced by two or more links that reflect corporate strategy rather than relations between cities. Furthermore, this lack of origin/destination information makes geographically detailed assessments of the connectivity of cities at a global scale difficult, as direct connections become less likely as one deals with less important and/or geographically distant cities. According to the airline database used in this chapter, 28% of international passengers make one or more stopovers, which suggests that classical statistics are heavily biased. A second obstacle to translating mainstream air transport statistics into analyses of urban connectivity arises from the fact that these data sources incorporate a *state-centric bias*. That is, despite their global aspirations, most databases contain information on international flows. The importance and the rise of domestic connectivity in countries such as the US, India, and China suggests, however, that both national and international connectivity should be considered in a single, consistent framework.

MIDT-Data

STANDARD AIRLINE STATISTICS ARE THUS NOT ALWAYS VERY WELL suited to present a detailed overview of a city’s connectivity. In this chapter, we therefore make use of a dataset that is able to overcome these problems. Our MIDT (Marketing Information Data Transfer) database contains information on bookings made through so-called Global Distribution Systems (GDS) such as Galileo, Sabre, Worldspan,



Amadeus, Topas, Infini, and Abaccus. GDS are electronic platforms used by travel agencies and airlines to manage airline bookings (i.e., the selling of seats on flights offered by different airlines), hotel reservations, and car rentals. With the cooperation of an airline, we were able to obtain a MIDT dataset that covers the period from January to August 2001, and contains information on a total of 3.7 million trips. Each MIDT record is made up of an entire airline trip, and comprises information on the IATA-airport codes of origin/destination, the air carrier, the connecting airports (if any), and the number of passengers. Airlines purchase the MIDT database for a variety of reasons, the most important of which is its ability to forecast demand. It is also a helpful tool for assessing the market share and the competitive position of an airline in a specific geographical area. In the context of our research, however, the database is used to construct inter-city matrices that can be used to assess urban connectivity from a number of different perspectives. Because of the way in which airline bookings are recorded in this dataset, we are able to circumvent the problems identified in the previous paragraph: (i) the actual route of passengers allows us to distinguish between real origin/destination connectivity on the one hand and hub connectivity on the other hand, while (ii) national and international connectivity is analysed in the same way.

To obtain our urban connectivity measures, we transformed this dataset in a number of ways. First, because we are mainly interested in the total volume of passenger flows between cities (rather than between airports *per se*), we relabelled airport codes into city codes. These city codes are needed to compute meaningful inter-city measures because a number of cities have more than one major airport. The particular airport used by a passenger is not important in this context because, for recording the London-New York relation, it is irrelevant whether a flight goes from London Heathrow to New York JFK or from London Gatwick to Newark. After having summed the directional information into a single measurement detailing the total volume of passengers between any pair of cities, we created two global inter-city matrices that focus on the most important cities in the world economy. The first dataset focuses on the actual origins and destinations of passengers (irrespective of the actual spatiality of their travel pattern, i.e. a direct connection or via a hub), the second on the networked function of cities in their role as transfer points for passengers. Accordingly, the overview of our results will focus on both features of a city's connectivity.

2,750,000,000
ANNUAL GLOBAL AIR PAX

Our selection of cities consists of a combination of two indicators. First, we omitted key holiday destinations and less important cities by drawing on the tentative world city list compiled by the Globalisation and World Cities research group and network (Gawc). This list contains 315 cities and includes the capital cities of all but the smallest states and numerous other cities that have an obvious global economic importance. Second, we complemented this inventory by adding all Metropolis member cities that do not feature in the Gawc list. A number of cities were excluded either because they had no airport (e.g., Bonn and Kawasaki) or because the airport was not serviced in the period under consideration (e.g. Kabul). **FIGURE 4**, which summarises the actual routes employed on the Paris–Seattle and Miami–Seattle connections, reveals the possibilities of our dataset in this context. The most popular way of flying from Paris to Seattle is via London, closely followed by a direct connection between both cities. Other popular hubs for this connection are New York, Copenhagen and Pittsburgh. Miami and Seattle, in contrast, have fairly well developed direct connections: 17,665 passengers took a direct flight opposed to 24,342 passengers that made use of one or more hubs. St Louis, Dallas and Atlanta are the most important hubs for this particular connection.

FIGURE 4
NUMBER OF DIRECT/INDIRECT PASSENGERS ON THE
PARIS–SEATTLE AND MIAMI–SEATTLE CONNECTIONS

Source: www.lboro.ac.uk/gawc/rb/rb152.html

PARIS–SEATTLE			MIAMI–SEATTLE		
	VIA HUB	PASSENGERS		VIA HUB	PASSENGERS
1	London	7,031	1	St Louis	4,766
2	Copenhagen	2,935	2	Dallas	4,462
3	Pittsburgh	2,641	3	Atlanta	2,612
4	New York	2,211	4	Houston	2,310
5	Toronto	2,197	5	Chicago	2,219
6	Amsterdam	2,178	6	Denver	2,182
7	Washington	2,082	7	Minneapolis	810
8	Charlotte	1,683	8	Charlotte	775
9	Cincinnati	1,611	9	Phoenix	678
10	Chicago	1,582	10	Memphis	451
	DIRECT	6,078		DIRECT	17,665

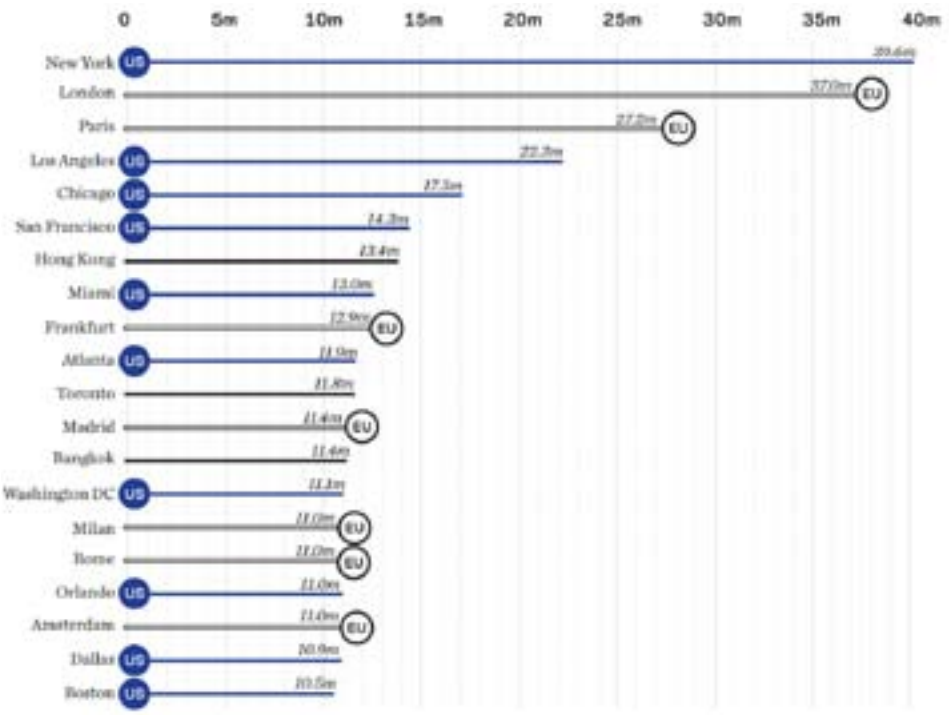


76.6^M

TOTAL INBOUND /OUTBOUND NEW YORK & LONDON PAX

FIGURE 5
TOP 20 MOST CONNECTED CITIES
In terms of origin/destination passengers

Source: www.lboro.ac.uk/gawc/rb/rb152.html



Origin/Destination Connectivity

FIGURES 5–6 AND FIGURE 7 GIVE AN OVERVIEW OF URBAN CONNECTIVITY in terms of origin/destination flows. **FIGURE 6** details the most important cities in the world economy in terms of air passenger connectivity (it includes all Metropolis members and the non-Metropolis members that feature in top-30 in terms of origin/destination connectivity); **FIGURE 9** presents the 20 most

FIGURE 6
MOST IMPORTANT INTER-CITY CONNECTIONS
 In terms of origin/destination passengers

Source: www.lboro.ac.uk/gawc/rb/rb152.html



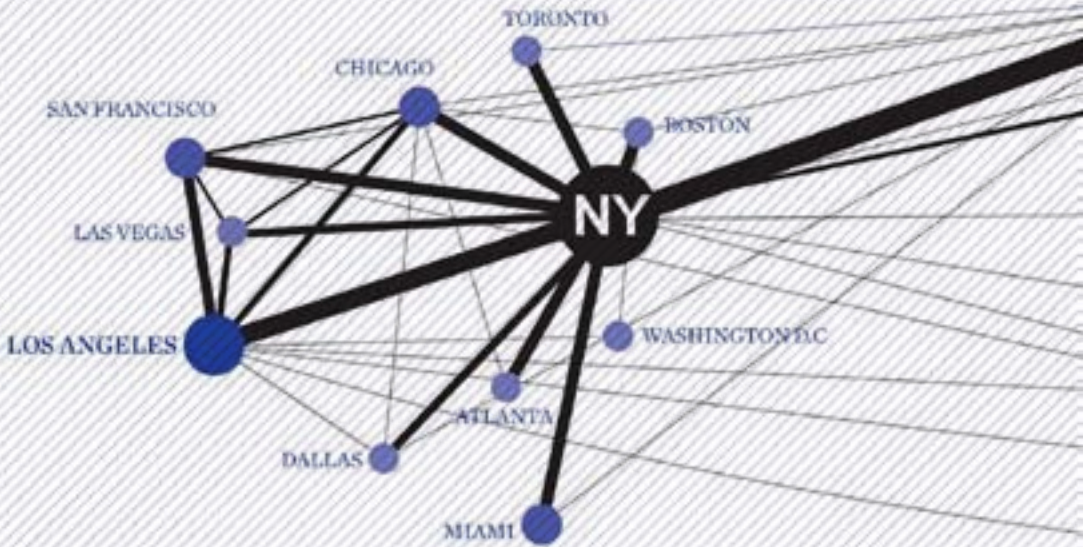
4TH

SYD-MEL
 FOURTH
 HIGHEST
 INTERCITY
 AIR ROUTE

FIGURE 7

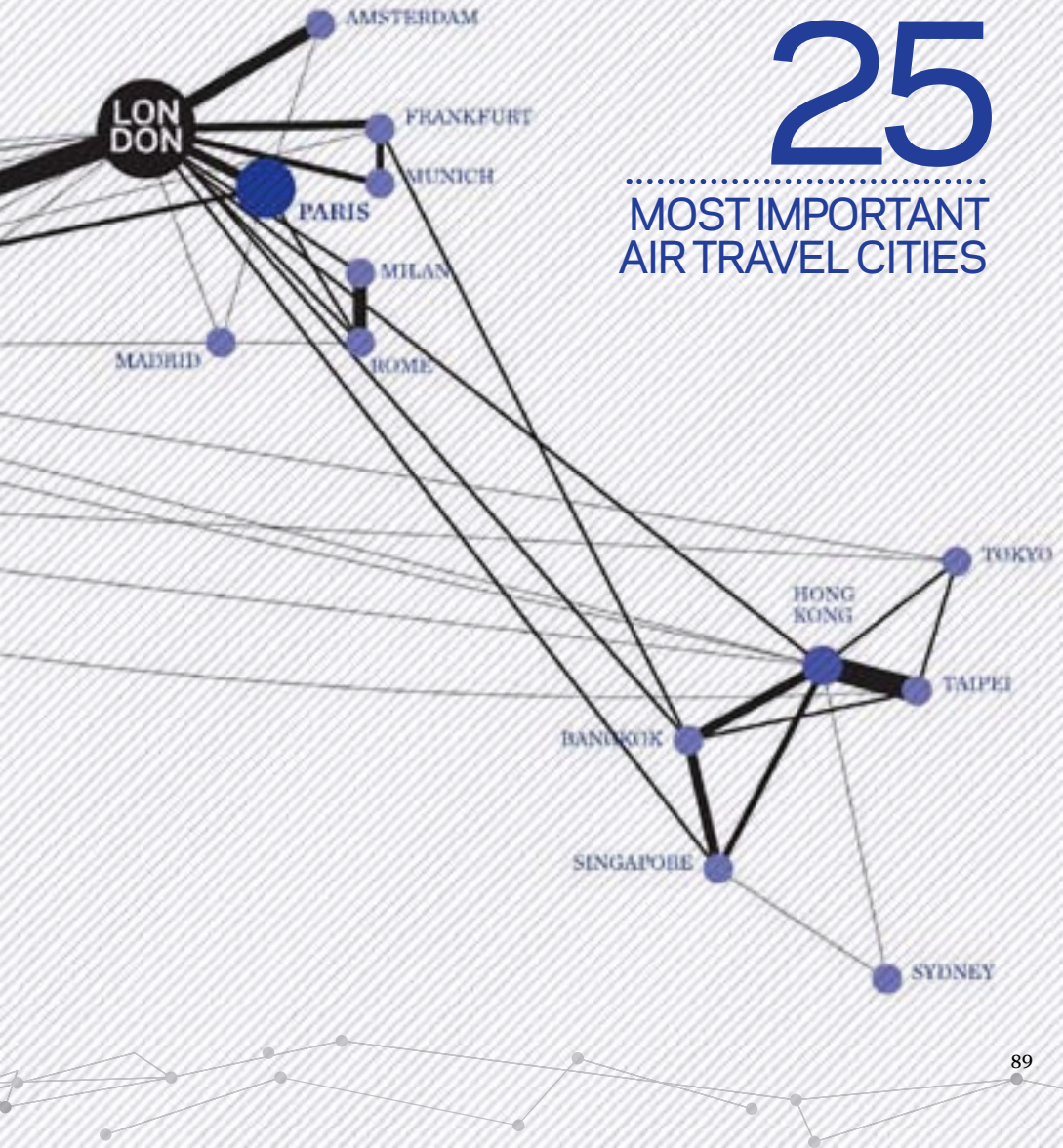
MOST IMPORTANT CITIES AND LINKS IN THE WORLD CITY NETWORK

Source: www.lboro.ac.uk/gawc/rb/rb152.html



25

MOST IMPORTANT
AIR TRAVEL CITIES



important inter-city relations in the dataset; and **FIGURE 7** depicts the connections between the 25 most important cities in terms of total passenger flows. The size of the nodes varies with the total number of incoming or outgoing passengers; the size of the edges varies with the number of passengers flying between two cities. For reasons of clarity, only the most important links are shown.

FIGURE 6 gives a straightforward overview of the main hierarchical tendencies in the urban networks as created by worldwide air transport linkages. The most obvious feature of the figure is that it is (still) dominated by cities from OECD countries in general, and by US cities in particular. The early deregulation of the US aviation market and the general lack of alternatives such as high-speed trains (perhaps with the exception of the Boston–New York rail connection) have historically boosted the airline connectivity of US cities, but—as we have stressed in the introduction—key cities from other world regions have been catching up rapidly in the last few years in terms of origin/destination flows, a trend which is expected to continue in the years to come. As a consequence, a number of cities from the erstwhile “Third World” assume an increasingly important role as origins and destinations

FIGURE 8
FIVE MOST IMPORTANT HUB CITIES PER REGION

Source: www.lboro.ac.uk/cawc/rb/rb187.html

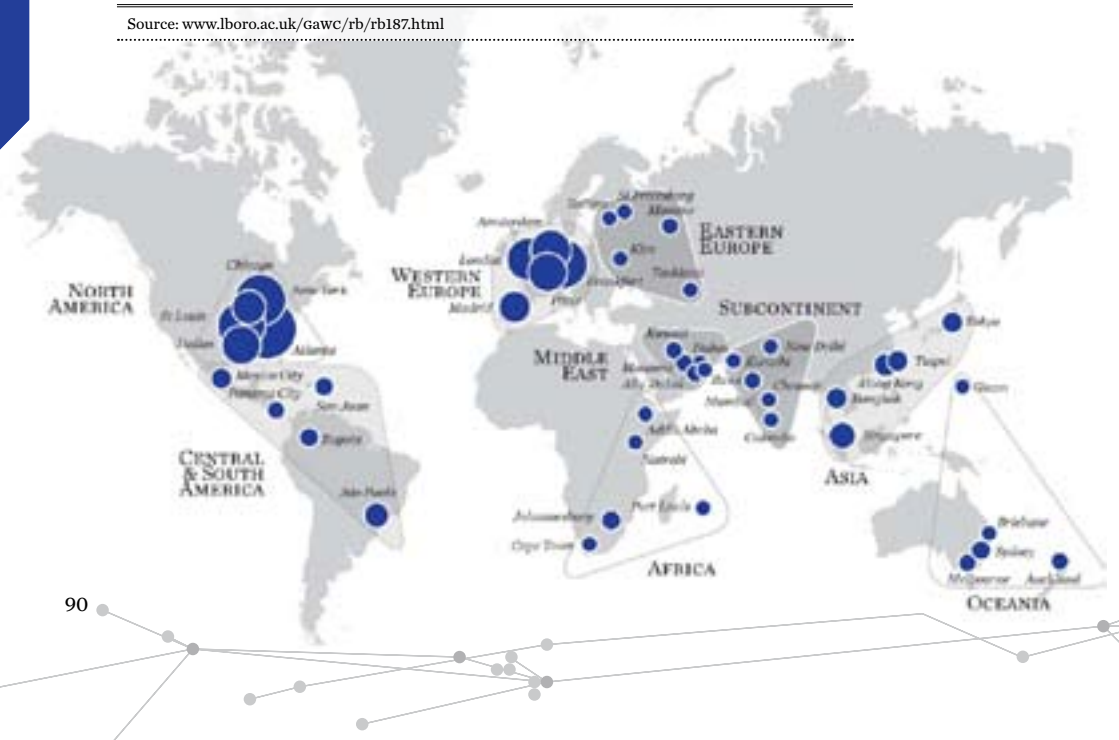
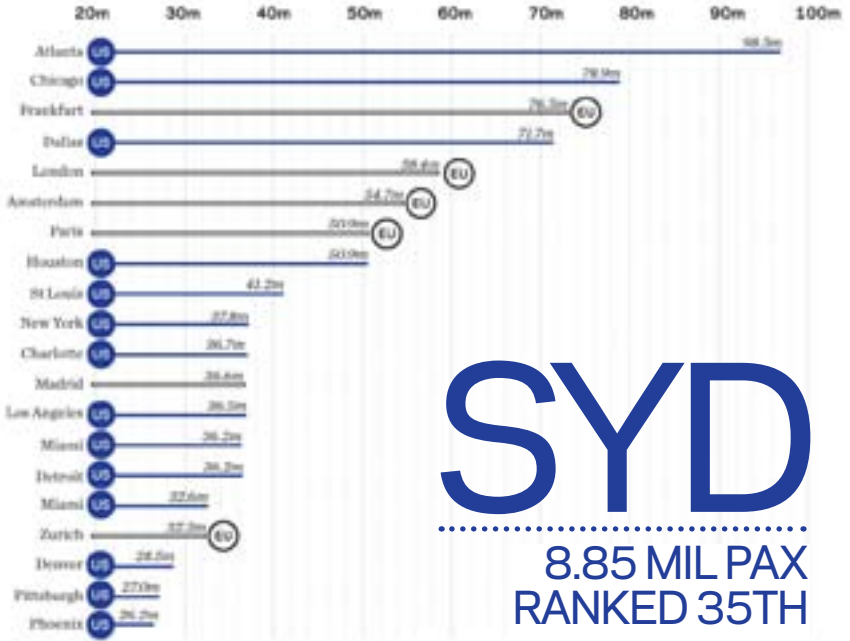


FIGURE 9
MOST CONNECTED CITIES
 In terms of hub passengers

Source: www.lboro.ac.uk/gawc/rb/rb187.html



in worldwide airline connections, as can be seen from the important connectivity of cities such as Bangkok, Mexico City, and São Paulo.

In terms of the geography of inter-city linkages, **FIGURE 6** and **FIGURE 7** reveal a threefold pattern. First, although airline connections are often assumed to be clear-cut signposts of the global connectivity of cities, it can be seen that national connections dominate the picture. In addition to a large number of US city-pairs, the list primarily consists of national connections such as Melbourne–Sydney, Milan–Rome and Johannesburg–Cape Town. Second, these important inter-city connections within states are complemented by a number of ‘regional’ connections, especially—but not exclusively—in the EU and Asia Pacific. Examples include the importance of the Bangkok–Hong Kong, Amsterdam–London and Paris–London

connections. And third, a number of worldwide origin/destination pairs are entering the picture as well. The most obvious example is the London–New York connection, which boasts a connectivity comparable to that of the New York–Los Angeles and Sydney–Melbourne connections. The absolute and relative importance of the London–New York connection can be thought of as a key example of how the fate of main cities around the globe is increasingly influenced by their worldwide connections to other cities.

Hub Connectivity

APART FROM BEING IMPORTANT ORIGINS AND DESTINATIONS IN THEIR own right, major cities around the globe also derive a substantial part of their connectivity from their role as switching points for travellers. The absence of major cities such as Dubai and Singapore in [FIGURES 5–6](#) can—at least partly—be attributed to this observation: their chief role in airline networks consists of connecting other city–pairs (particularly cities in Europe and the Asia Pacific region). In this concluding paragraph, we will therefore present an overview of the hub connectivity of major cities around the globe.

[FIGURE 9](#) features the most important cities in terms of the number passengers that make use of a city as a switching point. Similar to [FIGURE 5](#), it includes all Metropolis members and the non–Metropolis members that feature in top–30 in terms of hub connectivity. Perhaps unsurprisingly, the figure reveals that major nodes in the global airline network also function as major hubs in the airline network as a whole (perhaps with the exception of Tokyo, and, to a lesser degree, New York). There is a notable regional focus in this ‘global’ hierarchy: 24 of the 25 most important hubs in absolute terms are located in North America or Europe. The only exception here is Singapore, which is ranked 23rd. The figure suggests that hub–and–spoke connectivity is particularly important to North American and European cities. However, [FIGURE 6](#), which presents an overview of the five most important hubs per world region, clearly shows that this does not imply that urban networks in other regions are characterised by the *absence* of hubs: the lack of cities from other parts of the world in [FIGURE 9](#) merely hints at the fact that the volume of traffic through these hubs is at present too small to feature prominently in rankings based on transnational data. Once again, however, the steady rise of the hub connectivity of cities such as Dubai, Abu Dhabi and Singapore will, in conjunction with the above–average growth of the traffic in the markets they serve, likely change this picture in the years to come.

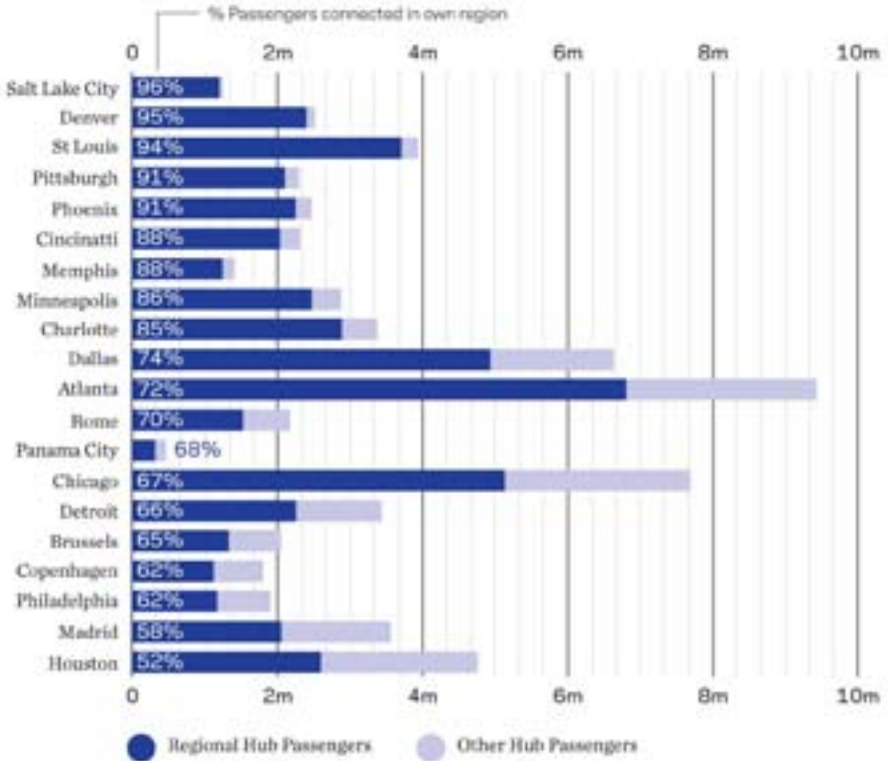


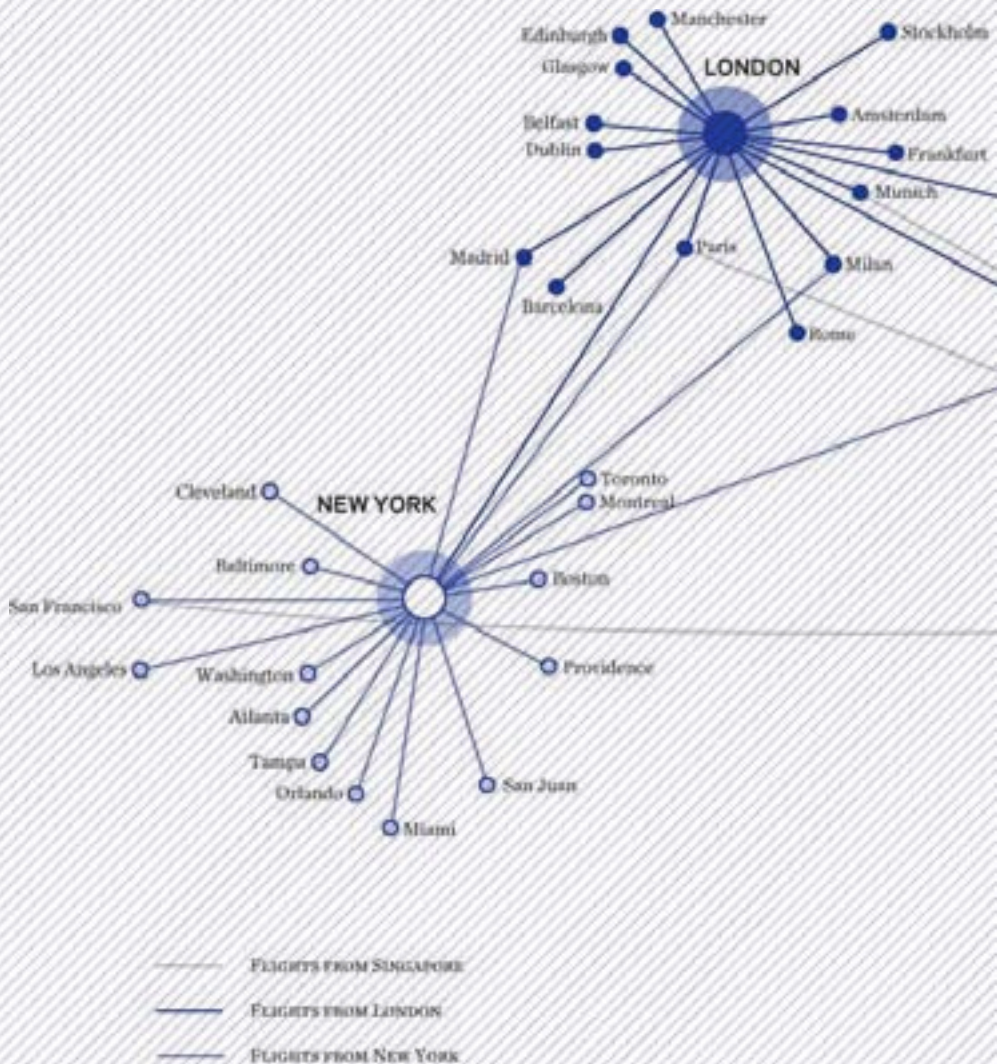
FIGURE 10
 PERCENTAGE OF PASSENGERS CONNECTED
 In the own region for a number of major hubs

Source: www.lboro.ac.uk/gawc/rb/rb187.html

This overview of major hub cities in air transport networks does, however, not provide us with an insight in the spatiality of a city’s hub function: it is a ‘de-spatialised’ measure in that it simply focuses on the number of passengers/cities that use a node as a switching point. In parallel with **FIGURE 6**, we will therefore complement the rankings in **FIGURE 9** and **FIGURE 8** with an assessment of some key spatial characteristics of hubness: we assess to what degree hubs connect extra-regional passengers, and complement this ranking with a more detailed examination of some notable examples.

FIGURE 11
TWENTY CITIES THAT MAKE THE MOST INTENSE USE OF
NEW YORK, LONDON, AND SINGAPORE AS HUB

Source: www.lboro.ac.uk/GaWC/rb/rb187.html



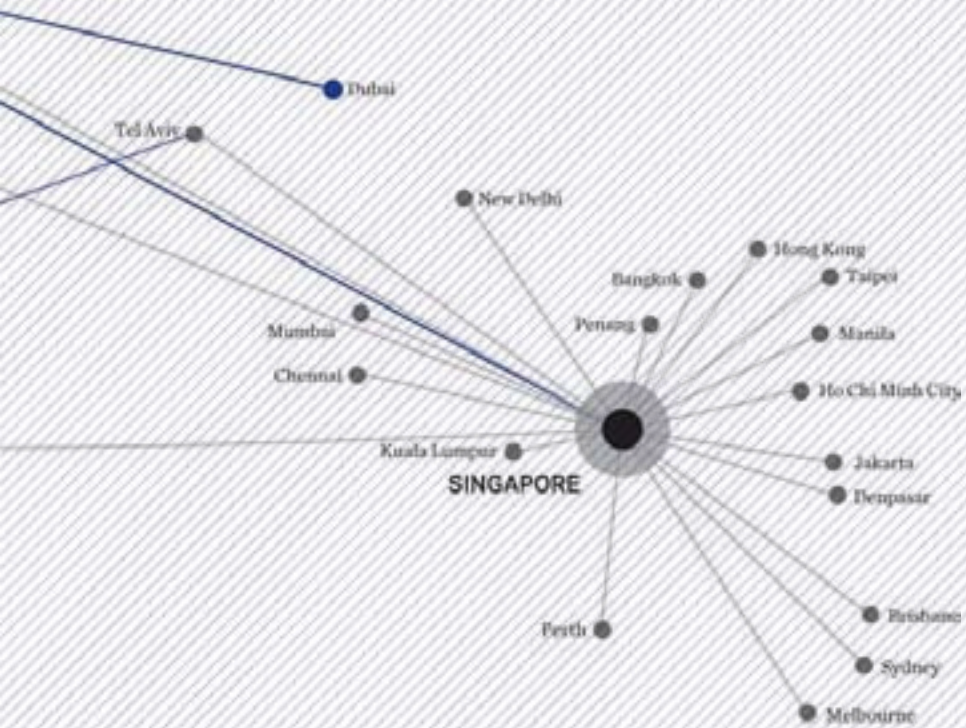


FIGURE 12
TWENTY CITIES THAT MAKE THE MOST INTENSE
USE OF ATLANTA AND MIAMI AS HUB

Source: www.lboro.ac.uk/GaWC/rb/rb187.html

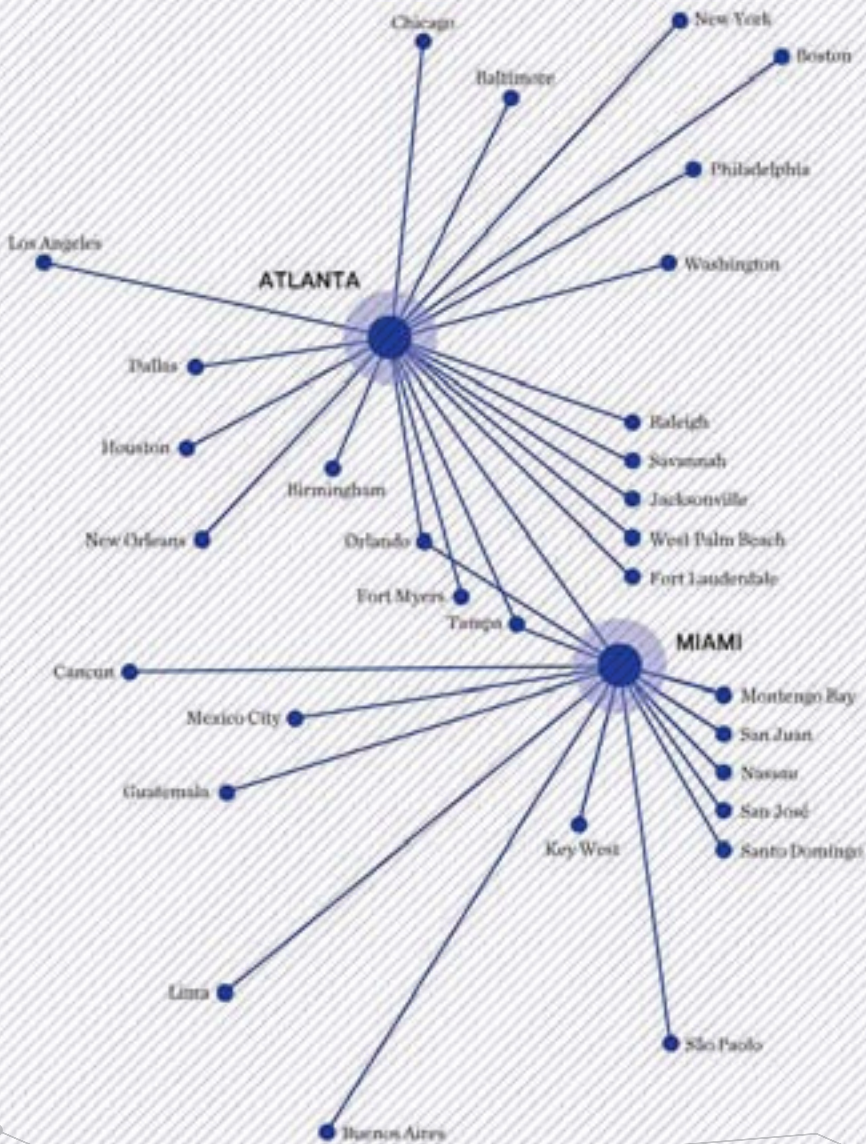
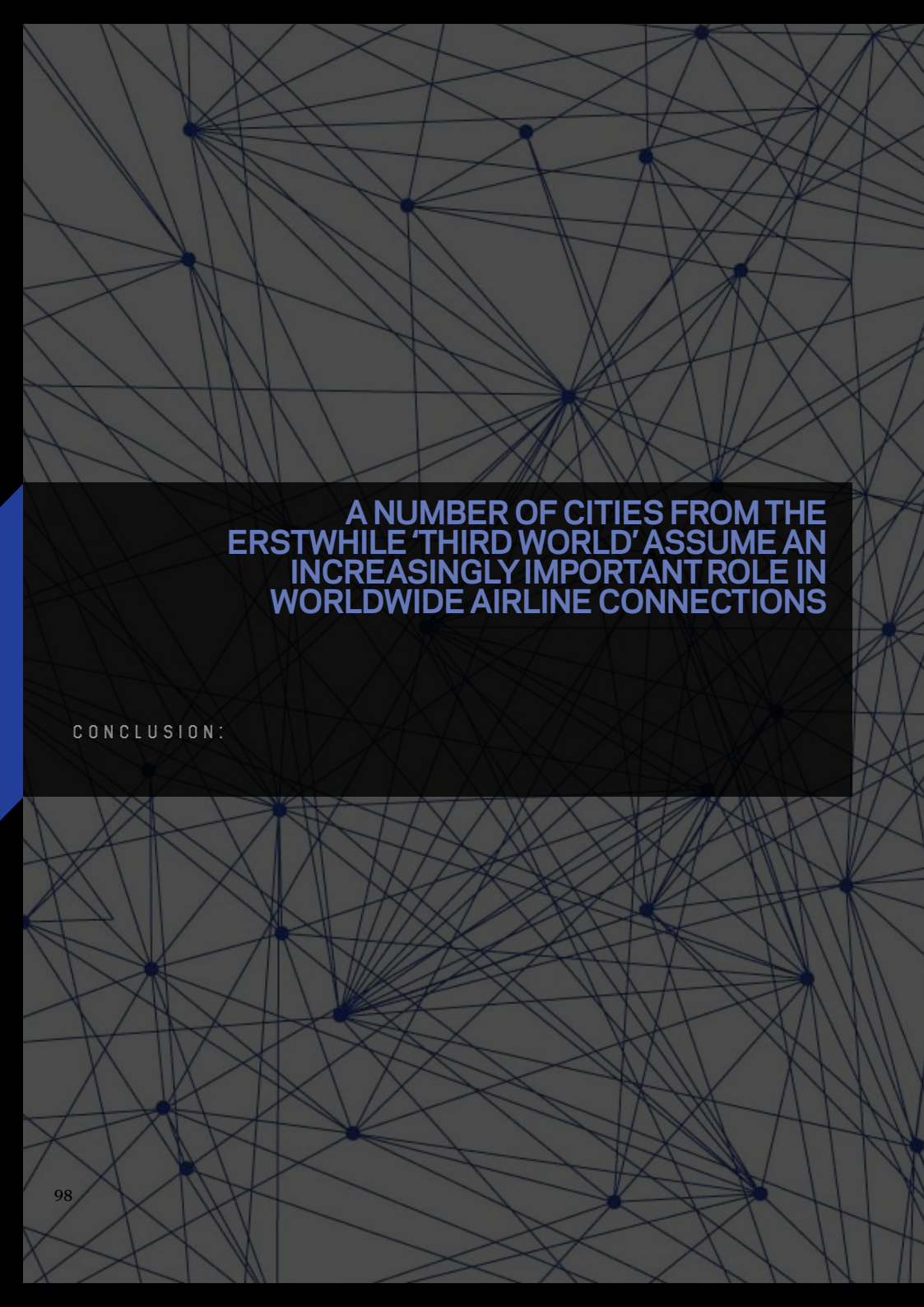


FIGURE 10 ranks a number of major hubs on the basis of the percentage of hub passengers connected *within* the same region. Cities such as Salt Lake City, St. Louis, Denver, Cincinnati, Pittsburgh, and Memphis almost exclusively connect passengers that travel within the US. This dominance of designated *regional* hubs is particularly well-developed in the US. Indeed, with the exception of New York, Miami and Los Angeles, most US hubs have a regional focus. This regionality is far less clear-cut in the case of European cities, although Copenhagen, Brussels and Rome can be designated as ‘European hubs’. Singapore, London, Miami, Amsterdam and Manama are the most ‘international’ among the important airline hubs, for example, only 5% of the passengers making an onward connection in Miami travel between two North American cities: as a hub, Miami functions almost exclusively as a gateway for passengers travelling from or to another region. To assess the spatiality of this hub function in more detail, **FIGURES 11 & 12** reveal the spatiality of the hub function of London, New York, Singapore, Atlanta and Miami. For each of these cities, the figures show the 20 cities that make the most intensive use of this node as hub.

FIGURE 12 clearly reveals that the extra-regional hub function of Miami primarily consists of connecting cities in North America and Latin America. The hub function of London and New York, in turn, is also fairly international, albeit that the dominant feeding flows chiefly emanate from North America and Europe (with the exception of San Juan and Tel Aviv for New York). Singapore’s position is even more international, with an important gateway function for cities in Asia, Australia, and Europe (in addition to San Francisco). The ‘internationality’ of London, New York and particularly Singapore is in sharp contrast with Atlanta, whose dominant resource cities are all located in the US. Thus, although Atlanta connects a larger number of passengers than New York, its hub function is far more restricted from a geographical point of view. Its most important non-US feeding connections are San Juan (ranked 21), London (ranked 45), and Nassau (ranked 54). As a consequence, and in parallel with the threefold scalar geography in origin/destination linkages noted above, there seems to be a *scalar* differentiation among cities: cities with a similar hub connectivity may be very different in their geographical focus.



**A NUMBER OF CITIES FROM THE
ERSTWHILE 'THIRD WORLD' ASSUME AN
INCREASINGLY IMPORTANT ROLE IN
WORLDWIDE AIRLINE CONNECTIONS**

CONCLUSION:

IN THIS CHAPTER, WE HAVE EXPLORED the main features of the worldwide urban geography of air passenger connections. Air transport links and their associated infrastructures are at the same time an important component and the most visible manifestation of a city's aspiration to world city status, while the importance of these physical transport infrastructures is further bolstered by the fact that the association between globalisation and the emergence of transnational urban networks is essentially a two-way relationship: globalisation results in dramatic increases in air passenger transport, while at the same time being facilitated by the possibilities offered by these very connections. Although there is a general growth pattern in the airline industry, these growth rates have a very uneven geography, with anticipated huge increases in connectivity for cities in the Middle East, developing economies in Asia and, to a lesser extent, in Africa.

While air passenger networks have traditionally been oriented towards major cities, there is a continuous shift towards a more

complex organisation in which selected cities such as Dubai and Singapore are gaining prominence in these networks through their role as switching points rather than as origins and/or destinations in their own right. Consequently, our overview of the most connected cities has distinguished between origin/destination connectivity and hub connectivity. In spite of a number of remarkable differences between these two rankings, they are both (still) dominated by cities from oecd countries in general and us cities in particular. The important domestic market and its early deregulation has historically boosted the airline connectivity of us cities, but key cities from other world regions have been catching up rapidly in the last few years, both in terms of origin/destination flows and hub connectivity. As a consequence, a number of cities from the erstwhile 'Third World' assume an increasingly important role in worldwide airline connections, as can be seen from the important connectivity of cities such as Bangkok, Mexico City, and São Paulo.