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African Gateways: Measuring airline connectivity change for Africa's global urban networks in the 2003-2009 period

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1. Introduction

Africa's general lack of an integrated transportation infrastructure has long been identified as a major obstacle for the continent's economic growth through intra-regional trade. This lack of integration is most evidenced in the fact that, as of 2012, only 11% of African trade happens within the continent. By contrast, other world regions, such as the European Union, have intra-regional trade shares of 70% (*Businessweek* 2012). To foster trade and foreign investment and to catalyze the continent's overall economic growth and integration, international development agencies such as the World Bank have promoted the development of Africa's international air transport infrastructure. Since Africa will be predominantly urban by 2030 (UN-Habitat 2001, p.271), the lion's share of its future economic growth will indeed be produced in and channeled through its cities which are, to varying extents, embedded in national, regional, continental African, and global urban networks that are produced by multiple actors.

The rapid growth of the airline industry, since the 1999 Yamoussoukro Decision that started liberalizing African Air Transport and opened up the continent's airspace to African airlines (*New Business Ethiopia*, Monday, May 9, 2011; Schlumberger 2010, see <http://www-wds.worldbank.org>, accessed online on August 7th, 2012), has simultaneously made air transportation a major driver of the globalization of African cities in the last decade. But because the changing geographies of the continent's airline flows are also connected to other forms of social, cultural, and economic globalization, we argue that existing and emerging airline connectivities can serve as a robust tool for studying the geographies of the broad-scale globalization processes of African cities (Otiso *et al.* 2011).

Therefore, the purpose of this paper is to measure the connectivity of African cities in regional and global airline networks. We do this through a comparative analysis of airline flows to and from 61 major African cities for the years 2003 and 2009¹. In the process, we distinguish between these cities' changing connectivity to African, non-African, and (aggregated) global airline networks. This approach adds to a growing body of empirical '*world cities research*', which has studied transnational city-networks as the operational spatial circuits of globalization processes. While so-called 'world-city networks' (WCN) can be empirically studied in terms of corporate organizational structures, including the networks of advanced producer service firms in finance, advertising, accounting, management consultancy and law (Taylor 2004), and various transnational infrastructures e.g., ICT (Devriendt *et al.* 2008), the connectivity of cities in transnational airline networks has proven to be a particularly fruitful all-round approach to map spatially variegated urban-centered globalization processes. As illustrated by a host of studies (Keeling 1995, Rimmer 1998, Smith and Timberlake 2001, Otiso *et al.* 2011), airline flows are fundamental factors in the formation of transnational urban networks at different scales.

Our main hypothesis is that African cities increased their globalization in the 2003-2009 period, but that this globalization has had a spatially diverse character at the individual city level thereby (re)producing a patchwork of differentially connected cities. Against the backdrop of growing trends towards a new 'scramble for Africa', we read the changing geographies of these urban connections as indications of processes that not only reproduce existing strong ties (e.g. colonial ties with European cities), but also generate new forms of 'global' integration through, for instance, the establishment or intensification of linkages with cities in the Middle East, China, and Asia in general. In our overview, we pay special attention to the five major cities in the African urban network – the "Big Five" if you will i.e., Johannesburg, Cairo, Casablanca, Nairobi and Lagos – that encapsulate the continent's major globalization trends. The changing nature of these cities' globalization, as epitomized by their inter-urban air linkages, is then linked to broader shifts in the global economy especially the growth of emerging economies.

The remainder of the paper is structured as follows: Section 2 briefly reviews the existing literature on world city network (WCN) formation and tries to find the place of African cities within it. Furthermore, we discuss how the use of airline data may prove a viable way to map and measure variegated globalization processes, given the general lack of transnational (or inter-city) flow data on

¹ The selection of both data points was mainly determined by the availability of data with 2003 and 2009 being the beginning and end of our data horizon. Moreover, the 2003 reference-point is valuable because it directly follows the planned full implementation of the Yamoussoukro Decision by 2002 besides allowing for a broad-scale longitudinal analysis of rapid airline connectivity growth over the six-year 2003-2009 period .

African cities or states. Section 3 provides a background on the rich Sabre airline passenger data source used in our analysis and highlights the main methodological steps of our approach. Section 4 discusses the main results of our analysis. For reasons of clarity, we define the overall network as the sum of networks that link African cities to all world cities in the dataset, thus covering intra- and intercontinental linkages between African cities and all world cities. Intra-continental linkages cover both the domestic urban air linkages of the featured African countries as well as the international air linkages between various African cities. The fourth section is divided into three parts: Part 1 focuses on overall changes in the African (i.e. intra-continental) and non-African (i.e. inter-continental) airline connectivity of the African cities under study. Part 2 focuses on the major changes in the airline flows of the African world city network (WCN) while Part 3 discusses the changing integration of African cities in global WCNs via a focus on the non-African airline flows. Section 5 wraps-up the paper with an overview of the implications of our analysis for the study of African cities in a rapidly-changing global economy.

2. African cities in world city networks and airline geographies

This paper hinges on the literature on ‘globalization’ through transnational or world city networks (WCN). The crux of this literature is that a focus on cities and their transnational linkages reveals a picture of the trans-state processes that are at the heart of the concept of globalization. As Manuel Castells (1996) has argued, material and informational economies increasingly operate through a space of flows that constitutes a globalized network society that operates at several levels including the world city network. According to this framework, globalization is the process “by which centers of production and consumption of advanced services, and their ancillary local societies, are connected in a global network” (ibid., p. 380). Hence, cities accumulate and retain wealth, control, and power from the transnational flows that inter-connect them.

Attempts to systematically and empirically map these linkages across the settled world (for an overview see Derudder 2006) have been dominated by two parallel approaches. The first focuses on corporate organization and maps things like the number of corporate links between cities while the second looks at infrastructure and focuses on the quality of the transportation infrastructure connecting cities across the world (van der Merwe 2004). The latter approach globalizes the long tradition of geographical research at the national scale in which city-systems are analyzed through infrastructure networks (e.g., Taaffe 1962). The link between the development of global urban systems and the associated, if not, causative growth of airline infrastructure has also been reiterated in research on WCNs. For instance, Keeling’s (1995) seminal chapter on ‘Transportation and the

world city paradigm' establishes the development of air transport as a key factor in the rise of a WCN since:

- i. airline networks and their associated infrastructure are, perhaps, the single most visible manifestation of a city's aspiration towards global prominence (cf. Dubai and Hong Kong);
- ii. the continued demand for face-to-face relationships in business processes calls for the globalized inter-city movement of people, in spite of the parallel development of (tele)communication networks (e.g., Denstadli 2004); and
- iii. air transport is the preferred mode of inter-city movement for the transnational capitalist class, migrants, and tourists.

In light of this, we postulate that airline connections between cities can be powerful proxies for mapping and interpreting transnational inter-city flows of capital, knowledge, and people. As Mahutga et al. (2010) have recently shown, the changing prominence of world cities is visible in their shifting involvement in global airline networks. Similar analyses have also been done on specific regions including Europe (Burghouwt et al. 2003) and Africa (Otiso et al. 2011, Pirie 2010). In Africa's case, Otiso et al. (2011) used airline connections to assess the globalization of African cities at the turn of this millennium. Pirie (2010), in turn, examined the changing inter-city African relations of the South African cities of Johannesburg and Cape Town and found evidence of persistent and intensifying links as well as sporadic and unstable intercity relations. His research also revealed that both 'major' world cities and smaller less well-known African places feature prominently in the air connections of Johannesburg and Cape Town. The latter conclusion chimes well with results from the scant research on African air transport geographies, in which it is suggested that the ongoing liberalization of air passenger markets is not necessarily resulting in the concentration of air connectivity in a few major cities. For instance, a recent paper by Daramola and Jaja (2011) shows that the liberalization of the Nigerian commercial air passenger service has resulted in a declining concentration of connectivity in a limited number of nodes and links as the service has expanded beyond first-tier cities like Lagos and Abuja. This counterintuitive result, together with the uneven impact of economic globalization throughout Africa, calls for a comprehensive and updated longitudinal analysis of the shifting position of African cities in global airline networks.

3. Data and methodology

This paper uses the ‘Sabre database’ to examine the changing airline connectivities of 61 African cities in the period 2003-2009. Sabre is a worldwide online Computer Reservation System (CRS) that travel agencies use to make and manage airline bookings, car rentals and hotel reservations. It contains booking information on passenger flights dating back to 2003. The main advantage of using booking information in this study is that the data comes in the form of ‘actually flown connections’. This, in contrast to more commonly available air transport datasets that feature flight schedules, permits the retrieval of information on air passengers’ actual origins (O), destinations (D), and any intermediate hub (H) stops. Thus, this dataset makes it possible to, for instance, gauge the evolution of air passenger traffic between, say, Kinshasa and Cairo, even in the absence of a direct flight between the two cities².

Despite the foregoing Sabre database strengths, the database has its limitations. First, its pure CRS-origin means that it excludes charter passenger flights as well as direct bookings with airlines. The latter are especially common among low-cost carriers. While this could lead to the underestimation of the actual number of air passengers, this does not significantly affect the results of our study given the low overall passenger volume of African low-cost airlines, which typically operate domestic or short-haul regional flights. Even in South Africa, Nigeria, Kenya and North Africa where the budget airline industry is relatively developed, regular airlines dominate the domestic as well as the regional/short-haul and the intercontinental/long-haul air passenger service market. Secondly, Sabre’s underestimation of actual passenger volume flows may also be caused by the limited coverage of the database itself given the existence of competing CRSs like Amadeus, Galileo, or Worldspan. However, Sabre makes up for its limitations by adjusting the number of passengers on all of its covered routes at the carrier, segment, and origin and destination level³.

To facilitate our analysis, we then performed three transformations on our database. First, because some cities in our database are served by multiple airports (e.g., New York, Johannesburg, and Nairobi), we aggregated our data at the city level. Second, to bring this paper in line with the broader literature on urban networks, we decided to focus on major *cities* rather than major *airports* per se. As a result, the Egyptian tourist airports of Sharm el-Sheikh and Hurghada and other similar ones

² The data source does not contain information on aircraft type, flight frequencies, or cargo volumes. Information is available on average fares, yield, and load factors – elements that are key to understanding operational dynamics in the African airline sector. Our analysis, however, is interested in the shifting geographies and intensities of urban networks, which explains why we focus on aggregate airline passenger numbers.

³ To check the robustness of our dataset, we aggregated OD and H passenger volumes for the ten most connected African airports and compared these figures with the reported number of passengers from the airport operators themselves (<http://www.azworldairports.com/azworld/index.cfm>). Thus, for 2009, for instance, the Sabre database covered, on average, 70% of the reported number of handled passengers; which is more than adequate for our present purposes.

were excluded from our analysis. This enabled us to focus our analysis on the 61 main African cities out of the 525 cities (with airports) from around the world that are covered by the Globalization and World Cities (GaWC) research project which forms the backdrop of this study (<http://www.lboro.ac.uk/gawc/index.html>). Third, in this paper we distinguish between three types of networks: (i) an ‘African network’ that features all routes interlinking the 61 African cities (i.e. a 61x61 matrix), (ii) a ‘non-African network’ that features all routes between the 61 African cities and the 464 other cities (i.e. a 61x464 matrix), and (iii) the ‘overall network’ combining (i) and (ii) above (i.e. a 61x525 matrix). In the next section, we discuss the main features of these networks, which will allow us to discuss the spatially variegated globalization of African cities during the period under investigation.

4. Empirical analysis: the shifting position of African cities in airline networks

4.1 Airline connectivity changes for African cities

As Table 1 shows, there have been a number of major changes in the air connectivity of African cities between 2003 and 2009. First is that almost all African cities have experienced a rise in total passenger volumes in the study period. This suggests that, in general, there has been a growing connectivity of African cities in global airline networks despite the fact that this six-year intensification has not been enough to displace Johannesburg, Cairo, Cape Town, and Lagos as Africa’s top-ranked cities in terms of total passenger volume. However, while the dominance of Johannesburg remains obvious, the biggest growth in the absolute passenger volumes has been recorded by Cairo, which has almost caught up with Johannesburg in OD passenger volumes besides strengthening its position as the leading hub city in Northern Africa. Furthermore, although the vast majority of African cities have recorded significant air connectivity growth in the study period, and the gap between the continent’s dominant and upcoming cities has narrowed; the continent’s air connectivity growth is spatially highly uneven. For instance, at the regional level, some cities have gained while others have lost connectivity; with the most important gainers being Luanda (Angola), Addis Ababa (Ethiopia), Nairobi (Kenya), Khartoum (Sudan) and Accra (Ghana).

Secondly, most of the air connectivity growth of the top cities in Table 1 has largely come from African flows or intra-continental linkages. In fact, for most of the cities in Table 1, growth in African flows has been accompanied with a corresponding decline in their non-African flows; a situation that is perhaps caused by the changing routing strategies of these cities’ dominant airlines. Underneath this growing importance of intra-continental flows is a basic geographic logic: closer places tend to be more connected than distant ones. Thus, distance to other continents is undoubtedly

an important factor in many cities' African and non-African passenger volume shares. Consequently, the Northern African cities that are closer to other continents have a bigger proportion of non-African passenger flows relative to their Southern African counterparts.

Third, as a group, the South African cities of Johannesburg and Cape Town have seen a large increase in their share of African passenger volumes, which is indicative of the pivotal role these cities play in the Southern African urban air networks. Nevertheless, these major, South African cities still have a high proportion of non-African flow levels because of their prominent position in the global world city networks. Cairo's share, by contrast, remained mostly external (87-93%) in the study period, which reflects the city's pivotal location and role in the Middle Eastern networks. This will be discussed in more detail below.

Fourth, the data in Table 1 shows dramatic connectivity changes that cannot be explained by distance, especially with respect to Abidjan, Accra, Khartoum, and Mombasa. Whereas Abidjan and Mombasa have seen very large increases in their non-African flows, Accra and Khartoum have, in contrast, seen substantial increases in their African flows. In the next two sections, we go beyond these general observations and examine in greater detail the connectivity of key African cities in African and non-African world city networks.

Fifth, some cities like Bamako (Mali), Cotonou (Benin), Douala (Cameroon), and Harare (Zimbabwe) that were among the top 25 air passenger volume in 2003 have since dropped out of this elite club for various reasons (e.g., economic decline and competition from better located cities) and have been replaced by Port Harcourt (Nigeria), Windhoek (Namibia), Luanda (Angola) and Alexandria (Egypt), all of which are in booming national economies.

INSERT TABLE 1 ABOUT HERE

4.2 African cities as nodes on continental urban networks

In this section, we explore the actual African inter-city relations and more specifically, the degree to which integration has taken place within the African network in the study period. Changes in the African urban network, as visualized in Figure 1, are largely centered on four distinct regions: North Africa, East Africa, Southern Africa and West Africa. Overall the highest growth is in the domestic networks of South Africa (especially the Johannesburg-Cape Town and Johannesburg-Durban links), Nigeria (e.g., the rapidly growing Lagos-Abuja link), and North Africa whose Cairo-Tripoli, Cairo-

Khartoum and Tripoli-Tunis links have grown substantially. In all four regions, the dominant cities have growing links to regional second-tier cities, with Lagos-Accra and Johannesburg-Lusaka being prime examples.

In North Africa Cairo is the dominant city though there are also intense interconnections with second-tier North African cities such as Casablanca, Algiers, Tunis, and Tripoli. These sub-networks reflect economic, social, and cultural realities that integrate these cities including migrant networks. The North African network also reflects the integration of the Arab World. This also explains Cairo's strong linkages to Khartoum and other Middle Eastern since Cairo is the cultural, social, and economic heart of this largely Islamic realm (Otiso *et al.* 2011). In West Africa, the air network is centered on Nigeria's domestic urban system. But beyond this, Lagos is the main connection point to other proximate West African cities including Accra, Abidjan and Freetown. On the opposite side of the continent, Nairobi (Kenya) is the premier air hub of the Eastern African network that connects other major Kenyan cities (e.g., Mombasa) as well as the region's political and/or commercial capitals including Addis Ababa (Ethiopia), Dar Es Salaam (Tanzania), Kigali (Rwanda) and Entebbe (whose airport serves Uganda's capital city of Kampala). In Southern Africa the urban network is dominated by the three main South African cities of Johannesburg, Cape Town, and Durban. Moreover, Johannesburg serves as the main gateway city to the wider Southern African region, linking up directly with Windhoek (Namibia), Gaborone (Botswana), Lusaka (Zambia), and Harare (Zimbabwe).

Apart from these intraregional flows, the African network also interconnects the continent's four regions through their most influential cities. For instance, Southern Africa has direct links to the other regions through Johannesburg. In North Africa however, several second-tier cities also serve as important gateways to other regions. Thus, Casablanca, rather than Cairo, is the main North African link to West Africa. Moreover, at interregional level, the relatively strong connection between Lagos and Johannesburg comes to the fore. There are some connections and nodes that are declining as well. For instance, Lome, the capital city of Togo, squeezed between the airports of Accra (Ghana) and Cotonou (Benin), has lost a lot of connectivity. Further, the interregional linkages between Harare and Mauritius, Tripoli/Khartoum and West Africa have diminished while Casablanca has strengthened its connections with West Africa.

The foregoing changes in interregional urban connections are due to many reasons including the survival/collapse of airlines, growth of competing non-Sabre airlines, and shifts in inter-country relations that airline airspace and landing rights. For instance, poor relations between Kenya and

Eritrea have effectively closed the Nairobi-Asmara air link even as a diplomatic spat between Kenya and Sudan in November 2011 threatened air links between the two countries and nearly forced inbound and outbound Kenya-Europe flights (including those of Kenya Airways) to fly costly circuitous routes around Sudan (Leftie 2011). Similarly, prior to the end of the apartheid regime in South Africa in the early 1990s, most inbound and outbound South Africa-Europe flights had to fly around the African continent because many African countries closed their airspace to such flights (Pirie 1992).

4.3 The position of African cities in intercontinental WCN

4.3.1. Overview

In this section we explore how African cities have been globalized through their connectivity to global urban networks. Here we ponder whether broader reorientations in the world economy such as the rise of emerging economies are reflected in the globalization of African cities. Moreover, we also explore how these trends relate to changes in pre-existing relations with European cities. To start answering this question, we compare how the 61 African cities in the database are connected to the 464 major non-African cities across the globe in 2003 and 2009. As evident from the aggregated data in Table 2, African cities experienced significant globalization in the 2003-2009 period. Much of this globalization was the result of deepening integration between African cities and cities in Europe and, to a smaller extent, cities in the Middle East, North America, and Asia. While Europe remains the prominent link for African cities in absolute terms, followed by the Middle East, Asia, and North America, the table also shows that the biggest growth is actually occurring on African connections with Asia (124%) and the Middle East (91%). Moreover, it is evident from Table 2 that although Europe is witnessing an absolute growth in passenger volumes, it is the only major region that saw a drop in its relative passenger volume with Africa (from 32% to 28%) between 2003 and 2009.

INSERT TABLE 2 ABOUT HERE

Obviously such general patterns play out differently at the level of individual cities. We have therefore mapped the role of each world region in the recent airline connectivity growth of African cities. Figure 2a to 2d detail the respective role of Europe, the Middle East, Asia, and North America on African cities' relative (percent) airline connectivity growth in the study period. First, as shown in Figure 2a, European cities have become more intensely linked to a host of African cities. Most of this growth is with the North African cities of Casablanca (Morocco), Cairo (Egypt), Tunis (Tunisia), and Algiers (Algeria) which are the gateways of growing European tourist inflows to the region. In addition, there are the enduring (return) migration flows of Moroccans, Algerians, and Tunisians in

France and other European countries (De Haas 2007). Other strong growth linkages with Europe involve the Western African cities of Lagos (Nigeria), Abidjan (Ivory Coast), and Dakar (Senegal), and the Eastern African tourist hubs of Port Louis (Mauritius), and Nairobi and Mombasa (Kenya). Growth in connections between Europe and cities in Southern Africa is far less pronounced, with some major cities in the latter region e.g., Johannesburg, Cape Town, and Durban (South Africa) losing connectivity with Europe in absolute terms. In Central Africa, Luanda (Angola) has made major connectivity gains with Europe. Many coastal West African cities also witnessed connectivity losses with Europe.

INSERT FIGURE 2A-D ABOUT HERE

Second, North African cities, especially Cairo and Alexandria and to a smaller extent, Casablanca, Tripoli, Khartoum, Algiers, and Tunis, have most grown their connectivity with the Middle East and the wider Arab world. This growth is due to many other factors besides the obvious religious and cultural ties between North African and Middle Eastern cities. Significant among these are:

- The growing role of Middle Eastern airlines in linking Middle Eastern actors from Abu Dhabi, Dubai, Doha, Riyadh, Jeddah, and Kuwait with their counterparts in various North African cities.
- The increased capital flows from the Gulf Region in transforming Northern African cities (e.g., the Dubai-based Emaar group's construction activities in Cairo and Rabat, or Bahrain-based Gulf Finance House investments in Tunis Financial Harbour, a project inspired by the Bahrain Financial Harbour).
- The increased tourism flows (leisure and business) from the Middle East to North African cities like Cairo.

Overall, the growing ties between Middle East and Northern Africa suggest that while the latter is located on the African continent, it operates mostly within the orbit of Middle Eastern North African (MENA) world-city-networks. This orientation is not accidental since Cairo is the educational and cultural center of the Middle East and North African region (Otiso *et al.* 2011). Further, connections between the Middle East and Eastern African cities of Djibouti, Mogadishu, and Dar Es Salaam have been on the rise because of these cities significant Islamic populations. With regard to West Africa, ties with the Middle East have generally been mediocre, except for those with Lagos, the commercial capital of Nigeria whose population is about 50% Muslim (Falola 2011). Middle Eastern links with

Southern African cities have also grown modestly as well - a trend only crosscut by links to the most vibrant cities of Johannesburg and Cape Town.

Third, the growth of connectivity between African and Asian cities has been well-rounded; without clear regional patterns. At the top end, growth has been mainly geared towards Africa's main world cities especially Cairo, Lagos, Nairobi, and Johannesburg. As a group, many North African cities, including Cairo, Algiers, Khartoum, Tripoli, Casablanca, and Tunis, have experienced growth in their Asian connectivity. In Eastern Africa, growing ties with Asia have been mainly limited to the major cities of Nairobi, Dar es Salaam, Addis Ababa, Entebbe/Kampala, and Mauritius. This pattern suggests that contemporary world-city-networks may create long-lasting patterns of cooperation and exchange around the Indian Ocean (Sheriff 2010). In Central Africa, Angola's capital city, Luanda, has been the major beneficiary of ties with Asia: a reflection of the growing involvement of Asian and particularly Chinese businesses in Angola's oil sector and in the country's post-civil-war reconstruction since 2002 (Zhao 2011).

Fourth and finally, the growth of linkages between African and Northern American cities has been most focused on Northern African cities, with Cairo being the runaway beneficiary followed distantly by Casablanca, Algiers, Tunis, Tripoli, and Algiers. Around the continent's other regions, the important nodes of Afro-North American connectivity are the West African cities Lagos, Abuja, Accra and Dakar; the Eastern African cities of Nairobi, Addis Ababa, and Entebbe/Kampala; and the Southern African city of Johannesburg though, as a whole, this region's cities appear to have missed out on most of the continent's growing connections with North America. In sum, it is clear that Africa's growing connections with North America are largely driven by countries with major U.S. geostrategic interests and installations including Egypt, Nigeria, Kenya, Morocco, Algeria, Ethiopia, South Africa, and Ghana, and (Carmody and Owusu 2007). The continent's links to North America are also being driven by the growing wave of recent African immigration (notably from Egypt, Nigeria, Ghana, Ethiopia, South Africa, Morocco, Libya, Liberia and Kenya) to the United States and Canada (Otiso 2006). These immigrants' transnational socioeconomic links are partly the reason for the growing list of African and non-African airlines (e.g., Kenya Airways, South African Airways, Delta, Royal Air Maroc, Ethiopian Airlines and Egypt Air) with direct or indirect code-share flights between Africa and North America. Moreover, the African continent's economic boom since 2000, has attracted increased US and Canadian foreign direct investment thereby strengthening airline and other socioeconomic ties between the two regions (Carmody and Owusu 2007, Jones 2010).

4.3.2. Five case-studies

To further refine our analysis, we examined air connectivity changes for Africa's "Big Five" or the most globalized African cities, namely Johannesburg (Southern Africa), Cairo (Northern Africa), Casablanca (Northern Africa), Nairobi (Eastern Africa), and Lagos (Western Africa). The changes in their airline hinterworlds are presented in Table 3.

Johannesburg: This is arguably the best-connected African city and it has, in the study period, undergone a significant 'reorientation' of its airline connectivity patterns away from North American and European world cities. While, as Table 3a shows, some of the city's linkages to these regions have experienced growth (e.g., Toronto and Washington, and Copenhagen), its linkages to the global cities of London and New York have recorded absolute passenger count (APC) declines of -79,000 and -5,000, respectively (Table 3b). By contrast, the city's links with Middle Eastern and Asian cities have grown. In the Middle East, cities like Dubai, Abu Dhabi, and Tel Aviv have become prominent partners; while in Asia, Beijing, Shanghai, Hong Kong, and Seoul have experienced the highest connectivity gains. Moreover, the Australian cities of Perth and Brisbane have clearly increased their importance in Johannesburg's hinter world. In general, however, outside of the greatly improved linkages with Dubai, Perth, Washington, Beijing, Delhi, Tel Aviv, Abu Dhabi, Shanghai, and Hong Kong, growth in Johannesburg's linkages with most other cities has been modest.

Overall, the changing geography of Johannesburg's airline connectivity is due to many factors including (1) the city's growing access to a diverse set of global markets since the end of South Africa's minority white government in the early 1990s; (2) Asian countries, notably China and India's, growing investment in the South African economy; (3) the travel patterns of the transnational South African Diaspora that is mainly concentrated in Australia, Europe, and North America; and (4) Johannesburg's role as one of the core cities in the Brazil-Russia-India-China-South Africa (BRICS) group of countries that have become key players in the global economy (Otiso *et al.* 2011, Hervieu 2011).

Cairo: This second-best-connected city on the African continent mainly derives its centrality from its location and from being a crucial node in the wider MENA region. As can be seen from Table 3, most of its non-African growth is related to the rising importance of all major cities on the Arabian Peninsula, including Kuwait, Jeddah, Riyadh, Dubai, Dammam, Doha, and Abu Dhabi, as well as growing connectivity to Amman, Tel Aviv, and Beirut. Cairo's linkages to Europe are mostly focused on leading West- and South-European cities especially London, Milan, Paris and Brussels. Its connectivity growth to Northern American cities has been less all-round and is mainly centered on

New York which experienced a large connectivity upsurge. Its linkages to Asian cities have seen a more general growth trend, since Cairo is now strongly connected to Tokyo and Guangzhou. Conversely, most of Cairo's shrinking linkages are with Mediterranean and Eastern European cities like Nice, Sofia, and Budapest (Table 3b).

Casablanca: While Cairo is emerging as a Middle Eastern city, Casablanca is becoming more European in terms of its airline hinter world (Table 3a). Most of the fast-growing linkages connect the Moroccan city to major West- and South-European cities especially Paris which has seen a massive growth of over 300,000 PAX in 6 years. Other growth poles are Brussels, Milan, Lyon, Bologna, Barcelona, Madrid, Marseille, Rome, Geneva, and Turin. The growth of these linkages can be traced back to the development of Morocco as a leisure hub for European tourists as well as the growth of the migration flows that link the city with large Moroccan communities in France, Belgium, Italy, and Spain. In the Middle East, Dubai, Jeddah, Tel Aviv and Riyadh have been the major growth partners. In Northern America, besides connectivity gains with New York, the fastest-growing connection has been with the French-speaking city of Montreal, Canada. In general, however, Casablanca's connections with North American cities have experienced low growth. Remarkably, Asian cities are virtually absent from Casablanca's growth picture; possibly due to the host nation's lack of the natural resources or trade opportunities that largely drive contemporary African-Asian airline links. Moreover, all of Casablanca's major shrinking linkages are with European cities such as Zurich, Montpellier, and Dusseldorf (Table 3b). However, since most of Casablanca's air linkages are focused on Europe; its declining European links have been offset by other growing European linkages.

INSERT TABLE 3 ABOUT HERE

Nairobi: Of the five case study cities, Nairobi has, perhaps, seen the most spatially diverse growth in air connectivity in the 2003-2009 period (Table 3a). In general, the city has experienced connectivity growth to European, Middle Eastern, Northern American, and Asian cities especially in relation to London, Dubai, New York, and Guangzhou. Overall, the connection to London has, by far, witnessed the fastest growth, followed at a significant distance by Dubai, New York, and Guangzhou, which have experienced similar growth levels.

Such a truly global connectivity pattern reflects Nairobi's role in multiple transnational networks ranging from:

- Being the global NGO capital as well as the global headquarters of various multilateral organizations such as the United Nations Environment Program – UNEP and the UN-HABITAT (which is partly reflected in the growth of the Nairobi-New York link) (Robinson, 2006);
- Its growing presence of foreign (European, American, Chinese, Arab, and Indian) multinational corporations that are eager to expand their African businesses by taking advantage of the city's role as the commercial, financial, and transportation hub and gateway to Eastern and Central Africa (Otiso and Owusu 2008, Otiso *et al.* 2011); and
- Its ongoing strong links with its former colonial power Britain – a relationship that is reflected in the growing Nairobi-London link which also stems from Britain's military training facilities in Kenya (Ministry of Defense 2012) as well as the country's popularity with British and other European tourists (Kenya National Bureau of Statistics 2009);

Nairobi's growing links with various North American and Western European cities are also reflective of the growing Kenyan diaspora in these cities especially London, Boston, and Minneapolis (Otiso 2011). As a result, a number of airlines including Kenya Airways, British Airways, and Delta, now operate direct and indirect flights that link Nairobi to these and other global cities even as these links feed the momentum of the city's growing global reach (Otiso *et al.* 2011, Kenya Airports Authority 2012).

Nairobi's air connectivity is also notable for its very few (only 3) declining links (notably with Abu Dhabi, Seattle, and Dublin) even though it has many slow growth ones with Zurich, Venice and other cities (Table 3b).

Lagos: Like Nairobi, Lagos exhibits spatially diverse globalization patterns, with growing links to Europe, the Middle East, Asia, and North America (Table 3a). Two cities particularly stand out in the exceptional growth of their links with Lagos, namely Dubai and London. Further, a host of Asian cities such as Guangzhou, Kuala Lumpur, and Beijing, are among the prime growth partners for Lagos. In North America, Lagos has growing links with Houston, Chicago, Toronto and Baltimore given these cities' gateway function as well as their large Nigerian immigrant communities. The changes in Lagos' hinterworld are also indicative of the changing involvement of U.S., European and Chinese oil companies in the Nigeria petroleum sector (Corporate Guides 2010/2011, p.46) hence the prominence of its links with London, Houston, and Guangzhou. The growing Nigerian trading diaspora in Guangzhou, China also explains this city's growing links with Lagos (Haugen 2012). The Lagos-London link is also prominent because of the large Nigerian diaspora in London as well

as the Nigerian middle and upper-classes' affinity for U.K. (more so London) shopping. They not only outspend American shoppers in the U.K. but were the fourth-biggest contributor to overseas tax-free shopping in the U.K. in 2011, behind only the Chinese, Russians, and the Middle Easterners. So significant is this business that some London businesses have multilingual discount signs that include the Nigerian language of Hausa and even British Airways has special accommodations for Nigeria-bound passengers that enable them to carry extra luggage free of charge (Shannon 2012).

Next to Nairobi, Lagos has the next fewest declining links (6), especially those with Athens, Hong Kong, Zurich, Turin, Karachi, and Glasgow. The vast majority of the declining links are with European cities (Table 3b).

5. Concluding remarks

In this paper we have explored how changes in the airline connectivity of African cities in the 2003-2009 period has been reflected in the changing position of African cities in the continent's local and global urban networks. In so doing, we specifically sought to analyze the relationship between African urban airline connectivity growth and globalization. Thus, we analyzed how the African urban network has been integrated into global airline networks with cities in Europe, North America, the Middle East, South America, Australia and Asia. Our initial hypothesis was that African cities globalized more in the 2003-2009 period, but that this globalization had a spatially different character at the level of individual cities, thus (re)producing a patchwork of highly-connected cities and disconnected ones .

Key among our findings are that the airline connectivity of African cities indeed grew significantly in the 2003-2009 period (Table 1); with 55 (90%) of the 61 cities in our African city sample experiencing growth in the total number of domestic and international passengers handled through their major airports in that period (Table 1). Fifty (82%) of the 61 cities experienced double-digit percent growth, while 16 had between 100-455% percent growth in their total air passenger volumes including Monrovia, Liberia (455%), Alexandria, Egypt (387%), Luanda, Angola (198%), Abuja, Nigeria (173%), Port Harcourt, Nigeria (147%), Addi Ababa, Ethiopia (107%), Lagos, Nigeria (102%), Casablanca, Morocco (101%) – some of these cities are shown in Table 1. While many of the cities that experienced the largest percent increases in connectivity were those that were relatively under-connected in 2003 e.g., Monrovia, Liberia, others like Johannesburg, Cairo, Casablanca, Nairobi and Lagos that were already key hubs in 2003 entrenched their positions even more by 2009 as the gateways of their respective sub-regions.

The growing global airline connectivity of African cities is being driven by global economic, social, and political integration processes. Key among these is the new ‘scramble for Africa’ that is, on one hand, reproducing old linkages to European, U.S. and Canadian cities, while simultaneously generating new urban networks that are connected to the economic activities (notably the resource extraction, infrastructure investments, and trade flows) of emerging economic powers such as China and India. Simultaneously, the growing circular migrations of the substantial global African Diaspora as well as the rising global consumption of African tourist attractions (e.g., wildlife, beaches, and the Egyptian pyramids) have been key factors in the growing global airline connectivity and globalization of African cities since the 1990s.

The spectacular growth of the African continent’s inter-urban air linkages in the study period shows that air travel is a growing substitute for the continent’s poor and costly overland (long-distance) transport system (Limão and Venables 2001) even though the relationship between long-distance air passenger transport and trade is certainly not one-to-one. Moreover, even with ‘airborne’ connectivities many land-locked regions and cities (e.g., in the Sahel or Central-Africa) still remain disconnected from growing African urban air networks which are centered on a few well-connected sub-regions. Still, within the African continent, trends towards politico-economic integration, as evidenced in, for instance, the formation of African Union (AU) and the signing of the 1999 Open Skies for Africa Yamoussoukro Decision (Schlumberger 2010), have significantly aided the air connectivity of African cities in the study period. Related to this is that a number of African airlines, e.g., Kenya Airways (KQ), Ethiopian Airlines (ETH), Royal Air Maroc (RAM) EgyptAir (EGY), and South African Airways (SAA) now have networks that span the continent and their rapid growth since 1999 has further added to the continental and global air connectivity of many African cities. Expectedly, the home cities of these airlines e.g., Johannesburg (SAA), Cairo (EGY), Casablanca (RAM), and Nairobi (KQ) are the giants of African urban air connectivity globalization. However, there are two exceptions to this. Lagos, despite being fairly globalized, has no dominant home airline though the city is well served by many foreign ones. Conversely, Addis Ababa is not as globalized despite being home to Ethiopian Airlines because it does not have as many headquarters of multinational corporations, nongovernmental organizations, financial institutions, and multi-lateral institutions.

6. References

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Table 1 Top 25 African Air Transport Hubs/Cities, 2003 and 2009. Source: Authors

City Name	Country	Rank	% AN	PAX		Total PAX Change	
				(2003/2009)	(2003/2009)	(x1,000)	(%)
Johannesburg	South Africa	1/1	64/70	7,151/9,492	+2,341	+33	
Cairo	Egypt	2/2	7/13	4,972/8,793	+3,821	+77	
Cape Town	South Africa	3/3	69/74	4,127/5,455	+1,328	+32	
Lagos	Nigeria	4/4	59/62	2,419/4,882	+2,463	+102	
Tunis	Tunisia	5/6	15/20	2,282/3,523	+1,241	+54	
Durban	South Africa	6/7	84/90	2,229/3,034	+805	+36	
Casablanca	Morocco	7/5	15/14	2,057/4,127	+2,070	+101	
Algiers	Algeria	8/8	23/20	2,034/2,806	+772	+38	
Nairobi	Kenya	9/9	53/51	1,622/2,515	+894	+55	
Mauritius	Mauritius	10/12	20/20	1,255/1,644	+388	+31	
Dakar	Senegal	11/14	42/40	1,018/1,419	+400	+39	
Tripoli	Libya	12/11	41/46	903/2,009	+1,106	+122	
Abuja	Nigeria	13/10	89/89	879/2,402	+1,522	+173	
Khartoum	Sudan	14/13	24/34	867/1,592	+724	+84	
Abidjan	Ivory Coast	15/19	69/51	761/1,063	+302	+40	
Accra	Ghana	16/15	31/49	739/1,376	+637	+86	
Oran	Algeria	17/21	42/36	670/824	+154	+23	
Addis Ababa	Ethiopia	18/18	32/29	534/1,105	+571	+107	
Bamako	Mali	19/28	64/59	505/531	+26	+5	
Mombasa	Kenya	20/24	67/58	501/744	+243	+49	
Cotonou	Benin	21/31	79/79	493/439	-54	-11	
Harare	Zimbabwe	22/30	69/69	472/494	+22	+5	
Douala	Cameroon	23/26	57/61	471/594	+123	+26	
Entebbe	Uganda	24/23	53/51	471/765	+295	+63	
Dar Es Salaam	Tanzania	25/22	44/47	442/798	+356	+81	
Port Harcourt	Nigeria	26/20	85/92	430/1,063	+633	+147	
Luanda	Angola	27/16	39/31	423/1,262	+838	+198	
Windhoek	Namibia	28/25	57/61	390/607	+217	+56	
Alexandria	Egypt	33/17	4/7	256/1,247	+991	+387	
Average			48/46	1,595/2,582	+1,005	+89	

% AN = Share of African connections in overall network

Table 2 Growth in passenger flows between African cities and major world regions, 2003-2009
(Source: Authors).

	PAX 2003		PAX 2009		PAX Change	
	(x1.000)	Share (%)	(x1.000)	Share (%)	(x1.000)	Share (%)
Africa	22,071	48	35,288	48	+13,216	+60
Europe	14,852	32	20,707	28	+5,854	+39
Middle East	5,380	12	10,263	14	+4,882	+91
Asia	1,469	3	3,290	4	+1,821	+124
North America	1,997	4	3,349	5	+1,351	+68
Other regions	538	1	953	1	+414	+77
Total	46,307	100	73,849	100	+27,542	+60

Table 3: Absolute PAX Change (APC) (2003-2009) of the most important growing intercontinental flows to and from Johannesburg, Cairo, Casablanca, Nairobi and Lagos

(3A) Major Growing Connections

Johannesburg to	APC	Cairo to	APC	Casablanca to	APC	Nairobi to	APC	Lagos to	APC
Dubai (ME)	24,874	Kuwait (ME)	296,738	Paris (EU)	311,471	London (EU)	99,346	Dubai (ME)	186,539
Perth (OT)	24,541	Jeddah (ME)	281,454	Brussels (EU)	170,334	Dubai (ME)	23,624	London (EU)	179,987
Washington (NA)	22,737	Riyadh (ME)	256,895	Milan (EU)	143,494	New York (NA)	21,368	Guangzhou (AS)	67,625
Beijing (AS)	19,003	Dubai (ME)	167,701	Lyon (EU)	121,409	Guangzhou (AS)	20,884	Jeddah (ME)	28,933
Delhi (AS)	14,504	Dammam (ME)	149,213	Bologna (EU)	115,961	Washington (NA)	12,052	Kuala Lumpur (AS)	17,372
Tel Aviv-Yafo (ME)	12,964	London (EU)	107,838	Barcelona (EU)	114,039	Ahmedabad (AS)	11,026	Istanbul (ME)	17,147
Abu Dhabi (ME)	12,186	Doha (ME)	105,698	Madrid (EU)	110,534	Toronto (NA)	9,194	Beijing (AS)	16,663
Shanghai (AS)	11,813	Milan (EU)	105,673	Marseille (EU)	77,877	Bangkok (AS)	8,754	Houston (NA)	16,259
Hong Kong (AS)	10,045	Amman (ME)	103,355	Istanbul (ME)	60,157	Atlanta (NA)	8,712	Baltimore (NA)	15,062
Jeddah (ME)	9,222	New York (NA)	101,074	Toulouse (EU)	56,479	Beijing (AS)	8,081	Mumbai (AS)	14,329
Brisbane (OT)	9,019	Sana'a (ME)	93,010	Montreal (NA)	39,527	Istanbul (ME)	7,771	Paris (EU)	14,039
Copenhagen (EU)	8,587	Abu Dhabi (ME)	78,045	Dubai (ME)	33,718	Munich (EU)	6,999	Beirut (ME)	13,010
Seoul (AS)	8,539	Paris (EU)	58,853	Jeddah (ME)	33,562	Copenhagen (EU)	6,874	Toronto (NA)	11,967
Istanbul (ME)	8,444	Tel Aviv-Yafo (ME)	53,356	Rome (EU)	31,234	Minneapolis (NA)	6,868	Rome (EU)	10,982
Toronto (NA)	8,350	Muscat (ME)	50,964	Geneva (EU)	30,221	Jeddah (ME)	6,712	Delhi (AS)	10,849
Rome (EU)	8,226	Tokyo (AS)	46,700	Turin (EU)	28,790	Hong Kong (AS)	6,632	Dublin (EU)	10,398
Doha (ME)	7,946	Istanbul (ME)	44,549	Tel Aviv-Yafo (ME)	25,809	Seoul (AS)	6,317	Atlanta (NA)	10,339
Munich (EU)	7,843	Beirut (ME)	44,385	New York (NA)	24,602	Boston (NA)	6,186	Auckland (OT)	10,044
Bangalore (AS)	7,491	Brussels (EU)	43,381	Riyadh (ME)	23,034	Tokyo (AS)	6,011	Madrid (EU)	9,893
Stockholm (EU)	7,225	Guangzhou (AS)	41,114	Nantes (EU)	21,904	Stockholm (EU)	5,920	Manchester (EU)	8,016

(3B) Major Shrinking or Slow Growth Connections

London (EU)	-78,807	Nice (EU)	-7,131	Zurich (EU)	-15,453	Abu Dhabi (ME)	-3,166	Athens (EU)	-3,340
Atlanta (NA)	-17,044	Gaza City (ME)	-4,164	Montpellier (EU)	-8,508	Seattle (NA)	-2,970	Hong Kong (AS)	-2,999
Frankfurt (EU)	-14,216	Sofia (EU)	-2,797	Dusseldorf (EU)	-6,120	Dublin (EU)	-185	Zurich (EU)	-2,223
Milan (EU)	-14,100	Budapest (EU)	-2,377	Nice (EU)	-4,224	Zurich (EU)	57	Turin (EU)	-1,622
Zurich (EU)	-11,442	Tampa (NA)	-2,339	Luxembourg (EU)	-2,689	Venice (EU)	569	Karachi (AS)	-1,137
Dublin (EU)	-8,663	Nagoya (AS)	-1,523	Stuttgart (EU)	-2,619	Stuttgart (EU)	583	Glasgow (EU)	-1,024
Brussels (EU)	-7,220	Belgrade (EU)	-489	Strasbourg (EU)	-2,580	Detroit (NA)	622	Vienna (EU)	189

APC = Absolute PAX Change

EU = Europe; NA = North America; ME = Middle East; AS = Asia; OT = Other regions Source: Authors

Figure 1: Major growing and shrinking air connections in the African urban network (2003-2009). Source: Authors.

Figure 2a-d Relative link change (2003-2009) between the 61 African cities and four world regions.