



Connecting African urban areas: airline networks and intra-Sub-Saharan trade



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ABSTRACT

Despite efforts to enhance the efficiency of the African air transportation sector through such actions the Yamoussoukro Decision, African represents less than 2% of the world's air passenger kilometers. This is despite the fact that air transportation can act as a means of transporting traded goods directly (including the individuals that are the "product" of tourism) and provide complementary services of labor mobility for those engaged in the production of more bulky goods that are shipped by land and maritime modes. We examine the network of intra-Sub-Saharan African airline connections to highlight the differential access enjoyed by the region's largest cities. Second, we develop a quantitative framework linking the availability of air connections to the main international trade flows in sub-Saharan Africa. Our findings suggest that, although there is a positive link between air transportation and economic development in Africa, the multilateral efforts at reducing institutional impediments to more open aviation markets have not produced significant results.

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1. Introduction

Aviation is the fastest growing means of both passenger and freight transportation. In lower income countries, however, it has traditionally been seen much more as a luxury good rather than as an instrument, appropriately used, for fostering economic growth. This has changed somewhat as activities including tourism, and the export of "exotics", such as flowers and fruits (Vega, 2008) have become important for many developing countries, and as there has been significant growth in the production of lower weight, high value products in these countries. Even the traditional extractive industries increasingly rely on air transportation to move personnel and ensure rapid access to components for equipment repair. Overall, however, African air traffic has only grown slowly. For example, according to the World Tourism Organization (UNWTO), tourism growth has lagged behind other regions; e.g. its market share for global tourism grew from 3% in 1980 to 5% in 2010, whereas that for arrivals in the Asia Pacific grew from 8% in 1980 to 22% in 2000.¹

The focus here is on the link between the provision of air transportation services between Sub-Saharan African countries

and the level of trade between them. Trade being seen here not as end in itself, but acting as a driver of economic growth; a view supported in Sub-Saharan context by the analysis of Bruckner and Lederman (2012). To develop this new perspective trade between the Sub-Saharan macro-region and the rest of the world is not considered. It is appreciated that this in no-way represents a full assessment of the role of air transportation in economic development, not least because some of these countries main markets are outside of the area. The interest is in whether developments in air service provision between countries in this region have facilitated, or even stimulated, intra-regional trade. Unlike investment in rail or road transportation that largely carries traded bulk commodities from remote regions, air transportation is more likely tied to urban areas where populations are increasingly concentrated.

The large scale movement of populations to cities, combined with the types of service airlines provide, means that most of the gains from enhanced aviation is to be felt in urban areas, although the extreme notion of the creation of African "Aerotropoles" along the lines suggested by Kasarda and Lindsay (2011) is unlikely in the near future. In 1950 (the start of the "independence period") 14.7% of Africa's inhabitants were urban, in 2000 this had risen to 37.2% and the United Nations expects it to rise to 45.3% in 2015. Lagos, Nigeria, that in 1963 had 665,000 inhabitants and 8.7 million in 2000 is expected to become the world's 11th largest

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¹ General data on global tourism is regularly up-dated at the UNWTO web site; <http://www2.unwto.org/>.

city by 2015 with 16 million inhabitants. The urbanization of Sub-Saharan Africa in particular, is growing rapidly.²

The Sub-Saharan region, however, contains some of the poorest countries in the world, and, overall, some of the most sparsely populated. Attempts at improving economic conditions, both by countries themselves but also involving international organizations such as the World Bank, the United Nations, and the International Monetary Fund have only enjoyed limited success. In the context of transportation, a long-standing focus on surface infrastructure investment has often proved costly and ineffective. Air transportation has largely been neglected until recently, in part because of an emphasis on developing extractive and manufacturing industries that are mainly dependent on surface modes for market access. The air transportation infrastructure in Sub-Saharan Africa, and in particular ground-based navigation aids, consistently score badly in international comparisons (e.g. Schlumberger and Weisskopf, 2014).

There have also been changes in the way multi-lateral aid has been directed. The World Bank, for example, has traditionally put limited finance into equipment such as aircraft for state-owned airlines, and infrastructure projects. More recently, the liberalization of the air transportation sector, the privatization of many state-owned airlines, and a reorientation of thinking more generally towards trade creation, have seen it shift to a more policy and regulatory support function.

2. Intra-African trade issues

Intra-African trade and international mobility is limited compared to most of the world. An institutionalist may think this surprising. The region contains the South African Customs Union (SACU), established in 1910 and the world's oldest surviving customs union; indeed Africa has 14 trading blocs with overlapping members. Most countries belong to at least two blocs, and many three. Much of sub-Sahara's trade, however, is with Europe and America with only about 12% "internal" with other African countries. Africa's trade looks all the more meager given that fifteen of its countries are landlocked; so much of what crosses their internal borders is in transit, and on its way to or from other countries. The World Bank (Limdo and Venables, 1999) has estimated that such countries pay about 50% more in transportation costs than coastal countries, and have up to 60% lower volumes of trade. We adjust for the possible effects of this geographical factor on intra-African trade flows in addition to GDP differentials.

While the lack of genuine free trade, as opposed to the rhetoric of free trade agreements, is one reason for the limited movement of people and goods, poor infrastructure in the context of difficult physical terrain is another. The World Bank, for example, estimates that only one-third of Africans living in rural areas are within 2 km of an all-season road, compared with two-thirds of the population in other developing regions, and there is considerable variation between countries with a range from 5% for Sudan to 67% for Lesotho. Furthermore, by way of comparison, there are 16.8 km of road per 1000 km² in Sub-Saharan Africa compared to 124 km for middle-income countries throughout the World.³

The problem is also not only a lack of investment, but also poor maintenance of what is there. Infrastructure, and especially energy and transportation infrastructure, can be expensive to both provide and maintain, and poses serious security issues especially for landlocked nations that have to rely on third-party countries for access to international markets. Surface transit routes also tend to be monopoly channels with the potential for rent-seeking charges

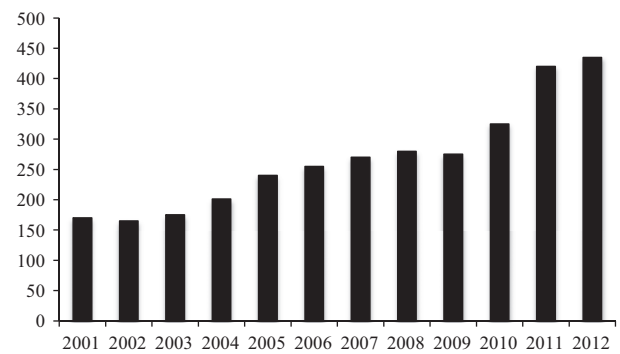


Fig. 1. Sub-Saharan Africa air transportation passengers (annual for January in millions). Source: <http://data.worldbank.org/indicator/IS.AIR.PSGR>.

being levied for using them. In this context it would seem that air transportation would assume a priority in policy and planning. While it is not relevant to the movement of bulk commodities, air transportation offers flexibility and relatively low infrastructure costs, with a more convenient mix of mobile and fixed capital for developing public-private partnerships, when it comes to high-value low bulk trade items, including the persons involved in the service sector and tourists.

In the particular context of international transportation, there is also the political challenge of conflicts between short- and long-term objectives (Button, 2010). In the short-term, countries often have limited foreign exchange reserves and thus treat international transportation essentially as an "import" and levy a variety of taxes on it and, because airlines have traditionally been state owned, seek to protect their "flag carrier". *Quid pro quo* actions inevitably lead to aggregate sub-optimal levels of transportation supply and high transportation costs. For longer term development, and, most markedly when it is export led, this lead can stymie the flow of goods from the country, as well as pushing up the price of key components needed in the creation of a modern industrial base.

3. Air transportation issues in the region

In terms of the overall size of its market, depending on the units of measurement used, Africa represents less than 2% of the world passenger aviation market, and less than 1% of the cargo market. Fig. 1, for example, provides some details of the growth in Sub-Saharan air passenger traffic, but this is totally dwarfed by global flow; indeed a graph fitting this data with global data would require two separate scales.

Looking forward, Boeing Commercial Airplanes (2012) forecasts, based on projected trends in such things as GPD, fuel prices, and demographical factors, indicate that African revenue passenger kilometers will grow on average by 5.7% per annum between 2013 and 2032, and cargo by 6.6% compared to global growth of 5% for each. Airbus' (2013) forecasts are slightly lower for Africa, for example 5.1% per annum for revenue passenger kilometers. This outpaces global trends slightly, but it is from a very low base.

A major issue is the lack of genuine interconnectivity within the African air transportation network despite efforts over the years to improve this.⁴ Modern legal initiatives began in 1961 when 10 African nations signed the Treaty on Air Transportation in Africa (the Yaoundé Treaty) that established a jointly owned airline, AirAfrique, although this went into liquidation in 2002. More importantly from a

² <http://esa.un.org/Unpd/Wup/>.

³ <http://data.worldbank.org/topic/infrastructure>.

⁴ There are some hub and spoke structures (Ssamula, 2012) based upon Johannesburg, Abuja, and Nairobi, but many of the routes are thin. Arvis and Shepherd (2011) provide a more rigorous of the linkages between airline networks in Africa using a connectivity index.

market liberalization process, and moving away from the rigid bilateral air services agreements that had grown up after the Chicago Convention in 1944, was the 1988 Yamoussoukro Declaration. This represented an African initiative to prepare for the ripple-out effects of economic deregulation in the United States, the movement towards an integrated European air market and the growth of Open Skies policies elsewhere.

The Declaration committed African States, both individually and collectively, to achieve the phased integration of their airlines within eight years. Progress, however, was slow. The 1997, the Banjul Accord for an Accelerated Implementation of the Declaration was adopted by Ghana, Sierra Leone and the Gambia, with Cape Verde, Guinea Bissau and Nigeria, recognized the region representing these states as a single geographical commercial air transportation operations zone. The Yamoussoukro Decisions of 1999 subsequently committed its 44 signatory countries to deregulate air services, and promote regional air markets open to transnational competition. Subsequent progress, however, has been slow, even when it has taken place. But as Schlumberger (2010) has shown, reform can be beneficial where it does occur. When the Nairobi–Johannesburg route was fully opened up in 2003, passenger volumes increased 69-fold. When the domestic South African market was liberalized, passenger volumes increased by 80%, and on average in the Southern African Development Community routes that were liberalized saw fares drop by 18%.

Overall, however, there remains little practical integration of national airline networks in Africa; there has been much rhetoric, particularly involving politicians and lawyers, and international bodies such as the UN's International Civil Aviation Organization but very little has actually been achieved. This is despite the considerable global evidence that has been accumulated on the importance of air transportation in stimulating economic development; in simple trade terms, about 35% of world trade by value goes by air. Some countries pursuing unilateral approaches have been exceptions and have seen significant increases in traffic and adjustments in their networks – for example, see Ismaila et al. (2014) and Daramola and Jaja (2011) regarding Nigeria. There are also some supportive findings that individual airports in Africa have yielded considerable economic benefits for the regions in which they are located; for example see, Irandu (2006) on Nairobi in Kenya.

While there are continuing problems of the public policy regarding air service agreements, there are also issues regarding the nature and structure of African airlines – for example, over a quarter of routes in Africa are served by a monopoly carrier – and of what is carried by African carriers, 80% goes on 20% of the airlines. In some regions the monopolization of markets is even greater; e.g. in 2013, 53% of the top routes in East Africa have a single carrier (Schlumberger and Weisskopf, 2014). Protectionism is often motivated by a fear that the “flag” national carrier will be unable to compete with the continent's larger carriers from Kenya, Ethiopia and South Africa, as well as intercontinentally with competitors from the Gulf and beyond. Change often occurs as a part of crisis management. For example, in 2013 it took the collapse of Air Malawi for Kenya Airways to be allowed to operate between Malawi and other countries, despite “fifth freedom” rights that allow an airline to carry revenue traffic between foreign countries as a part of services connecting them to its own country, having already been agreed through the Yamoussoukro Decision.

In addition to restricting competition, and thus limiting the number of flights, many countries also provide subsidies to their flag carrier thus using scarce resources to prop up inefficient airlines. The situation has also acted to prevent the growth of low cost airlines that have been a major stimulus to greater economic efficiency in other macro-regional markets. Similarly support has been given to large national airports irrespective of the demands for their services.

Regarding the carriers themselves, in part because of political interference, less efficient flag airlines have tended to remain in the market preventing a natural hub-and-spoke system being developed by African airlines (Heinz and O'Connell, 2013). African domicile carriers, in particular, find it difficult to compete with non-African airlines in this context. Indeed, if we combine both intra-Africa and inter-continental traffic involving Africa, then 80% of traffic goes by non-African airlines. Adding to this problem, although there are exceptions, most notably South Africa, has been a focus on trunk-haul services to the neglect of domestic feeder services, with low cost carriers that often serve that role elsewhere, finding market and institutional forces more hostile than in many other places. In addition, there is a tendency to direct resources on the major international airports, often using revenues from other airports in their support; Schlumberger and Weisskopf (2014) provide examples of this, as well as of high airport charges and taxes used to “gold-plate” large gateway airports.

In addition, there is a shortage of skilled labor in Africa, corruption, over staffing, a strong travel agency network that takes 7% commission, thin routes, low Internet penetration, poor or lack of investment opportunities for fleet modernization. In terms of future labor issues, the growth of mega-markets such as China will in particular put increasing pressure on the availability of pilots, with Sub-Saharan Africa having to compete globally for a limited number of personnel (Boeing Commercial Airplanes, 2012). One outcome of these trends is low average utilization of aircraft – some 6.9 h a day compared to 9.9 for European carriers – and low load factors – 69.7% in 2010 compared with a global average of 75.2%. This has led to considerable market instability with 37 new airlines being launched in the decade from 2000, and 37 failing. The continent also has a poor safety record with 23% of the world's jet hull losses occurring there in 2010, or put another way, in 2012 African airlines had one accident for every 270,000 flights whereas the industry average was one accident per five million flights.⁵

Here we are concerned with the extent to which recent trends in the provision of air services have contributed to economic development in Sub-Saharan Africa. The approach, unlike that of Aschauer (1989) and others who have looked at infrastructure provision and productivity growth, takes an indirect path based upon the experience in Europe where enhanced aviation has led to more trade and that this in turn fosters economic growth. In that sense, it adopts, as an underlying theory, a neo-classical, as opposed to an endogenous, approach to economic growth (Button, 2011).

4. Methodology and data

There are debates about causality when examining links between transportation supply and economic development: which is the dependent variable and which the independent? A fully specified equation system provides one way of looking at this but developing this sort of framework is thwarted with difficulties, not the least of which is our poor understanding of economic development itself. What has been found when there have been efforts to define causality is that air transportation can, at least when there is latent economic potential in a region, facilitate economic growth.⁶

In terms of trade creation and the availability of air transportation services, there has been rather less work, and particularly so in the context of lower income countries. The assumption here is that trade, in line with the thinking of the World Bank and International Monetary Fund, stimulates economic growth.

⁵ <http://www.iata.org/pressroom/pr/Pages/2013-09-17-01.aspx>.

⁶ For example see Button et al. (1999) for work involving Granger causality testing and Button et al. (2010) using random effects modeling. A study of African aviation that implicitly assumes economic growth is the driver of air traffic is Ismaila et al. (2014).

In terms of an analytical, what is essentially a Tinbergen (1962) gravity model framework is deployed, namely;

$$T_{ij} = G(M_i^{\beta_1} M_j^{\beta_2} / D_{ij}^{\beta_3}) \quad (1)$$

where T is the trade flow between i and j , M is the economic mass of each country, D is the distance, and G is a constant.

The model has also been used in international relations to evaluate the impact of treaties and alliances on trade. Tinbergen's general framework has proved to be robust when used to test the effectiveness of trade agreements and organizations such as the North American Free Trade Agreement and the World Trade Organization. Here we make use of more economically oriented variables, such as countries' relative GDP, rather than physical masses, the airline capacity available on a route in addition to the distance between origins and destinations, and make allowance for the overall dependence of an economy on trade. Additionally, control variables are added to reflect whether the countries involved are land-locked.

The analysis focuses on trade between the various Sub-Saharan African countries included in the aviation database that is largely derived from the *Official Airline Guide*.⁷ While this does include all air travel between the countries included, it is essentially interurban movement between the largest cities. Given the physical sizes of many states and the distances between their major urban areas, there is very little domestic air transportation in Sub-Saharan Africa, and what does exist is limited to a small number of countries and based on their largest metropolitan areas. The same source is used for information on this potential feeder traffic. Data on the characteristics of the countries involved are taken from *UNCTADstat*, the standard United Nations source, and from the World Bank.⁸

The analysis embraces pooled data related to trade and air travel involving those countries in the *Guide* that are in Southern Africa, Central/Western Africa, and Eastern Africa, and had scheduled airline services from 1997 to 2011. Some countries are omitted because of lack of reliable data on GDP and/or trade flows (e.g., Djibouti, 2008–2011; Somalia, Sao Tome and Principe, 1997–1999). This leaves 5523 observations allowing calculation of the coefficients in a log-linear specification. No efforts are made to introduce lags into the model. First, airline seats are put on sale well before the takeoff date thus separating the travel decision from the flight. Second, the time series is too short to look statistically for lagged causal patterns.⁹

$$\begin{aligned} TRADE_{A \rightarrow B} = & \alpha_0 + \alpha_1 SEATS + \alpha_2 AIRLINES + \alpha_3 KM + \alpha_4 GDP_A \\ & + \alpha_5 GDP_B + \alpha_6 TOTAL TRADE_A + \alpha_7 TOTAL TRADE_B \\ & + \alpha_8 LOCAL CONNECTIONS_A \\ & + \alpha_9 LOCAL CONNECTIONS_B + \alpha_{10} LANDLOCKED \quad (2) \end{aligned}$$

- **TRADE.** This variable measures trade flows and is computed as the sum of imports and export of “total product” from the annual merchandise trade matrix – product groups, imports (exports) in thousands of dollars. In case of countries with only the value of import (export) the value has been doubled to get the trade value, this constitutes 7% of our database (*Source: UNCTADstat*).

- **SEATS.** This is the sum of the seats offered on non-stop flights from country A to country B. There is considerable variation in the annual seats provided per route, with an average of 45,325 and a standard deviation of 73,383 (*Source: Official Airline Guide* database).
- **AIRLINES.** Number of airlines operating flights each from country A to country B, including cargo airlines (*Source: Official Airline Guide* database).
- **KM.** This is the average distance flown in kilometers (*Source: Official Airline Guide* database).
- **GDP.** This is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current U.S. dollars. Dollar figures for GDP are converted from domestic currencies using single year official exchange rates. For a few countries where the official exchange rate does not reflect the rate effectively applied to actual foreign exchange transactions, an alternative conversion factor is used (*Source: World Bank*).
- **TOTAL TRADE.** This is the sum of trade values for each country in the dataset. These are computed as the trade of each African country with all the other countries included in the database. There are some anomalies in the base data in that often the records of export values from say country A to B are not the same as the records of imports to country B from country A, but little can be done about this. Where there are missing cells, balanced trade is assumed to maximize the number of observations. By global standards, the levels of trade are low, averaging \$133,300, and there is considerable variations between countries in their trading activities, with a standard deviation of \$385 thousand (*Source: UNCTADstat*).
- **LOCAL CONNECTIONS.** This is the number of airports with direct domestic services to the international gateway in the origin and destination countries and is designed to capture the feeder networks that serve the trunk services. The variable provides guidance as the importance of local airline services as part of the larger international air transportation system (*Source: Official Airline Guide* database).
- **LANDLOCKED.** These are the landlocked countries of Botswana, Burkina Faso, Burundi, Central African Republic, Chad, Ethiopia, Lesotho, Malawi, Mali, Niger, Rwanda, Swaziland, Uganda, Zambia and Zimbabwe. We consider separately the cases where one of an origin–destination country is land locked and when both are.

5. Results

Estimations are based on ordinary least-square regression techniques, and the results are seen in Table 1. The specification is essentially log-linear, in line with the underlying gravity style model; standard assumptions are made to allow for values of zero. Inspection of the correlation matrix indicates some degree of multicollinearity between seats and airlines, and between the GDP and trade conducted by countries. Because the objective is not to use the estimation results for forecasting, no effort is made to adjust the specification for this.

A number of robustness tests were also performed. Removing the trade routes where there is missing data on either imports or exports only reduces the number of observations by 22 and has no appreciable effects on the estimations. Equally removing routes, in various combinations, with few seats, of short distances, or involving little trade leaves the signs of coefficients unchanged with similar values and broad levels of significance to those in

⁷ www.oag.com/.

⁸ From http://unctadstat.unctad.org/wds/ReportFolders/US_popup.html and <http://data.worldbank.org/indicator/NY.GDP.MKTP.CD>, respectively.

⁹ The countries included are: Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo, Democratic Republic of the Congo, Cote D'Ivoire, Djibouti, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, South Africa, Swaziland, Tanzania, Togo, Uganda, Zambia, and Zimbabwe.

Table 1
Relationship between trade flows and airline service provision.

	Model I	Model II
Log(SEATS)	0.219***	0.199***
Log(AIRLINES)	0.782***	0.756***
Log(KM)	-0.886***	-0.890***
Log(GDP _A)	-0.129***	-0.119***
Log(GDP _B)	0.028	0.034
Log(TRADE _A)	0.755***	0.768***
Log(TRADE _B)	0.594***	0.612***
Log(LOCAL CONNECTIONS _A)	0.079**	0.081**
Log(LOCAL CONNECTIONS _B)	0.058*	0.061*
BOTH COUNTRIES LANDLOCKED	-1.140***	
AT LEAST ONE COUNTRY LANDLOCKED		-0.501***
CONSTANT	-2.795***	-3.218***
R-squared	0.634	0.627

*** Significant at 1%.

** Significant at 5%.

* Significant at 10%.

Table 1. Likewise combining trade and traffic data into and out of a country as single variables makes little difference.

The overall explanation offered by the models, given the nature of the data set, is relatively good, as is that of most of the individual explanatory variables. In terms of *a priori* expectations, the signs are largely as would be anticipated in a Tinbergen style gravity model. The underlying pattern of trade flows is significantly from lower income countries (negative GDP_A coefficients) to higher income countries (positive, although not significant GDP_B coefficients), with distance acting as an impediment.

There is clearly, as expected, a strong positive relationship between the number of airline seats offered and airlines serving a route, and the scale of trade flows, although it is not possible to test for causality. The positive correlation associated with the number of airlines, and its high degree of statistical significance, alongside the statistical significance of the seats variable, would suggest the former is reflecting competitive pressure on routes rather than simply being linked to more capacity; the airline variable is capturing the degree of competition on each route. Also in line with the Tinbergen gravity model, trade declines as the distance between countries increases.

The relatively high statistical significance and positive signs of coefficients associated with the presence of domestic airports providing services linked to gateways would seem to add credence to the complementary of international and national air transportation networks. There would seem to be gains to trade, and *ipso facto* economic growth, from developing appropriate feeder services infrastructure, in this case potential feeder airports, as well as focusing on international services from gateway airports.

The issue of the role of landlocked countries is addressed by using two specifications as shown in Table 1. The negative signs for landlocked countries, irrespective of the specifications examined, are in line with Limdo and Venables's (1999) work. The larger negative coefficient when two landlocked countries are involved in trade provides additional support to their findings. Unfortunately the data do not allow rigorous analysis of the role enhanced air transportation policy could play in opening up trade involving landlocked countries.

Efforts were also made to consider the effects of relaxation of the bilateral air service agreements, including the signing of multilateral open skies style agreements, and of civil unrest in the countries involved. The main problem with the former is defining which regimes are *de facto*, as opposed to *de jure*, liberal in their approach to air transportation, and with the latter it is a matter of degree and spatial coverage of unrest in a country. For example, there may be internal conflicts but these need not be close to major

airports. Incorporating these variables proved difficult and the results sensitive to the variable specifications used, but there was no indication that the multilateral treaties, in particular, had any significant positive effects over the period studied. The results are not reported.

6. Conclusions

The evidence provided in this paper indicates a direct link between the provisions of airline capacity and international trade within Sub-Saharan Africa, and thus a link with the economic performance of urban areas in the region. Added to this, there emerges complementarity between the scale of the domestic air transport system and trade, suggesting an important role for synergistic feeder networks to support trunk services. The relative short time series available, together with the difficulty of specifying a full system of equations given the available data must inevitably make the conclusions tentative, but the findings do give support to the gradually growing number of studies linking air transportation provision with economic development.

Modern industry and service activity is international in scope and often requires air transportation to allow its full integration into the world economy. For the countries of sub-Saharan Africa, policy shifts that facilitate improvements in inter-regional air transport maybe a critical element in making the link to this world economy.

Any extension and improvement in the air services can also contribute to the fairly rapid process of urbanization as emerging business and industry connections associated with trade are likely to be concentrated in cities. Hence the sustainability of these expanding urban economies over the longer term may well be shaped by policy and planning for air transportation.

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