Growth in Air Transportation of Sub-Saharan African Nations [*]

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Abstract

Over the last decade, SSA nations have undergone unequivocal development in air transportation. This development has been exemplified by a 45 percent rate in passenger traffic which is comparable to that of the United States during the same period. This paper assesses the development of air transportation and its role in the transportation system in twenty five SSA countries from 1990 through 2006. The paper uses the number and quality of airports in 2006 and the1990-2004 progress in air transport performance as represented by the number of passengers and quantity of cargo handled by air ports and transported by air carriers and the number of aircraft departure. Based on the examination of these factors three groups of countries in SSA have been identified: countries with high growth rates, low growth rates, and negative growth rates in air transportation. The overall division of countries into these groups was based on the average growth rate in the performance factors (i.e., number of passengers, quantity of freight and aircraft departure). Eight countries have been classified into either high growth rate, low growth rate, or negative growth rate consistently in all of the factors. Noting that the relationship between air craft departure and air cargo is statistically insignificant, regression results indicate that in the twenty five countries of interest, an average increase of 141 passengers and 8,000 tons per kilometer result in an increase of one aircraft departure.

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Introduction

In Sub-Saharan Africa (SSA), road transportation dominates the transportation system. In this region air transportation, which has grown rapidly in the past years, appears to be next in significance to road transportation, with the remaining modes, air, water, and pipeline transportation, playing a minor role in the system(Addus and Khan, 2000). Over the last fifteen years Sub-Saharan African (SSA) nations have experienced unequivocal growth in air transportation (World Bank Groups, 2006). Data on the volume of air passengers and cargo traffic in twenty-five SSA nations indicate significant overall increases between 1990 through 2004.[1] During this period, the overall growth rate of 45 percent (from 13.8 million in 1990 to 29.0 million in 2004) in SSA nation's air passenger traffic is nearly par to the 46 percent (from 464.6 million in 1990 to 678 million in 2004) growth rate in the United States. The rapid rise in air transportation in SSA has brought forth many issues including changes in air transport infrastructure, high jet fuel price leading to higher airline operating costs, and safety problems with Trans-Atlantic flights, particularly, after the September 11, 2001 terrorist incidents in the United States (Mkiaru, 2004; Time, 2006).

As the fastest mode of transportation, air transportation has time-saving advantages, which increases with the length of line haul operation, over other modes of transportation; and it does not require heavy investment in the construction the right of way as in the case of motor carriers, railways, pipelines. Yet not every SSA country has been able to take the full advantage of moving passengers and cargos by air. The uneven development in air transportation of the SSA countries calls for an investigation into the relative growth rates in these countries.

The purpose of this paper is to assess the development of air transportation in SSA countries, by providing a baseline account of airports, the volumes air passenger and cargo traffic, the number of aircraft departure from 1990 to 2004. It presents a statistical survey and analysis of the number of airports in 2006, the number of passengers and the quantity of cargo handled by airports and carried by air carriers, and the number of aircraft departure between 1990 and 2004 in twenty five SSA countries. These countries have been selected based on data availability. This paper is organized in the following way, methodology and data will be discussed in section two, airports will be presented in section three, Air transportation performance reported in section four, regression results discussed in section five, and last conclusions.

Methodology and Data

This study adopts a combination of descriptive and linear regression approaches to examine the development of air transport in twenty-five SSA nations, which have been based on data availability, from 1990 through 2004. The factors of interest for analysis include the number and quality of air ports, passenger and freight traffic volume, and number of aircraft departure. In the first phase, the number and quality of commercial airports in 2006, the 1990-2004 volume of passenger and freight traffic, and 1990-2004 number of aircraft departure were examined. The development of air traffic volume and aircraft departure was based on examination of data at every four to five-year interval in 1990, 1995, 2000 and 2004. In the second phase of the study, the relationship between air passenger and freight traffic and aircraft departure and between aircraft departure and air ports in the SSA region were investigated through linear regression method. The

results are evaluated by grouping the SSA nations according to the robustness of the growth (the relative growth rate in) in air transportation.

Time series data on air cargo transport, air and cargo traffic, and airplane department have been obtained from the World Bank Groups' 'World Development Indicators (Source and date). Airport information has been compiled from the U.S. Central Intelligence Agency (CIA), International Transport Association (IATA), and other Internet sources, including Aircraft-charter-world.com, Aviation Networks, Inc., Azworldairports.com, Fallingrain.com, Wikipedia.com, WorldAeroData.com, and World-airport-codes.com. A few information gaps within the time series have been filed by using linear extrapolation method between two end points of each gap in order to maintain consistency of the published data. Accuracy of published time series data has been strictly maintained and no changes have been contemplated to the published data set.

Airports in Twenty Five SSA Nations

The earliest history of commercial airports in Sub-Saharan Africa can be traced back to the time when South Africa entered into the air transport age in the 1930s. The current Johannesburg International Airport was first opened in 1952 in South Africa, and it has reached the standard of any international airport in the world after major developments in 2002 and 2003 (www.Azworldairports.com, 2006). In many of the other SSA nations air ports were constructed before the countries gained their independence from European colonial powers. A case in point is the Zambia's Lusaka International Airport that was built prior to the country's independence in 1990[3] (1960?). Air ports in SSA countries are divided into airstrips, small domestic commercial airports,

large domestic commercial airports, and international airports. An airstrip is a piece of open field next to woods or grassland usable for small single engine propeller airplanes. Commercial airports, as defined by the U.S. Federal Aviation Administration's, are airports with scheduled passenger service and more than 2500 annual enplanements, with allowance for minor variation in some countries. International airports, as defined by, IATA, are airports fully equipped with paved runway of over 9800 feet to accommodate Boeing 747 jumbo or equivalent jets, air traffic control tower, and terminals with customs services for processing arriving and departing international passengers. Table 1 lists airport information in the twenty-five SSA nations as of 2006. (Put Table 1 below)

Table 1 lists the number of commercial air ports international air ports, airports with paved runways, and the percentage of the later in the twenty five SSA nations in 2006. The total number of air ports range from 728 in South Africa to 2 in Sao Tome. Of the 2,762 airports in 24 SSA countries (excluding Botswana for which the number of total airports are unavailable), 37 percent (1,018) are commercial airports, and the remaining 63 percent are airstrips. The number of commercial airports for the 25 countries in question range from 195 in South Africa to only one in Sao Tome. The top four nations with large number of commercial air ports are South Africa (195), Kenya (172), Zimbabwe (129), and Botswana (101). It should be noted that South Africa is relatively a more advanced economy in the Africa continent as a whole. At the bottom of the list are countries, including Cameroon, Cape Verde, Gabon, Ghana, Mauritania, Mauritius, San Tome, Senegal, Seychelles, and Uganda, which have twenty or less number of commercial air ports. These countries are either small in number in terms of land area (San Tome and Principe), or have large undeveloped land (Mauritania).

Botswana, in descending order. Four countries, Cameroon, Cape Verde, Mauritius, and San Tome, with 100 percent (all) paved commercial air ports have the lowest number of commercial airports ranging from one to seven. The lowest paved commercial air port stands at 7 percent in Burkina Faso. Four the 25 SSA countries paved commercial airports average 34 percent. In these countries there are a total of 103 international airports. Tanzania has 10 international airports and Botswana, South Africa, and Sudan 8 international air ports each.

Air Transportation Performance in Twenty five SSA Nations

The twenty five SSA countries under consideration have been divided into three groups according to their air cargo, passenger traffic, and aircraft departure growth rates between 1990 and 2004. Because of difference in growth rates separate standards have been used to group the countries in these three areas.

Air Cargo Traffic

The types of cargo for airfreight include, perishable and nonperishable merchandise, livestock, raw materials, semi-finished and finished products such as machines, garments, electronics, chemical product, medical equipment, and medicine. Data on air cargo traffic growth in the twenty-five SSA nations from 1990 to 2004 are presented in Tables 2 through 4. These countries have been divided into three groups. Group I include countries with high growth rats of 100 percent and above. In group II are countries with low growth rates of between 21 and 99 percent. Group II consists of countries with negative growth rates.

Group I. Table 1 lists seven SSA countries with high air cargo traffic growth rates from 1990 to 2004. During this period all countries, with the exception of the Sudan and

Namibia for a period, have had steady growth in air cargo traffic volume handled. The growth rate for these countries ranged from 117 percent (from 10.4 million tons in 1990 to 22.6 million tons per kilometer in 2004) for Seychelles to 5,548 percent (from one ton in 1990 to 56.5 tons per kilometer in 2004) for Namibia. The average growth rate for the seven countries was 341 percent. These seven countries accounted for 48 percent and 84 percent of the total air cargo traffic in 1990 and 2004 respectively.

Group II. Table 3 shows data on air cargo for seven SSA countries with low air cargo traffic growth rates from 1990 to 2004. During this period, air cargo shipment fluctuated in many of these countries. In Uganda, air cargo freight declined from 21.7 in 1990 to 1.1 million tons per km in 1995, but climbed to 20.7 million tons in 2000 and increased to 26.7 in 2004, which was contrary to decline in air passenger traffic and aircraft departure during the same period. Between 2000 and 2004 air cargo traffic declined in Cameroon and Tanzania, but it creased in Ethiopia, Angola, Malawi, Uganda, and Sao Tome.

The growth rate in air cargo for this group ranged from 20 percent (from 0.05 ton in 1990 to 0.06 ton per kilometer in 2004) for Sao Tone to 76 percent (from 66.6 tons and 13.1 in 1990 to 93.5 tons and 23.0 tons per kilometer in 2004) for Ethiopia and Cameroon respectively. For these countries the average growth rate between 1990 and 2004 was 47 percent. The countries accounted for 20 and 12 percent of the total air cargo traffic in 1990 and 2004 respectively.

Group III. Eleven SSA countries with negative air cargo traffic growth rates from 1990 to 2004 are shown in Table 4. During this period, three countries including Burkina Faso, Senegal, and Zambia had insignificant amount of cargo handled in 2004. For

instance, Zambia, a copper rich country, does not ship copper by air cargo due to the cost of handling in transportation. Copper is transported via railroad and highway. Mauritania lost nearly all its air cargo shipment in fifteen years by moving from 17.9 million tons per km to 0.09 in 2004 due to high fuel and other costs. Zimbabwe had an up-and-down pattern like Ethiopia did by increasing its cargo handle from 64.9 in 1990 to 159.4 million tons per km in a decade then decreased to one tenth of that amount (17.4) four years later. The collapse of Zimbabwe export sector especially tobacco by restructuring the land ownership in the country is a major factor of this decline. A similar situation occurred in Ghana, due to internal political conflict and disturbance in the economy.

Air cargo shipment generally declined in these countries, with highest decline ranging from negative100 percent (from 17.7 tons, 17.7 tons, and 29.6 tons per kilometer inn 1990 to nothing in 2004) for Burkina Faso, Senegal, and Zambia respectively to negative 23 percent (from 0.06 tons in 1990 to 0.46 tons per kilometer) for Cape Verde. For these countries the average growth rate between 1990 and 2004 was negative 67 percent. This group's share of air cargo traffic declined from 32 percent in 1990 to only 4 percent in 2004.

Air Passenger Traffic

Data on air passenger traffic growth in the twenty-five SSA nations from 1990 to 2004 are presented in Tables 5 through 7. These countries have been divided into three groups. Group I include countries with high growth rats of 80 percent and above. In group II are countries with low growth rates of between 1 and 79 percent. Group II consists of countries with negative growth rates.

Group I. Table 1 lists seven SSA countries with high air passenger traffic growth rates from 1990 to 2004. During this period these countries have fairly had steady growth in air passenger volume handled. Senegal experienced the highest growth rate of 184 percent from transporting 148,300 passengers in 1990 to 420,600 in 2004. Kenya increased its passenger flow from 794,400 in 1990 to 2 million persons in 2004. The heaviest volume increase was found in South Africa, from 5.36 million in 1990 to 9.88 million in 2004, an increase of 84 percent. Mauritius in the Indian Ocean doubled its passenger travel from half a million in 1990 to over one million travelers in 2004. Most of this country's increase is due to the development of the tourist industry for foreigners originated from Europe, the Americas, and Asia. Higher air passenger traffic usually more contributes to a country's economic output, which in turn causes higher demand for country's air passenger services.

The growth rate for these countries ranged from 81 percent (from 22,300 passengers in 1990 to 40,300 passengers in 2004) for Sao Tome to 184 percent (from 148,300 passengers in 1990 to 420,600 passengers in 2004) for Senegal. The average growth rate for the seven countries was 99 percent. These seven countries accounted for 55 percent and 75 percent of the total air passenger traffic in 1990 and 2004 respectively.

Group II. Table 3 shows data on air passengers for seven SSA countries with low air passenger traffic growth rates from 1990 to 2004. During this period, the number of air passengers carried fluctuated in most of these countries. Seychelles, a tourist oriented island nation in the Indian Ocean had 242,400 air travelers in 1990 (slightly less than that in Mauritania), and 409,900 in 2004 (slightly less than that in Gabon). Its growth was steady without interruption every five years from 1990 to 2004. Madagascar enjoyed

surges of air travelers all the way to 650,000 persons in 2000, then suffered a loss of 150,000 passengers to half million persons in 2004. Three nations reported minor increases Gabon, Mozambique and Sudan, all under 10 percent. Sudan, facing civil war between the North and the South, had up-and-down changes in the study period and the total passenger traveled was under one-half million people for the study period.

The growth rate in air passenger volume for this group ranged from 5 percent (from 454,100 passengers in 1990 to 475,800 passengers in 2004) for the Sudan to 69 percent (from 242,400 passengers in 1990 to 409,900 passengers in 2004) for Seychelles. For these countries the average growth rate between 1990 and 2004 was 23 percent. The countries accounted for 16 and 14 percent of the total air passenger traffic in 1990 and 2004 respectively.

Group III. Eleven SSA countries with negative air passenger traffic growth rates from 1990 to 2004 are shown in Table 4. During this period, in these countries the number of air passengers transported declined, with fluctuations within the years. Zambia lost 88 percent of the 407,000 passengers it had in 1990, by transporting only 49,400 in 2004. The decline in copper price in the international market and drought in the region did much harm to the Zambian economy and subsequently contributes to the reduction in passenger traffic. For years Zambian Airways has served domestic and international routes, yet the Aviation Association of Zambia in 2004 was seeking another national airline for possible tourist and revenue flow from the 2010 World Soccer Cup event in South Africa.[2] Passenger traffic flow in Angola gained 22 percent between 1990 and 1995, from then on it decreased to a loss of 51 percent in 2004. The main reason for this decline is due to political factor of prolonged civil war in the country. In

1990 Nigeria's air passenger traffic was nearly one million people (which was the highest in this group), but the traffic substantially declined to 548,000 persons in 1995 (which was lower than Zimbabwe's 625,700 for the same year). However, air passenger traffic in the country picked up 2000 reaching up to total passenger flow went up to 681,700 persons in 2004. Ghana had a large gain in passenger traffic from 186,000 in 1995 to 314,000 in 2000, then dropped to 96,000 in 2004. High airline operating costs due to high jet fuel price coupled with fluctuating international gold prices affected Ghana's economy and the air passenger traffic. The famed Ashanti Goldfields had cut 10,000 workers in 2000 due to low gold price.

The decline in air passenger traffic for this group ranges from 88 percent (from 407,000 passengers in 1990 to 49,400 passengers in 2004) for Zambia to 5 percent (from 120,000 passengers in 1990 to 114,300 passengers) for Malawi. For these countries the average growth rate between 1990 and 2004 was negative 45 percent. This group's share of air cargo traffic declined from 29 percent in 1990 to only 11 percent in 2004.

Aircraft Departure

Data on aircraft departure growth in the twenty-five SSA nations from 1990 to 2004 are presented in Tables 8 through 10. These countries have been divided into three groups. Group I include countries with high growth rate of 60 percent and above. In group II are countries with low growth rates of between 1 percent and 59 percent. Group II consists of countries with negative growth rates.

Group I. Table 1 lists five SSA countries with high aircraft departure growth rates from 1990 to 2004. During this period all countries, with the exception of a reduction in the number of aircraft departure in Senegal in 2000 and in South Africa in 1995, have had

steady growth in aircraft departure. Nation-wise, the peak departures for Kenya were reached in 2000 instead of 2004. Senegal had the lowest magnitude 900 for 2000 yet it bounced back to 6,400 departures in 2004. The big fluctuations in Senegal are consistent with that found in air passenger traffic during the same period. As in Tables 2 and 3, Kenya, Mauritius, and South Africa are classified as high positive growth in air transportation in the SSA region in the period 1990 to 2004.

The growth rate for these countries ranged from 60 percent (from 84,000 departures in 1990 to 133,600 departures in 2004) for South Africa to 102 percent (from 13,000 departures in 2990 to 26,200 departures in 2004) for Kenya. The average growth rate for the seven countries was 66 percent. These seven countries accounted for 35 percent and 53 percent of the total air cargo traffic in 1990 and 2004 respectively.

Group II. Table 3 shows data on aircraft departures for seven SSA countries with low departure growth rates from 1990 to 2004. During this period, the number of aircraft departures fluctuated in most of these countries. Ethiopia had steady increase without any gap in fourteen years. All other countries revealed one spike or one dip in aircraft departures within the period. The growth rate in aircraft departure for the group ranged from 7 percent (from 17,200 departures in 1990 to 18,000 departures in 2004) for Madagascar to 56 percent (from 3,600 departures 1990 to 5,600 departures in 2004) for Malawi. For these countries the average growth rate between 1990 and 2004 was 36 percent. The countries accounted for 23 and 26 percent of the total air cargo traffic in 1990 and 2004 respectively.

Group III. Thirteen SSA countries with negative aircraft departure growth rates from 1990 to 2004 are shown in Table 4. During this period, the number of aircraft

departures generally declined, while fluctuating in most of these countries within the years. The least severe case was found in Seychelles, and the most severe one in Ghana. Ghana had 12,600 departures in 1990, but decreased to 1,300 in 2004. Two possible reasons contribute to this drastic decline one is related to the air transport industry itself such as change in the number of registered airlines in the country, less number of routes and flights. The other is outside the industry such as civil war and regulatory policies.

The decline rate for the countries ranged from 90 percent (from 12,600 departures in 1990 to 1,300 departure in 2004) for Ghana to 3 percent (from 15,800 departures in 1990 to 15,400 departure in 2004) for Seychelles. For these countries the average growth rate between 1990 and 2004 was negative 34 percent. This group's share of air cargo traffic declined by 100 percent, from 32 percent in 1990 to only 4 percent in 2004.

The distribution of total cargo handled in various years is reported in each column of Table 2. The high growth group not only yields high growth rate in the study period but also captures larger share of total volume in cargo handled in the SSA region. In 1990, approximately half of the total 719.55 million tons per km was shipped through the seven positive high growth nations. The Group II seven positive low growth nations handled only one fifth of the total freight, and Group III picked up the rest three tenth of total freight. In the next fifteen years total air cargo freight in the SSA region increased steadily: a 45 percent increase to 1046 million tons per km in 1995, another 58 percent increase from 1995 to 1648.5 in 2000, then a 10 percent increase from 2000 to 2004. Of all such surges, Group I thrust forward taking up 53 percent of total freight of 25 nations in 1995, 69 percent in 2000 and 84 percent in 2004. Group II was not able to maintain its share and declined to 13 percent in 2000, then 12 percent in 2004. The gain in Group I is

at the expense of Group III, which revealed a steady loss of total tonnage handled from 32 percent in 1990 to 4 percent in 2004. A chi-square statistical test for each of the four years suggests that the null hypothesis of even distribution of shares of total tonnage handles by these three groups of nations has been rejected. For instance, the chi-square statistic for 1990 is 11.85, which is statistically significant at zero percent probability level. The unusual growth in air cargo handled from Group I is very evident. South Africa alone handled slightly more than half of total tonnage in 2004. Mauritius and Ethiopia picked up almost one fifth of the total tonnage in 2004.

In the study period, Group I emerges to be the magnet in passenger traffic distribution by providing ever larger proportion each year. Expansions in the first group steadily increased from 55 percent of all passenger traffic in 1990, to 61 percent in five years, then to 68 percent in the next five years and to 75 percent in 2004. This gain is solely at the expense of the third group. The second group of low positive growth rate had minor fluctuations from 17 percent in 1995, settling to 14 percent in 2004. Group III went on a downward slide from 29 percent in 1990 to 22 percent in 1995, to 16 percent in 2000, and finally 11 percent in 2004. The chi-square tests over years indicate that the three groups exhibit a different pattern other than an even share in passengers traveled. For instance, chi-square statistic in 2004 was 78.34, which is much higher than the critical value of 5.99 at the five percent probability level at 2 degrees of freedom. This is because that Group I recorded three fourth of total passenger traffic of the year and Group III contributed slightly higher than one-tenth of the total passenger flow, the rest was due to Group II.

In 1990, the aircraft departures pattern in the SSA region was more evenly distributed among three groups. Group I logged 35 percent of all departures, Group II contributed 23 percent, and Group III 42 percent. The chi-square statistic 5.55 confirms this result and the test was not statistically significant at five percent probability level. The Group I nations recorded 109,600 departures and Group III nations had 112,400 departures. The even pattern was found again in 1995, departures for Group I was 101,900 and 86,300 for Group III. Again, chi-square statistic 2.96 fell in the range of acceptance of the null hypothesis that three groups had an even distribution. This pattern changed in 2000, nearly half of all departures were in Group I, and one quarter in Group III. The resulting chi-square test had reversed suggesting Group I had significantly more departures than other two groups. The pattern in 2004 followed that in 2000 implying the change is long lasting than transient.

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Regression Results

The effects of air cargo handled and passenger traffic on aircraft departure in the study area have been examined through linear regression analysis. The results are estimated for all 25 nations without classifying them into groups. The reason for using aggregate data is that the compositions of nations in each group are different. There are different nations in Group I of air cargo service and in Group I of passenger traffic. Consequently, regression analysis based on group will yield inconsistent results. By utilizing information of all the years available instead of several selected years, we have

375 observations for each series. The advantage of this reporting is that complete information includes all growth rates. The disadvantage is that prediction for future values of high performance nations tends to be averaged out and produces underestimation for high growth rate countries, and over estimation for negative growth rate nations.

Table 11 summarizes the results of a regression equation which treats air craft departure as a dependent variable and air cargo and passenger traffic as independent variables. As expected, the equation indicates that the relationships between aircraft departures on one hand and air cargo and passenger traffic on the other are positive, meaning the higher the volume of air cargo and passenger traffic, the higher would be air craft departure. Specifically, for the results suggest that 8,000 tons per kilometer of cargo and 141 passengers are required for adding one air craft departure. However, the relationship between air craft departure and air cargo is statistically insignificant.

Conclusions

Four factors of air transportation, namely, number of airports, air cargo handled, air passenger traffic and air craft departures, in twenty-five SSA nations were studied for the period 1990 through 2004. Currently there are 2,762 airfields in these countries, where major differences exist in growth of cargo handled, passenger traffic and aircraft departures. These countries are classified into three groups in terms of the direction of movement and growth rate in each of the three factors. Eight countries, Kenya, Mauritius, South Africa; Ethiopia, Cameroon, Sao Tome, and Seychelles, have been classified into the first group (countries with high growth rates) or the second group (countries with low growth rates) consistently in all of the factors. Six other countries,

Nigeria, Mauritania, Ghana, Burkina Faso, Zimbabwe, and Zambia, have been classified into the third group (countries with negative growth rates) consistently in all the factors. The remaining thirteen countries have had mixed growth rates in the three factors, usually low growth rates in some factors and negative growth rates in the others. Overall in SSA countries, air transportation performance has improved over the past fifteen years. The average performance of over 100 percent increase in air cargo has been a lot higher than the rise in air passenger traffic and air craft departure. However, several SSA countries have to reverse negative and/or speed up their growth rates of air transportation performance in order to make this transportation mode's contribution to socio-economic development efficient and effective.

Table 1

Airports in the Twenty-five Sub-Saharan African Nations in 2006

Nation	Total no. of air ports	No. of air strips	No. of commercial Airports	No. of international Air Ports	No. of air ports with paved runway airports	Percent of commercial airports with paved runways
Angola	243	208	35	1	17	48.6
Botswana	NA	NA	101	8	13	12.9
Burkina Faso	33	6	27	2	2	7.4
Cameroon	38	31	7	5	7	100.0
Cape Verde	7	5	2	1	7	100.0
Ethiopia	82	41	41	3	6	14.6
Gabon	56	44	12	4	9	75.0
Ghana	12	4	8	1	5	62.5
Kenya	224	52	172	6	39	22.7
Madagascar	116	88	28	5	27	96.4
Malawi	42	19	23	4	5	21.7
Mauritania	24	4	20	4	9	45.0
Mauritius	6	4	2	1	2	100.0
Mozambique	158	137	21	5	20	95.2
Namibia	136	111	25	5	14	56.0
Nigeria	70	24	46	7	16	34.8
Sao Tome	2	1	1	1	1	100.0
Senegal	20	7	13	2	9	69.2
Seychelles	15	1	14	1	9	64.3
South Africa	728	533	195	8	103	52.8
Sudan	86	42	44	8	11	25.0
Tanzania	123	51	72	10	12	15.4
Uganda	28	16	12	1	3	25.0
Zambia	69	40	69	5	11	15.9
Zimbabwe	404	275	129	5	23	17.8
Total	2762	1744	1119	103	382	34.1

Source: Compiled from data obtained from the U.S. Central Intelligence Agency, Aviation Networks Inc., WorldAeroData, Aviation Networks Inc., and that met International Air Transport Association.

Table 2

Air cargo Traffic Volume in Sub-Saharan African Countries
with High Growth Rates (million tons per km, 1990-2004)

Nation	1990	1995	2000	2004	Percentage change 1990-2004
Namibia	1.0	27.3	76.0	56.48	5548.0
South Africa	179.2	263.1	687.6	930.46	419.0
Kenya	52.2	52.8	77.0	193.46	271.0
Mauritius	64.1	116.4	183.0	219.6	243.0
Sudan	12.9	52.6	36.5	40.8	216.0
Gabon	26.1	32.2	58.2	61.8	137.0
Seychelles	10.4	12.8	19.9	22.6	117.0
Subtotal	345.9	557.2	1138.2	1525.2	341.0
Average	49.4	79.6	162.6	217.9	341.0
Percent of total	48.0	53.0	69.0	84.0	106.0

Source: The World Bank Group (2006), World Development Indicators.

Table 3

Air cargo Traffic Volume in Sub-Saharan African Countries
with Low Growth Rates (million tons per km, 1990-2004)

Nation	1990	1995	2000	2004	Percentage change 1990-2004
Ethiopia	66.6	114.7	78.3	93.5	76.0
Cameroon	13.1	38.9	50.5	23.0	76.0
Angola	39.9	58.3	60.6	64.2	61.0
Tanzania	1.4	2.9	3.4	2.1	51.0
Malawi	0.9	3.5	0.8	1.2	37.0
Uganda	21.7	1.1	20.7	26.7	23.0
Sao Tome	0.05	0.05	0.05	0.06	20.0
Subtotal	143.7	219.5	214.4	210.8	47.0
Average	20.5	31.4	30.6	30.1	47.0
Percent of total	20.0	21.0	13.0	12.0	15.0

Source: The World Bank Group (2006), World Development Indicators.

Table 4

Air cargo Traffic Volume in Sub-Saharan African Countries with Negative Growth Rates (million tons per km, 1990-2004)

Nation	1990	1995	2000	2004	Percentage change 1990-2004
Burkina Faso	17.7	15.3	12.3	0	-100
Senegal	17.7	15.3	10.0	0	-100
Zambia	29.6	15.0	12.0	0	-100
Mauritania	17.9	15.5	12.5	0.09	-99.5
Botswana	3.1	0.3	0.3	0.3	-90
Zimbabwe	64.9	144.4	159.4	17.45	-73
Madagascar	30.2	31.5	33.0	12.66	-58
Ghana	15.7	24.1	39.9	6.7	-58
Nigeria	23.5	1.9	8.8	10.12	-57
Mozambique	9.1	5.5	7.2	5.5	-45
Cape Verde	0.6	0.8	0.6	0.46	-23
Subtotal	230	269.6	288.7	76.92	- 67
Average	20.9	24.5	26.3	7.0	- 67
Percent of total	32.0	26.0	18.0	4.0	- 21

Source: The World Bank Group (2006), World Development Indicators.

Table 5

Air Passenger Traffic Volume in Sub-Saharan African Countries
with High Growth Rates (thousands of passengers, 1990-2004)

Nation	1990	1995	2000	2004	Percentage change 1990-2004
Senegal	148.3	149.7	20.3	420.6	184
Kenya	794.4	740.4	1554.9	2005.5	152
Ethiopia	620.3	749.9	944.6	1403.3	126
Botswana	101.3	99.9	163.9	214.2	111
Mauritius	519.7	675.8	949.1	1089.5	109
South Africa	5364.9	6395.5	8000.8	9876.3	84
Sao Tome	22.3	22.3	35.1	40.3	81
Subtotal	7571.2	8835.5	11668.7	15049.7	99
Average	1081.6	1261.9	1666.9	2149.9	99
Percent of total	55.0	61.0	68.0	75.0	128

Source: The World Bank Group (2006), World Development Indicators.

Table 6

Air Passenger Traffic Volume in Sub-Saharan African Countries
with Low Growth (thousands of passengers, 1990-2004)

Nation	1990	1995	2000	2004	Percentage change 1990-2004
Seychelles	242.4	314.0	393.8	409.9	69
Cape Verde	176.9	124.2	263.5	282.3	60
Cameroon	284.2	345.0	311.6	357.9	26
Madagascar	424.2	497.2	666.7	513.5	21
Gabon	398.3	508.2	446.7	432.6	8
Mozambique	279.5	168.2	259.6	299.0	7
Sudan	454.1	496.9	414.2	475.8	5
Subtotal	2259.6	2453.7	2756.1	2771.0	23
Average	322.8	350.5	393.7	395.9	23
Percent of total	16.0	17.0	16.0	14.0	30

Source: The World Bank Group (2006), World Development Indicators.

Table 7

Air Passenger Traffic Volume in Sub-Saharan African Countries with Negative Growth Rates (thousands of passengers, 1990-2004)

Nation	1990	1995	2000	2004	Percentage change 1990-2004
Malawi	120.3	148.7	115.8	114.3	- 5
Tanzania	292.1	236.4	193.1	247.5	- 15
Nigeria	964.8	547.9	507.4	681.7	- 29
Namibia	455.0	224.6	247.1	280.5	- 38
Mauritania	222.7	227.9	185.1	128.5	- 43
Ghana	188.1	185.9	314.3	96.4	- 49
Angola	451.5	552.5	235.4	223.0	- 51
Burkina Faso	136.6	137.5	143.5	61.7	- 55
Zimbabwe	601.3	625.7	605.5	237.8	- 60
Uganda	116.0	94.6	39.4	45.7	- 61
Zambia	407.2	173.0	89.6	49.4	- 88
Subtotal	3955.6	3154.7	2676.2	2166.9	- 45
Average	359.6	286.8	243.3	197.0	- 45
Percent of total	29.0	22.0	16.0	11.0	-58

Source: The World Bank Group (2006), World Development Indicators.

Table 8

Number of Air Craft Departure in Sub-Saharan African Countries
with High Growth Rates (hundreds, 1990-2004)

Nation	1990	1995	2000	2004	Percentage Change 1990-2004
I. High positive growth (5):					
Kenya	130	135	291	262	102
Sao Tome	7	7	11	13	86
Senegal	35	45	9	64	83
Mauritius	84	89	122	149	77
South Africa	840	743	1104	1336	60
Subtotal	1096	1019	1537	1824	66
Average	219.2	203.8	307.4	364.8	66
Percent of total	35.0	40.0	46.0	53.0	

Source: The World Bank Group (2006), World Development Indicators.

Table 9

Number of Air Craft Departure in Sub-Saharan African Countries
with Low Growth Rates (hundreds, 1990-2004)

Nation	1990	1995	2000	2004	Percentage change 1990-2004
Malawi	36	35	48	56	56
Mozambique	56	32	67	86	54
Cameroon	71	38	56	104	47
Cape Verde	67	71	130	96	43
Ethiopia	206	262	266	295	43
Botswana	58	40	67	79	36
Madagascar	172	178	222	180	7
Subtotal	666	656	856	896	36
Average	95.1	93.7	122.3	128	36
Percent of total	23.0	26.0	26.0	26.0	

Source: The World Bank Group (2006), World Development Indicators.

Table 10

Number of Air Craft Departure in Sub-Saharan African Countries
with Negative Growth Rates (hundreds, 1990-2004)

Nation	1990	1995	2000	2004	Percentage change 1990- 2004
Seychelles	158	140	190	154	- 3
Sudan	91	93	78	84	- 7
Namibia	81	68	52	70	- 14
Tanzania	75	56	60	64	- 15
Gabon	104	120	74	83	- 20
Zambia	65	32	61	49	- 25
Angola	69	73	44	48	- 30
Burkina Faso	22	31	34	14	- 36
Nigeria	174	66	128	103	- 41
Mauritania	36	46	38	17	- 53
Zimbabwe	103	99	138	44	- 57
Uganda	20	9	3	3	- 85
Ghana	126	30	49	13	- 90
Subtotal	1124	863	949	746	- 34
Average	86.5	66.4	73	57.4	- 34
Percent of total	42.0	34.0	28.0	21.0	

Source: The World Bank Group (2006), World Development Indicators.

Table 11

Regression Results for 25 Sub-Saharan African Countries

Equation	1
Dependent variable	Departures
Constant	33.44 (2.44) **
Air cargo (million tons per km)	0.0079 (0.052)
Passengers (in thousands)	0.141 (0.004) **
Observations	375
R square	0.95
Regression F	3759.6 **
Durbin-Watson	1.86

Note: Based on all 25 SSA nations for the period 1990 through 2004.

Notes

1. These twenty-five nations are: Angola, Botswana, Burkina Faso, Cameroon, Cape Verde, Ethiopia, Gabon, Ghana, Kenya, Madagascar, Malawi, Mauritania, Mauritius, Mozambique, Namibia, Nigeria, Sao Tome and Principe, Senegal, Seychelles, South Africa, Sudan, Tanzania, Uganda, Zambia, and Zimbabwe.
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