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Addis Ababa  
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School of Graduate Studies



# The Economic Effects of Progressive Air Transport Liberalization in Africa: *The Case of City-Pair Routes to/from Addis Ababa*

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## **List of ACRONYMS**

ATAG	Air Transport Action Group
BASA	Bilateral Air Service Agreement
EAL	Ethiopian Airlines
ECA	Economic Commission for Africa
EU	European Union
GLS	Generalized Least Square
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
USA	United States of America
YD	Yamoussoukro Decision

## **Abstract**

Empirical analysis on economic effects of liberalization in the context of African air transport sector is not much discussed in the literature and the continent's policy makers and the industry operators need such analysis to implement liberalization initiatives. As such, the purpose of this study is to empirically measure economic effects of progressive air transport liberalization in Africa by taking the case of 20 city-pair routes to/from Addis Ababa for the period 2000-2005. By employing a Two-Stage Least Square estimation procedure for a panel data set, passenger demand, fare and departure frequency models are estimated to see the impact of Bilateral Air Service Agreement (BASA) liberalization. Liberal policies are assumed to affect the two supply side variables, i.e. fare and departure frequency. Accordingly, the frequency model indicates that a significant increase in departure frequency is observed in routes that experienced both 'full' and 'restricted' type of liberalization compared to those governed by restrictive bilateral arrangements. In addition, higher increase in the number of departure frequency in routes which experienced restricted liberalization relative to those operated under fully liberalized arrangement is observed. Regarding the fare model, a statistically significant negative impact of liberalization policy on standard economy fare is not found. Finally, it is recommended that liberalizing BASAs, especially provisions pertaining to departure frequency, will enhance service quality.

**Key Words:** Air Transport, Liberalization, Yamoussoukro Decision, Bilateral Air Service Agreements, Africa

**JEL Classification:** L93, L51, L9

# Chapter One

## Introduction

### 1.1 Background

One of the main factors which have been playing a vital role in the current wave of globalization is the progress registered in transport sectors in general and the air transport sub-sector in particular<sup>1</sup>. In addition to being a catalyst to the ever integrating global economy, the airline industry itself has gone through tremendous change. Like many international industries which have long started operating in the worldwide market in liberal arrangements, the airline industry's regulatory scene has also shifted towards liberalization. Currently, most international air transport services are conducted under restrictive Bilateral Air Services Agreements (BASAs)<sup>2</sup> between countries. However, there has been a general move towards more open regulation in bilateral and regional arrangements in various parts of the world. This move had its beginning when the United States of America (USA) deregulated its domestic market in the late 1970s. Subsequently, the USA started to follow a liberal 'Open Skies'<sup>3</sup> policy in its air transport services negotiations with the rest of the world.

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<sup>1</sup> Rodriguez (2005, pp-12) indicates, "The scale, volume and efficiency of international trade have certainly increased over the last 30 years. As such the relationship between space and time has reached a point where large amount of space can be traded for decreased time and this at lower cost."

<sup>2</sup> Most international air transport services are governed by more than 3500 BASAs signed between countries (Hubner and Sauv e, 2001).

<sup>3</sup> 'Open Skies' policy refers to airline markets where there is an absence of regulatory controls. It could be applied to a bilateral agreement, in which there are no capacity, entry or price regulations on the airlines of the bilateral partners which do, or might, serve the route. Such agreements will typically allow for more competition between the airlines of the partner countries and they make more trade possible." (Forsyth, pp. 56, 2001)

In the following years, other main aviation regions like the European Union (EU) and Australia, learning from the experience of the USA and being under pressure from its liberal policy<sup>4</sup>, followed a similar path in order to gain the benefits available from liberalization and to minimize its possible threats. Particularly, in the EU, despite the difference in the level of aviation development across member countries, a regional ‘Open Skies’ agreement was imposed. Van Antwerpen (2002) indicates that since 1993, the EU has created a single market in which member countries’ airlines are given freedom of establishment, market access, capacity and tariff (fare) fixing for air transport within its borders.

Elsewhere, in Africa and the South-East Asian sub-region (Forysth *et al*, 2006) countries started to embark on air transport liberalization policies with their respective regions. Unlike the EU’s liberalization policy, which applies regionally, in these regions the policy is supposed to be implemented in a bilateral basis. Hence, each country has some control on the pace and the extent of openness since liberalization is a negotiated move.

In Africa, such a continent-wide package is the ‘Yamoussoukro Decision’ (YD)<sup>5</sup>, which was adopted on 2000 by Heads of States to progressively open air transport on intra-Africa routes. According to Article ‘7’ of the Decision, provisions of the YD take precedence over all the previous BASAs signed between African countries. However, the trend so far has been a

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4 ‘Theory of Encirclement’ or ‘Encirclement Strategy’ refers to the approach the USA used to pressurize major aviation countries to open by signing a series of liberal bilateral agreements with minor alternative European and Far East gateways. Doing so diverts air traffic to alternative cheaper routes. Thus, countries would be pressurized to open their market to bear such an indirect threat (Antoniou, 2001).

5 The Decision was signed in Yamoussoukro (Cot Devour) and is expected to progressively eliminate all the non-physical barriers relating to: the granting of traffic rights, particularly fifth traffic right, the capacity of aircrafts, tariff regulation, designation of airlines and air freight operations (UNECA, 2002).

negotiated move, in which individual countries negotiating (agreeing) based on its provisions on a bilateral basis to bring about liberalization in to effect. Abeyrantne (2003) points to the inherent problem of the Decision by indicating that the YD resulted in a ‘limited open skies regime’ since the ‘State Parties’ (signatory countries) have the ultimate discretion on fifth air traffic rights<sup>6</sup>.

Currently, most international air transport services in Africa are conducted under the web of bilateral agreements that put restrictions on entry (market access), capacity (frequency and aircraft type), and foreign ownership of airlines. Besides, traffic rights, airline designation and fares are also subject to restrictive regulatory control. Provisions of these agreements are based on a reciprocal exchange of rights, which are supposed to be exploited by the designated airlines of the two bilateral partners.

## **1.2. Statement of the Problem**

Geographical misfortunes in the sense of being land locked or being very far away from major international markets have been overcome by improvement in infrastructural facilities. The limitations posed by physical barriers on a seamless transportation of goods and people across countries are also now less pronounced. However, in the case of international air transport, non-physical barriers are impeding the chance for both intra-industry and overall trade expansion between countries. Such barriers usually come from restrictive regulatory arrangements which dictate the way the service is rendered. Owing to this trade deterring

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<sup>6</sup> Please refer to the Annex 1 to see the definition of air traffic rights.

impact of restrictive regimes, there is a general move towards liberalization in the world as indicated earlier.

Basically, liberalization of air transport is meant to maximize benefits associated with the direct and indirect gains from a competitive environment. In addition, Baltagi *et al* (1995) attributes the route structure effects of liberal policies as the most impressive of all due to the fact that air transport is a network industry. Thus, having flexibility in terms of route selection, frequency of operation and aircraft capacity choice allows an airline to operate in the most efficient network. One can find a lot of evidences for this assertion in matured markets of North America, Europe and Australia (see for example, Oum *et al* 1991, Productivity Commission 1998, the Brattle Group, 2002). But, for airlines in places like Africa with very small aircrafts, operating in a thin market and with limited infrastructural facilities, the practicability of such gains is yet to be tested.

Nevertheless, African countries find the virtues of air transport liberalization particularly crucial in order to redress their shortage of foreign currency in the form of revenue to their aviation industry. On top of this, presence of efficient air transport system can halt the apparent marginalization of the continent from the globalizing world. Evidences show that Africa's share of total world trade and total air passenger traffic movement is not more than 5% (ICAO, 2005). A more gloomy fact is both the case of intra-Africa trade, which is only 10% of their total trade with the rest of the world as well as intra-Africa air traffic movement as a percentage of total traffic to/from the continent which is also in that range. It was with full ambition that African countries embarked on the aforementioned open air transport operation

arrangement at a multilateral level to facilitate intra-African movement of goods and people so as to reshape these dim realities.

Implementation of liberalization initiatives in Africa, however, has not been satisfactory. Though it was expected to enter fully into force after adoption, many of the signatory countries of the 'YD' have been showing reluctance to enter into agreement based on its liberal provisions (UNECA, 2003). This reluctance arises mainly from apprehension of some African countries that liberalization would be incapable of delivering benefits to their own air transport industry and economies in general. The apprehension towards open policy in the airline industry is similar to one of the main hindrances facing regional integration initiatives in Africa. As indicated by Alemayehu and Haile (2002), relatively poor African countries fear that their industries may get adversely affected by industries from more advanced countries as a result of opening their market in regional integration arrangements.

In order to implement initiatives like the YD successfully and to connect Africa to the rest of the world through efficient air transport service, it requires one to study why full implementation of liberalization policy is not yet achieved. The key questions - who gains from liberalization and can every country gain - should also be answered. Except a general belief and assertion on the merits/demerits of liberalization both at the level of policy makers and airlines, so far there are limited empirical studies that try to systematically evaluate the benefits or threats of liberalization to Africa. To that end, assessing economic effects of liberalizing intra-Africa air transport is indispensable.

### **1.3. Objectives of the Study**

The general objective of this study is to evaluate the economic effects of air transport liberalization in Africa by taking a sample of intra-African routes to/from Addis Ababa as a case in point. Furthermore, the status and trends of air transport market in Africa is reviewed.

### **1.4. Methodology and Data**

Three econometric models based on Schipper *et al* (2002) are used to see the effects of bilateral air transport services liberalization. First, a passenger demand model, which is a function of ‘gravity type’ variables and standard consumers demand affecting variables, is estimated. Furthermore, two supply side variables, fare and frequency, are modeled to see the economic effects of progressive introduction of liberal policies. The fare and frequency models are augmented by dummy variables that are included to capture the effect of liberalization. In line with Schipper *et al* (2002) and Dresner and Tretheway (1992) all the three models are estimated by a Two-Stage Least Square ‘random effects’ for a panel data set of 20 intra-African city-pair routes to/from Addis Ababa from 2000-2005. These routes represent varying degree of liberalization status and distance. They also represent more than 75% of all intra-Africa air results to/from Addis Ababa. As for the data, publications of Ethiopian Civil Aviation Authority, Ethiopian Airlines, International Civil Aviation Organization (ICAO), International Air Transport Association (IATA) and the World Bank Development Indicators databases are the main sources.

## **1.5 Scope and Limitation**

This study focuses on only on the case of scheduled air transport services and non-scheduled (charter) services are not considered. Bilateral liberalization policy between African countries is the base of analysis as opposed to multilateral liberalization. Therefore, the study is limited to intra-African air transport market in which African airlines are the players. A more thorough analysis of the issue at hand can be made by taking many city-pair routes from other African countries. However, availability of data seriously constrains such kind of endeavors and countries may not be willing to provide the status of their BASAs to third party.

## **1.6 Significance of the Study**

The findings of this study will be useful to inform policy makers on how would liberalization affect economic variables. Though the city-pairs considered may seem small as compared to total intra-Africa routes, effects of policy changes on them can be taken as representative to evaluate the policy since they are regulated by varying degrees of liberalization. Moreover, these routes can help us see performance under liberal policies in a presence of a dominating airline (Ethiopian Airlines) and thin market, which is more or less the case in other parts of Africa. Therefore, the routes considered can warrant generalization of conclusions to a justifiable degree.

Furthermore, the study can give additional impetus for liberalization efforts in Africa. Many of the signatory states of the YD have shown reluctance to negotiate based on its provisions mainly because of lack of empirical findings in support of or against liberalization. Thus, this

kind of study will fit to this gap and adds to the limited literature concerning African air transport industry.

### **1.7 Organization of the study**

The thesis is organized as follows. In chapter two, overview of the air transport industry in Africa is presented. The third chapter reviews theoretical and empirical literature relevant to the study. In the fourth chapter an empirical model to analyze the economic effects of liberalization is developed and in the fifth chapter results and interpretation of the estimated model is presented. Finally, chapter six summarizes major conclusions and relevant policy recommendations of the study.

## **Chapter Two**

### **The Air Transport Industry in Africa**

#### **2.1 Overview**

Africa with a population of more than 870 million and large land mass (30.3 ml km<sup>2</sup>) presents a favorable environment for the thriving of air transport industry. On the other hand, air transport is indispensable for many African countries since the service is the main corridor for the flow of international passenger and freight traffic. To transport high value goods and fresh agricultural products Africa needs air transport which is a reliable and safe mode of transportation. In terms of job creation, the air transport sub-sector and associated activities employ around 470,000 people and it contributes more than US\$ 11.3 billion to African economies (ATAG, 2005).

UNECA (2005) indicates that efficiency in the provision of air service increases economic competitiveness of African countries through access to world market, labor mobility, and attraction of private investment in aviation as well as development of key hard currency earning export industries. In addition, international and intra-regional tourism flow to the continent will expand as more flexible air connectivity is availed. When the fact that almost one-third of African countries are landlocked is taken into consideration, air transport becomes all the more important to the continent.

### **2.1.1 African Airlines**

When it comes to the issue of airlines in Africa, the first question is whether African countries can ever manage to have a place in the highly sophisticated and capital intensive industry like air transport. In view of intentional trade theories which focus on comparative cost advantage, factor abundance or the desire to exploit economies of scale as the underlying reasons for trade to take place, African countries are effectively ruled-out of trade in international aviation services. This is mainly because of the facts that factor endowments (capital and skilled labor) and ability of airlines to exploit economies of scale make African countries comparatively disadvantaged. Therefore one has to answer how developing countries and African countries in particular are expected to be players in any aviation service trading arrangement. To that end, Weisman (1990) indicates, in developing countries reasons other than factor endowments may dominate the determination of comparative advantage. Mainly, he emphasizes ‘geographical advantages’ allowing countries to serve as hubs and to take advantage of six freedom traffic right can lead to comparative advantage. Besides, regulatory frameworks and resulting networks also contribute to country’s ability to establish successful trade in aviation services. Traffic density access due to location or networking plays an important part in this determination.

The case for air transport services in Africa can be seen from the above perspective as well. Very few countries run a successful airline in the continent. These countries’ geographical position can be taken as one of the main reason as to why they are running successful airlines. Ethiopia, Kenya, Morocco, South Africa, Egypt and Senegal can supply air services cheaply for simple reason that their geographical location enables them to utilize 6<sup>th</sup> and 5<sup>th</sup> freedom

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rights in intra-Africa routes. These countries are also natural gateways to the African continent to the rest of the world.

Coming to operational issues, most African countries do not have a competent airline that can operate international services<sup>7</sup>. Besides, intra-Africa air traffic is very small to require the operation of several airlines on a particular route and the capacity of civil aviation authorities to sufficiently regulate safety and security standards is also very minimal. As a result, only an airline or airlines of one of the contracting countries with a competent airline end up serving the routes stipulated in the agreement.<sup>8</sup>

The majority of African countries depend on few African based and foreign airlines to provide air services. According to ECA's (2003) study around 75% of air traffic to/from Africa is carried by foreign airlines. (Please look at Table 2.1 presented in the Annex to see rank of African Airlines).

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<sup>7</sup>Schlumberger (2007, p.p. 35) classifies African Airlines to the following 4 categorization: "(i.) five countries have dominating state-owned carriers: Egypt, Ethiopia, Kenya, Morocco, and South Africa; (ii) twenty countries have weak or small state-owned carriers: Algeria, Angola, Botswana, Cameroon, Cape Verde, Comoros, Djibouti, Libya, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Seychelles, Sudan, Tanzania, Tunisia, and Zimbabwe; (iii) twenty five countries have private operators: Botswana, Burkina Faso, Burundi, Chad, Congo, Côte d'Ivoire, Democratic Republic of Congo, Equatorial Guinea, Eritrea, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Nigeria, Rwanda, Sao Tome & Principe, Senegal, Sierra Leone, Somalia, Swaziland, Togo, Uganda, and Zambia; (iv) four countries have no known operators: Central African Republic, Niger, Lesotho, and the Saharawi Arab Democratic Republic." (Please see rank of African countries based on total number of kilometers performed on Table 2.3 in the appendix part).

<sup>8</sup>In the case of Ethiopian Airlines, except in its service to Kenya, Egypt, Sudan, South Africa and Djibouti it is the sole operator on its 20 intra Africa routes to/from Addis.

Due to lack of capital and inherent inefficiencies African airlines operate only a total of 639 aircrafts (Airclaims, 2006), a number which is not more than a total aircraft owned by one major American or European airline. Besides, the financial performance of African airlines has also been very discouraging. They registered in the year 2004 and 2005 a net loss of \$339 and \$ 376 million respectively (ICAO, 2006).

## **2.2. Air Traffic Statistics**

Regardless of the pressing need to have an efficient air transport system and the presence of promising market for the service, Africa accounts for small percentage of world air traffic flow. The Continent has generated less than 5% of the world air traffic flow in the form of to, from and within Africa in the past 10 years (see Africa's share for the period 2001-2005 in Table2.1 in the annex part). Due to the low income level of its population which undermines the ability to enjoy air travel coupled with the very minimal participation of Africa in the global trade and investment flows, low air traffic generation is not unexpected. Poor infrastructural facilities as well as proliferation of small and incompetent national airlines have also made air travel expensive and unreliable mode of transportation in many parts of Africa to develop potential market if there is any.

International passenger air traffic statistics to/from Africa for the period 2001-2005 is presented on Table 2.1. It is observed that intercontinental passenger air traffic flow constitutes far more than intra-African passenger traffic flow. The composition of traffic to/from Africa reveals that it is very much tilted towards Europe (more than 2/3) followed by the Middle East, Asia and North America respectively. The big share of the intercontinental

traffic flow should not be surprising since the number of airlines in this particular segment of market is many and non-African airlines<sup>9</sup>, which generally have far better competitive edge, account for 75% market share (ECA, 2005).

The big market share of intercontinental traffic is also attributed to the fact that the route network of African airlines that is characterized by a poor regional route network and greater focus on route development mostly to European Capitals usually those associated with a previous colonial presence. Another possible source of divergence between intra-African traffic and intercontinental traffic is the apparent positive correlation of direction of Africa's international trade and air traffic. Europe, which is the major origin and destination of air traffic for Africa, is also its major trading partner followed by USA and Asia. On the other hand, intra-Africa traffic has not been more than 10% for the period under consideration. The small level of intra-African trade, investment and tourism flows which have resulted in the limited propensity to travel across borders in Africa are the main reasons for the small percentage of air travel across the continent.

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<sup>9</sup> Foreign airlines operating in the African skies include: British Airways, Air France, Emirates, Alitalia, Emirates, Turkish Airways, Qantas, Cathay Pacific Airways, KLM, Yemen Airways, Qatar Airways (ECA, 2005)

**Table 2.2 Air Traffic Statistics for Africa:  
International Passenger Traffic**

Flow	2001		2002		2003		2004		2005	
	A	B	A	B	A	B	A	B	A	B
Africa- Africa	1873561	9%	1961615	10%	1848337	10%	2036121	10%	2001074	9%
Africa-Asia	691573	3%	695768	4%	709672	4%	836854	4%	906262	4%
Africa- CA/Caribbean	97787	0%	0	0%	167	0.00%	0	0%	0	0%
Africa-Europe	13067081	67%	13261680	69%	12332555	67%	13095293	65%	13743033	65%
Africa-Middle East	3234310	16%	2664183	14%	2762557	15%	3361372	17%	3690936	17%
Africa-North America	460976	2%	377824	2%	415661	2%	446819	2%	467783	2%
Africa-South America	91970	0%	88233	0%	139768	1%	175212	1%	180152	1%
Africa-Southwest Pacific	272623	1%	266779	1%	268259	1%	267686	1%	258074	1%
<b>Total</b>	19789881	100%	19316082	100%	18476976	100%	20219357	100%	21247314	100%
Percentage Share of World										

Source: IATA  
(2005)

A: Total Traffic

B: Percentage Share of Total

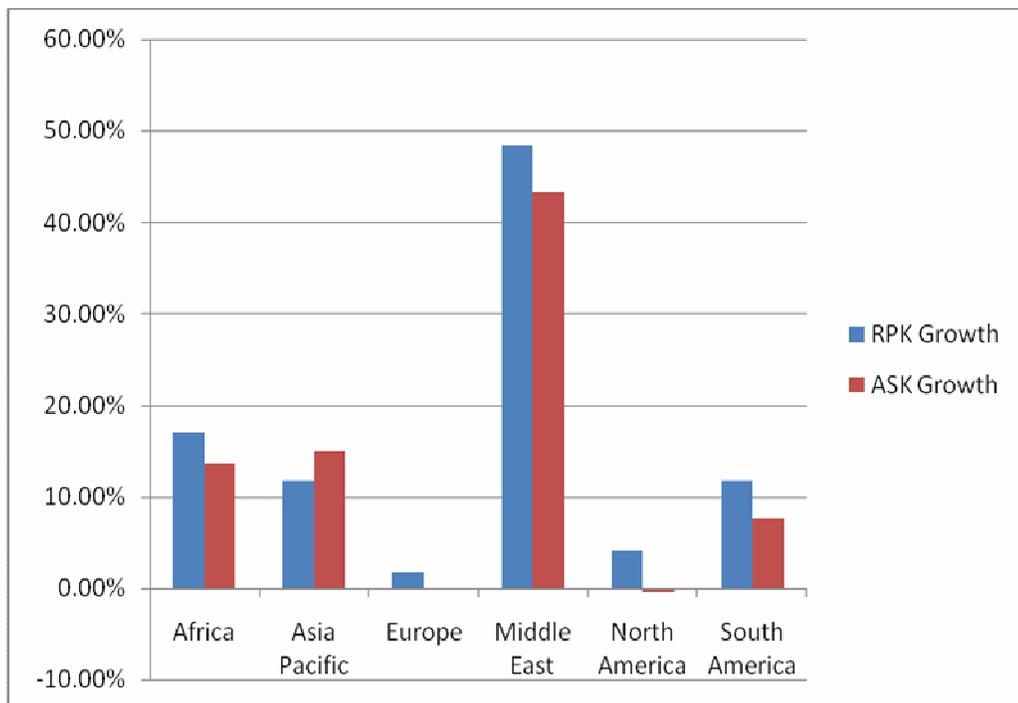
CA- Central America

The growth of Revenue Passenger per Kilometer (RPK) and Available Seat per Kilometer (ASK) has been rather encouraging for Africa. As indicated on Figure 1, Africa is surpassed only by the Middle East region in terms of RPK and ASK growth respectively over the period 2000-2004. The reason behind high traffic statistic is mainly due to the fact that in recent years foreign airlines especially from the Middle East region has grown to be important player on 'African Skies' in expanding RPK and ASK to/from the continent. This growth should also be seen from the untapped market that is still expected to grow parallel with the African economies.

The prospects of African air transport industry are relatively promising. According to International Air Transport Association's (IATA) forecast presented on Table 2.2, a robust international passenger growth of 5.1% to, from and within Africa is expected in the period 2006-2010. International freight traffic is also expected to grow by 5% per year in the same period. In addition, to the extent that African economies are expected to grow air transport activities are expected to boom since the population will have more disposable income to enjoy air transport services and expansion of business activities will induce the propensity to travel. ATAG's (2003) study indicates that growth in GDP explains about two-thirds of air travel growth. It is expected that Africa-to-Africa air traffic movement will grow proportionally to the extent of the expansion of socioeconomic ties amongst African countries. This expectation is justifiable given the economic prospect of the continent and the focus on tourism; a sector that has been

considered as untapped potential of many African countries anticipated to be the main sources of foreign exchange (ComMark, 2006).

**Figure 1 RPK and ASK Growth - (Jan-Sept) 2004 over 2000**



Source: IATA (2004)

**Table 2.3 - IATA Traffic Forecasts - 2006 to 2010**

International Passengers- Region to Region Forecast	Passenger Vol.	Forecast annual percent changes					AAGR
	2005 (000)	2006	2007	2008	2009	2010	2006- 2010
Africa - Africa	7,237	3.30%	3.50%	3.80%	3.40%	3.40%	3.50%
Africa - Asia/Pacific	1,873	6.10%	5.70%	5.30%	5.10%	4.90%	5.40%
Africa - Europe	31,149	5.10%	5.20%	5.30%	5.00%	4.80%	5.10%
Africa - Lat. America/Caribbean	280	1.40%	2.60%	3.00%	3.30%	3.40%	2.70%
Africa - Middle East	7,676	8.10%	7.80%	6.20%	5.50%	5.00%	6.50%
Africa - North America	712	8.20%	7.30%	6.80%	6.00%	5.60%	6.80%
<b>Africa Total</b>	<b>48,928</b>	<b>5.40%</b>	<b>5.40%</b>	<b>5.30%</b>	<b>4.90%</b>	<b>4.60%</b>	<b>5.10%</b>

Source: IATA (2005)

### 2.3 Regulatory Scene of Intra-African Air Transport Market

The market structure of international air transport is effectively predetermined by Bilateral Air Service Agreements (BASA) signed between countries (more in this issue in the next chapter). The bilateral system results in a complex regime of protectionist economic regulation and allows countries to exercise sovereignty over their air space. However, following the general trend towards liberalization in many parts of the world coupled with the aim of benefiting benefits entailed in liberalization, African countries also embarked on various liberalization initiatives both in bilateral and regional level. At

continental level, the Yamoussoukro Decision (YD) of 1999 is the umbrella arrangement which consolidated the various liberalization initiatives.

<b>Table 2.4 COMPARISON of LIBERALIZATION OF INTRA- AFRICAN AIR TRANSPORT MARKET</b>			
<b>Provisions</b>	<b>Traditional Bilateral</b>	<b>Liberalized Bilateral</b>	<b>YD Provisions</b>
<b>Airline Designation</b>	One from each contracting States	Multiple	At least one
<b>Traffic Right (Routes)</b>	Limited 3 <sup>rd</sup> , 4 <sup>th</sup> and 5 <sup>th</sup> (Only Specified routes in the BASA)	Full fifth freedom (Open market access, flying on any route between two States	Full fifth freedom in Africa, as of 2002
<b>Fares</b>	Double Approval	Double Disapproval	Double Disapproval
<b>Capacity</b>	Equally shared among both designated airlines	Free choice of A/c type and frequency	Unlimited number of frequency and
<b>Ownership</b>	Substantially and Effectively owned by nationals or government of the contracting States	More Liberal provision on foreign ownership	Substantially and Effectively owned by nationals or government of the contracting States, or State Parties to the YD

Source: Own summary based on Doganis (1995) and the YD Articles

Table 2.4 presents the main provisions of the YD compared to traditional BASAs and Liberalized BASAs. It can be seen from the table that in terms of fare and capacity regulation, the YD is as open as liberalized BASAs. Traffic right provision is also very

open but covers points in Africa only. Further, though more liberal than traditional BASAs, the YD allows ownership of airline by third states if they are signatories of the decision. However, liberalized bilateral allow flexible airline ownership arrangement. In general, the YD is an ambitious liberalization package which would liberalize intra-African markets if it is fully implemented. ECA (2005) refers to this agreement as a comprehensive framework to replace the current fragmented regulatory regime by a unified system that gives African airlines commercial opportunities on equal basis. Despite the prospects of the YD, the implementation of the policy has been not satisfactory. According to Tewodros (2006), the main hurdle in implementing the policy has been the fact that BASAs are still the main regulatory framework through which African countries conduct their air transport relations. He further indicates that lack of political will by African governments to fully implement the policy as significantly impeding the pace at which countries are opting for YD type provisions in their air service negotiations in Africa.

## **Chapter Three**

### **Literature Review**

#### **3.1 Regulation of International Air Transport**

To fully understand liberalization in the context of air transport, it is necessary to look at the institutional set-up and regulatory framework under which the service is rendered. The first attempt to come up with a general framework to coordinate international air transport service was the ‘Chicago Convention’<sup>10</sup> of 1944. The main purpose of the Convention was to coordinate the regulation of international air services at a multilateral level. Nevertheless, since it was difficult to come up with a global scale regulatory mechanism, especially in the economic aspect of regulation, Bilateral Air Service Agreements (BASAs) came into existence to regulate air service between countries. Article one of this Convention gives every country a sovereign right over its air space. As Lyle (1995) indicates, the consequence of the ultimate discretion over their air space by countries led to a need for an agreement or a mutual consent between at least two countries in the course of conducting international air transport services.

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<sup>10</sup> The Chicago Convention of 1944 was signed during intergovernmental meeting to establish a global framework which guides all aspects including technical standards and economic regulation of air transport operations.

The BASAs had as their prime purpose, the control of the so called ‘hard rights’ which include market access (cities served and traffic rights), market entry (designation of airlines), aircraft capacity and frequency of departure. In addition, typical BASAs include provisions relating to currency conversion, avoidance of double taxation, air safety and security issues etc, which are meant to ease the business process of international air transport services (Doganis, 2001 and Huber and Sauv  , 2001).

The features of ‘traditional’ BASAs are protectionist in nature. As far as market access is concerned, entry points in the respective contracting parties’ territories are limited. Countries are generally reluctant to allow many intermediate and beyond points to be served by the designated airlines of the other country using fifth traffic rights. Furthermore, designation of airlines<sup>11</sup> is usually limited to one and the airlines have to be substantially and effectively owned by the nationals of the designating countries. Fare, capacity and frequency are also mostly controlled.

### **3.2 Movement towards Liberalization**

In recent decades, as a result of opening up of major aviation regions negotiating based on liberal provisions became an imperative for other countries. Liberalization in air transport markets involves abandoning the aforementioned restrictive provisions of traditional BASAs by allowing more designation of airlines, increasing the number of routes served by fifth traffic rights and letting fares, aircraft and frequency decisions to be taken by the airlines based on market conditions. Lyle (1995) identifies two main reasons

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<sup>11</sup> The number of airlines that can be designated and the conditions they have to fulfill are stipulated in BASAs usually.

which necessitated further liberalization. Firstly, commercial realities requiring airlines to go offshore to locate parts of their operations in order to remain competitive demands the relaxation of traditional BASAs. Secondly, globalization has forced equity investment by one carrier in another, commercial and technical alliances and franchising so that airlines would resist the ever growing competition.

### **3.2.1. Why Liberalize?**

Before looking at the theoretical foundation underlying the need to liberalize air transport market, it is appropriate to look at and answer the two fundamental questions of international trade with regard to trade in international aviation services. These two questions, ‘why trade?’ (the case for trade) and ‘who gains from trade?’ can be readily answered as follows:

International air transport (including domestic air services in some cases) involves trade in international services. Forsyth (2001) and Weisman (1990) show that a pair of countries engage in trade in international air transport services when an airline from one of the countries sells its services to a passenger resident in the other country. Essentially, countries are exporting aviation services whenever they sell the service to a non-resident (foreigner). Therefore, there is a sound economic rationale for countries to engage in aviation related trade. On the other hand, the demand for air transport services is a derived demand. Air travelers pay for air service not for the sake of flying *per se* but to meet their end results such as to reach to a holiday destination, to make business trips or to visit their relatives. As such the demand for air transport largely depends on economic

and social interactions between countries. Thus, countries engage in trade in aviation services as a natural consequence of their overall social, economic and political ties.

As for ‘who gains’ from trade, in principle all countries can gain from any air transport services trading arrangements provided that they own airlines to transport traffic generated in their own territory on which they possess sovereign right. Besides, any air traffic rights provided under the trading arrangement are exchanged on a reciprocal basis allowing countries to be on equal footing. On the other hand, even if countries do not possess competent airlines to exploit trading opportunities created, the traveling public as well as sectors like tourism may benefit from the presence of efficient air transport service regardless of the provider of the service. Therefore, it is a vested interest of countries to dictate the rules and conditions under which trade takes place to ensure maximum gains for their airlines, consumers and other economic sectors related to air transport in general.

### **3.2.2. The Case for Air Transport Liberalization**

From a strict theoretical point of view, the justification for liberalization comes from the desire to maximize benefits entailed in a competitive environment. To this end, Ehmer (2001) reasserts that minimum government intervention and virtues of competition in the air transport market will ultimately lead to: optimum allocation of factors of production, consumer sovereignty and technical progress. Especially air transport liberalization is considered to benefit consumers in two ways. First, the competitive environment created by opening up of the regulatory environment forces airlines to operate at lower costs in

order to be efficient. Consequently, part of this efficiency gain can be transferred to consumers in the form of lower prices. Secondly, flexible route selection enjoyed by airlines as a result of doing business in open and flexible arrangements gives consumers a broader set of choices (product diversity). In a liberalized environment airlines will have the discretion of choosing the number of weekly frequencies, aircraft type and convenient routing based on market conditions. As a result, consumers will most likely benefit since airlines will vigorously compete to provide services tailored to the specific needs of their customers (Gillen *et al*, 2002, and Marin, 1995).

From an airlines' point of view, their profitability and success largely depends on ability to build efficient networks which enable cost savings. However, restrictive regulatory environments prevent airlines from building optimal networks. Weisman (1990) states that the cost saving resulting from optimal use of networks results in what is referred to in Industrial Organization literature as 'economies of scope'. Such economies emanate from the cost savings from joint production of two or more product lines in one firm rather than to produce them separately. In the air transport context, airlines have to sometimes serve multiple destinations to minimize cost in particular route operation. Accordingly, in a liberalized environment, airlines enjoy the freedom of choosing and building cost efficient networks to remain competitive (Baltagi *et al*, 1995, Smyth and Pearce 2006)

In general, both demand (consumers) and supply (airline operators) side forces against restrictive BASAs have already settled the debate over the need for liberalization in

places where the industry is matured. It seems that the focus has now shifted towards achieving a multilateral negotiation in the World Trade Organization (WTO) system.<sup>12</sup>

### **3.2.3. The Case against Air Transport Liberalization**

As indicated earlier, international air transport is governed by web of bilateral agreements which essentially define the market structure for participating airlines. The very nature of such agreements give every country to have the ultimate discretion over the pace and level of liberalization allowed to their air transport market. The basic justification for the bilateral system is to allow countries exercise right over their own territory depending on the level of their air transport sector development. The latter reason is mostly forwarded as a reason not to engage in liberalization. The International Civil Aviation Organization (ICAO) also maintains this basic desire of every state to participate in the airline market by advocating a progressive liberalization to ensure fair competition and continued participation of smaller countries instead of outright openness of provisions of the BASAs. Therefore, the case against air transport liberalization boils down to the protectionist rationales forwarded by countries which have an interest to protect their national airline (Huber and Sauvé, 2002). Further, Lyle (1995) identifies protection of National Airlines interests, physical limitations on market access (airport congestion) and

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<sup>12</sup> Due to the difficulty in reconciling bilateral air service agreements' provisions which give access to agreed routes, only to designated carriers of the bilateral partners with the two basic GATT principles of most favored nation (MFN) and national treatment, air transport services are yet to be negotiated in the WTO system. As a result, there are only three areas which are explicitly included in the Annex of GATS. These areas are: aircraft repair and maintenance services, computer reservation system services and the selling and marketing of air transport services (ICC, 2005 and Huber and Sauvé, 2002).

air space sovereignty and prestige as some of the underlying motives forcing countries to pursue restrictive policy regimes.

However, clearly articulated justifications against air transport liberalization are not very common in the literature. It seems that liberalization initiatives and policies at bilateral and regional levels are the order of the day for the industry. Even countries with low level of air transport sector development, like African countries, recognize the irreversibility of liberalization phenomenon, and have long embarked on regional liberalization policies. A study by UNECA (2003, p.p. 3) states that *“the emphasis of air transport policy has shifted from challenging liberalization to ensuring the full involvement of stakeholders”*.

### **3.3 Review of Theoretical Framework**

#### **3.3.1 Contestability Theory**

The theoretical justification behind USA’s deregulation of domestic air transport industry in the late 1970s was based on the hypothesis of the contestability theory. A contestable market structure is one where entry is free and exit is costless (no sunk cost). Potential entrants to a particular industry are also assumed to have free access to technology. Incumbents in such a market behave in welfare maximizing manner due to the threat posed by the potential entrants which are capable of entering markets where super normal profit is earned ( Baumol 1982).

A deregulated airline industry is cited as a practical approximation of contestable market hypothesis due to the relative ease of entry to a market and presence of equal access to

technology. Moreover, relatively cost can be easily recapitalized upon exit from airline markets compared to other industries. If incumbent airlines on a given route are suspected of charging higher prices, other airlines which can serve the route will start operation in the route until price decreases to a competitive level. Therefore, the threat posed by potential entrants to the route disciplines the conduct of the incumbents to operate as if in a competitive environment. However, in reality incumbent airlines enjoy customer loyalties and they have well established networks which enable them provide better services than potential entrants. Bailey (2002) adds that despite deregulation airline competition remains imperfect, particularly at hub airports where incumbent firms enjoy “grandfather” rights (i.e. the right to maintain control over slots that were controlled by them in previous years) in slot<sup>13</sup> allocations. The author concludes that these imperfections are better explained by models of oligopoly. Contestability particularly fails to explain trade in international aviation services in which entry and exist is effectively controlled by webs of BASAs (Wiseman, 1990, Hurdle *et al* 1989).

### **3.3.2 Oligopoly Theory**

Due to the apparent incapability of the contestability hypothesis to explain conduct of firms in the airline industry, the degree of competition in the air transport market is usually assessed in the framework of oligopoly theory. Fisher and Kamerschen (2003) Oum *et al* (1993), Brander and Zhang (1990) based their theoretical underpinning on this theory to analyze the market conduct of duopoly airline routes in the USA. Schipper *et al* (2002), Marin (1995) and Nero (1998) also employed a similar framework to analyze the

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<sup>13</sup> Please refer to Appendix 2 for the definition of slot.

level of competition in European interstate routes. In this study, in particular the focus is on the relevance of this theory to predict how airlines strategically interact in a regulated market and their reaction as more market oriented policies are introduced in the context of international air transport services.

Traditional BASAs, which allow for single designation, result in a duopolistic market provided that each country has a capable and willing airline to operate the routes specified in the agreement. In situations where one of the bilateral parties has no such airline to operate international services, the market will end up being a monopoly. Whereas, if the BASAs allow multiple designation or airlines from third countries, the number of airlines operating in a given route can be more than two. Furthermore, under traditional BASAs pricing and capacity decisions (i.e. type of aircraft and number of weekly frequencies) of airlines are restricted and subject to the approval of aviation authorities. Consequently, the airlines tend to engage in collusive practice and jointly maximize profit.

However, as more and more competition is introduced (as a result of domestic market deregulation or BASAs liberalization) the airlines tend to go from collusive to non-cooperative pricing decision. The relative ease of restriction on pricing, capacity, and designation and traffic rights forces the airlines to compete aggressively to provide efficient service to consumers. The resulting conduct in the market will have a reducing effect on equilibrium prices and improve service quality (Marin, 1995, Dresner and Tretheway, 1992).

In a market to which regulation is eased, a parameter, which is the basis to predict the degree of competition and hence the type of conduct in the market, is calculated from a representative airline's profit function. This parameter is usually referred to as 'conjectural variation' and is interpreted as the expectation that firm 'i' entertains regarding the adjustment of output by all other firms in response to a change in its output. The value of the conjectural variation<sup>14</sup> reveals whether the behavior (conduct) of firms in a particular market is in line with Bertrand, Cournot or collusive models (See Fisher and Kamerschen 2003, Schipper *et al* 2002, Oum *et al* 1993, Brander and Zhang 1990, and Iwata, 1974).

The Conjectural Variation models are not without flaw. These models are criticized on a number of grounds in the literature. The prime shortcoming of the model is that it is 'inherently static' (Fischer and Kamershen, 2003, and Martin, 1993). Thus employing this static framework to analyze dynamic behavior would be inconsistent. However, Fisher and Kamershen (2003) argue that with a slight modification of the interpretation of the conjectural variation parameter, one can view it as a parameter describing market conduct rather than an indicator for the firms' expectation. Furthermore, Oum *et al* (1993) and Brander and Zhang (1990) indicate that dynamic patterns can be approximated by repeated one shot static-equilibrium models.

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<sup>14</sup> See formal derivation in the next section

Generally, the range of market structure resulting from varying degrees of liberalization within BASAs can be better analyzed in the framework of oligopoly model discussed above. It is also possible to predict the movement of main variables of interest due to structural changes. In this study, this theoretical underpinning in the context of international passenger air transport services is used. The next section describes the theoretical structure of the investigation.

### 3.4 The Theoretical Structure

Air transport demand ( $q$ ) measured as a total round trip passenger on route ‘ $r$ ’ is (shipper *et al*, 2002 and Tresner and Tretheway, 1990):

$$q = q(z_r, p_r, f_r) \tag{1}$$

Where  $z_r$  is a vector of exogenous gravity type demand variables which include income and population at either end of the route and  $p_r$  and  $f_r$ , are the price and departure frequency on route  $r$  respectively.

The price equation can be derived from the profit function of a representative airline  $i$  on route segment where two carriers are operating (this analysis can easily be generalized to the ‘ $n$ ’ firm case). The profit function is given as:

$$\Pi_r^i = p_r^i q_r^i - c(q_r^i, f_r^i, d_r^i) \tag{2}$$

The airlines maximize profit with respect to price and frequency  $c(q_r^i, f_r^i, d_r^i)$  is the cost function and  $d_r$  is the stage length of the route. The profit maximizing price under liberal agreement can be derived from the first order condition of the following:

$$\frac{d\Pi_r^i}{dp_r^i} = q_r^i + p_r^i \frac{dq_r^i}{dp_r^i} - MC^i \frac{dq_r^i}{dp_r^i} = 0 \quad (3)$$

$$\text{Where, } MC^i = \frac{dc(q_r^i, f_r^i, d_r^i)}{dq_r^i}.$$

Rearranging the terms price will be:

$$p_r^i = MC_r^i - q_i \frac{dp_r^i}{dq_r^i} \quad (4)$$

On the other hand, airlines operating under traditional restrictive agreement are assumed to engage in collusive pricing behavior, i.e. the airlines jointly maximize profit. For the two airlines case profit maximization for carriers i, given carrier j, can be derived as follows:

$$\text{Max}(\Pi_r^i + \Pi_r^j) = p_r^i q_r^i(p_r^i, p_r^j) - c(q_r^i, f_r^i, d_r) + p_r^j q_r^j(p_r^i, p_r^j) - c(q_r^j, f_r^j, d_r) \quad (5)$$

The profit maximization price after further manipulation<sup>15</sup> will be:

$$p_r^i = \frac{dc_r^i}{dq_r^i} - q_r^i \frac{dp_r^i}{dq_r^i} (1 + \delta) \quad (6)$$

$$\text{where, } \delta = \left( p_r^j - \frac{dc_r^j}{dq_r^j} \right) \frac{dq_r^j}{dp_r^i}$$

$\delta$  is the conjectural variation<sup>16</sup> parameter which captures the effect of liberalization.

<sup>15</sup> See Tresner and Tretheway (1990) for complete proof.

<sup>16</sup> The parameter  $\delta$  may be used to index the degree of competitiveness or collusiveness of firm conduct. The higher the level of  $\delta$ , the greater the price-cost margin and hence the more collusive the firm conduct. The Cournot solution corresponds to zero conjectural variations, so that if a firm behaves more competitively (collusively) than Cournot,  $\delta < (>) 0$ . in particular, in price rather than quantity is the choice variable, the Nash price (or 'Bertrand') solution will yield marginal cost pricing." (Oum et al, 1993, Martin, 1998 and Tirole, 1997)

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If  $\delta > 0$  the airlines are exhibiting a collusive behavior and

$\delta < 0$  shows non-cooperative behavior due to the effect of liberalization.

$\delta = 0$  shows a Cournot solution

Since  $\frac{dp_r^i}{dq_r^i} < 0$  under  $\delta > 0$  (regulated traditional bilateral agreement) prices will be higher than the  $\delta=0$  case. Therefore, the effect of liberalization on the equilibrium price is expected to be negative. Accordingly, the profit maximizing price for each route can be written as:

$$p_r^* = p(q_r, \delta_r, f_r, z_r) \tag{7}$$

Service quality improvements in the form of increases in departure frequency, flexible routing options and aircraft type are the main channels through which the benefits of liberalization are manifested. A theoretical analysis (formal proof) in the framework of a conjectural variation model using departure frequency as a choice variable is given by Schipper *et al* (2002). As indicated above, liberalization has a negative impact on price and hence demand is likely to rise after liberalization. This increase can induce airlines to raise departure frequency making this variable one of the determinants of demand. Accordingly, in the post liberalization period there is expected increase in the level of departure frequency to accommodate increase in demand.

### 3.5 Review of Empirical Models

#### 3.5.1 Models of Air Passenger Demand

As a result of the intensification of overall economic, social and political ties between countries on one hand and the advent of technology in the other, the demand for air

transport services has grown enormously. In line with this, the desire to understand and model the pattern of this demand from the academics, policy makers and the airlines has been given special attention. Though the main thrust of this study is not to model the demand side, reviewing demand determinants helps to single out the effect of different policy regimes (the main objective of this study). Accordingly, the following paragraphs highlight studies related to modeling air transport demand.

Jorge-Calderon (1997) summarizes that the demand for air transport can be explained in two broad categories. Firstly, geo-economic variables which arise from activity (economic) and location factors determine the level of air transport demand between countries. The variables most commonly used to capture the influence of these factors are income and population of route end points (cities, countries) and the distance between them. The first two are ‘generative’ variables since air transport demand is positively related with them. Other studies (see Dargay and Hanly, 2001 Mallilabiau and Hansen, 1995) used exports and imports between route end points instead of income to capture the propensity to travel by air between countries.

In the second category, service related variables which include quality of service and price are used as the main determinants of air transport demand. To this end, Jorge-Calderon (1996) indicates that the number of flight frequency and aircraft size are mostly used to capture the influence of quality related variables.

### **3.5.2 Modeling Effects of Air Transport Liberalization**

On top of the factors which are presented above, air passenger flows across countries and the market structure under which firms operate is determined by variables pertaining to the BASAs and the degree of their openness. The permitted number of airline designation, level of pricing and capacity controls and air traffic rights effectively define the market structure for airlines. As such, the effect of liberalizing these attributes on the level of passenger traffic, price and service quality is handled in the literature by including a vector of dummy variables differentiating across routes depending on the openness status of the BASAs in regression analysis. The following paragraphs present the leading studies in this area.

Dresner and Tretheway (1992) developed an econometric model to analyze price (fare) effects of changes in market structure as a result of liberalization of the North Atlantic market (between Europe and North America). Their theoretical framework to estimate determinants of fare across routes governed by varying degrees of liberalization is based on a neoclassical profit maximization equation<sup>17</sup>. The empirical model hence formulated is estimated using a two-stage least squares technique to treat the problem of endogeneity of including passenger volume (demand) in the price equation. The effect of liberalization is captured by a dummy variable differentiating between liberal<sup>18</sup> and restrictive regulatory regimes alongside other explanatory variables. (Passenger fit from the first regression as well as time and route dummies due to the usage of panel data).

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<sup>17</sup> As discussed earlier, this framework assumes that airlines operating in liberal agreements choose price according to Bertrand pricing behavior, which lead to low price equilibrium, thus simulating competitive conditions under oligopoly. Whereas, traditional bilateral agreements are assumed to result in collusive pricing behavior, making prices higher.

<sup>18</sup> Dresner and Tretheway (1992) define a liberal route as one where there is freedom of pricing and capacity decisions , multiple designation of airlines and presence of inter-modal competition.

Dresner and Tretheway (1992) concluded that there had been significant negative effect of liberal policies on price.

The main drawback of this model is its failure to include other explanatory variables especially pertaining to quality of service in the price equation. The effect of liberalization is assumed to be channeled to final consumers only through lower prices. However, liberalization brings about more competition among airlines forcing them to provide services more tailored to the needs of their customers.

Maillebiau and Hansen (1995) found the same result for the North Atlantic market indicating that liberalization<sup>19</sup> had the effect of reducing fares by increasing the level of fare competition and by allowing more efficient US domestic carriers to operate. Further to the price effect of liberalization, they indicated that service accessibility was enhanced through the expansion of the number of gateways specified in the bilateral agreements and encouraging airlines to serve new gateways as a competitive strategy. The fare and accessibility variables are treated as exogenous in the demand equation and estimated independently using ordinary least square estimation.

Recently Schipper *et al* (2001) used a frequency variable instead of ‘Accessibility’ to capture the service attribute impact in analyzing the welfare effects associated with liberalization of European interstate routes. They estimated the demand, fare and

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<sup>19</sup> Maillebiau and Hansen (1995) focused on articles pertaining to fares and capacity to characterize liberalness of BASAs.

frequency equations separately using 2SLS procedure to treat endogeneity problems. The estimated fare and frequency equations show that standard economy fares and departure frequencies on fully liberalized routes are on average, 34% lower and 36% higher, respectively than on routes without such liberalization.

### **3.5.3 Empirical Studies on Air Transport Liberalization in Africa**

Empirical studies on the effect of air transport liberalization in Africa are very few. A recent study by ComMark (2006) tried to analyze the impact of BASA liberalization and the presence of a low-cost airline on the fare rates charged by airlines in Southern Africa Development Community (SADC) member states. The econometric model employed in this study is an extension of Dresner and Tretheway (1992) model discussed above. Dummy variables differentiating across routes depending on the liberalization status of the BASAs and presence of low-cost airlines are used to capture the effect of freer regulatory arrangements. ComMark's (2006) result indicates that fares in routes governed by liberalized agreement are 18% cheaper per kilometer and that the presence of a low-cost airline is expected to reduce price by 40%. Further, this study analyzed the impact of entering into open skies agreement between South Africa and other countries in SADC and elsewhere on the volume of air passengers using a panel data set from 1998 to 2004. The result indicates that liberalized agreements had increased passenger volume by 23%.

A UNECA (2003) report indicated that intra-African air traffic increased by 7.5% in 2001 as a result of liberalization policy advocated by the YD. However, the report doesn't

indicate what kind of methodological approach is used to evaluate the policy. In general, there have not been sufficient empirical studies on the African air transport industry.

## **Chapter Four**

### **Model Specification, Data and Methodology**

#### **4.1 Model Specification**

##### **4.1.1 The Demand Model**

Following the theoretical structure discussed in section 3.4, the city-pair route demand equation is specified below to analyze the effect of Bilateral Air Service Agreement (BASA) liberalization. The standard air transport demand equation specification includes own price (fare) and service quality as explanatory variables. Furthermore, ‘gravity’ type variables are usually used to capture economic size of the two route end cities. These variables are classified as ‘generative’ and ‘impedance’ depending on their respective impact on demand (Doganis, 2002). Population size and GDP at both the origin and destination points are important ‘generative’ variables which indicate the catchment area

for potential travelers. Whereas, distance is the main ‘impedance’ variable which deter air traffic flow between two end points since social and economic interactions decline with it. In line with Schipper *et al* (2002) and Dresner and Tretheway (1992) a complete passenger air transport demand for route, ‘r’, in period ‘t’, is given as:

$$pass_{rt} = \beta(yfare / km_{rt}, frequency_{rt}, income_{rt}, pop_{rt}, dist_{rt}) \quad (8)$$

Where:

- pass* = the number of round-trip passengers carried;
- yfare/km* = roundtrip economy fare;
- frequency* = the number of departure frequency to route endpoints;
- income* = the product of the per capita income of the endpoint countries;
- pop* = the product of the populations of the route endpoint countries;
- Dist* = the great circle distance between airports of the route Endpoints in km;

According to (8) the route demand, ‘ $q_r$ ’, can be specified in a log-linear form so that the estimates are interpretable as elasticity in the following manner:

$$\log(pass)_{rt} = \beta_1 + \beta_2 \log(yfare / km)_{rt} + \beta_3 \log(freq)_{rt} + \beta_4 \log(income)_{rt} + \beta_5 \log(pop)_{rt} + \beta_6 \log(dist)_{rt} + \varepsilon_{rt1} \quad (9)$$

The inclusion of fare in the passenger demand equation is justified for obvious reasons. However, the usage of standard economy fare requires a symmetry assumption due to the fact that airlines offer various fare levels depending on the type of travelers (business, leisure etc). Ideally, one should use the lowest available fare to see the response of demand to fare level change since most likely this category of fare is the one that would

affect consumer's expenditure decision by inducing people to spend on air travel as it gets cheaper. Thus any analysis to see the effect of fare on demand should use discount fare (Mallebiau and Hansen, 1995). Unfortunately, the data set does not allow meeting this standard. Despite the potential measurement bias, the widely available economy fare is used in the literature as a proxy for all fare classes (Nero (1998, pp. 469), justifies usage of economy fare by arguing that it is more linked to costs and other fare categories are determined as either a 'mark-up' or a 'discount' on economy fare).

Since Addis Ababa is a common end point of all the route pairs included in the sample, only population and income of countries at the other end of the route are considered<sup>20</sup>. I expect these two 'generative' variables to have a positive impact on the number of air traffic between the route end cities. Distance, the 'impedance' variable, is expected to have a negative impact on the level of demand.

All the variables are exogenous except fare and frequency which pose potential simultaneity bias with demand. Endogeneity of fare comes from the simultaneity of price and demand determination. Particularly, in air transport case there is a possibility that higher traffic leads to realization of 'economies of traffic density'<sup>21</sup> that results in lower average costs and, hence decreased fare. Thus, there is a feedback effect from the left

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<sup>20</sup> This approach is common in the literature, see for example Oum *et al* (1993), and Brander and Zhang (1990).

<sup>21</sup> Caves *et al* (1984, p.p. 475) define 'economies of density' as 'the proportional increase in output made possible by a proportional increase in all inputs, with points served, average stage length, average load factor, and input prices held fixed.' If airlines manage to realize such economies there is a possibility that they may transfer it to consumers in the form of lower fare.

hand side variable, ‘*pass*’, to the fare level. As regards frequency, previous studies (see for example, Jorge-Calderon, 1997 and Schipper *et al*, 2002) have shown that frequency has a positive impact on demand. But, it is only the later that treated frequency as endogenous arguing that it is a distinct possibility that airlines adjust their departure frequencies as a response to an increase in demand, a case which reverses the causality maintained in the model. Therefore, this endogeneity problem should be taken into account in any estimation. Accordingly, in section 4.3 below, an attempt is made to treat the problem.

#### 4.1.2 The Fare Model

Based on equation (7), the fare level between two route endpoints is a function of the following variables:

$$yfare / km_{rt} = \alpha(pass_{rt}, LIB_{rt}, cost_{rt}, income_{rt}, dist_{rt}) \quad (10)$$

Where:

*LIB* = a vector containing liberalization dummy variables ‘*libf*’ and ‘*libr*’ defined in section 4.2.1 below;

*Cost* = marginal cost of the main operators in the route

The above equation is specified as per the following log-linear specification:

$$\begin{aligned} \log(yfare / km)_n = & \alpha_1 + \alpha_2 \log(pass)_n + \alpha_3 libr + \alpha_4 libf \\ & + \alpha_5 \log(cost)_n + \alpha_6 \log(income)_n + \alpha_7 \log(dist)_n + \varepsilon_{n2} \end{aligned} \quad (11)$$

All the variables except total passenger number, ‘*pass*’, are exogenous. The liberalization dummies are expected to have a negative effect on the fare level as explained in the theoretical structure section above. The sign of the passenger variable depends on the

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relative strength of two distinct effects noted by Dresner and Tretheway (1992): i.e. 1) the demand variable in the fare equation will have a positive sign due to the marginal cost effect – where higher output levels lead to higher marginal costs, if firms are operating on the upward sloping part of their marginal costs (this is a positive cost effect when airlines operate under short-run capacity constraint), 2) a negative coefficient of the passenger variable can arise when airlines operate in the declining part of their marginal cost (this happens in the presence of excess capacity and/or realization of ‘economies of traffic density’, Nero, 1998). I expect the first effect to dominate since most African airlines are faced with capacity constraint. The cost and distance variables are expected to have a positive coefficient. The former is usually estimated by  $c^i_{rt} = cpk^i_t (D_r / AFL^i_t)^{-\theta} D_r$  for route specific marginal cost. Where  $cpk^i_t$  is each airline’s cost per-kilometer for an average route in Africa,  $AFL^i_t$  is each airline’s average flight length for the Africa market as a whole and  $D_r$  is the distance of the route ‘r’. The value of ‘ $\theta$ ’ lies in  $0 < \theta < 1$  range<sup>22</sup> (Oum *et al*, 1993, Brander and Zhang, 1990). In this study, cost symmetry is assumed and estimated from a representative airline’s financial data in the respective routes. To this end, Ethiopian Airlines’ operating cost data will be used for all the city-pair routes considered. Positive coefficient of distance is expected showing that cost per kilometer declines with distance as fixed costs incurred at route end points is averaged over longer distance. Finally, ‘*income*’ is expected to have positive coefficient since airlines may tend to charge higher prices in places where there are richer people.

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<sup>22</sup>The rationale behind this range suggested in the airline economics literature is that costs are strictly concave in distance. Therefore, ‘ $\theta$ ’ captures economies of ‘stage length’, whereby the cost per unit distance decreases as fixed terminal costs are spread over more distance units. The value of theta is usually assumed to be 0.5 (Oum *et al*, 1993).

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### 4.1.3 The Frequency Model

Following the discussion in the theoretical structure section, the number of departure frequency rendered in a particular route, 'r', at a given time 't' is given as:

$$freq_{rt} = \lambda(pass_{rt}, acsize_{rt}, dist_{rt}, LIB_{rt}, operators_{rt}) \quad (12)$$

where:

*acsize* = the average number of seats per flight

*operators* = the number of airlines in the route

Accordingly, the proposed specification for the frequency equation is as follows:

$$\log(freq)_{rt} = \lambda_1 + \lambda_2 \log(pass)_{rt} + \lambda_3 \log(acsize)_{rt} + \lambda_4 \log(dist)_{rt} + \lambda_5 libr + \lambda_6 libf + \lambda_7 \log(operators)_{rt} + \varepsilon_{rt3} \quad (13)$$

The main variables of interest again are the two liberalization variables, 'libf' and 'libr'. It is assumed that in a liberalized environment, service quality (accessibility) gets enhanced since airlines increase their frequency to accommodate a surge in demand in a post liberalization period which comes from a decline in price. A liberalized regulatory environment enables airlines to respond to this increase in demand by mounting departure frequency as well as to provide service suitable to consumers. In addition, as indicated in section , liberalization increases frequency due to presence of fifth traffic right which are very crucial to sustain operation in thin interstate markets like that of Africa. Many players in a given route means higher departure frequency compared to those routes served by monopoly or small number of airlines. Besides, many players in a given route means that there is a tendency for the airlines to compete with each other so as to avail

the most suitable service to the final consumers leading ultimately to higher departure frequency. Thus, I expect the ‘*operators*’ variable to have a positive coefficient. Furthermore, ‘*dist*’ and ‘*acsize*’ will affect frequency negatively. The former as indicated above is a major ‘impedance’ variable and hence departure frequency tends to decline with it. As for ‘*acsize*’, operating by larger aircraft size to a given route (i.e. increasing the number of seat) effectively results in a decline on the number of flights.

## **4.2. The Data**

### **4.2.1. Definition of the Liberalization Dummies**

The city pair routes under investigation comprise more than 75% of the air link Addis Ababa has with other cities in Africa and represent various regulatory status and flight stage length<sup>23</sup>. One of the main challenges of studying the effect of liberalization policies on international air transport services is how to succinctly measure liberalization policy for empirical analysis. Basing their definitions on actual BASAs signed between countries or simulating changes of main provisions of a typical BASAs Schipper *et al* (2002), Dresner and Tretheway (1992), Maillebiau and Hansen (1995), Nero (1995) and (1998), Gillen *et al* (2002) and interVISTAS-ga<sup>2</sup> (2006) all used a dummy variable to capture the effect of change in the regulatory status in their analysis. In this study three regulatory statuses, namely ‘full liberalization’, ‘restricted liberalization’ and ‘restricted BASA’ have been defined as per the following explanation.

The liberalization definition used in this study is based on the provisions of Ethiopia’s BASAs with countries in which the cities under investigation are located. The relative degree of ‘liberalizedness’ of provisions pertaining to capacity (frequency and aircraft

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<sup>23</sup> Flight Stage refers to the operation of an aircraft from take-off to its next landing.

size), fifth traffic rights and fare define the overall liberalization status of a given BASA.

A BASA is considered as 'liberalized' if it freely allows 5<sup>th</sup> traffic rights (to beyond and

**Table 4.1 Liberalization Status of Ethiopian BASA with African Countries**

intermediate points), free departure frequency and gives airlines the discretion on pricing decisions. Particularly, as regards capacity, a given BASA is termed as 'liberal' if there is no government interference in departure frequency and aircraft size choice and restrictive otherwise. Concerning 5<sup>th</sup> traffic rights, a BASA is considered as 'liberal' if it allows

Year of Agreement	Bilateral Partner	Provisions					Free 5th traffic right
		Capacity Choice					
		Multiple Design.	Free Frequency	Free Aircraft Type	Fare Regulation		
1970	Burundi	Yes	Yes	Yes	DA	Yes	
1988	Chad	No	No	No	DA	Limited	
2005	Congo	Yes	Yes	Yes	DD	Limited	
1992	Cot Devour	Yes	No	Yes	DA	Limited	
1998	Djibouti	No	No	No	DA	No	
2005	DRC	No	No	No	DA	Limited	
1995	Egypt	No	No	Yes	DA	Limited	
2005	Ghana	Yes	Yes	Yes	DD	Yes	
2005	Kenya	Yes	Yes	Yes	DD	Yes	
2005	Malawi	Yes	No	Yes	DA	Yes	
2005	Mali	No	Yes	Yes	DA	Yes	
2005	Nigeria	Yes	Yes	Yes	DD	Yes	
2004	Rwanda	Yes	Yes	Yes	DD	Yes	
1997	South Africa	Yes	Yes	Yes	DA	Yes	
1993	Sudan	No	No	Yes	DA	No	
2004	Tanzania	Yes	Yes	Yes	DD	Yes	
2005	Togo	No	Yes	Yes	DD	Yes	
2005	Uganda	Yes	Yes	Yes	DD	Yes	
2005	Zambia	Yes	Yes	Yes	DD	Yes	
1990	Zimbabwe	No	No	No	DA	Yes	

Source: Ethiopian Civil Aviation Authority (2005)

Key:

DA- Double Approval<sup>24\*</sup>

DD- Double Disapproval\*

usage of 5<sup>th</sup> traffic right to all intermediate and beyond points in Africa or restrictive otherwise. Also, a BASA is considered as 'liberal' if fare charged by airlines is invalidated by the disapproval of both bilateral partners or/and if approval of fare by

<sup>24</sup>DA- A case where a proposed fare would be permitted when both nations approve it.

DD- A case where a proposed fare would be permitted unless both nations veto it (this the most permissive form of pricing provisions in BASA) (Doganis, 1995).

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either countries' aeronautical authorities is not mandatory. The overall status of a BASA is labeled as: i.) fully liberalized, '*libf*', if it attains two or more 'liberal' status as per the above definition, ii.) restricted liberalization, '*libr*', if it is labeled liberal in only one of the above definitions and, iii.) restrictive otherwise. Accordingly, the number of the routes which attained the '*libf*', '*libr*' and restrictive status are 10, 5 and 5 respectively. Table 4.1 summarizes the BASAs of Ethiopia relevant to this study.

In general, liberalization is assumed to affect the supply side variables fare and frequency. It is hypothesized that liberalization reduces fare by increasing competition between airlines. Also, a move from restricted BASAs to progressive liberalization regimes will improve service quality by increasing departure frequency. The thin point-to-point intra-Africa air traffic flow forces airlines to operate multiple destinations simultaneously necessitating the presence of fifth traffic rights to beyond and intermediate points of a given two route end cities. Owing to such reasons, mostly African airlines are required to engage in connecting rather than point-to-point operation.

A liberalized bilateral framework would enable airlines to offer more frequency due to availability of fifth traffic rights that sustain increased frequency which otherwise would not be financially viable. As more and more, fifth traffic rights are granted airlines can manage to connect more city-pairs in Africa resulting in a general improvement in air transport service quality<sup>25</sup>. It is implicitly assumed that a general increase in frequency is

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<sup>25</sup> Malibaue and Hansen (1995) mention fifth traffic operations as sources of disutility since they require multiple stops as compared to non-stop services. However, in the context of Africa the

made possible by the presence of multiple points that can be served by 5<sup>th</sup> traffic right. Thus, Strong correlation between provisions related to ‘fifth traffic rights’ and actual number of frequency provided to route end points is expected.

#### **4.2.2 Data Source**

The data on the number of passengers, aircraft size, cost and frequency are found from Ethiopian Airlines and Ethiopian Civil Aviation Authority statistical publications. The data on the number of passengers relate to all passengers who traveled to/from Addis Ababa regardless of whether Addis is their initial origin or final destination. However, it is estimated that about 65% of the total travelers to/from Addis Ababa are transit passengers who stop for connection flights (Girma, 2007). On the other hand, fare and departure frequency variables relate to the city pair routes under consideration. To solve this discrepancy, I have used only 35% of the total number of passengers to represent the actual number of travelers in the city-pair routes to estimate the passenger and fare models. Total passengers figure is used in the frequency model since departure frequency rendered between two cities depends on the total passenger number regardless of their origin or destination between them. Data on fare relates to Addis Ababa to the city at the other end and it is gathered from the Official Airline Guide (OAG) publication. Information on population, GDP and GDP *per capita* (both in 2000 USD) are gathered from World Bank Development Indicators (2007) online database. Summary statistics of the main variables is presented in table 4.2 in the annex.

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presence of air-link between city pairs has greater importance than the disutility entailed in multiples stops.

### 4.3. Methodology

In the present study, fare and frequency variables are assumed to be endogenous. One of the following alternatives can be followed to treat the problem of endogeneity. Marin (1995) applies an instrumental variable estimation method to treat endogeneity of passenger and fare variables and uses the price and demand equations to find instruments by estimating the equations separately. A Two-Stage least square (2SLS) estimation procedure in a panel data setting is employed by Dresner and Tretheway, (1992) and Schipper *et al*, (2002). On the other hand, Mallebiau and Hansen (1995) estimated fare and passenger equations independently treating the two variables as exogenous in the respective equations, while Adler and Hashai (2005) estimate their passenger demand equation without taking fare as an explanatory variable. The latter two approaches do not treat the endogeneity problem and hence estimate based on them generally results in inconsistent estimators of all the  $\beta$ s (coefficients) since  $\text{cov}(x_{rt}, \varepsilon_{rti}) \neq 0$ . Furthermore, without more information, it is not possible to consistently estimate any of the parameters in each of the endogenous equations (Wooldridge, 2002). Therefore, to estimate consistent coefficients, the 2SLS procedure will be used for all the models. Although the three equations can be solved simultaneously, each of the three equations will be estimated separately using 2SLS as structural equations since each parameter has an economic interpretation (see for example, Schipper *et al*, 2002, Marin, 1995 and Nero, 1998 who used similar procedure).

The models will be estimated for 20 city-pair routes to/from Addis Ababa for the period 2000-2005 using a panel data econometric technique. The limitation of panel data estimation is that it assumes a constant elasticity for all the city-pair markets. However, by pooling data across time and cross-section, it is possible to increase the number of observations and hence the significance of the variables. Besides, panel data models allow one to control for individual-specific (route specific in this case) and time-specific unobserved effects which may be correlated with the explanatory variables (Balestra and Nerlov, 1966). Owing to the panel nature of the data, the unobserved effects should be tested whether they are fixed or random depending on their relation to the explanatory variables<sup>26</sup>. Accordingly, I apply a Hausman specification test to contrast the null hypothesis  $H_0: \text{corr}(u_i, X) = 0$  (random effects model) against the alternative  $H_1: \text{corr}(u_i, X) \neq 0$  (fixed effects model). The LM test for specification and a test for the presence of autocorrelation will also be conducted.

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<sup>26</sup> Dargay and Hanley (2001), Mallibiau and Hansen (1995) included country specific dummies to capture heterogeneities across routes in the demand equation. Schipper *et al* (2002) further include time dummies to treat unobserved time specific heterogeneities.

## **Chapter Five**

### **Results and Interpretation**

#### **5.1 Specification Tests**

##### **5.1.1 Hausman Specification Test**

A Hausman (1978) specification test is conducted to correctly specify the passenger, fare and frequency models. I apply the specification test to contrast the null hypothesis,  $H_0: \text{corr}(u_i, X) = 0$  (random effects model) against the alternative  $H_1: \text{corr}(u_i, X) \neq 0$  (fixed effects model); where ‘ $u_i$ ’ is unobserved route specific heterogeneity and ‘ $X$ ’ represent the explanatory variables. Having performed the test, the outputs presented on Table 4.1, 4.2 and 4.3 (see the tables in Annex 3) are found for all the three models. The p-values in all the three cases indicate I cannot reject the null hypothesis that difference in coefficients is not systematic. Accordingly, these results imply that ‘random effects’ model is the correct specification in all the three models. From theoretical point of view, the ‘random effects’ model is usually preferred to estimate a cross-section drawn from a larger population allowing one to view the individual the individual (route) specific terms in the sample as randomly distributed effects across the full cross-section (Baltagi, 1995). The 20 ‘city-pair’ routes considered in this study are small percentage of the total air routes to Addis Ababa that cannot allow controlling for the unobserved heterogeneities. In addition, the ‘random effects’ model is particularly important for this study since it enables me to estimate the two liberalization dummies and distance, both time invariant variables that would have been dropped if ‘fixed effects’ model has to be

estimated, which have important economic interpretation.

### **5.1.2. The Lagrange Multiplier (LM) Test**

A Breusch and Pagan Lagrange Multiplier test is conducted to contrast the null hypothesis  $H_0: \varepsilon_{rti} = e_{irt}$  (classical regression model (pooled OLS)), against  $H_1: \varepsilon_{rti} = e_{irt} + u_{ir}$  (random effects model) assuming that  $\varepsilon_{rt1} \dots \varepsilon_{rt3}$  are distributed i.i.d. standard normal across the routes. To that end, based on the least squares residuals, a LM test statistics of 121.54, 240.85 and 111.42 are found for the passenger, fare and frequency models respectively which far exceed the 95 percent critical value for chi-squared (Greene, 2003: p. 299). Furthermore, the p-values, reported as 0.000 for the three models, inform the probability that the null hypothesis is true. Since this is zero it is possible to reject the classical regression model in favor of the random effects model.

## **5.2 Diagnostic Tests**

### **5.2.1 Wooldridge Autocorrelation Test**

A Wooldridge (2002) autocorrelation test for panel data is conducted to test for the presence of first order-autocorrelation (AR (1)). The result of the test indicates that for all of the three models, the null hypothesis of no first-order autocorrelation is rejected. Wooldridge (2002, pp. 282-283) suggests computing a robust variance matrix for the FD estimator or using a GLS analysis under the assumption that  $E(e_i e_i' | x_i)$  is a constant  $(T-1)*(T-1)$  matrix. Fortunately, the 'random effects' model employed in the study is a GLS estimation method. This kind of estimation technique takes care of possible problems of autocorrelation within panels and cross-sectional correlation and/or heteroskedasticity

across panels. Therefore, the results presented below are corrected for the autocorrelation and heteroskedasticity problem.

### 5.3 Results and Interpretation

#### 5.3.1 The Passenger Demand Model

In table 5.4 estimates of 2SLS ‘random effects’ model of the passenger demand model is presented. The endogenous fare and frequency variables are instrumented by the two liberalization dummies, ‘*libf*’ and ‘*libr*’, operators and the cost variables which are exogenous variables in the fare and frequency models presented below. All the explanatory variables are significant and have the expected sign except the dummy for year 2001 and ‘*Lincomep*’, logarithm of income *per capita*, which has negative but insignificant coefficients.

**Table- 5.4 2SLS Results of Passenger Model**

Variables	Coeft.	t	P-value
constant	2.89	2.27	0.020
Log fare per km	-0.72	-1.81	0.070
Log distance	-0.40	-2.03	0.040
Log urban population	0.26	3.39	0.000
Log income per capita	-0.06	-0.59	0.550
Log frequency	0.59	8.17	0.000
year 2001	0.09	1.46	0.150
year 2002	0.14	1.91	0.060
year 2003	0.28	3.13	0.000
year 2004	0.55	5.00	0.000
year 2005	0.70	4.94	0.000
R-sq- overall		0.86	
F ( 10, 100)		139.8	
Prob. > F		0	
No. of Observation		120	
No. of Groups		20	

Dependent variable: Log of number of round-trip passengers carried

Instrumented: Log fare per km, Log frequency

Instruments: libf, libr, operators, and Log cost

The value of the fare elasticity is in the range for business travelers elasticity reported by Oum *et al* (1992)<sup>27</sup>. This value suggests that air transport demand for the city-pairs is price inelastic; i.e. a percentage increase in fare results in a less than proportional decrease on demand for air transport. This fare insensitiveness of air transport demand is not farfetched for the sample under consideration due to the following idiosyncratic features of the African air transport markets. The low income level of the population makes air transport still a luxury service to be enjoyed by the mass in Africa. As such, it can be safely assumed that majority of air travelers in Africa are price insensitive affluent business travelers or leisure travelers. Although the later are generally shown to be price sensitive in other markets (see for example, Brons *et al*, 2002, Ippolito, 1981), lack of adequate alternative modes of transportation across the continent makes them opt for air transport regardless of the fare level.

The number of departure frequency to the city-pair routes under consideration has a significant positive impact on demand at 1% level of significance. Furthermore, two of the three gravity variables, distance and urban population<sup>28</sup> are found to be significant determinants of passenger demand in the city-pair routes under consideration. Distance has the expected negative effect on demand at 5% level of significance. This result is in line with the prediction of the gravity model that the chance for air travel between countries located far apart is minimal owing to limited commercial as well as overall

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<sup>27</sup> Oum *et al* (1992) give summary of demand elasticity of air passenger travelers which is usually used for comparison purpose in the air transport economics literature. They report the range 0.65 -1.15 for business passengers as the range usually found by researchers.

<sup>28</sup> Urban population variable will be used as instrument for passenger in the subsequent models since it is very significant at 1%.

socio-cultural relations. By the same token, the incidence of air travel will be expected to be higher for cities located closer to Ethiopia. Income per-capita, which is the third gravity variable has appeared to be insignificant and have unexpected negative sign.

### **5.3.1 The Fare Model**

In table 5.5 results of the fare model is presented. Due to possible endogeneity between fare and passenger variables, 2SLS ‘random effects’ estimation method has been applied. Exogenous variables in the passenger model are used as instruments for the endogenous passenger variable in the fare model. Since most of Ethiopia’s Bilateral Air Service Agreements (BASAs) went from restrictive to either of the two liberalization statuses, ‘*libf*’ and ‘*libr*’ defined in section 4.2 in the post 2000 period, it might be difficult to net-out the effect of liberalization from impacts of other incidences in this period. Therefore, two models have been estimated, Model ‘1’ controlling for time and Model ‘2’ without time dummies. The passenger variable has the expected positive sign in both models (but it is insignificant in Model 1) confirming the anticipated presence of short run capacity constraint. This result explains a typical problem of many African airlines which face capacity constraint due to failure to fly as many aircrafts as the market demands due to shortage of financial resources. Therefore, airlines tend to increase their fare level to ration their services or to capitalize on short run demand surges.

Distance has the expected negative sign and is highly significant at 1% level in both models.<sup>29</sup> The negative sign indicates the presence of ‘economies of flight length’ which accrues to airlines since the fixed costs per flight (take-off and landing costs) decrease as

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<sup>29</sup> A strong negative correlation between distance and the cost variable is observed (-0.9836) (please refer to Annex 3 to see the pair-wise correlation coefficient of all the variables). Therefore, the cost variable is dropped.

longer distance is flown.

**Table 5.5 - Random Effects 2SLS Fare Model Results**

Exp. Var.	Model 1			Model 2		
	Coefficient	t.	P-value	Coefficient	t.	P-value
cons	0.40	0.54	0.588	-1.85	-2.66	0.009
Log pax	0.01	0.21	0.834	0.27	7.72	0.000
Log income per capita	-0.05	-2.01	0.047	-0.17	-2.62	0.010
Log distance	-0.30	-3.94	0.000	-0.18	-2.02	0.046
Full liberalization	-0.11	-1.04	0.301	-0.32	-2.58	0.011
Restricted liberalization	-0.03	-0.27	0.786	-0.17	-1.16	0.250
year 01	0.05	6.65	0.000			
year 02	0.12	12.07	0.000			
year 03	0.17	11.47	0.000			
year 04	0.21	7.35	0.000			
year 05	0.28	6.93	0.000			
R-sq- overall		0.65		R-sq- overall		0.17
F ( 10, 110)		330.31		F ( 5, 115)		16.13
Prob> F		0.000		Prob > F		0.000
No. of Observation		120		No. of Observation		120
No. of Groups		20		No. of Groups		20
Corr (u <sub>i</sub> , x)		0		Corr (u <sub>i</sub> , x)		0

Dependent variable: Log of roundtrip economy fare

Instrumented: Log pax

Instruments: Log distance, Log income per capita, full Liberalization, restricted liberalization, Log urban population

The main variables of interest in the fare equation are the two liberalization dummies that capture the effect of liberal BASAs on standard economy fare. Accordingly, in Model ‘2’ only ‘*libf*’ (full liberalization variable) has a significant negative effect on price at 5%

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significance level. The result is in conformity with the prediction of the theoretical model of section 2.2 that shows a liberalized market arrangement would result in lower price level. On the other hand, '*libr*' (restricted liberalization variable), is insignificant in both models though it has the expected negative sign. Furthermore, the impact of '*libf*' becomes insignificant in Model '1' which takes time specific effects into account suggesting that the effect of '*libf*' might have been overestimated in Model '2' (inclusion of time dummies ensures that any factors other than liberalization affecting fare during the period under consideration are not absorbed into liberalization coefficients). The disparity in the significance of '*libf*' in the respective models poses a dilemma as to which model to choose for analyzing the effect of full liberalization. The conservative Model '1' which controls time heterogeneities is selected since it is more appropriate approach to see the net effect of liberalization. And, it fairly explains the pricing implication of the liberalization of BASAs in Africa since the possible channels through which price reduction could come are mostly non-existent as explained in the next paragraph.

Previous studies in other markets<sup>30</sup> showed that consumer welfare enhancing impact of liberalization policies come from increased competition between existing or new entrant airlines in the post liberalization period with a resultant negative impact on fare. However, in the African air transport context questions such as; 'what are the channels through which competition comes to bring about negative impact on fare?' and 'was fare

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<sup>30</sup> See for example Maillebiau and Hansen (1995) who empirically substantiated this assertion taking the case of North Atlantic Market (routes between USA and Europe) resulted in lower prices by encouraging entry of efficient domestic airlines (Strassmann, 1990 Lijesen ,2002).

seriously regulated in the pre-liberalization period to justify a decline in fare, if there is any, in the post- liberalization era?’ should be analyzed.

Closer look at the city-pair routes considered in this study shades light on the above two basic questions. Regarding the first question, the possibility of intensification of competition between existing or new entrant airlines has been virtually nonexistent for the period under consideration. Ethiopian Airlines has been the sole operator in almost 75% of the routes considered in this study. Besides, though multiple designations of airlines is provided for under liberalized BASAs there has not been a single new entrant airline during the study period. Therefore, it is less likely that the liberalized arrangements would have lead to lower fare level by eliciting competition from any such sources. Owing to the dominance of EAL in these routes, an equally appealing argument is a possibility that Ethiopian Airlines would charge monopoly markup due to its dominance or good reputation that may rule out reduction in fare. However, based on the empirical result there is no ground to argue that liberalized arrangements had lead to abuse of dominant position since the sign of the two liberalization dummies are not positive. As for the second question there is a possibility that countries might have stopped regulating fare though the BASA is restrictive. Therefore, any move towards liberalization would have little impact tampering a possible significant decline in price.

In line with the above conclusion, the following important points can be raised to shade light on the economic impact and implementation of air transport liberalization policy initiatives in Africa. Aviation policies, like other trade policies, reflect a balance between

consumer, tourism, airline companies' and employees' interests. Forsyth (2001) argues persuasively that this balance is changing in a number of countries, with the move towards liberal bilateral agreements and domestic deregulation reflecting a greater weight being put on consumer interests. In the African context, similar shift towards consumer interests is yet to happen to shape policy orientation of countries in aviation related issues.

The following assertion by ECA (2001, p.1) summarizes the reality in most African countries:

*“An overriding motivation of the history of the economic regulation of air transport in Africa has been the desire to ensure the protection of national flag carriers. African aviation policies have been based more on the concern of protection of the interests of national airlines rather than the interests of the consumers (passengers and shippers). The desire of protection of flag carriers explains much of the attitudes of African countries vis-à-vis air transport liberalisation.”*

Generally, most African countries are rather interested in having a national airline which is shielded by restrictive bilateral agreements in order to generate hard currencies. Subsequently, the airlines become strong interest groups which dictate policy to their own ends. In the case of Ethiopia, EAL's desire to widen its network in Africa has been the prime driving force behind the countries' commitment to fully implement continental

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liberalization policy like the YD<sup>31</sup>. Such policy stance by the country is prompted by presence of potential net economic gain since it has a strong airline which can benefit more than proportionally in any liberal arrangement.

On the other hand, there are many countries in Africa with incompetent airlines that are effectively shielded from competition by restrictive BASAs. The policy followed by these countries makes sound economic sense as well due to the credible threat posed on their airlines by aggressive expansion of countries with strong airlines such as Ethiopia. In a nutshell, airlines are still seen as national pride and source of the much needed foreign exchange in Africa from the perspective of, both those countries which are pro intra-African liberalization and those against it.

In conclusion, unless the interest of consumers and the general welfare gains in all economic sectors outweighs the current consideration of airlines as ‘cash-cow’ by many African countries, the argument for liberalization as a means to lower prices will not be a persuasive one to reverse the current restrictive policy direction. Countries have to be more open and willing to allow participation of the private sector and ease their policy in airline control and ownership.

#### **5.4 The Frequency Model**

On table 5.6 output of the ‘Frequency Model’ is presented. Exogenous variables from the

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<sup>31</sup> Ethiopia presented several position papers on African Union Ministerial Meetings (AU, 2006, 2007) reaffirming its commitment to fully implement continent-wide liberalization policies like – the YD, COMESA Legal Notice No. 2.

passenger model are used as instrument for the endogenous passenger variable in the frequency model. All the explanatory variables except the time dummies<sup>32</sup> are significant and have the expected sign. The coefficient of the passenger variable reveals that an increase in number of passengers results in less than proportional increase in departure frequency. Schipper *et al* (2002) also found similar result for intra-European air transport markets. Their explanation indicates that at constant aircraft size, an increase in passenger number is accommodated partly by a frequency increase and partly by an increase in load factor (passenger carried as a percentage of the seats available for sale)<sup>33</sup>. Distance has the expected negative sign and is highly significant at 1%.

The two liberalization dummies '*libf*' and '*libr*' are again the main variables of interest. As explained in the theoretical structure part of the study, the move from restrictive bilateral regimes to liberalization gives freedom to airlines to mount departure frequency so that they meet growing demand and/or to deliver service tailored to the needs of consumers. The case for demand increase as a result of decline in fare level is ruled out since the fare model did not predict a statistically significant impact of liberalization policy. Therefore, possible positive impact of the two liberalization variables comes from the open arrangement which enables airlines to exploit fifth traffic rights to sustain more frequency.

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<sup>32</sup> Coefficients for time dummies are not reported. But all have positive sign indicating the overall upward trend of air traffic movement over time.

<sup>33</sup> EAL's average Load factor in its intra-African routes has been 65% on average. As per the prediction of the model, a good part of increase in passenger has been accommodated by filling empty seats rather than a one-to-one increase in departure frequency.

**Table 5.6 2SLS Frequency Model Result**

Expl. Var	Coef.	t	P-Value
cons	2.41	3.74	0.000
Lpax	0.76	8.93	0.000
Lacsize	-0.08	-2.96	0.004
Ldist	-0.36	-5.52	0.000
libf	0.31	3.18	0.002
libr	0.35	3.55	0.001
operators	0.04	0.33	0.742
R-sq- overall		0.83	
F( 11, 109)		40.44	
Prob>F		0.000	
No. of. Observation		120	
No. of. Groups		20	
Corr(u <sub>i</sub> , x)		0	

Dependent variable: Log of departure frequency

Instrumented: Lpax

Instruments: Lupop

In line with the above discussion, both of these variables have shown to have a highly significant positive effect on departure frequency. The estimated coefficient of 0.34 of ‘*libr*’ reveals that routes which experienced restricted liberalization resulted in a 40% higher departure frequency than those routes without such regulatory reform. The equivalent figure for ‘*libf*’ is 35%.<sup>34</sup> It is interesting to see that the effect of ‘*libr*’ is larger than ‘*libf*’ although greater freedom is enjoyed by airlines in fully liberalized regulatory environment. This seemingly reversed effect can be explained by the diminishing marginal effect of progressive movement towards liberal bilateral

<sup>34</sup> The figures are calculated as  $100*(e^{0.34})$  and  $100*(1-e^{0.30})$  respectively.

arrangements on departure frequency. Restricted liberalization has proportionally higher impact since it comprises of frequency provisions (rights) that are actually utilized by airlines. Whereas, frequency provisions in fully liberalized bilateral arrangements might not necessarily be operated.

Generally, a statistically significant positive impact of liberalization policy on the number of departure frequency is observed for the sample considered in this study. This finding indicates that restricted BASAs have been hindering air service accessibility. Further, it is shown that a move towards restricted liberalization has a relatively higher impact than fully liberalized BASA. Therefore, it is implied that there is a potential of substantial positive gain as an improvement in service quality by liberalizing the currently restricted bilateral arrangements and by introducing liberal provisions to markets which are already open to a certain degree.

## **Chapter Six**

### **Conclusion and Recommendations**

This study empirically measures economic effects of progressive air transport liberalization in Africa by taking the case of 20 city pair routes to/from Addis Ababa. Passenger demand, fare and departure frequency models based on Schipper *et al* (2002 ) are used to verify the theoretical structure which predicts liberalization policies will result in lower fare level and improved service quality (proxied by the number of departure frequency). The empirical evidence substantiates the alleged benefits and/or threats of liberalization policy in the context of African air transport. It is suggested that more benefits can be unlocked in the form of improvement in service quality by abandoning the currently restrictive regulatory regimes. Accordingly, the frequency model indicates that a significant increase in departure frequency is observed in routes that experienced both ‘full’ and ‘restricted’ kind of liberalization compared to those governed by restrictive bilateral arrangements. The model also indicated that there is higher increase in the number of departure frequency in routes which experienced restricted liberalization relative to those operated under fully liberalized arrangement. Hence, the implied diminishing marginal return in the impact of progressive liberal policies suggests that there is potentially significant gain from liberalizing the currently restricted BASAs. Regarding the fare model, unlike the prediction of the theoretical structure, a statistically significant negative impact of liberalization policy on standard economy fare is not found

for the sample. This result rules out possible consumer welfare improving impact as a result of decreased fare level. The sign of the liberalization coefficients does not reveal the presence of market dominance, however.

The above conclusions help to clear two competing hypothesis concerning air transport liberalization policy in Africa. As indicated, there are group of countries which resist liberalization policies arguing that it may lead to abuse of market dominance by established big African airlines. On the other hand, there are countries (usually those with big airlines) and multilateral institutions (UNECA, African Union, the World Bank) that promote full implementation of the YD (Schlumberger, 2007) by putting forward merits of liberalization as a solution for the inherent problem that the industry faces in the continent. The apparent implication of the empirical model is that the case for the presence of abuse of market dominance is not as such credible while service quality improving effect of liberalization (the merit side) is justifiable.

Based on the above conclusions of the study, the following recommendations are forwarded. Currently, few countries in Africa are connected by direct air link. Sometimes travel from one point in Africa to another requires transit through other continents. To mitigate such hassle, African countries should opt for more liberalized policies to get closer to each other and to access international markets. In particular, African countries should give more flexible rights of departure frequency determination to airlines. On top of this, the forecast for air transport demand for the continent shows that it will continue to register the second largest growth rate requiring the current artificial barriers on air transport service operation within Africa to be removed. Finally, if regional and bilateral

air transport liberalization policy is to be achieved in Africa, those countries with competent airlines should demonstrate that the benefits of liberalization can be enjoyed by all the players, at least in the long run. There should also be a mechanism through which countries with a less developed air transport sector are integrated in the progressive liberalization process without being strategically disadvantaged.

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## Annex- 1-

### **Freedoms of the Air (Air Traffic Rights)**

<i>First freedom</i>	The right of an airline from one economy to fly over the territory of another economy without landing
<i>Second freedom</i>	The right of an airline from one economy to land in another economy for non-traffic purposes, such as repairs and maintenance, while en route to another economy
<i>Third freedom</i>	The right of an airline from one economy to carry traffic from its own economy to another economy
<i>Fourth freedom</i>	The right of an airline from one economy to carry traffic from another economy to its own economy
<i>Fifth freedom</i>	The right of an airline from one economy to carry traffic between two other economies provided the flight originates or terminates in its own economy
<i>Sixth freedom</i>	The right of an airline from one economy to carry traffic between other economies via its own economy. This is a combination of third and fourth freedom
<i>Seventh freedom</i>	The right of an airline to operate flights between two other economies without the flight originating or terminating in its own economy
<i>Cabotage</i>	The right of an airline of one economy to carry traffic between two points in another economy

Source: DTRD (1998) cited in Doove *et al* (2001)

## Annex -2-

### Definition of Air Transport Terms

**City-pair-** Two cities between which travel is authorized by a passenger ticket or part of ticket (a flight coupon) or between which shipments are made in accordance with shipment document or a part of it ( freight bill or mail delivery bill)

**Traffic-** For air transport purposes, traffic means the carriage of passenger; freight and mail

**Revenue passengers-** A passenger for whose transportation an air carrier receives Commercial remuneration

**Stage Distance** – ideally this should be the air route distance between two airports. Many airlines and IATA use the great circle distance, which is shorter than the distance actually flown

**Available Seat-kilometers** – this is obtained by multiplying the seats available on flight by the stage distance

**Passenger-kilometers** – the number of passengers on a flight multiplying the stage distance.

**Passenger Load Factor or Seat Factor-** on a single sector this obtained by expressing the passengers carried as a percentage of the seats available for sale. On a network of routes, the seat factor is obtained by expressing the total passenger-km as a percentage of the total seat-km available

Annex -3-

Table 5.1 Hausman Specification Test for the Passenger Model

	----- Coefficients-----			
	(b) fixed	(B) random	(b-B) Difference	sqrt (diag (V_b-V_B)) S.E.
Lfreq	.5837368	.5977551	-.0140183	.023676
Lupop	-.3157506	.2627348	-.6584854	.531679
Lincomep	.1784733	-.0659988	.264472	.1800691
Lfkm	2.369136	-.7000946	3.06923	.8523268
_Iyear_2001	-.0649699	.0830083	-.1479783	.0474077
_Iyear_2002	-.1823529	.1360391	-.318392	.1031829
_Iyear_2003	-.1848435	.2729715	-.457815	.1500665
_Iyear_2004	-.0528894	.541959	-.5948484	.1950484
_Iyear_2005	-.0909989	.6855427	-.7765416	.25194

b = consistent under Ho and Ha; obtained from xtivreg  
 B = inconsistent under Ha, efficient under Ho; obtained from xtivreg  
 Test: Ho: difference in coefficients not systematic  
 $\chi^2(9) = (b-B)'[(V_b-V_B)^{-1}](b-B)$   
 = 14.59  
 Prob>chi2 = 0.1028  
 (V\_b-V\_B is not positive definite)

Table 5.2 Hausman Specification Test for the Frequency Model

	---- Coefficients ----			
	(b) fixed	(B) random	(b-B) Difference	sqrt (diag (V_b-V_B)) S.E.
Lacsize	-.0432711	-.0483172	.0050461	.0064041
Lpax	.699239	.710186	-.010947	.0510748
_Iyear_2001	.0382374	.0388575	-.0006202	.0089485
_Iyear_2002	.060933	.0633242	-.0023911	.0118081
_Iyear_2003	-.0245772	-.0247199	.0001427	.0160454
_Iyear_2004	-.1237214	-.1266659	.0029445	.0314036
_Iyear_2005	-.0517799	-.0536959	.001916	.0442177

b = consistent under Ho and Ha; obtained from xtreg  
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg  
 Test: Ho: difference in coefficients not systematic  
 $\chi^2(7) = (b-B)'[(V_b-V_B)^{-1}](b-B)$   
 = 0.75  
 Prob>chi2 = 0.9979

**Table 5.3 Hausman Specification Test for the Fare Model**

	---- Coefficients ----		(b-B)	sqrt (diag (V_b-V_B))
	(b)	(B)	(b-B)	S.E.
	fixed	random	Difference	
Lpropax	.027388	.0222079	.0051801	.
Lfreq	-.0252608	-.0263747	.0011139	.
Lincomep	-.0311849	-.0533843	.0221994	.007074
_Iyear_2001	.0544455	.0553594	-.0009139	.
_Iyear_2002	.1154514	.1169355	-.001484	.
_Iyear_2003	.1637533	.1660146	-.0022613	.
_Iyear_2004	.2077875	.2124569	-.0046694	.
_Iyear_2005	.2715759	.2781368	-.006561	.

b = consistent under Ho and Ha; obtained from xtreg  
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg  
 Test: Ho: difference in coefficients not systematic  
 $\chi^2(8) = (b-B)' [(V_b-V_B)^{-1}] (b-B)$   
 = 8.58  
 Prob>chi2 = 0.3786  
 (V\_b-V\_B is not positive definite)

**Table 5.4 Breusch and Pagan Lagrangian multiplier test for random effects: Passenger Model**

$$Lpropax[route,t] = Xb + u[route] + e[route,t]$$

Estimated results:

	Var	sd = sqrt(Var)
Lpropax	.5943134	.7709173
e	.0253492	.1592144
u	.0703126	.2651653

Test: Var(u) = 0

$\chi^2(1) = 121.54$   
 Prob >  $\chi^2 = 0.0000$

**Table 5.5 Breusch and Pagan Lagrangian multiplier test for random effects: Fare Model**

$$Lfkf[route,t] = Xb + u[route] + e[route,t]$$

Estimated results:

	Var	sd = sqrt(Var)
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	Lfkm	.0787843	.2806855
	e	.0002986	.0172798
	u	.0191383	.1383413
Test:	Var(u) = 0		
		chi2(1) =	240.85
		Prob > chi2 =	0.0000

**Table 5.6 Breusch and Pagan Lagrangian multiplier test for random effects:  
Frequency Model**

Lfreq[route,t] = Xb + u[route] + e[route,t]  
Estimated results:

	Var	sd = sqrt(Var)	
-----+-----			
Lfreq	.450317	.6710566	
e	.0302611	.1739571	
u	.0713907	.2671903	
Test:	Var(u) = 0		
		chi2(1) =	111.42
		Prob > chi2 =	0.0000

**Table 2.1 Rank of African Airlines**

Country	Total Operations			International Operations		
	Passenger- Kilometer Performed (millions)	Africa Rank	World Rank	Passenger- Kilometer Performed (millions)	Africa Rank	World Rank
South Africa	29191	1	23	21289	1	23
Egypt	9401	2	41	8720	2	37
Kenya	6540	3	46	6292	3	44
Morocco	6434	4	47	6181	5	46
Mauritius	6266	5	48	6217	4	45
Ethiopia	5418	6	50	5286	6	50
Algeria	3101	7	64	2505	8	67
Tunisia	2995	8	67	2995	7	64
Gabon	829	10	99	728	10	97
Namibia	1012	9	90	982	9	95

Source: ICAO (2005)

**Table 4.2 Descriptive Statistics**

Variable	Mean	Std. Dev.	Min	Max
pax	25135.4	26484	4970	136066
freq	481.275	406.558	104	2387
dist	2907.8	1338.87	565	5239
incomep	572.358	677.936	105	3406
fare	717.1	253.986	165	1316

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catk	0.364	0.1223	0.22782	0.8041
dcrtk	0.66923	0.2247	0.41081	1.46439
fare/km	0.1356	0.0368	0.06359	0.22862
operators	-	-	1	3

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*Source: own calculation*

### Pair-wise Correlation Coefficients of the Variables

	Log pax	Log distance	Log income	Log frequency	Log fare per km	Full liberalization	Log urban population	Restricted liberalization	Operators	Log cost	Log aircraft size
Log pax	1.000										
Log distance	-0.1279	1.000									
Log income	0.4062***	0.3633***	1.000								
Log frequency	0.8331***	-0.3454***	0.1526*	1.000							
Log fare per km	-0.2092**	-0.6818***	-0.4102***	-0.0849	1.000						
Full liberalization	0.2098**	0.2577***	-0.0204	0.2280**	-0.2882***	1.000					
Log urban population	0.4513***	0.4484***	0.9397***	0.1644*	-0.4373***	-0.0084	1.000				
Restricted liberalization	-0.1339	0.0702	-0.1307	-0.0442	0.0335	-0.5000***	-0.0875	1.000			
Operators	0.4144***	-0.6340***	-0.0247	0.4541***	0.1059	-0.2798***	-0.0870	-0.2331**	1.000		
Ldcrtk/ Log cost	0.1826**	-0.9841***	-0.3506***	0.3697***	0.7210***	-0.2537***	-0.4330***	-0.0691	0.6239***	1.000	
Log aircraft size	0.5143***	-0.1037	0.3167***	0.2860***	-0.0020	-0.0331	0.3227***	-0.0471	0.1149	0.1345	1.000

Note: \*\*\* denotes significant at 1% level,  
\*\* significant at 5% level and  
\* significant at 10% level