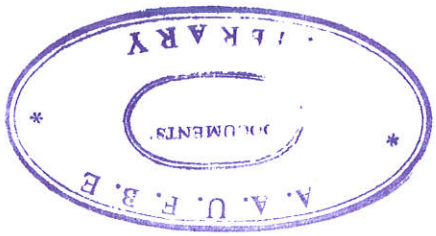
The Demand For Domestic Air Transport In Ethiopia



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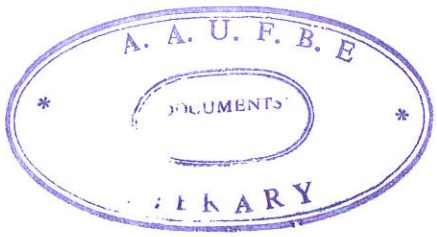

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THE DEMAND FOR DOMESTIC AIR TRANSPORT IN ETHIOPIA

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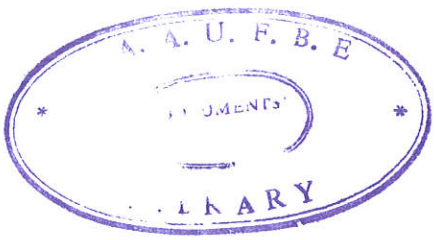

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Abstract

Since 1975, for about 20 years, air transport service had been provided by single Government enterprise, Ethiopian Airlines. The sector was moderately opened to private investors by the Federal Democratic Republic of Ethiopia Investment Proclamation No.37/1996. The restrictive provisions of this proclamation permit only Ethiopian nationals to invest in this sector using aircraft of maximum loading capacity up to 20-passenger or cargo capacity up to 2700kg. However, the proclamation plays no significant role in enhancing the capacity and competition in the overall domestic passenger air transport service and none in scheduled one.

It is hypothesized that air travel demand is determined by income of the population, price of air travel, access to alternative means of transport and price of competing service. Furthermore, the demand of air travel is expected to be price inelastic. Using quarterly time series data and co-integration analysis the long- run relationship result suggested that price of air travel, income and access to alternative means of transport significantly determine the demand for air travel while price of competing service is insignificant. In the short-run analysis only price of air travel is found to be significant while the other variables are not significantly different from zero. The result also suggested that the price elasticity of demand for air travel is unitary. The policy conclusion is that price is a significant factor determining schedule domestic air transport demand and hence private participation, competitiveness and supply of the service in Ethiopia.

CHAPTER ONE: INTRODUCTION

1.1 Statement of the Problem

Air transport has a long and proud history in Ethiopia. The technology was introduced to the country only twenty five years after the first attempt was made in the year 1903 by the Wright Brothers to fly in the air and not long after human beings were able to cross the Atlantic Ocean in an airplane (Aviation, 1997).

Ethiopia is believed to be one of the first nations in Africa to adopt the air transport technology. Accordingly, the country was one of the founding members of the International Civil Aviation Organization (ICAO) which was established in 1944.

The demand for air transport in Ethiopia originates from the large size of the country, about twice the size of France. The distance by air from Moyale, near the Kenyan border in the South, to Axum, near the Eritrean border in the North, is about 1,240 Kilometers. And the distance from the Western border of Gambella to Jijiga near the Western border of Somalia is about 1,064 Kilometers. The big size of the country, the large size of the population and its wide dispersion as well as the ruggedness of the terrain makes air transport fitting and important (Lovink, 1997).

Furthermore, because of the underdevelopment and poor condition of the road and rail infrastructure which make surface transportation slow, costly and uncomfortable, air transport has been playing a crucial role in connecting the widely dispersed communities of the country.

In addition, the increased demand for air transport also emanates from the country's substantial tourism potential, including historical sites, scenic beauty of nature, large varieties and unique species of indigenous animals and plants.

Air transport has a great potential demand in the above context. Also a safe and efficient air transport service is essential for the over-all economic activity. However, despite years use of air transport service in the country, there is a widespread perception in the civil aviation circle that the domestic air travel demand is hardly met and remains underdeveloped when compared to neighboring countries.

Before 1974, private sector participation in the air transport sector was noted, especially in general aviation. In the period between 1962 up to 1975, there were seven private air transport operators engaged in commercial aviation. These companies were serving the charter passenger and cargo-spray segments of the domestic market. On 16th May 1975, the Government nationalized all private aircrafts with Ethiopian registration and Ethiopian Airlines was the designated custodian of the nationalized aircrafts. After that, and throughout the period of the Derg regime the air transport service was totally monopolized by one company, Ethiopian Airlines [Aviation(1997), Helina (2001)].

In 1996 the domestic air transport sector was re-opened for private sector participation, with conditions. The Federal Democratic Republic Of Ethiopia Investment Proclamation No. 37/1996 declares the air transport industry open for investors but attaches several conditions: the investor has to be Ethiopian national and can only give the air transport service using aircraft with a sitting capacity of up to 20 passengers or with a cargo capacity of up to 2,700Kg.

The Investment Proclamation appears to give an opportunity for private investors to participate in the air transport sector. It also seems that the objective of the proclamation stems from the idea that opening this sector to private operators may increase supply, competition and efficiency of the domestic air transport. However, it is evident that private investors face restricted market access because it may not be profitable to provide scheduled air service with aircraft capacity of up to 20 passengers or with a cargo capacity of up to 2,700Kg using the existing fare structure. As a result, the scheduled air transport service in the country still remains under the control of a single Government enterprise.

The main purpose of this paper is to investigate and show the determinants of scheduled domestic air transport demand in Ethiopia. And it will also examine to what extent the new investment policy of the Government (Investment Proclamation No. 37/1996) helps private investors to participate in the air transport sector (especially, in the provision of scheduled service).

To this effect, we need to investigate and show empirically whether or not the domestic air transport demand is price- / fare-inelastic and to what extent the Investment Proclamation of 1996 has had an impact facilitating effective competition in the overall domestic air transport, especially in the scheduled air transport sector.

1.2 Objectives of the Study

In light of the above, the paper has the following major objectives: -

A. To evaluate the overall economic performance of the air transport system in Ethiopia.

B. To find out if the existing scheduled air transport service sufficiently meets the existing demand.

C. To determine (and show the determinants) the demand for domestic air transport in Ethiopia.

D. To evaluate the effects of public policy (Federal Democratic Republic of Ethiopia Investment Proclamation NO. 37/1996) on private sector participation in the provision of scheduled air transport service.

E. To make policy recommendations with a view to enhancing the supply of domestic scheduled air transport service and stimulating competition in the industry.

1.3 Significance of the Study

The significance of this study is seen in its potential contribution towards improving the supply and enhancing competitiveness in the domestic scheduled air transport service. In addition, the paper would be filling a gap in the extremely limited literature of the air transport sub-sector in the country.

1.4 Hypothesis to be tested

The hypothesis to be tested is that the major determinants for the domestic air transport service are the price of air travel, the income of the population, access to alternative means of transport and the price of competing services. In addition to determining whether or not the demand for domestic air transportation is price-/fare-inelastic, it will also be demonstrated that Investment Proclamation No. 37/1996 in particular and public policy in general have not

achieved the goal of competitiveness and private participation growth in the sectoral activities so far.

1.5 Methodology of the study and Data Source[1]

In this paper both qualitative and quantitative techniques of analysis are used. In the quantitative technique, statistical computation of ratios, percentage and average growth rates are used to analyze and review the domestic air transport demand, supply and assess the impact of economic regulation over the period of 1992 to 2000. Moreover, an attempt is made to identify and specify the factors that affect scheduled domestic air transport demand. To this end, a co-integration analysis technique will be used. The qualitative analyses provide intuitive explanation of the nature of air transport supply and demand in the country.

Quarterly data obtained from various sources and covering the period June1992 - June2000 is used in this study. The major sources of data are obtained from the databases of Ethiopian Airlines Enterprise, Ethiopian Civil Aviation Authority, Ethiopian Road Transport Authority, The Central Statistical Authority and National Bank of Ethiopia.

1.6 Scope of the study

Eventhough the domestic air transport system incorporates both scheduled and non-scheduled air transport services, this study will focus only on the scheduled passenger service.

[1] The detailed methodology of quarterly data generating presented as appendix 1

CHAPTER TWO

THE DOMESTIC AIR TRANSPORT CONTEXT: AN OVERVIEW

2.1 The History of Civil Aviation in Ethiopia

Compared with many African nations, aviation in Ethiopia has a long history. According to one source[2], which has not been corroborated by others, the history begins in 1921 when the Ethiopian Government officials went to visit Yemen. During this period they also visited the British Royal Airforce base of the country, where their attention was drawn by the sight of an aeroplane and its performance. Accordingly, when they returned home they reported that air transport was a better means of transportation since surface transportation was under-developed. Air transportation could also address better the challenges faced by the rugged terrain and large size of the country (Abraham, et al., 1972).

The officials' idea of introducing air transport in the country was accepted by the Government. Then, seven years later in 1928, the first Aeroplane, a French-made potez-25, arrived in Ethiopia at the Western side of Addis Ababa and landed at a place called Geffersa. This event occurred only twenty-five years after the first attempt had been made by the Right Brothers to fly in the air. (Abraham, et al., 1972; Asfaw et al., 1984)

From 1929-1936 the country acquired twenty aeroplanes mainly used for the purpose of postal and humanitarian services. During this period the aircraft technology did also cross a new frontier in Ethiopia with the assembling of the first aircraft named Ethiopia One or

[2] The historical Development of Aviation in Ethiopia , April,1984

Tsehay. However, this development suffered a terrible setback due to the Italian Occupation between the period of 1935-1941 (Aviation, 1979).

After the ousting of the Italian forces in 1942, air transport development was restarted with the founding of Ethiopian Civil Aviation Organisation (ECAO), (Today called Ethiopian Civil Aviation Authority) in 1944. The ECAO had begun its activity with five staff members and an annual budget of not more than 61,000 Birr. In that same year the country also became one of the founding members of the International Civil Aviation Organisation by signing the Chicago Convention (ICAO)[3] (Aviation, 1997)

Only a year after the founding of Ethiopian Civil Aviation Organisation the Ethiopian Government and the US Government concluded an agreement to establish a commercial air transport industry in Ethiopia. This effort culminated with the establishment of Ethiopian Airlines (EAL) which was founded with a contract agreement between the Ethiopian Government and Transcontinental and Western Airline in 1945 (the recently liquidated Trans World Airline, TWA (Price, 1996).

The establishment of the new commercial airline and the demand for air transport service necessitated new systems of airport in the country. As a result of this, the Ethiopian Civil Aviation Organisation built, With a loan of 50 million US dollars from the US Government in 1961, three new international airports in Addis Ababa (Bole), Dire Dawa and Asmara, as well as one domestic airport at Jimma. These airports began to provide full-fledged airport and air navigation services required by the modern jet aircraft (Abraham, et al, 1972).

[3] The Chicago Convention was signed in 1944 to develop the international civil aviation among nations.

Except for the above-mentioned airports, there were some landing and take off spots, which were primitive grass stripes, providing little in the way of ground support. However, The Airline extends its operation using DOUGLAS C-47 Sky train aeroplanes that fit the rough airstrips in various places of the country. By the end of 1952, the Airline linked 21 cities and towns to the capital, Addis Ababa. In addition to the growing number of passengers, the Airline also involved in cargo service. Sacks of coffee beans and pepper, small containers of butter and honey, hide and even livestock were transported by this cargo service. (Price, 1996)

Today the Ethiopian Civil Aviation Authority runs two international, seven medium standard, and other several domestic airports. Besides, the Authority provides efficient services in constructing, controlling and administering airports and the air spaces of the country. The national carrier, Ethiopian Airlines, is one of the best airlines on the continent. Presently, the Airline provides an international scheduled service to 43 countries all over the world, except Australia and Latin America, of which 19 are in Africa. In addition, the Airline serves 34 destinations in the domestic network using B737-200, FK-50 and DHC-6 types of aircraft.

2.2 The supply of Domestic Air transport Service

The domestic scheduled air transport operation is exclusively conducted by the Ethiopian Airlines since its establishment. At present, the fleet used to serve the domestic network consists mostly of Fokker –50 and DHC-6 turbo-prop aircrafts, supplemented by one B-737.

There is a widespread perception in civil aviation circle in Ethiopia that the domestic air transport supply, measured by available seat kilometre (ASK), is not enough to serve the

existing demand. The available air transport service between different routes is seen as insufficient, leading to long wait before seats can be reserved which results in greater extra cost.

Justifying the above perception, Lovink (1997) presents a detailed analysis of the passenger traffic and number of scheduled flights available at each point on EAL's domestic network. In his investigation, he found that the domestic air transport is distinguished by low number of enplaned and deplaned passengers at many communities and low correlation between potential user population size and air transport demand. However, the supply of this service characterised by more than proportionally low frequency than demand.

As it is indicated in the above analysis though the domestic scheduled air transport demand characterised by low number of passengers, the number of seats provided by the Airline are not sufficient. The domestic operation of Ethiopian Airlines (The sole operator of domestic scheduled air transport service) is inefficient which can be indicated by erratic flight schedule, low frequency and frequent flight cancellation, that force people to use alternative means of transport. Nevertheless, the scheduled domestic air transport demand is not sufficiently satisfied by the existing supply. This could be better appreciated looking the following table that show the average load factor for the last five years estimated 72 Percent in the year ending June 2000[4].

[4] Since 65 percent is considered as reasonably good load factor in the air transport sector 72 percent shows high demand. See Doganis (1995) and the International Civil Aviation Organization digest of statistics No.480 (1999)

CAPACITY, TRAFFIC AND LOAD FACTORS OF EAL DOMESTIC SERVICES, YEARS ENDING JUNE 30,1996 TO JUNE 30,2000 (IN THOUSANDS).

Table2.1

Measure	1995	1996	1997	1998	1999	2000
KM. Flown	13,639	11,288	11,082	15,381	11,057	14,069
Available seat Km.	170,755	154,409	151,892	197,472	145,955	158,069
Revenue Passenger Km.	120,947	110,400	109,345	142,949	102,435	117,114
Average load factor	70.83	71.5	72	72.4	70.2	74.1

Source: Ethiopian Airlines Statistical Report ending June, 1995-2000

The above-mentioned average load factor is probably substantially high. This is mainly because most domestic airstrips do not have the standard runway length and several airports have high elevation. For example, Addis Ababa and Axum airports are 7600 and 7000 Ft. above sea level respectively. These factors prohibit aircrafts to operate at a full load factor. Besides, it is only 6 airports from the 34 domestic destinations served by Ethiopian Airlines that have fuel stations. Hence, aircrafts are forced to carry more fuel as a result forced to carry passengers and cargoes below their capacity to adjust their load.

From the above-mentioned observation a tentative conclusion can be drawn. That is, if most airfields had standard runway length, low elevation and fuel stations, the average load factor would most likely be higher than the indicated 72 percent which is measured by the ratio of the number of seats flown from the actually available.

The data in table 2.1 further shows that when EAL increased its domestic capacity (measured in available seat kilometre) as it did from 1997 to 1998 and from 1999 to 2000, demand (measured by revenue passenger kilometre) expanded parallely. In line with this when capacity reduced during the period of 1995 to 1997 the domestic air travel demand also declined systematically to about the same degree.

Considering the evidence presented above it can be argued that for the past six consecutive years, whenever supply increases there is enough demand to guarantee 'the average load factor to be too high by any reasonable standard'[5]. Thus one can reasonably raise a question as to why the domestic air transport supply (available seat) is not enhanced to the extent of sufficiently meeting the existing demand.

One of the major reasons for the insufficient supply of air transport services in the country is the fact that the Airline is prevented from acting as a price-fixer though it operates as a monopoly in the scheduled domestic air transport network. Hence, the fare level is neither competitive nor monopoly, rather it is set by the Government. As a result, from late 1980's up to mid 1999, the air transport tariff did not match the services rendered-possibly for social or political reasons. Because of that, the Airline was forced to incur losses in the domestic air transport services. This situation can be appreciated from the following table.

[5] See foot note 3

Table 2.2 **Domestic income statement of Ethiopian Airline (ETB'000)**

	1994/95	1995/96	1996/97	1997/98	1998/99
Operating Revenue	63382	63473	81596	83471	96511
Direct Cost	58069	65061	89740	114171	86035
Indirect Cost	13584	10876	14517	18938	14246
Total Cost	71653	75937	104257	133109	100281
Operating P(L)	(8271)	(12464)	(22661)	(49638)	(3770)

Source: Ethiopian Airlines Financial Report, Year ending 1993/94 -1998/99

The significance of the losses shown in the table above is to be noted. Compared to other airlines, the domestic air travel fare charged by Ethiopian Airlines was too low (see table 2.3). Despite this fact, the need to increase domestic fares to more profitable levels, required to maintain a reasonable level of financial viability, was rejected until mid 1999 by the Government. One way of reducing cost under this condition of upward price rigidity due to regulation is to reduce frequency (supply) of service as shown in table 2.1.

Comparison of Domestic Air Fare Level between Ethiopia and Selected Countries

Table 2.3

Country	Sector	Average Sector Distance (KM)	Average Fare(ETB)	Fare/Km. (ETB)	Index
Ethiopia	Addis Ababa-Dire Dawa	344	192	0.56	100
Tanzania	Dare Selam-Kilimangaro	482	840	1.74	312.2
Greece	Athens-Kozani	310	343	1.11	198.2
Kenya	Nairobi- Kisumu	640	571	0.89	150.9
India	Bombay-Delhi	708	956	1.35	241.9
Thailand	Bankok - Phitsanulok	378	371	0.98	175.8
Nigeria	Lagos-Calabra	581	485	0.83	149.6

Source: Ethiopian Airlines Review of the Domestic Operation (1998)

After the Government allows to enhance the fare level to some reasonable magnitude in mid 1999, the Airline has increased the fare level substantially in three different phases from 0.41 to 0.77 ET cents per kilometre. As a result of this, the Airline has recently improved its revenue performance and even increased available seat in the domestic flights. Surprisingly, the demand for domestic air travel has increased parallel with the enormous increase of fare, and in the year ending June, 2000 the load factor was 74.10 which was higher than the previous years. This circumstance to a limited extent justifies the perception that the domestic scheduled air transport supply is not enough to serve the existing demand. Nevertheless, it is necessary to investigate whether this rise in demand is permanent (stable) or caused by due to some transient factors such as political instability, greater movement of public officials and high risk of surface transport etc.

2.3 The demand for Domestic Air Transport service

The rugged topography, the dispersed nature of centres of population concentration, the long distance among centres of production and the under development of surface transport tend to increase the demand for air transport as an alternative mode. However, it is clear that the demand for domestic air transport in Ethiopia is low because of the relatively high cost of this service. Since more than 60 percent of the population is below poverty line, it is fare to argue that the effective fare level is too high for most Ethiopians to be affordable.

The Ethiopian Government has recently modernised five domestic airports, four in the North (at Mekelle, Axum, Gondar and Lalibella) and one in south (Arbaminch) which has raised the total number of airports accommodating a 115 seat B-737 jet aircraft (excluding Addis Ababa

and Dire Dawa) to seven. However, the utilisation of jet aircrafts in the domestic network is limited. This is mainly because if the airline often times use jet aircraft, the minimum acceptable frequency of service by the Government and public would decline significantly. Thus when we are analysing the demand and supply in the domestic air transport context it has to be clear that, except the supplementary role of B737, we mainly discuss five FK-50 and two DHC-6 aircrafts that have 50 and 18 seats respectively and the public utilise them.

The argument of using a jet aircraft necessitate a decline in frequency in the domestic network can be clearly seen from the following Table 2.4. To interpret the data correctly, it should be explained that every person taking a return domestic trip is counted twice at her/his airport of origin (upon enplaning and deplaning), and twice at his/her airport of destination.
As it is shown in the Table 2.4, the average enplaned / deplaned passengers at the top twelve airports for three years ending December 2000 was only 27 passengers per aircraft per airport. Based on this observation, it can be argued, except some routes, which guarantee an occasional use of jet aircraft, often times the utilization of small aircrafts in the domestic air transport service is unavoidable.

Eventhough the domestic scheduled air transport demand is low as shown in table 2.4, based on an interview of knowledgeable observers of the domestic market, Lovink, (1997) argues that its price elasticity of demand is very low (this issue investigated empirically in Chapter five.) According to him, the major reason for the low price elasticity in this sub-sector emanates from the fact that 80 percent of air service users are business travellers (including public servants) and tourists who are not sensitive to small price changes.

In this context, it can be argued that the domestic demand for air transport is limited due to the high cost involved in providing this service and the low disposable income of the population. However, it can also equally be argued that there are significant number of people who can afford but are discouraged because of insufficient supply and low frequency leading to long wait until a seat is reserved. This could be better appreciated looking at the increase in load factor whenever supply increases during the period of 1995 to 1999. This circumstance continues even when the airfare has been almost double in some major routes by the year 2000.

Based on the above supply and demand analysis of the scheduled domestic air transport in Ethiopia it can be concluded that the number of people that can afford to travel by air is limited. Nevertheless, the supply of air transport is not sufficient to serve the existing thin demand. From the discussion it could be suggested that one of the major causes for the divergence between supply and demand might arise from improper public enterprise pricing.

Thus, proper number of aircrafts with optimal seat and competitive price has to be set to harmonise the demand and supply in the domestic air transport system. However, to calculate the optimal price and the required number of aircraft with proper seat for the scheduled domestic air transport system is not the purpose of this study.

The above discussion of the aviation history in Ethiopia, the domestic scheduled air transport demand and its supply gives some highlights on the domestic air transport context in the country. In addition, whether or not price, income, access to alternative means of transport and the price of competing service determine the demand, as the conventional demand theory states will be investigated in chapter five.

NUMBER OF DOMESTIC ENPLANED/DEPLANED(E/D) PASSENGERS AND AIRCRAFT MOVEMENTS AT THE TOP TWELVE AIRPORTS IN ETHIOPIA (1998 - 2000)

TABLE 2.4

YEAR	1998			1999			2000		
AIRPORT	E/D PAX	A/C MOV'T	PAX per A/C	E/D PAX	A/C MOV'T	PAX per A/C	E/D PAX	A/C MOV'T	PAX per A/C
ADDIS ABABA	292,634	8,022	36.48	227,971	6,838	33.34	242,799	7,523	32.27
ARBAMINCH*	474	60	7.90	1,493	267	5.59	1,406	319	4.41
AXUM*	9,141	403	22.68	2,784	124	22.45	12,857	603	21.32
BAHIR DAR*	31,653	1,984	15.95	41,802	2,316	18.05	44,170	2,619	16.87
DIRE DAWA	83,667	2,600	32.18	135,720	2,213	61.33	63,706	2,467	25.82
GAMBELLA*	6,230	198	31.46	12,926	385	33.57	10,454	370	28.25
GODE*	6,849	364	18.82	11,940	1,139	10.48	15,784	1,237	12.76
GONDAR*	19,670	1,212	16.23	21,046	965	21.81	29,260	1,679	17.43
JIMMA*	6,328	762	8.30	11,909	1,692	7.04	10,300	1,645	6.26
LALIBELLA*	4,943	551	8.97	9,095	743	12.24	13,333	1,286	10.37
MEKELE*	26,562	1,215	21.86	44,338	1,216	36.46	52,212	1,516	34.44
ROBE(GOBA)*	3,206	208	15.41	7,346	540	13.60	4,148	400	10.37
AVERAGE	40,946	1,465	**27.95**	44,031	1,537	**28.66**	41,702	1,805	**23.10**

***Source**: Ethiopian Civil Aviation Authority (ECAA) year ending December (1998(six months*) - 2000).*

NOTE : E/D = Enplaned and Deplaned
A/C= Aircraft
PAX = Passenger

CHAPTER THREE: LITERATURE REVIEW

3.1 THEORETICAL BACKGROUND

As in any other service the demand for air transport mainly depends on the income level of the service user (population), their capacity to pay for air transport service, their willingness to travel by air and the price level of the airlines. According to Holloway (1997), ability implies not only that the travelers have sufficient money to make the purchase, but also that they are in possession of adequate information about the availability of the service. Thus, information has also some role to determine the demand for air transport.

The demand for travel to and from a place is influenced by the level of economic and social activities that occur there, as well as its cultural, recreational and other attractions. The cost of traveling between cities, including both the money and time required, also affects the level of trip making. The demand for air travel also depends on the delay in travelers' schedules imposed by the availability, frequency and specific scheduling of aircraft departures (Mayer and Oster, 1987).

Mayer and Oster (1987) further argue that besides the factors mentioned above, there are other elements that affect air transport demand such as availability or non-availability of alternative means of transport. Various means of surface transport, particularly private automobiles, public buses and speedy trains can serve the same purpose as the commercial airline.

Strengthening the above idea, Holloway (1997) argues that demand for air transport can be measured over a specified period, such as a day, week, month, season or year, under a given set of assumed market condition. The most obvious, but not always the most important, condition is the price of the service concerned. Related to this are expectations consumers might hold about likely future price trends, together with the current and prospective prices of competitor services. The availability and price of substitute services, offered by firms both inside and outside the industry are also relevant. For example, though it is not relevant in Ethiopian context, videoconferencing facilities and videophones could minimize business travel demand, especially if related to travel for (business) meetings, as their prices fall and availability increases. Alternative modes of transport, such as automobiles or high-speed train are potential substitutes for short-haul air travel in some markets. Consumers' incomes and their confidence in future earnings are other important conditions, accounting in this case for the pronounced cyclicality of air transport demand in response to macro-economic conditions (Holloway, 1997).

Wells (1994) gave some insight regarding the imbalance of demand and supply in the airline industry. He argued that the realities of public transportation, whether bus, train, or air, result in an imbalance between the number of seats, or capacity, available and the current demand for travel by the public. The two simply do not mesh at precise the same time, the same place and the same rate. Airlines can not fine-tune capacity to match demand, because capacity can only be added or taken away in total planeloads. The aircraft unit itself is obviously inflexible; if a given carrier's FK-50 is equipped with 52 seats; that seat supply on a particular schedule can not be shrunk or expanded between Thursday and Friday and changed again for Saturday (Wells, 1994).

Consistent with the above argument, Doganis (1995) forwards the idea that the demand for passenger services arises from the complex interaction of a large number of factors which mainly falls in to two groups: the general economic and supply related factors that influence demand in all markets, and the more particular factors that may influence demand on some routes but may be totally absent on others.

Of the general factors affecting demand, the price of air transport and the level and distribution of personal income in the markets served are perhaps the most important. Other than price there are various supply conditions that affect demand such as frequency, seat availability, departure and arrival times and number of route steps, which can be considered as service.

In line with this, ICAO Doc 8991-AT/722/2 (1985) presents that the demand for air travel is affected by various aspects of the level of service provided, including the amount of travelling and waiting time. The greater flight frequency for a particular route, the more likely a flight will close to the desired departure time of a passenger, and also the lesser the waiting time would be for the next flight if the desired flight were fully booked. Further more, for a given aircraft type, a higher frequency reduces the average load factor on a route increasing the probability of a passenger obtaining a seat on his desired flight.

In addition to the above general factors affecting all markets, there are other factors that may be particular to individual routes to influence demand. Demand for holiday trips is related to the tourist attractiveness of particular destinations. In order to be attractive and have tourist potential, towns must enjoy certain unique preferably scenic, climatic, historical or cultural

advantage. In addition, they must have the right infrastructure to cater for tourist needs. And these facilities have to be priced correctly for the market they hope to have.

Despite the fact that air travel demand is determined by the above major fundamentals of economic factors like price of air travel and disposable income, air transport system is not free from the influences of government regulation. Thus, the other major factor which affect air transport demand is government policy. These policy regulations are both economic and non-economic in character, and may well place severe limitations on airlines' freedom of action (Doganis, 1995). For the purpose of this paper, the focus will be only on economic regulation.

The government in general has five crucial aspects of economic regulation to effectively determine the nature of air transport industry:

1. The control of passenger and freight tariffs.

2. The control of frequency and capacity.

3. Control entry into and exit from the industry.

4. Control mergers and inter carrier agreements and

5. Investigate deceptive trade practices and unfair method of competition. (Bailey, Grahma and Kaplan, 1991)

Richmond, (1971) as quoted by Doganis (1995) argues that economic regulation in air transport sector is justified because air transport is not a natural monopoly; unregulated, this competitive market may have adverse consequences for the public at large. In addition to

this, since this sector shows strong oligopolistic tendencies, absence of any regulation would inevitably lead to wasteful competition.

The other economic argument by the same author favoring regulation is based on the concept that air transport is a public utility, or at least a quasi-public utility. Thus, this industry needs to be regulated in order to ensure that any benefits are not jeopardized. These benefits are assumed to be not only economic but also strategic, social and political.

On the other hand recently, there are economists who argue that there is a need for deregulation of the air transport sector. This is mainly because a major concern of those regulating the industry had been to protect license holders, with comparatively little regard given to matters of efficiency or the interests of consumers. Therefore deregulating or relaxing the regulation in this sector would provide considerable benefits for consumers by creating competitive environment (Williams, 1996).

Balassa (1984) also argues in favor of deregulation. According to him, in developed countries, distortions in the product and service market may result from government intervention in the form of price control and limitations on competition. Among services he singles out transportation, which is often subject to regulations in most developed countries. However, deregulation in the United States appears to have importantly reduced the cost of air and surface transportation. This, occurred as competition, has led to the streaming of operations and to reductions in featherbedding practices.

Based on the above-presented theoretical framework, in the next section, an empirical evidence of air travel demand is presented.

3.2 A Review of Empirical Evidences

Most econometric demand models of air traffic, formulated by the above-mentioned framework, tend to be based on simple or multiple regression models where traffic is a function of one or more independent variables. The two variables most frequently used are the airfare and some measures of per capita income.

The hypotheses that price of air travel, income and quality of service mainly determine air transport demand has been tasted by several economists mainly in the context of developed countries. One such model was developed in 1977 for forecasting demand for Air Algeria traffic between Algeria and France. The data used for the time series analysis on which the model based on incorporates eight years 1968-1975. Using ordinary least square estimation the model establishes a price elasticity of -1.4 on the Algeria Paris route and an income elasticity of 1.4, with high t - test value which validate the significance of the coefficients (Doganis, 1995).

Mellman R., Nellson, M. and Pino J. (1980) tried to test the above hypothesis using a time series data for passenger traffic demand at Boston's Logan Airport. Two explanatory variables, regional income and airfare rate, were included as major determinants of demand for air travel in the model. The authors of the study acknowledged the relevance of other factors such as scheduled frequency, reliability, population size and the price and quality of services provided by competing modes, but they argued practical considerations prevented from conducting a more detailed analysis by including these variables. Using a regression analysis, the model resulted in a fare elasticity of –0.7 and income elasticity of 1.7 with a reasonable high t-value, which imply the significance of the coefficient utilised in the model.

Lic. Lenc Rodriques (1981) tested the hypothesis i.e. effects of income and price on Mexico's domestic travel demand. The price of air travel was represented by airline's yield, measured in real terms, while income explained using two "income type" variables, the first is the measure of real output of the Mexican economy excluding exports of petroleum and the second a measure of the international buying power of petroleum exports. Using this model he found an average income and price elasticity of 2.4 and –1.1 respectively.

On a report presented by International Air Transport Association (IATA), Report TP 2046 (1979), the Canadian Air Transport Administration produced annual passenger travel forecast for 25 largest regional airports. In this study, the aggregate domestic passenger's demand is specified as a function of real per capita income and airfare level. A cross section analysis based on the date acquired from the different areas of the country where the 25 airports situated resulted in an income and price elasticity of 1.4 and -1.5 respectively.

The International Civil Aviation Organisation (ICAO) manual on Air Traffic Forecasting (1985), in line with the above mentioned hypothesis, presents several studies conducted by many organisations around the world (Australian International Travel, Riyadh Airport, European Airports, Canadian Airline study, ICAO global Study, ICAO Asia Pacific Study, ICAO Latin American study and ICAO Middle East Study). A range of different income- type variables, including gross national product, import plus exports, and consumption expenditure have been used to represent market size and spending power. Similarly, most of these studies used two types of price/fare of air travel variables i.e. average fare and yield measured by gross passenger revenue divided by passenger kilometres performed. Using these variables the regression result shows that the demand elasticity that is related to income type factors

ranges from 0.8 to 2.5. This high elasticity implies that economic growth has usually made a major contribution to historical traffic growth (DOC 8991-AT/722/2, 1985).

Accordingly, most of the fare/price elasticity in the above mentioned studies ranges between -1.5 to –0.7. This elasticity indicates that the decline in fare/price of air travel, in real terms, which has generally occurred in the past, has made a significant contribution to traffic growth (DOC 8991-AT/722/2, 1985).

Most econometric studies do not consider the effect of service on demand. A difficulty in measuring the impact of changes in service levels on market demand arises because of the interaction between the demand for, and the supply of, airline service. When analysing the relationships between traffic trends and changes in service frequency over time, or between traffic and frequency differences across O-D pairs, the problem becomes one of identifying the extent to which frequency determines traffic levels and vice versa (DOC 8991-AT/722/2, 1985).

Nevertheless, there have been some statistical analyses using time series and cross-sectional data and specialised regression techniques which have sought to estimate the response of demand to frequency, making allowance for the reverse influence of demand on frequency. One such study was based on cross-sectional data for a carefully chosen sample of monopoly flight demand equation included both flight frequency (reflecting the choice of flight available) and average load factor (reflecting seat availability) as independent variables. The elasticities with respect to flight choice and seat availability were estimated to be 0.76 and 0.85 respectively. In other study, the level of service was defined as a ratio of non-stop jet

flight time to the sum of average passenger travel time and time between desired and actual departure. This measure of service reflected not only flight frequency, but also stops and connections and aircraft speed. The regression analysis was based on 15 large long-haul market in the United States over a six-year period and produced a service elasticity of 0.43. (Ippolito R.A. , 1981; Eriksen S.E. and Lin E.w. ,1979)

However, the influence of service factors may be particularly important for certain routes. For example, demand is more sensitive to frequency in markets consisting predominantly of business travellers, for whom time is valuable, and in short-haul markets where competition from other modes may be considerable. Furthermore, in some developing regions, the rate of increase in air transport service frequencies may be such that the contribution of service improvements to the growth in traffic demand is substantial even given modest service elasticities. (DOC 8991-AT/722/2, 1985).

As discussed above, there are various factors, which have affected and will affect traffic volumes. However, it can be safely argued that air travel is primarily determined by income and the cost of air travel as well as price of competing service.

The next section review past studies conducted in relation to air transport demand in Ethiopia.

3.3 PAST STUDY RELATED TO ETHIOPIA

Eventhough there is no detailed empirical study made by Ethiopian Airlines and The Ethiopian Civil Aviation Authority on air transport demand in Ethiopia, there are several documents that assess the air transport sector of the country. One document worth mentioning in this regard is the Survey of Ethiopian Civil Aviation prepared by the Federal Aviation Agency in 1964.

In this document, it is explained that Ethiopia has the potential for great economic and social advancement. The agricultural and industrial Potential of the country is promising. The large hydroelectric potentials, combined with an easily trainable labour force could foster industrialisation. Agricultural studies had proved that the good climate, and some of the richest soil on earth with proper utilisation of its water resource could double, if not triple, the agricultural production of the country. Based on estimate of the enormous economic potentials of Ethiopian economy, the study showed the key role to be played by air transportation in the realisation of this potential (FAA, 1964).

The document also explains that Ethiopia could demonstrate its potential to be one of the emerging economies of the time. This perception is attributed to the fact that the country had vast and potentially rich resources awaiting development. And since the country lacks the surface transport network the study consider air transport as substitute to play a remedial role in penetrating the vast resourceful areas and there by establishing communication links. Thus, it may be said that the study envisaged the growth of air transport as being a partner in the development of the country's economy. That notion could well be appreciated by the fact that,

in 1964, the Ethiopian Airline used to operate 30 schedule air transport services domestically and 13 internationally.

However, the perception that Ethiopia could become an emerging economy turned out to be in the negative. The 1973 drought, the bad media coverage on the 1974 revolution, the oil crisis and its resulting effect in price increment which had been prevalent between the period 1974 through 1981 and the government's restriction on tourist travel were all to blame.

Accordingly, the demand for air travel both domestically and internationally declined for the same reasons mentioned above. To overcome the high cost and the problem of weak traffic, the Airline was forced to increase its tariff and suspend various domestic stations such as the one at Hossana, Ghinir, Mendi, and Nejo in May 1974 (Baharu, 1998)

The observation on the preceding paragraphs shows a relation between the economic performance of a country and air transport demand. There are also other external factors like the oil crises and its consequences. As oil price goes up, airlines may incur additional cost that would otherwise be not. So as to compensate the additional cost, airlines may be forced to increase their tariffs thereby making the once affordable airfare unbearable. Hence, this cycle confirms that the demand for air travel and airfare are inversely related while the demand and income is positively related.

Contrary to the studies discussed in1970's, some studies conducted by Ethiopian Airlines and Ethiopian Civil Aviation Authority in the 1980's make optimistic remarks on Ethiopian air transport demand. According to the Ten Year Plan (1985-1994) of the Airline, the

international passenger and cargo traffic are estimated to grow at annual average growth rate of 7.8 and 9.8 percent respectively while the domestic annual average growth rate are 9.8 for passenger and 9.1 for cargo. These analyses of demand mainly depend on the historical traffic data with out considering the economic performance of the country or other factors that affect air travel demand.

Furthermore the Addis Ababa International Airport Master Plan Study for the year 1991-2010 demonstrated that in this period there would be an increase in the international and domestic air travel demand. To justify the forecast the study subjectively assesses all the necessary economic and social factors that affect air transport demand.

Nathan Associates (1993) also conducted a study at Addis Ababa Airport and claimed that they developed a multiple regression model that forecast the growth of passenger and aircraft movement at the airport. According to this study, there was a high correlation between income and passenger movement and presented an over optimistic forecast of future aircraft and passenger movement at the airport. However, information was not presented how the model was constructed and it also did not measure price and income elasticities of demand.

Lovink (1999) using a data from 1992/93 up to 1997/98 argues that the correlation between the growth in real GDP and the number of international passengers has been fairly high while that between GDP and the number of domestic passengers has been very low. However, the writer does not show the strength and stability of correlations.

So far, based on various literatures, this chapter of the paper provides some insight regarding major determinants of air travel demand. Besides, it is presented some conceptual background regarding regulation and deregulation in the airline industry. In light of the theoretical back ground and empirical results reviewed above, chapter four and five are devoted to examining the economic regulation of domestic air transport and developing air transport demand model in Ethiopia respectively.

CHAPTER FOUR

Evaluating Economic Regulations of the Domestic Air Transport in Ethiopia

When the Paris convention, signed in 1919, accepted that states had sovereign rights in the air spaces of their territories, direct government intervention in air transport became inevitable. As a result, the free trade *(lassies-fare)* approach towards international air transport in the early years of aviation was gradually replaced by an economic regulation since a country's air space became one of its valuable natural resources. Following this, countries began to regulate their domestic air transport systems essentially by determining which airlines, types of aircrafts used and their capacity, flights frequency, routes and passengers and cargoes tariffs (Doganis, 1995).

From an economist's view point, the price, capacity and entry together effectively determine the nature of any industry including airlines, for they regulate the entry of firms into the market, the degree of pricing freedom and the nature of controls on production, if any (Doganis, 1995).

Economic regulation often extends as well to controls on mergers and acquisitions, to limit the extent of foreign ownership and prohibition of anti -competitive behaviour.

In Ethiopia the recent broad Government policy objectives, strategies and priorities were manifested in the policy framework paper for economic reform for the year 1998/99-2000/01. In this document [prepared by the Government of Ethiopia in collaboration with the International Monetary Fund (IMF) and The World Bank (1998)] it is clearly expressed that the government is committed to give the private sector a substantial role for the economic

development of the country. To this end, the government outlined a program focused on economic stabilisation and structural reform measures, particularly in the financial sector, public enterprises and civil service areas, aiming at removing cost and price distortions, and improving market-related incentives so that progressively liberalising the economy and reducing the role of the public sector.

According to the same document the long-term development strategy that the government follows to fulfil its objectives, such as limiting the role of government to selected economic activities and promoting greater private sector initiatives in services and investment, is agricultural development led industrialisation. This strategy believed to be the best alternative to foster the overall economic development of the country by enhancing efficient allocation of resources, improving the role of market and strengthening the legal and regulatory framework.

In Ethiopia, Economic regulations of the transport sector including air transport are the jurisdiction of the Ministry of Transport and Communications. The long term air transport policy document issued by the Ministry that worth mentioning here is the draft strategy paper for Transport and Communication (1993). This document reviews the major problems of air transport in the country and formulates the following broad objectives for the civil aviation sector.

1) ensure regular, economical and safe air transport services to the major administrative regional cities and towns, tourist and industrial centres of the country,

2) encourage regular and ad-hoc air service operations to more towns and remote settlement areas,

3) support the national carrier to maintain its international air services by making the country an air transport destination,

4) create the necessary flexible conditions for the operation of charter and non-scheduled international air transport to develop the country's tourist and trade potential, taking the interest of the national carrier into consideration,

5) encourage the development and expansion of agricultural -spray activities in particular, and general aviation in general.

Although the document defines the major objectives in the civil aviation sector, it does not address the issue of how the domestic air transport is to be regulated with regard to entry, price, scale of operation, etc. Nonetheless, it is abundantly clear that the domestic air service in Ethiopia had been tightly regulated. This can be substantiated from the fact that for more than twenty years, that is until June 18, 1996, the domestic air service was provided only by one Government enterprise, Ethiopian Airlines. Besides, the fare level of this service was artificially depressed until mid 1999 and it is tightly regulated by the Government to date.

Based on the recent policy framework for the country, the Government of the Federal Democratic Republic of Ethiopia issued the Investment Proclamation No.37/1996 in order to fulfil one of the objectives of its economic policy. The proclamation is believed to play a

crucial role in stimulating the participation of private investment so as to promote the economic and social development of the country.

Accordingly, the domestic air transport has been moderately re-opened to private participation by this proclamation beginning 18 June 1996. The Federal Democratic Republic of Ethiopia's Investment proclamation No.37/1996 declares this sector open for Ethiopian nationals using aircraft with a seat capacity of up to 20 passengers or with a cargo capacity of up to 2,700 kg.

Despite the Government's objective to enhance private participation in different sectors of the economy, it is clearly seen from the proclamation that there are some sectors exclusively reserved for the Government. Among these sectors is air transport service rendered using more than 20 seat or 2700 kg.

Besides, though the proclamation permits foreign investment in different sectors of the economy, the airline industry is exclusively reserved for Ethiopian nationals. This shows the Government's commitment to keep the air transport sector purely under Ethiopian control. Here one may reasonably argue that, this restriction may limit the emergence of new airlines mainly because there may not be many Ethiopians with sufficient financial resources and experience to establish new airlines.

Furthermore, though the government claims that direct price controls are virtually eliminated, and internal marketing, transport and commerce are liberalised (deregulated), the air transport sector falls outside this category. To date, this sector remains tightly price regulated. Also, government strictly regulates entry and the services provided.

Moreover, though the investment proclamation allows private participation in this sector, there is no detailed guideline issued by Government following the proclamation regarding the economic regulation the sector. Without such a guideline it would be too difficult to regulate to what extent the entry stretches i.e. the number of airlines allowed to operate, where, how often and the optimal prices to be charged. Since the domestic air transport system is not virtually deregulated the government has to design a guideline that induce investors and ensuring stable and regular scheduled service so as to protect the public interest as well.

In addition to the qualitative policy restrictions, the following paragraphs demonstrate to what extent the domestic scheduled air transport service is open for private participation using quantitative information.

Comparison of Estimated Total Direct Flying Cost for Ethiopian Airlines DHC-6, FK-50 and B-737-200 Domestic Services, Year Ending June, 2000

Table 4.1

Aircraft type	Per block hour	Per km. flown	lable seat km.
DHC-6 (18 seat)	3262.86	13.76	0.76
FK-50 (50 seat)	8168.44	25.23	0.49
B737-200 (115 seat)	23552.11	39.46	0.34

Source: Ethiopian Airlines Financial Report, Year ending June, 2000

Though there are exceptions, as a general rule the larger an aircraft is the lower will be its direct operating cost per unit, measured by cost per tonne-kilometre. In other words, other things being equal, the direct operating costs of aircraft do not increase in proportion to their size or there pay load capacity. The cost per hour of the largest aircraft will be higher than that of a smaller aircraft; but when converted to a cost per seat-kilometre, it is lower (Doganis, 1995).

Accordingly, the table above shows the unit cost savings achievable when substituting a Fk-50 for the DHC-6 and then when replacing the FK-50 with B737-200. The table also shows clearly how the lower cost of DHC-6 per block hour increases when calculated per kilometre flown due to the low speed of turbo-prop aircraft. Then, when recalculated per available seat-kilometre the cost of the DHC-6 becomes dramatically high, because of its much lower number of seats compered to other aircrafts.

The above observation substantiates the argument that an aircraft's capacity and unit cost are inversely related. This shows that, other things being equal, an airline operating with higher capacity aircraft usually has a comparative advantage since its unit cost is lower. Accordingly the data in table 4.1 reveals that with the existing fare structure, it is impossible for private investors to enter the domestic scheduled air transport market with an aircraft capacity of 20 seats. This is mainly because when the indirect cost around 0.06 cents per kilometre included in it, the direct flying unit cost, which is around 0.76 cents per kilometre, will become necessarily higher than the average unit revenue of 0.77 a service provider is allowed to charge by the Government.

In addition to this, the Ethiopian Civil Aviation Authority restricts private operators not to station their aircraft at Addis Ababa Bole International Airport because of congestion. This exposes the private airlines for extra cost since the majority of the market is in Addis. For example, an airline that has to transport passenger or cargo from Addis Ababa to Bahirdar but whose principal base of operation is at Jimma is forced to incur additional costs between the sectors of Addis -Jimma because of this restriction.

Assuming even the government's restriction on fare level is eased and there is a positive margin of profit for an airline that serves the domestic market using 20 seat aircraft, It may not be possible for private operators to engage in the market. This is because the Ethiopian Airlines has a freedom of utilising least cost larger capacity aircrafts in the domestic market while the newly emerged airlines are restricted by the proclamation only up to 20 seats or 2700 kg. In other words, they will be forced to engage in an unfair competition.

The above observations can be further substantiated from the fact that the limited number of private applicants for participation in this sector. Since the investment proclamation was issued on June 18, 1996, it is only four applicants who have showed interest to enter this market. Out of which only two are presently engaged in providing air transport services. And these operators only perform non-scheduled service where price is not regulated.

The freedom to operate with aircraft up to 20 seats or 2700 kg. is not necessarily minor, especially where most markets are small and several of the airstrips do not allow the operation of large aircrafts. Nevertheless, considering the existing fare structure and in condition where there is no detailed guideline of economic regulation to create a favourable environment for private investment in the sector, it can be safe to conclude that the investment proclamation

No.37/1996 plays no significant role in enhancing the capacity and competition in the overall domestic passenger air transport service, and none in the scheduled one.

CHAPTER FIVE:

MODEL SPECIFICATION AND EMPIRICAL RESULTS

5.1 Model Specification

The functional form employed in this study is the double log function. This kind of model specification has been widely used in different demand studies of air transport industry and found to give a reasonably good fit [see ICAO Doc 8991-AT/722/2(1995), Alamdari and Morell (1996)].

Eventhough a number of problems appear to be associated with this functional form such as not satisfying the additivity requirement in that the weighted average of expenditure elasticity is not necessarily unity, and that the sum of predicted expenditure on individual item given a certain total expenditure does not necessarily equal with that of total expenditure, the easy comprehensibility of the elasticity concept and the fact that elasticity's are pure numbers leads the double log specification as one of the most important tool in the empirical demand analysis. (Deaton and Muellbauer, 1994).

Accordingly, the scheduled domestic air travel demand equation for essential variables can be specified as follows: -

$$\log NPAX = a_0 + a_1 \log GDP + a_2 \log YLD + a_3 \log AAMT + a_4 \log PCS + u \quad (5.1)$$

$$(+) \qquad (-) \qquad (-) \qquad (+)$$

Where:

NPAX number of revenue passengers travel by air in the domestic air transport network

GDP Real gross domestic product

YLD Domestic scheduled airline passenger yield in real terms. This variable measure the average revenue obtained per available passenger kilometer.

AAMT Access to alternative means of transport measured by the available road length through time.

PCS Price of competing service. i.e. the fare level of 'cross-country' buses that serve destinations more than 250-km.

μ The error term

It may be possible to argue that the above model for scheduled domestic air travel demand is not comprehend all the variables that affect it. For example, it is possible intuitively to suggest that the demand function have to be restrictive since there are peoples in the country who want to travel by air but may not get the access due to lack of the service and the necessary facility in their vicinity. However it is not possible to get sufficient data in order to estimate a restrictive demand function. Nevertheless, looking at the available data set and reviewing various empirical studies on the same area, this model is expected to give a better insight concerning the determinants of domestic scheduled air transport demand. To this end, therefore, this study attempts to model the most relevant factors in determining the domestic air travel demand in Ethiopia.

5.2 Identification of the Determinants

Chapter three of this paper has reviewed some of the theoretical and empirical studies pertaining to factors underlying the air transport demand. So based on the reviewed studies, in this section we identify the variables that are retained in the model. In identification of variables it is important to include only those variables which theory, experience and intuition suggest may be most essential for the case under consideration. To this effect, the major variables considered as the determinants of the scheduled domestic air travel demand in econometric model presented in equation (5-1) are identified in the following section.

5.2.1 Size and Spending Ability of the Population

The state of a country's economy is an essential determinant of air travel demand. Thus, based on various trends of fundamentals of economic growth, air travel demand may vary from one country to another. Most economic literatures and empirical findings show that the demand for air travel increases during prosperous times and declines in periods of recession.

Based on the above premise the income level used in the model is represented by the GDP of the country. This is mainly because GDP measures the level of income of the country through time. The functional relationship between income and the demand for air travel is expected to be positive.

5.2.2 The Price of Air Service

The demand for air travel, as any other goods and services, depend apparently on price (fare) level. Other things being equal, price and travel demand are expected to have inverse relationship. Thus the expected sign of price level will be negative.

The measurement of the price of air travel is usually complicated by the presence of fare type (first, normal, economy, excursion etc.). A simple measure of price may be calculated as an average of various fares weighted to account for their relative importance in the traffic mix. However, when and where available, airline revenue yield per passenger-kilometer or tone-kilometer is considered as one of the best variable that can be used as a measure of price. (Doganis, 1995 ; Doc 8991-AT/722 /2)

Hence, the Ethiopian Airlines passenger revenue yield data is used as a proxy of price (fare) level in the model utilized by this study.

5.2.3 Access to Alternative Means of Transport

In a country like Ethiopia where many places are devoid of other means of transport, there is a perception that some part of the demand for air travel may result from lack of alternative means of transport. Though air transport is one of the costly services, the people in some areas of the country do not have any option but to travel by air transport. For example in the 1960's

air transport was the only alternative to travel to Bale, Gode etc. This situation is also true at present in some parts of the country. Thus, it is necessary to consider this phenomenon in the air transport demand model.

To accommodate this variable in the model the available road length in kilometers through time is used as a proxy. When the length of road increases the demand for air travel is expected to decline. This is mainly because people who travel by air as a result of lack of access to other means of transport can shift to alternative means of transport (road transport) when availability of road increases. Thus, the expected sign of this variable in the model is negative.

5.2.4 Price of Competing Service

The demand for air travel is affected to some extent by the performance of alternative means of transport. This is because of factors such as travel time, frequency, safety and the price level. In this study, the price level is considered the most important variable to determine the substitution effect i.e. to determine the choice either to travel by bus or aircraft. The effect of price (fare) level of alternative means of transport on air travel demand is expected to be positive.

In this study, the variable that is used as a proxy for the price level of alternative means of transport is the fare charged by 'cross-country buses'. These buses provide service for distances of more than 250 km. between their originating and destination points. To use this fare level as a proxy may be reasonable, mainly because the mentioned buses are the only option (except Dire-Dawa) for passengers to travel to major destinations where air transport service is provided.

5.3 Methodology

The classical regression model assumes that in regression analysis the dependent as well as the independent variables have to be stationary. Nevertheless, most time series data of economic variables exhibit long-run trend movement. Thus conducting regression analysis using ordinary least square (OLS) technique based on this data series in levels resulted in a spurious result. Hence, it is necessary to make the data series stationary before regression in order to avoid spurious regression result. This could be done possibly by differencing the data series and most of time series data became stationary after first difference [see Madala (1992), Thomas, (1993), Harris (1995)].

Since running a standard regression analysis on a non-stationary data series resulted in a spurious result, it is obviously necessary to test the variables for stationarity before estimation is conducted. To this end, the augmented Diky Fuller and Philliphs Peron tests for unit root is applied to test the hypothesis of stationarity. The result suggests that all the variables are non-stationary in levels while their first difference is stationary. This implies that they are all integrated of order 1 i.e. I (1). The result is reported in table 5.1.

Eventhough the variables utilized in this study are stationary at their first difference estimating the model using these transformed variables would only give the short-run dynamics. However, it is intended to determine the long-run equilibrium relationship as well. Thus it is necessary to introduce the concept of co-integration in order to determine if there exists a

long-run equilibrium relationship or not. To this effect, the Johansen (1988) Maximum likelihood methodology is introduced since it makes possible to estimate both the long-run equilibrium and short-run dis-equilibrium relationships. This is proved by Engle and Granger (1987); if an equilibrium relationship exists (if two variables are co-integrated) then the short run dis-equilibrium relationship between the co-integrated variables can be represented by error correction model ECM-a model which combines both the long-run equilibrium and the short-run, dynamics. However, if no equilibrium relationship exists then it is only possible to estimate the short-run dynamics.

5.4 Empirical Results

5.4.1 Time Series properties of Variables

As it is indicated in the previous section, it is important to investigate the time series properties of the variables used in the model before estimation. To this effect, the following table summarises the results of tests for unit root using augmented Diky Fuller and Philliphs Peron tests. Based on these tests, all the variables, which will be utilised in the co-integration analysis in the following section, are tested for their order of integration. The finding suggest that all variables are integrated of order one [I (1)].

Table 5.1 **Results of Unit Root Test**

Series	ADF test with trend and constant; and two lag ADF critical values; 5%=-3.58 1% = -4.323		Phillips pheron test with trend and constant PP critical values:1%=-3.6576 5%=-2.9591	
	Level	1st Difference	Level	1st Difference
NPAX	-2.9442	-7.1754*	-0.03309	-8.12586*
GDP	-3.4717	-19.592*	-3.23084	-4.00687*
YLD	-3.1014	-7.4384*	-2.73851	-8.5778*
AAMT	-2.5483	-3.22344**	-1.14775	-2.63866**
PCS	-2.3122	-7.2564*	-2.11367	-7.47228*

- *and **, implies rejection of the null hypothesis of non-stationarity at 1 and 10 percent respectively.
- The lag truncation for Bartlett Kernel is 3
- All the variables are in log form

5.4.2 Co-integration Analysis and the Vector Error Correction Model

The Johansen procedure of co- integration analysis assumes there is no a priori categorizing of variables as endogenous and exogenous. Thus it can be possible to represent the variables in equation 5-1 by a vector Z_t and specify a model as an unrestricted vector autoregression (VAR) involving up to K-lags of Z_t:

$$Z_t = A_1 Z_{t-1} + \ldots\ldots + A_k Z_{t-k} + U_t \qquad U_t \sim IN(0,\Sigma) \qquad (5\text{-}2)$$

Where Z_t is an (n-1) variables matrix and each of A_i is an (n × n) matrix of parameters. U_t is independently and normally distributed with mean of null vectors zero and vector of variances Σ as shown on the above equation(5-2). This system of equation is in reduced form with each variable in Z_t regressed on only lagged values of both itself and all other variables in the system. The vector error correction model can be reformulated from equation (2) as follows: -

$$\Delta Zt = \Gamma_1 \Delta Z_{t-1} + \ldots\ldots + \Gamma_{k-1} \Delta Z_{t-k+1} + \Pi Z_{t-k} + U_t \qquad (5\text{-}3)$$

Where $\Gamma_I = -(I - A_1 - \ldots\ldots - A_i)$, $(i = 1\ldots, k-1)$ and $\Pi = -(I - A_1 - \ldots. - A_k)$. Since the estimates of Γ_i represent short-run adjustment while Π represent long-run information, the short- and long–run adjustment to changes in Z_t can be captured via the estimates of Γ_i and Π respectively. In the case where there is a reduced rank, it is proved that $\Pi = \alpha \beta'$ (for the proof see Harris, 1995). Where the α matrix represents the speed of adjustment to dis- equilibrium, and β is a matrix of the long-run co-efficient. Thus the term $\beta' Z_{t-k}$ embodied in equation (5-3) represent up to (n-1) co- integrating relationships in the multivariate model which insure that Z_t converge to their long- run steady state solution.

Assuming Z_t is a vector of non stationary I (1) variables, then all the terms in equation (5-3) which involve ΔZ_{t-1} are I (0) while ΠZ_{t-k} must also be stationary for $U_t \sim$ I (0) to be 'white noise'. There are three instances for the requirement that $\Pi Z_{t-k} \sim$ I (0) is met: -

1) When all the variables in it are in fact stationary
2) When there is no co-integration at all which imply there are no linear combination of Z_t that are I (0) and Π is an (n×n) matrix of zero.

3) When there exist up to (n-1) co- integrating relationship (Harris, 1995).

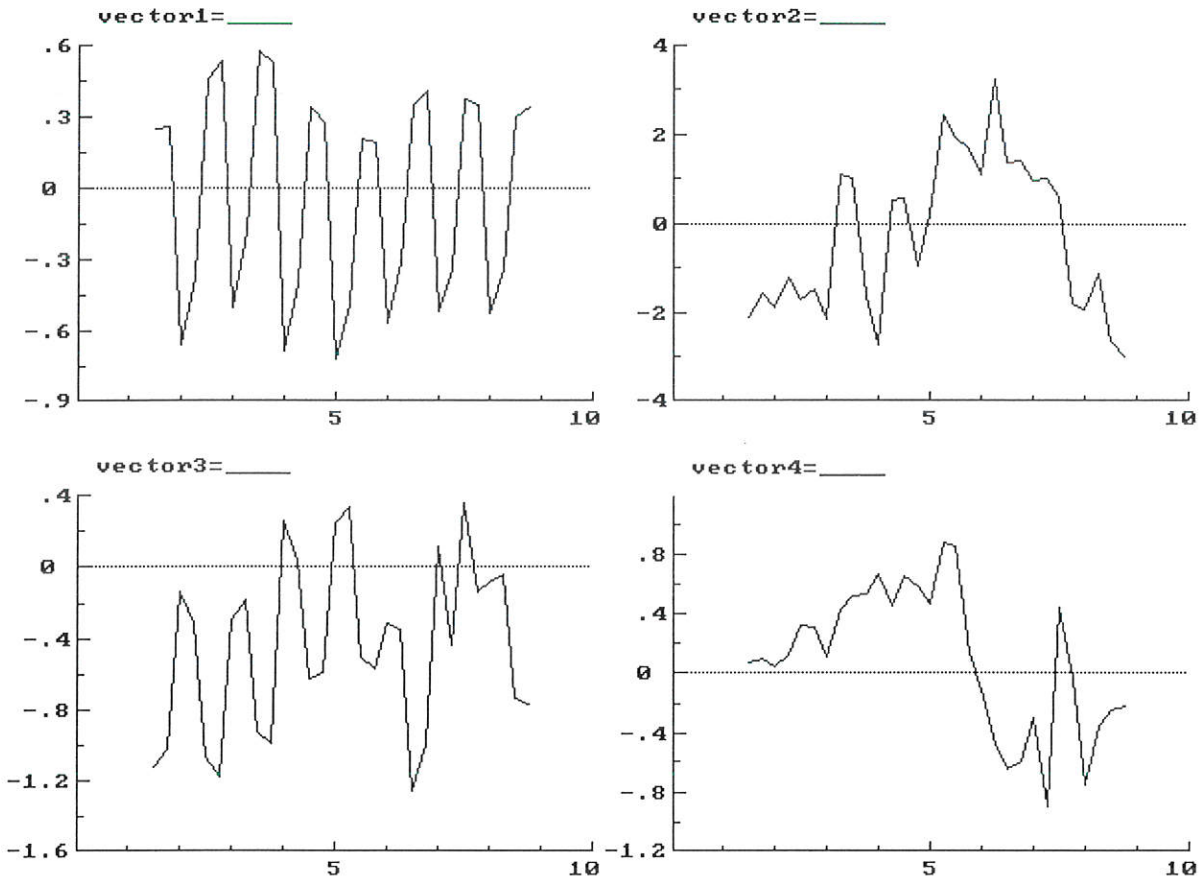
In this study, it is assumed that there will be up to (n-1) co-integration relationship. Since all the variables involved in equation one are I (1) as shown in the previous section, it is necessary to determine the co-integrating vectors that span long-run relationship. In doing so the estimates of α and β will also be generated as well. However, it is worth examining the data congruency of the VAR before determination of the co-integration rank. Thus, the Shwartz Bayesian criteria (SBC) and Hannan -Quinn (HQ) statistics are used, and according to these tests' the first order VAR is selected as an appropriate specification. Following this, the Johansen Maximum likelihood procedure is used in order to test for co -integration and determine the long-run parameters of equation (5-1) using a quarterly data series from June 1992 - June2000. The results are summarised in table 5.2.

Table 5.2 Test for number of co-integrating vector.

Ho:Rank =P	λ Max	Reimner adjusted	95%	λ trace	Reimner adjusted	95%
P = 0	69.53**	46.36**	34.4	115.3**	76.86*	76.1
P 1	17.88	11.92	28.1	45.76	30.51	53.1
P 2	13.81	9.21	22.0	27.88	18.59	34.9
P 3	7.312	4.87	15.7	14.07	9.38	20.0
P 4	6.758	4.51	9.2	6.758	4.51	9.0

As it is clearly seen in table 5.2, the null hypothesis of zero co-integration is rejected. Both the λ trace and λ max statistics for the significance of the eigen vectors support one co-integration vector. The result is unaffected even when both of the statistics are adjusted for the degrees of freedom. The co-integration graphics also support that the one co-integrating vector as the most significant (see figure 5-1).

Figure 5-1 **Co-integration vector graphics**



Since the co-integration rank is determined it is possible to impose a rank restriction in the co-integration space. The result of the rank restriction for one co- integration vector along with the standardized α and β is summarized in table 3. Tests for vector serial correlation and normality do not detect serial correlation and normality problem respectively.

Table 5.3 **Results of co-integration Analysis** (PCFIML Output)

Standardised β' eigen vectors					
LNPAX	LGDP	LYLD	LAAMT	LPCS	Constant
1.000	-3.244	0.9911	2.003	0.03600	-8.711
Standardised αcoefficients					
LNPAX	-0.01283				
L GDP	0.3273				
LYLD	- 0.04463				
L AAMT	-0.02552				
L PCS	-0.2536				
Diagnostic Tests Vector AR 1-2 F(50,12) = 1.267 (0.3411) Vector Normality X(10) = 5.4198 (0.8614) Variable entering unrestricted: Constant.					

As it is shown in table 5.3, the β' eigenvector is normalized with respect to the demand for air travel. The next step that follows here is that to test for the long-run weak exogeniety and identify the unique co-integrating vector.

Imposing zero restriction on the α coefficients along with identifying β vector is necessary to conduct a test for weak exogeniety. The test is based on the LR test with asymptotic χ^2 distribution. The result of the test reveals that real yield and real price of competing service

are weakly exogenous while the GDP and access to alternative means of transport (AAMT) are not weakly exogenous (see table 5.4). Thus, it is necessary to test whether there is a causality between the variables that are not weakly exogenous. To this effect, a Granger causality test is conducted and the result confirmed that there is no two-way causality between them. This implies that we do not have a serious problem of endogenity in modeling the short-run dynamics.

Table 5-4 **Test for zero restriction of α coefficients**

	NPAX	GDP	YLD	AAMT	PCS
α-coefficient	-0.01283	0.3273	-0.04463	-0.02552	-0.2536
LR-test:$\chi^2(1)$	19.62	43.55	0.0739	24.98	4.532
p-value	0.0000**	0.0000**	0.7857	0.0000**	0.3205

The structural long-run relationship derived from the co-integrating vector normalised with respect to NPEX can be presented as: -

log NPAX = 8.711+ 3.244 log GDP - 0.991 logYLD - 2.00 log AAMT - 0.036 log PCS

Besides, the coefficients of respective variables in the above long-run equation should be tested for their significance to determine which variables uniquely constitute the co-integrating vector. This can be done employing the LR test by imposing zero restriction on each variable of the long-run parameter. The test rejects the zero restrictions for all variables, except real price of competing service (PCS), implying that they are significant (see table 5-5).

Table 5-5: **Tests for Zero Restrictions on the Long-run Parameters**

	NPAX	GDP	YLD	AAMT	PCS
β-coefficient	1.00	-3.244	0.991	2.003	0.036
LR-test:X2(1)	34.13	43.55	11.47	24.98	14.21
p-value	0.0000**	0.0000**	0.0062**	0.0000**	0.4256

** Rejection at 1% level of significance.

The above result shows that the sign of the price level of alternative means of transport is unexpected and insignificant. One of the possible causes may be arise from the gap between the airfare and the price charged by surface transport (buses) providers is too high. In the Ethiopian context it is true that the consumers who travel by surface transport (bus) are usually more sensitive to price than comfort, safety and time. Thus, the insignificance of this variable is not a surprise.

The other variables, namely, income (GDP), real fare (yield) and access to alternative means of transport proxy by road length are statistically significant and the signs are as expected. The result also suggests that the income elasticity of demand is positive and elastic. This is consistent with the theory of demand since air transport can be considered as a luxury good in the Ethiopian context. The price elasticity is unitary implying that there is a proportional decline/increase for air travel demand if the airfare decreases/increase. Access to alternative means of transport proxy by road length is elastic suggesting that in the long-run an expansion of the road network enhance the choice of the public for an access to alternative means of transport. This phenomenon may finally lead the air travel demand to decline by more than proportionally.

The long-run relationship among the variables is identified so far. What remains to complete the analysis in the context of the Johansen procedure is to estimate the co-efficient of the short-run dynamics using the ECM.

Since there is only one co-integrating vector and there is no two-way causality among the variables, there is no need to use a simultaneous equation estimation technique. Thus the ECM (error correction model) is estimated by OLS; and the result is summarized in the following table.

Tabel 4-6: **Results for the ECM**

Dependent Variable is DLNPX		
Variable		
Constant	1.0124	AR 1-3(3,19) = 0.9986(0.420)
DLGDP	0.0113	
DLYLD	-0.9355**	ARCH 3F(3,16) = 1.514(0.2491)
DLAAMT	-0.0404	
PCS	-0.0063	Normality $\chi 2(2)$ = 3.6297(0.1629)
CIVec-1	-0.07857**	
Seasonal	-0.0438*	$\chi 2F$ (11,10) = 0.56499(0.8187)
R2 = 0.87 F (6, 22) = 221.9 DW =1.95		RESET F(1,21) =1.7704(0.1976)

*Rejection at 5% level of significance.

**Rejection at 1% level of significance.

In the above short-run dynamics estimation the necessary diagnostic tests are conducted. The rests (the Breush-Pagaan test of high order serial correlation up to two lags, the auto-regressive conditional heteroscedastic test, the test for normality based on skiwness and Kurtosis, the white test of hetroscedasticity , the specification / hetroscedasticity test, and the remsey's RESET test of functional form, in the order they are reported in table 5) did not detect statistical problem for which they are assigned.

The coefficient of the error correction term is significant with expected sign and reasonable magnitude (-0.08)

In the short-run dynamic analysis, it is observed that only the price of air travel found to be the major determinant of the short-run while income (GDP) and access to alternative means of transport have only long run effect but do not explain the short-run dynamics. To this end, it can be concluded that price of air travel is the most important policy variable in determining air travel demand in the short run.

The result also shows that the fluctuation in GDP does not affect the demand for domestic schedule air transport in the short-run. This may result from the fact that most of the air transport service users are business travellers (including Government officials and employees), tourists and those people who have no alternative means of transport except air transport. For such group of consumers the demand for air travel usually does not fluctuate with respect to GDP (income), especially in the Ethiopian context. In addition, the insignificance of access to alternative means of transport may arise because it takes a long period of time to supply this facility. Besides, most of the consumers who travel by air are

business travellers who are sensitive for time and safety. Thus even if there is an increase in the availability of alternative means of transport in the short -run it may not affect air travel demand due to the mentioned reasons.

CHAPTER SIX

Conclusions and Policy Recommendations

6.1 Conclusions

Air transport has a long history in Ethiopia. However, the role of the private sector in this industry is not impressive mainly because of the thin demand, the required very high initial capital investment, the lack of enough skilled personnel in the area, and the restrictive government policy that preclude the private sector from participation in this sector until 1996, for more than 20 years.

Air transport service had been the domain of the government since 1975 for over 20 years. However, the investment proclamation No.37/1996 issued by the Government of Federal Democratic Republic of Ethiopia in 1996 moderately opens this sector for private investors. Nevertheless, it is proved that the role of this proclamation in enhancing the supply of domestic scheduled air transport service and competitiveness in the sector do not impressive. This is mainly because, given the existing fare level, it is not possible to make profit by providing schedule service with an air craft capacity of up to 20 seats or 2700 kg. Thus, the private sector has not yet started to effectively participate in the domestic scheduled air transport service since its primary motive to enter in any sector emanates from profit.

To create a better environment and enhance capacity and competitiveness in this sector, it is believed that understanding the demand for domestic air travel and its determinants gives a better information for policy makers. To this effect, the scheduled air transport demand

model is formulated and the Johansen maximum likelihood estimation procedure is used in the econometric analysis. In time series analysis using Johnson procedure is superior since it shows the long-run relationship and the dynamics of short-run simultaneously.

The appropriate quarterly data from different sources that cover the period from June 1992 to June 2000 are used in the analysis. The time series property of the data is tested using Augmented Diky Fuller and Philiphs Peron tests for unit root and the result shows that all variables are stationary at their first difference i.e. integrated order one [I (1)].

All the necessary conditions are fulfilled in order to apply the Johansen procedure and to specify the long-run relationship. Besides, the parsimonious error correction model (PECM) is formulated from the long-run model using the general to specific modeling approach of David Henry.

The estimation result shows that the price of air travel, income of the people and access to alternative means of transport proxy by road length determine the long-run demand for air travel while price of competing services has insignificant implication in determine long-run relationship. This may originate because the gap of the price level between the two services is too high as a result travelers who use buses may not easily shift to air transport service even if the surface transport (bus) fare increases significantly. As to the coefficient of the short run dynamics, only that of real yield is found to be significant while the GDP, access to alternative means of transport, and the price of competing services are not significantly different from zero. This implies that, in the short-run, pricing policy is useful to analyze the domestic scheduled air travel demand.

6.2 Policy Recommendations

The initial required foreign currency investment out lay is very high to establish a commercial airline, and also the required personnel have to be highly qualified. Thus, minority ownership of foreigners is recommended mainly because it improves the financial ability of airlines and enhances efficiency.

Since the domestic air transport is not virtually deregulated it is recommended to design a detailed policy guideline regarding price, entry, route, etc. that encourages private investors so as to create a better environment for competition and to increase the available choice of service for the public at large.

The capacity restriction on the private operators has to be eased at least to the extent of using aircrafts that have equivalent capacity with those of EAL's aircrafts. This may encourage private investors to participate in the sector and create a better situation for fair competition and to increase the available service (supply) as well.

Pricing policy is most useful for the government and airlines to control and manage the domestic schedule demand for air travel. Thus, using price as the most significant element in policy designing in this industry helps to enhance competition.

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Appendix 1

Methodology of Quarterly data series generating

1. Number of revenue passenger

A monthly data for the number of revenue passengers is available in the Ethiopian airlines statistical digest report. Thus, the quarterly data easily generated by adding three consecutive months.

2.Gross domestic product (GDP)

Quarterly data of GDP is not available for the country. However, researchers usually generate a quarterly data from the annual GDP using different technique. According to Bahmani-Oskooee (1987:123), the generated quarterly data for GDP should be adjusted in such away that

$$QI + QII + Q\ III + QIV = \text{Annual GDP}.$$

Based on this, since the Ethiopian production is highly susceptible to seasonal variations some adjustment would be made based on derived coefficients with respect to each sector:

Agriculture

Data on labour requirements for each agricultural operation for major cereal crops per hector were obtained from Development Bank of Ethiopia. Based on labour input in agriculture, coefficients for each quarter are derived. That is, the activities are carefully identified in which quarter they are performed and the weight attached to each activity would be used to generate the quarterly data of agricultural GDP.

Industry

Data on industrial public enterprises are available on quarterly basis (MEDaC). These are used to obtain coefficients for the breakdown of the industrial sector. Accordingly, the share for each quarter is determined and the shares for corresponding quarters are averaged to obtain a single coefficient for each quarter.

Service

Quarterly data on the disbursement of loans to distributive service (domestic and international trade, hotels and restaurants and transport and communication) from the banking system are used to obtain coefficients that help to disaggregate the Service Sector GDP. In addition the "Other Services" section of the MEDaC 's classification and assumed to be same over quarters and hence distributed equally to each quarter.

Using the above methodology the GDP data can be generated on a quarterly basis.

3. Price of Air Travel (Yld)

The quarterly data of yield is available in the Ethiopian Airlines statistical digest report. However, there is no air transport price deflator, which is necessary to generate real price through time. Thus, to generate the real price and use it in the study a price index developed using Laspeyres' index or base year method. i.e.

Weighted aggregate index with base year quantity weights = $\frac{\Sigma P_n q_0}{\Sigma P_o q_0}$

Where: P_o - price of the base period

P_n - Price of typical period

q_0 - Quantity of base period

All the information required to generate the index is available in the Ethiopian Airlines statistics digest report as a ready-made.

4. Access to Alternative Means of Transport (AAMT)

The available published information in the Ethiopian Road Authority is organized on a yearly basis. However, the authority has unpublished quarterly data generated using different weight for different season. The latter is used in this study.

5.Price of Competing Service (PCS)

The quarterly data of this variable is available in the various reports of Road Transport Authority. However, the data only constitute the current price level through time. Thus it is necessary to deflate this price using a road transport price deflator. To this effect, a price index is developed using Lspeyres' index.

Weighted aggregate index with base year quantity weights = $\frac{\Sigma P_n q_0}{\Sigma P_o q_0}$

Where: P_o - price of the base period

P_n - Price of typical period

q_0 - Quantity of base period

The price level used to calculate the index is available in the various reports of Road Transport Authority while the number of passengers data is presented on a yearly basis. Thus, to generate the quarterly data for number of passengers and to construct the index an expert in the area from road transport authority consulted and the proper weight is assigned. According to the expert, this weight is usually used whenever a quarterly data required for different purposes.

Appendix 2

DEFINATION OF TERMS RELATED TO AIR TRANSPORT

AIRCRAFT MOVEMENT A take-off, landing, or simulated approach by an aircraft at an airport.

CARGO All freight, air express and excess baggage for which any tariff is charged. Cargo does not include mail and aircraft stores, or passenger baggage for which no charge is made.

CHARTER SERVICE The transportation of passengers or goods by aircraft when a person other than the air carrier operating aircraft, and other than the carrier's agent, contracts for a block of seats or a portion of the cargo capacity for that person's own use or for resale in whole or in units to members of the public.

COMMERCIAL OPERATIONS Flights by aircraft operators licensed by, or operating under permit from the Civil Aviation Authority to perform commercial air services

DEPLANED PASSENGER /CARGO Passenger or cargo off-loaded from an aircraft at an airport. Deplanements apply to connecting traffic (interline and interline transfers) as well as to traffic terminating at that point. If the number of a flight is changed during an aircraft itinerary, all traffic on the flight is reported as deplaned at the point where the number was changed, even though some passenger and cargo remained on board for the next flight stage.

ENPLANED PASSENGERS/CARGO Passengers or cargo loaded on to an aircraft at an airport. Emplacements apply to connecting traffic as well as to traffic originating at the airport. If the number of a flight is changed during an aircraft itinerary, all traffic departing on board the aircraft is reported as enplaned, even though some of the load may have been aboard the aircraft when it arrived at the airport where the number was changed.

DOMESTIC SERVICE Air transportation provided on a flight from one point to another point with in a country.

GENERAL AVIATION Commercial and non-commercial flying which is not air-carrier activity, i.e., flying which does not involve the transport of passengers or goods from one place to another for remuneration.

GOODS TONE-KILOMETRE A unit of measure covering the carriage of one tonne of cargo, or excess baggage through a distance of one kilometre. The carriage of normal baggage not subject to excess baggage charges is included in passenger tonne-kilometres (see definition below).

INTERNATIONAL SERVICE a flight from a point outside of a country to a point in the country or that from a point in the country to a point outside of a country.

.PASSENGER-KILOMETRE A unit of measure of the carriage of one passenger through a distance of one kilometre. A total of passenger- kilometre flown is obtained by summing the number of kilometres flown by each passenger.

PASSENGER LOAD FACTOR A ratio arrived at by dividing the number of passenger kilometres by the number of available seat-kilometre.

PASSENGER TONE-KILOMETRE A unit of measure of the carriage of one tonne of passengers and their allowed baggage weight through a distance of one kilometre. Passengers and their normal luggage are assigned a standard weight per person for this calculation.

REVENUE PASSENGER A Person who pays an air carrier 25 percent or more of the regular economy fare for air transportation services.

REVENUE PASSENGER-KILOMETRES A unit of measure of carriage of one passenger through a distance of one kilometre. A total of passenger- kilometres flown is obtained by summing the number of kilometres flown by each passenger.

SCHEDULED SERVICE Transportation of passengers or goods by aircraft where by the carrier or his agent operates the air service and sells seats or cargo space directly to the public on the basis of a price per seat (per unit of weight or volume of cargo) , or per kilometre.

Declaration

I the undersigned, declare the thesis is my own original work, has not been presented for a degree in any other university and that all sources of material used for the thesis have been duly acknowledged.

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