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THE NEXUS BETWEEN ECONOMIC GROWTH AND PASSENGERS AIR TRAVEL DEMAND IN ETHIOPIA (THE CASE OF ETHIOPIAN AIRLINES)

Msc THESIS

By

SINAFIK ASEGID

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The Nexus between Economic Growth and Passengers Air Travel Demand in Ethiopia: The case of Ethiopian Airlines

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The Nexus between Economic Growth and Passengers Air Travel Demand in Ethiopia: The case of Ethiopian Airlines

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Abstracts

Despite the fact that various studies have proved the connection of air transportation and economic activities, their dynamic short-run and long-run interactions and causality varies between countries and it remains complicated. So, the major goal of this study is to evaluate the nexus and direction of causation between economic growth and air travel demand (domestic and international) in Ethiopia by using ARDL model, pair-wise granger and modified Wald causality tests for the period 1991-2020. Furthermore, for the study period, the study looked at the short-run and long-run dynamic relationship between economic growth, passenger air travel demand, and selected variables (Consumer price index, international tourism receipts, foreign direct investment inflow, official exchange rate and education). Two distinct models were built in this study using air transport indicators, economic growth indicators, and selected factors. The relationship between domestic air travel demand, economic growth, and selected variables was examined in the first model, while the relationship between international air travel demand, economic growth, and selected variables was analyzed in the second model. The results of the ARDL-bound test shows a long-run co-integrating relationship between air travel demand (domestic and international) and economic growth in Ethiopia. The result of causality also shows that, for domestic air travel demand there exist bi-directional causality both in the short-run and long-run, and for international air travel demand, there exist short-run bidirectional causality and uni-directional causality from air travel demand to economic growth in the long-run. Furthermore, domestic air travel demand is only responsive to economic growth in the short term, while economic growth, foreign direct investment, the consumer price index, and international tourism receipts are all relevant in the long run. Economic growth, foreign direct investment, education, the consumer price index, international tourism receipts, and the official exchange rate all play a role in international air travel demand. Finally, the researcher recommended raising income, maintaining Ethiopian airlines' competitiveness by expanding bilateral and multilateral agreements, building airport infrastructure (increasing the number and quality of international airports in the country), and easing bureaucracy for foreign investors, increasing tourism sites in the country, and lowering consumer goods prices to improve Ethiopia's air travel demand performance.

Keywords: Air travel demand, Economic Growth, Short-run and Long-run dynamics, Direction of causality, ARDL Model, Bilateral and multilateral agreements, Airlines Competitiveness, easing bureaucracy.

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Table of Contents

Contents   Page

List of Figures

List of Tables

Acronyms and Abbreviations

ACI- -------------------------------Airports Council International

ARDL------------------------------Autoregressive Distributed Lag

ATAG------------------------------Air Transport Action Group

ETG---------------------------------Ethiopian Airlines Group

FDI----------------------------------Foreign Direct Investment

GBTA------------------------------Global Business Travel Association

GDP---------------------------------Gross Domestic Product

IATA--------------------------------International Air Transport Association

ICAO--------------------------------International Civil Aviation Organization

MOFEC-----------------------------Ministry of Finance and Economic Cooperation of Ethiopia

MWAD------------------------------Modified Wald

OEF---------------------------------Oxford Economic forecasting

PAX-----------------------------------Passengers

USD-----------------------------------United States Dollar

VAR----------------------------------Vector Autoregressive Model

WB- ---------------------------------World Bank

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Air transport, like every other means of transportation, is critical to a country's economy. It plays an important supporting role in worldwide, regional, and local economic growth and prosperity. It also improves people's quality of life by increasing access to jobs, education, health care, markets, social and recreational activities (Baikgaki&Daw, 2013).

As literatures confirmations, air transport activities can have an impact on economic growth through a variety of avenues. Firstly, air travel is an important source of foreign exchange (Van de Vijver et.al, 2014). Second, air travel plays a vital role in driving new infrastructure investment. Third, because of the diverse mix of transportation-related companies, air travel supports other economic sectors through direct, indirect, and induced effects. Fourth, air transportation contributes to the creation of jobs and support economic growth (KağanAlbayrak et.al, 2020). Fifth, air travel generates favorable economies of scale, which helps a country's competitiveness, and finally, air travel is a key factor in the spread of technology.

Furthermore, air travel is a major contributor to global economic development and provides the sole rapid global transportation network, making it critical for international trade and tourism. It is facilitating world trade by increasing access to international markets and allowing the globalization of production, with the total value of goods transported by air reaching $6.5 trillion, representing 1% of all international trade; tourism is a major contributor to economic growth, particularly in developing countries, transporting over 4.5 billion passengers in 2019, with revenue passenger kilometers totaling nearly 8.7 trillion; Additionally, air transportation is a major global employer, with the industry supporting a total of 87.7 million employment worldwide. In general, Aviation's global economic impact (direct, indirect, induced and tourism catalytic) was estimated at $3.5 trillion, equivalent to 4.1% of world gross domestic product (GDP) (ATAG, 2020).

On the contrary, the spread of air transportation also can be influenced by a country's economic progress. For example, the development of physical infrastructure, such as airports, allows for the promotion of export activities, such as tourism, as well as the enhancement of corporate operations and productivity, as well as the influence of firm location and investment decisions (Halpern&Brthen, 2011).

Economically, Ethiopia has been one of the world's fastest-growing countries, with a GDP growth rate of 10.3 percent on average between 2004 and 2019. Large-scale public infrastructure investment has fueled growth. While poverty decreased by roughly 10% from 2004 to 2016, the benefits were small when compared to other nations that saw rapid growth, and there is evidence that rural inhabitants and the poorest have not benefited evenly from recent growth. Ethiopia grew at 6.1 percent in 2020, with the COVID-19 epidemic affecting the country primarily in the fourth quarter of the fiscal year. Crop production increased, while service and manufacturing growth slowed to single digits (WB, 2021).

Further, Ethiopia's air transport industry, which includes airlines and their supply chain, is predicted to contribute $1.54 billion to the country's GDP. Foreign visitor spending contributes another $2.61 billion to the country's GDP, bringing the total to $4.15 billion. Inputs to the air transport sector and foreign tourists arriving by air account for 5.7 percent of the country's GDP. Ethiopian aviation is a high-growth sector with rising demand for passenger and cargo air transportation, with the sector growing at a rate of 20% on average (IATA, 2018).

In addition to that, Ethiopia is a home for the major and leading airlines in Africa. In terms of passengers transported, destinations served, fleet size, and revenue, Ethiopia Airlines is Africa's largest airline. Ethiopian Airlines is also the world's fourth largest airline in terms of destinations served. Ethiopian Airlines carried over 13.3 million passengers in the year to the end of May 2019, up 11.6 percent from the previous year's comparable period (The Africa Logistics, 2020).

As stated above, air travel is a critical component of achieving economic growth and development, and it fosters integration into the global economy and provides crucial linkage both on a national, regional, and worldwide scale but it is still less researched area in developing countries like Ethiopia. So, in this study, the short run and long run relationships and causality analysis between domestic and international passenger’s air travel demand and economic growth were studied by using empirical facts from Ethiopian airlines.

1.2 Statement of the problem

Air travel is both a contributor to and a measure of economic progress. On the one hand, it is a factor of economic progress because it allows for transit within large countries or countries with poor land transportation infrastructure, as well as with other parts of the earth. On the other hand, it is a development indicator because its volume is directly proportional to the degree of economic activity as well as the population's prosperity. Furthermore, a more outward-oriented economy may be connected, other things being equal, with more intense passenger or freight air traffic, which could be an indicator of economic development structure (François &Darpeix, 2016).

In addition, air travel has direct, indirect, induced and tourism catalytic effects on the economy, as a result of higher expenditure and broader economic gains linked with enhanced access to resources, markets, technology, and economic mass. As a result of economic activity, demand for air travel is supported and generated. But, despite its importance, the reciprocal nature of the causal relationship between air transportation and economic performance has received little attention (Zhang, & Graham, 2020).

Recently empirical studies by Hu et al. (2015) in China, Silva, et al. (2018) in Brazil, and Tassew D, et al. (2020) in Sub-Saharan Africa found evidence of a link between air transportation and economic growth and development. The results of the above stated and other empirical findings clearly showed understanding the short-run and long-run dynamic relationship and causality between passengers air travel demand (Domestic and International) and economic growth has several important policy implications, and based on the countries income, and economic status the relationship and causality between economic growth and air transport demand varies and it is complex. In high income countries the results suggesting bi-directional causality between air transport and economic growth. In contrast, causality results from middle-income countries such as Brazil and South East Asian showed strong causality run from economic growth to air transport but weak causality run from air transport to economic growth. Most importantly, the literature on a causal analysis between air transport and economic growth for low-income countries (with potential for very strong growth of air transport demand) is rare especially for African countries, which is one fundamental gap in context appears to matter to these relationships and study.

Ethiopia has been Africa's star performer, according to major economic sources, with its industry improving in tandem with the country's economic progress. With a population of over 110 million people, it's a market worth pursuing. It offers a one-of-a-kind opportunity, with a massive population and an average yearly economic growth rate of 10% during the last 15 years(WB, 2021), and Ethiopian Airlines is one of the world's fastest-growing airlines, and as the continent's largest carrier, Africa is its primary market, followed by the Middle East and Asia-Pacific in terms of passenger traffic. In 2017, 4.3 million passengers (60 percent of total) arrived in Ethiopia from Africa, 1 million (14 percent of total) from the

Middle East, and 900 thousand (12 percent) from Asia-Pacific (IATA, 2018). According to ICAO long-term traffic projections, the African aviation sector has the highest potential for growth of all global regions, owing to the fact that it is a new industry with a large and growing population. Passenger traffic in Africa is expected to grow at a rate of roughly 4.3 percent per year until 2045, slightly faster than global total growth. This rise will drive growth in economic output and jobs supported by air transportation in the future decade, with a USD 159 billion contribution to GDP predicted by 2036 (an increase of 184%)(ATAG, 2019).

Ethiopia has a global competitive carrier (Ethiopian Airlines) as well as a regional advantage, as a result of which the air transportation industry supports 1.1 million jobs (19,000 direct, 179,000 indirect, 80,000 induced, and the remaining 815,000 tourism catalytic), and the industry contributes $4.15 billion to GDP, which accounts 5.7 percent of the country's GDP. And from this, airlines and their supply chain contributing $1.54 billion, and spending by foreign tourists supports remaining $2.61 billion USD. According to the current trends scenario, Ethiopia's air transport market will rise by 226 percent during the next 20 years, and by 2037, an additional 16.3 million passengers will have travelled. If met, Ethiopia's increasing demand would generate $13.5 billion in GDP and more than 2 million jobs (IATA, 2018).

Despite the fact that the air transport sector has such a large and promising economic impact and growth potential, it is hampered by a number of factors. In addition to the industry's turbulent and uncertain behaviour (Mitchel & James, 2016), which includes fierce rivalry and rising fuel prices (overall costs), Ethiopian GDP per capita and propensity to fly are among the lowest in the group of busiest countries, with 2311USD and 0.11 trips per capita (Royal, H, 2020), and Ethiopia's airport per capita is 0.768 per 1 million inhabitants. Similarly, the quality of air transport infrastructure (WEF) is one of the components of the World Economic Forum's annual Global Competitiveness Index, and Ethiopia has one of the lowest quality air transport facilities, with a score of 3.3. Based on 34 countries, the global average for 2019 was 3.79 points. South Africa received the highest score of 5.5, while Lesotho received the lowest score of 1.4. (Nation Master, 2017).

Despite the fact that air transportation has such a large and potential economic influence and growth potential, as well as potential barriers, it is a less researched subject in Ethiopia, and obtaining empirically validated publications remains a challenge (We may find dissertations such as Fikre M, (2015), Tassew D. (2017)). As the reviewed literatures support , understanding the short-run and long-run relationships and causality directions between economic growth and passenger air-transport demand (domestic and international), as well as other selected variables, is critical and the first step in devising alternative policy options and raising our awareness and knowledge.

Furthermore, different econometric models for different countries were used in various studies to find the relationship between air transport demand (passengers and freight) and economic growth (GDP) (Chi and Baek (2013) in the United States used ARDL, and Tassew D, et.el (2020) in SSA countries used VECM). However, to the best of the researcher's knowledge, there is scanty research on Ethiopian literature that examines the relationship and causality between domestic and international passenger air transportation demand and economic growth separately. And additionally, the relationship between domestic and international passenger air transportation demand, GDP, and other variables has not been thoroughly examined using the ARDL bounds testing approach.

So, this study will help us better understand the relationship between passengers air traffic(Domestic and International) demand, country’s economic growth, and also the results of causality tests can increase our understanding on the relationships, it shed light on future aviation policies, such as airport infrastructure planning, aviation strategic planning, and others. Hence, it is important to understand the relationship between domestic and International passenger’s air traffic, economic growth and other variables. Thus, the purpose of this study is to fill the gap in the empirical literature on the nexus between passenger’s air traffic demand (domestic and International) and economic growth in Ethiopia by studying the specific situation in the case of Ethiopian Airlines.

1.3 Objective of the Study

1.3.1 General Objective

The overall goal of the study is to examine the nexus between economic growth and passengers Air travel demand in Ethiopia.

1.3.2 Specific Objective

- To analyze the trends of passengers Air travel demand and economic growth in Ethiopia.
- To analyze the short run and long-run relationships between domestic and international passengers air travel demand and economic growth in Ethiopia

- To analyze causality between domestic and international passengers air travel demand and economic growth in Ethiopia.

1.4 Research Question

1. What is the short-run and long run relationship between passengers (Domestic and International) Air travel demand and economic growth in Ethiopia?

2. What is the direction of causality between passengers (Domestic and International) Air transport demand and economic growth in Ethiopia?

1.5 Research Hypothesis

Based on the literature and case study reviews, the following hypotheses are proposed:-

H1: There exist positive short-run and long-run relationship between Passengers travel demand (Domestic and International) and Economic growth in Ethiopia

H2: International Passengers travel demand and economic growths have uni-directional causality (runs from International air transport demand to economic growth) both in the short-run and long-run.

H3: Domestic Passengers travel demand and economic growths have Bi-directional causality both in the short-run and long-run.

1.6 Significance of the Study

This study contributes to the existing literature as follows: firstly, it examined and identified the short-run and long-run relationships and causality between Domestic and International passenger's air travel demand and economic growth in Ethiopia separately. Secondly, it assessed and identified factors that influence air travel demand (Domestic and International) in Ethiopia. Finally, the study assessed the trend of air travel demand (Domestic and International), economic growth and selected variables in Ethiopia. In general, it gives some insight to increase our awareness and knowledge on the relationship between passenger's air travel demand and economic growth in Ethiopia. Additionally the study has the following significance:-

- It will increase aviation professionals' knowledge of the feedback loop between Ethiopian economic growth and domestic and international air travel demand, as well as the industry's impact on the economy and the impact of numerous variables on the sector. As a result, it will be used as a starting point for subsequent research by aviation-related individuals and private airlines in Ethiopia and beyond.

- It informs interested bodies about the elements that drive air travel demand(determinants of Air travel demand) in Ethiopia, as well as how to create and monitor adjustments to maintain the industry's economic impact.
- Provides Ethiopian Airlines' senior management and relevant government bodies with a better understanding of these relationships, allowing them to see strategic concerns and outlooks and place greater emphasis on critical components from Ethiopian viewpoints.
- Policymakers and others need to have a better grasp of the airline business because it makes a significant contribution to the country's economy, tourism, investment, and image building.

1.7 Scope and Limitation of the study

Ethiopian Airlines is the subject of the study, and while the Ethiopian Airlines group has a number of key business divisions, such as freight transport, charter, hotels, and Aviation University, the study focused only on passengers transportation demand because it is the greatest source of revenue. Furthermore, by using time series data from 1991 to 2020, the analysis were focused primarily on the relationship between domestic and international passenger transportation demand, Ethiopian economic growth, and chosen variables. The researcher faced a problem of collated secondary data for some variables as the investigation progresses, and in order to solve the problems the researcher implemented interpolation and forecasting method on Eviews-10 software.

1.8 Organization of the Study

The study is divided into six sections. The first chapter is an introduction; it covers the overall concept of the study, as well as how it relates to past research, the researcher's goal, research problem, research objectives, and the scope and structure of the study. The second chapter devoted to a survey of the literature: The study's theoretical and empirical perspectives were presented. It also covers significant theoretical discusses as well as an overview of research on related themes, with all consulted materials properly cited. In the third chapter, brief history of Airlines industry in Ethiopia, and the current status of Ethiopian airlines were presented. The research paper's methodology and design was discussed in the fourth chapter. Data Analysis and Presentation were covered in the fifth chapter. In this chapter, all of the research findings were presented utilizing various data presentation approaches. Conclusion and recommendations were presented in the final chapter. Conclusions and recommendations, management implications, policy implications, and possible areas for additional research were all addressed in this section. Finally, this study included references, and appendices.

CHAPTER TWO: LITERATURE REVIEW

In this chapter review of theoretical and empirical literatures on the relationship between economic growth and passenger Air transport Demand were undertaken.

2.1 Theoretical Literature Review

Here the researcher presented definition of key words, historical development and theoretical background of the study as below:

2.1.1 Definition of Basic Terms and Concepts

Demand in air travel industry is defined as the ability and willingness to purchase certain quantities of a good or a service at different prices in a given time period under the same or similar conditions. The amount of air travel that people would prefer in a particular situation is referred to as **air transport demand**. The fact that the demand for air transportation is derived, which is, generated from the desire for consumption or usage of another item or service, is a significant feature of the analysis. To put it another way, the demand for air travel is driven by causes other than the transportation itself. Individuals do not demand travel directly; rather, their urge to travel originates from the reason they wish to do so. They pick between different modes of transportation and, eventually, different airlines once they have opted to travel. Their primary desire, though, arises from their motivations for traveling (Vasigh B, et.al 2018).

The thing that is unique to transportation demand is that, transportation demand does not generate utility in and of itself, and because of this Air travel demand is called derived demand. Air travel demand is derived because consumers don't buy airline products just to fly; instead, they buy airline products as part of other activities such as leisure and business engagement. We can define airline demand as demand arising from leisure or business commitments, among other things (James, G.W., 1982).

People travel for a number of reasons, including business, pleasure, personal reasons, or a combination of these. Although air travel is similar to other modes of intercity travel in many ways, it is distinct in others. Aside from the traveler's perception of travel time and restrictions on the traveler's desire to select a route, a carrier, and a mode of transportation to reach their final destination, one major difference between air and ground inter-city travel modes is the traveler's perception of travel time and restrictions on the traveler's desire to select a route, a carrier, and a mode of transportation to reach their final destination (Kwakkel et.al, 2010).

The propensity to fly (PTF) is a valuable indication of a country's aviation traffic. It speaks something about a country's importance of air travel and provides insight into its growth potential. Propensity to fly (number of air journeys per population) greatly influences future demand and changes in propensity to fly have an impact on demand for air travel in markets all over the world, and as future demand grows, so does the need for aviation infrastructure investment. A variety of interconnected circumstances like economic health (and thus personal income levels), demographic shifts, and air travel affordability influence one's willingness to fly (Hayley M.&Claudia B. 2014).

A revenue passenger kilometer (RPK) or Revenue Passenger Miles (RPM) is a transportation industry term that reflects the number of kilometers travelled by paying passengers and is commonly used to calculate airline traffic. The number of paying passengers is multiplied by the distance travelled to compute revenue passenger miles/kilometer. For example, a plane carrying 100 passengers and flying 250 miles has an RPM of 25,000. Most transportation indicators are built around revenue passenger miles/Kilometers. **The available seat miles (ASM)** or Available Seat kilometer (ASK) is a measure of an airplane's overall carrying capacity available to produce revenue, is sometimes compared to RPM/RPK. An airline can calculate load factors by dividing RPM/RPK by ASM/ASK. The load factor is a percentage that indicates how well an airline sells seats and generates income. Higher load factors are obviously desirable because vacant seats are an airline's opportunity expense (Kenton, 2021).

2.1.2 Factors Affecting Air Travel Demand

A variety of factors influence the demand for passenger and freight transportation and logistics services and all of which are taken into account in the applicable prediction models. The economy, as measured by a country's GDP or total added value, and a region's gross output or added value, influences general derived demand (Theodore, &Charalambos, 2011). Following economic factors, demographic variables are the second most important elements that influence air transportation demand. The size of the population and the rate of urbanization are two of the most important factors (Demirsoy, 2012, and Sivrikaya, O. &Tunc, E., 2013).

Generally, there are two types of factors that influence air travel demand: external and internal influences. Internal factors are those that occur within the aviation business, whereas external causes are those that are outside the industry's control. Internally, the most important factors are airfares and the degree of service provided. External variables include long-term economic, social, demographic, and political trends such as age, income, population, ethnic and cultural ties to other countries, and international trade. Short-term factors like inflation, interest rates, and currency exchange rates can all have an impact on the future increase of air transportation demand (Vasigh et.al, 2018).

Internal Factors: from internal factors, ticket prices and the costs of alternative modes of transportation like trains and buses are influential factors for air travel demand (Alperovich&Machnes, 1994). Previous studies have shown that deregulation has a generally favorable influence on air transportation demand by allowing for reduced costs and greater market competition (Isthutkina& Hansman, 2008). As a result, passenger demand for air travel is expected to rise.

External Factors: The external environment of the airline business is extremely important to the existence of various airlines because it has a huge impact on the sector. Because macro-environments fluctuate on a regular basis, the aviation industry's external environment can be defined as particularly unstable. Recent macro-environmental events have had a considerable impact on the airline sector. In most situations, government restrictions have been unstable and restrictive. Disease outbreaks, war, terrorism, and recession are all common occurrences in the industry. Most companies in the business face these risks, which have a significant impact on their capacity to operate and survive (Dempsey, 2008). Economic factors, geographic considerations, demographic factors, market structure, social factors, and maturity factors are the five groups of factors that determine air travel demand. Economic factors include GDP, income, spending, fares, and the rate of inflation, among others. Population size, urbanization rate, and other demographic factors are examples of demographic factors. Education and immigration are examples of social factors (Demirsoy, 2012).

From economic factors, Economic activity and income are the major factors because; Air transportation and economic activity are intertwined and have a reciprocal influence. In other words, air transportation stimulates economic activity, which in turn generates demand for air transportation services. Markets and people are brought closer together by air travel. Air transportation produces economic activity by producing jobs and providing an enabling environment. Ishutkina& Hansman (2008) defined the total economic impact of air travel availability on economic activities as "the total economic impact on employment and income created by economic undertakings that are dependent on the availability of air transportation services".

On the other hand, rising incomes can be attributed for the increase in air travel (Dargay&Hanly, 2001). Per capita income (or GDP) and consumer expenditure are two categories of income that have received a lot of attention in the literature. According to Steiner (1967), aside from changing habits, discretionary wealth is the most essential element driving air traffic development. GDP, along with disposable income and consumer expenditure, is used as an alternative measure of income in some research (Graham, 2000).

After economic issues, demographic factors are the second most commonly noted factor influencing air travel demand. Given current population growth, it is estimated that the world's population will double in 70 years, resulting in a population of 13 billion people. This statement alone indicates that demand for air travel will continue to expand at a rapid pace. Despite the fact that the relationship between economic considerations and air transport growth is becoming less intertwined, population shifts continue to drive a portion of the increase in air passenger demand. On the other side, we can assume that there is a maximum proportion of the population that utilizes air transportation, and that once this maximum proportion is reached, the air traveler/population ratio will remain stable and unresponsive to future changes in income and prices (Graham, 2000).

To some extent, air passenger demand is influenced by population size and density. "Passenger demand and the location of airport amenities are proven to be highly influenced by the location of population and economic activities," Bhadra& Wells (2005) write. As a result, air transportation demand is concentrated in these densely populated and urbanized areas, affecting airport location selection.

Globalization has had a tremendous impact on air travel because it has accelerated the urbanization process. Most critical components of air transport demand are accommodated in urban areas: highly populated cities, economic significance, and the need to be mobile. According to Dobruszkes et al. (2011), there is a link between population density and airport proximity to densely inhabited areas. Furthermore, the urbanization process has pushed migration from rural to urban areas as a result of globalization (Graham, 2006).

The third factor was geographic issue, and various studies have linked air transportation demand to country geographic factors. Bhadra and Wells (2005) discovered that when a state's population grows, so does demand for air travel within that state. If we think of each state as a country, we can apply this result in a broader meaning.

Finally market structure including new business models such as domestic market liberalization, competition, and bilateral agreements continue to boost air travel demand. All of this is the effect of deregulation in the aviation industry. Deregulations are a watershed moment for the aviation industry in many countries, as they allow new airlines to enter the market, resulting in increased demand for air travel. For example, in Europe, LCC carrier traffic stimulates a significant portion of European passenger demand, particularly following the EU member states' enlargement (Steiner, et al., 2008). As a result of deregulation and increased competition, prices have dropped dramatically (Dargay&Hanly, 2001). As a result, more people can afford to travel because it is no longer considered a luxury items.

2.1.3 Impact of Air Transport on Economic growth

There are various methods for calculating the economic impact of air travel, but in general, the sector has a direct, indirect, induced and catalytic impact on the economy of a given country. Prior to Covid-19, the entire global economic impact of aviation (including direct, indirect, induced, and tourism catalytic) was estimated to be around 3.5 USD trillion, or 4.1 percent of global GDP in 2019. The aviation industry supports around 87.7 million jobs worldwide. If aviation were a country, it would rank 17th in terms of GDP, equivalent to Indonesia or the Netherlands, according to the ATAG assessment. Air transportation in Africa produced 7.7 million employment and $63 billion in economic activity. In 2018, this amounted to 2.2 percent of total employment and 2.7 percent of total GDP in African countries (ATAG, 2020).

A) Direct impacts

By directly employing peoples at airlines, airports, and air navigation service providers, the business creates enormous economic activity. Check-in, baggage processing, on-site shopping, cargo, and catering are just a few of the services available. Aviation, on the other hand, provides high-skilled manufacturing jobs with firms that produce planes, engines, and other vital technologies (IATA, 2018).

B) Indirect impacts

Suppliers to the aviation industry, such as aviation fuel suppliers, construction companies that build airport facilities, suppliers of sub-components used in aircraft, suppliers of air traffic management products, such as radars and satellite-based navigation systems, manufacturers of goods sold in airport retail outlets, and a wide range of activities in the business services sector are all examples of indirect impacts (such as call centers, information technology and accountancy) (IATA, 2018).

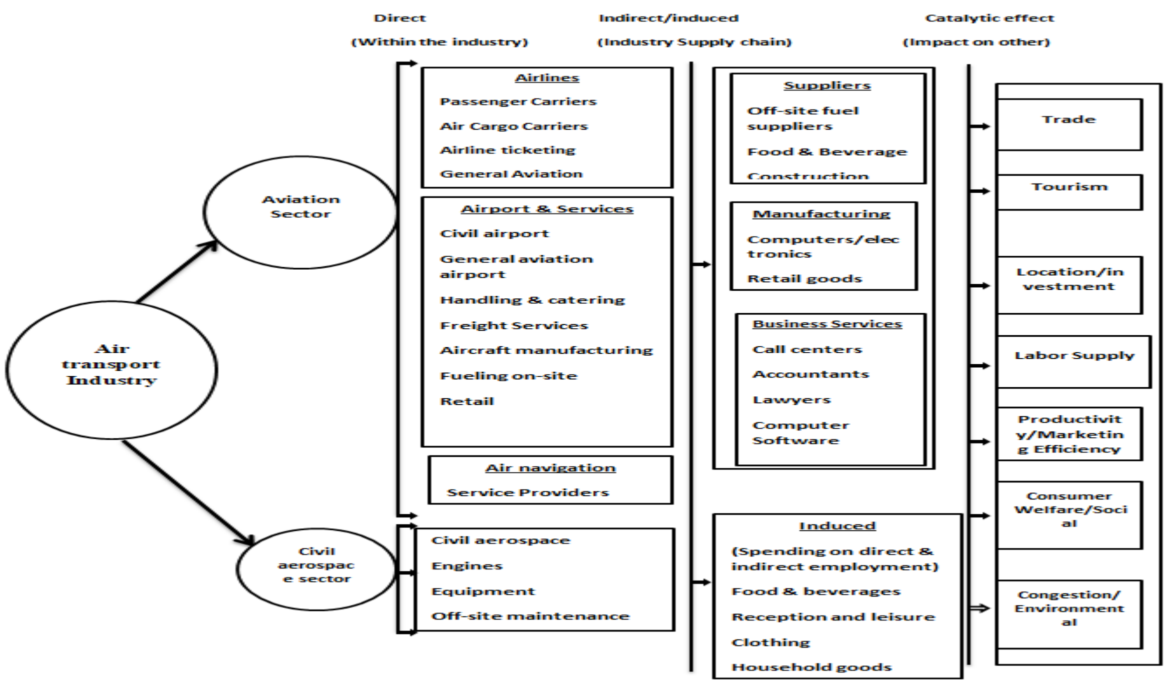
C) Induced Impacts

People that work in the aviation business spend more money, either directly or indirectly, which supports additional jobs in areas like retail, consumer goods manufacture, and a range of service industries (such as banks, telecommunication providers and restaurants). Employees in the air transportation business (direct or indirect) used their earnings to buy products and services for their own consumption, resulting in 13.5 million induced employment worldwide (IATA, 2018).

D) Tourism Catalytic impacts

Aside from the direct, indirect, and induced effects of the global aviation business, air transportation has a far broader economic impact. Many additional industries rely on reliable air connections to operate. Tourism is one of the industries that heavily rely on aircraft. Many countries that rely on a regular intake of tourists (particularly emerging countries in regions far from their source tourism markets) would be unable to maintain their current levels of economic growth without the connectivity afforded by aviation (ATAG, 2020).

Figure 2.1: Impact of Air transport sector on Economy



Source: OEF, 2005

E) Impact on Social Development

More than merely pursuing economic prosperity while being ecologically conscious is included in sustainable development. Other than financial a riches, which is an important aspect of this concept, people's lives can be better in other ways. These social objectives are an important part of the Sustainable Development Goals, and civil aviation contributes to them in a number of ways. For many individuals all over the world, the ability to travel to any other country is a crucial asset, as it allows them to visit friends and family, work and study abroad, and, of course, go on holiday. Without air transportation, experiencing diverse countries and cultures would be far more difficult – and potentially impossible in a short period of time. In the most catastrophic of circumstances, plane travel might be the difference between life and death (ATAG, 2020).

Air transport supports social development through the following ways:-

Leapfrogging development issues: - Airfields can provide access to areas where road building is too difficult or expensive and modern air traffic management technology is helping developing countries to jump ahead of the pack to the most cost-effective technologies.

Supporting families back home: - According to the United Nations, there were around 272 million international migrants worldwide in 2019, with roughly six out of ten being migrant workers who relocated to another country for employment. Migrants sent $714 billion in remittances around the world in 2019, $554 billion of which went to low- and middle-income countries.

Quality education: - Ensure accessible and equitable quality education and promote lifelong learning opportunities for all is a stand-alone sustainable development goal. For many people, obtaining a better education necessitates going to a different country, if not a different continent. These possibilities would be impossible to realize without air transportation, particularly for shorter-term academic exchange programs such as the European Erasmus programmed.

Highly skilled workforce: - Air transport professions cover a wide range of tasks and necessitate a diverse set of abilities. Air traffic control and airspace design planning, as well as occupations as air traffic controllers; satellite systems that provide communications, surveillance, and tracking of aircraft and air navigation services; airline and airport logistics, and complex information and communication technology systems that link aircraft and other systems. Furthermore, the aerospace sector's expansion is contributing in the development of innovation and capacities in countries that have not historically been associated with aircraft manufacturing.

Good health and well-being:- The ability to transport vaccines is a great example of how aviation can help with public health. Not only are these vital medical supplies time-sensitive, rendering other long-distance forms of transportation impractical, but they also require exact temperature control, something cargo airlines excel at.

Providing vital aid: - Because of its unique ability to combine speed and flexibility, aviation is a crucial tool for promptly responding to natural and man-made disasters

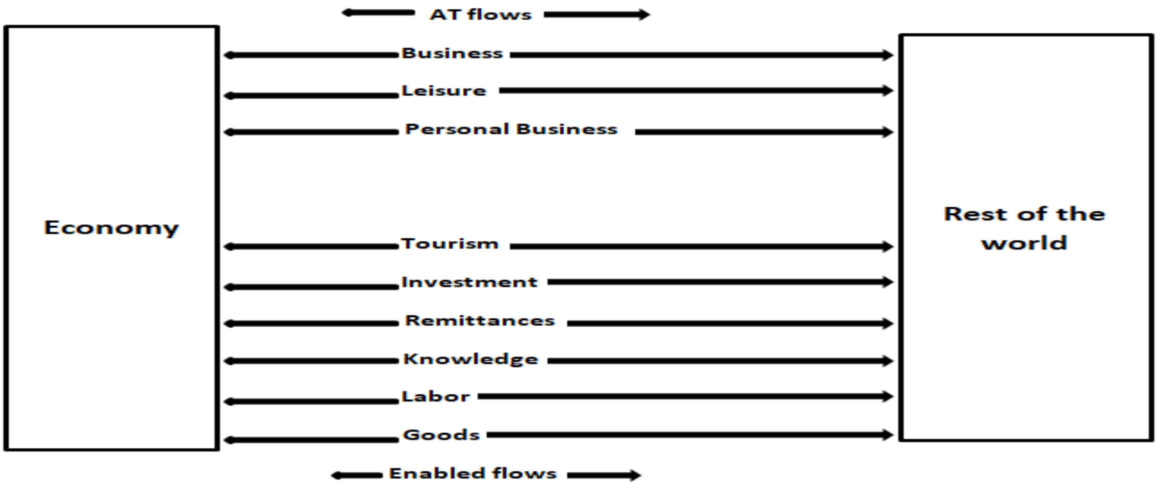
Helping to end trafficking: - On-board planes and at airports, the aviation industry is assisting appropriate staff in spotting signs of human trafficking and reporting concerns to law enforcement. IATA and ACI resolutions have been issued to ensure that airlines and airports are aware of the problem and are given advice on how to address it.

2.1.4 Air transport and Economic Growth Theories

- **The Relationship between Air Transport Flows and Economic Attributes**

Figure 2 shows how air transportation flows translate to enabled flows, which affect the traits that define the competitiveness of the economy. It depicts passenger and freight movements between a specific economy and the rest of the world. Business, leisure (recreation and holidays), and personal business are the three major categories of passenger flows (visiting friends and relatives, health, migrant, and education-related trips). Inbound leisure passengers spend money in the economy, whereas outgoing leisure passengers spend money abroad. In this study, inbound passengers are defined as those whose primary residence is outside of the economy of interest, while inbound cargo is defined as goods produced outside of the economy. Tourism, investment, remittances, information, labor, and goods are all enabled by these air transportation flows. Business passengers provide a source of labor, knowledge, and investment; personal business travelers provide a source of remittances, labor, knowledge, and investment; and leisure passengers result in tourist flows (IshutkinaM. &Hansman, 2008; IshutkinaM.&Hansman, 2009).

Figure 2.2: Enabled flows between an economy of interest and the rest of the world as a result of air transportation.



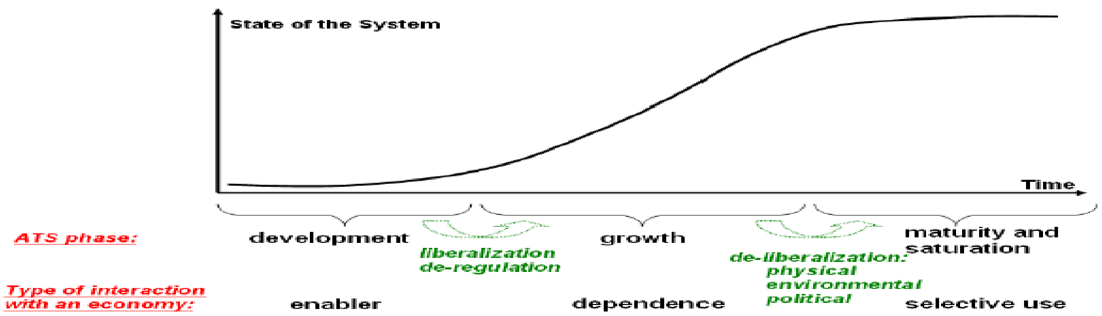
Source: Adopted from (IshutkinaM. &Hansman, 2008; IshutkinaM.&Hansman, 2009)

- **Limits to Growth and S-shape Curve**

Many regions' air passenger growth rates have exhibited exponential growth behavior, but no real system can grow indefinitely, and air transportation is likely to follow the S-shaped growth pattern seen in many limited systems. The growth is exponential at initially in the S-shaped growth, but it eventually slows as the system becomes confined by available resources. Adoption of new technology and population growth models in ecology, where resources are bound by a fixed carrying capacity, are examples of S-shaped growth behavior (Sterman, 2000).

Similarly, there are three distinct stages in the evolution of the air transportation system: the start-up development phase, the growth period, and the saturation phase. The interplay of the air transportation system with the economy changes as the system evolves. The more expensive air transportation services that serve as an enabler for specific sorts of economic activities characterize the start-up development phase. The second stage is the expansion phase, which is marked by the economy's continuous reliance on air transportation as demand grows and air travel becomes main-stream. Changes in the regulatory framework, such as airline deregulation or liberalization, typically result in an increase in the growth rate. However, as the system becomes confined by available resources, growth rates begin to slow. The effective cost of air travel rises, and attractiveness of air travel reduces when the system matures. Airport infrastructure is the most significant resource limitation to continued expansion in air transportation. Airports have usually been built in major metropolitan areas, and when the cities grew, they often encircled the airport infrastructure. As a result of a lengthy history of traffic growth, limited land availability, and environmental constraints, many of the world's most major airports are currently running at nearly full capacity. To increase airport capacity, several strategies have been implemented, including capacity expansion at existing airports, the development of multi-airport systems through the promotion of underutilized secondary airports near urban centers, the development of new Greenfield airports, and improving operational efficiency. If these options for capacity growth aren't available, demand management measures like congestion pricing and slot allocations can help relieve congestion at large airports. Physical infrastructure limits aren't the only thing preventing the economy from expanding further. Political and environmental restraints, as well as a restricted supply of fuel, are all considerations that could influence behaviour. Aside from the issues that limit air transportation supply, demand for air travel may become saturated as well (IshutkinaM. &Hansman, 2009).

Figure 2.3: S-shaped growth of the air transportation system and its relationship to economic activity.



Source: Adopted from (M. Ishutkina&Hansman, 2008; M. Ishutkina&Hansman, 2009)

❖ **Air travel Demand and Economic Growth Linkage**

Through a number of mutual causation feedback interactions, air transportation services and economic development interact. Air transportation creates jobs in the aviation industry as well as larger socioeconomic benefits by allowing specific types of businesses in a local economy. As a result, the provision of air transportation services effectively expands the scope of economic activity and reduces its cycle time. The region's economic activity, in turn, fuels demand for passenger and freight travel, as well as for air transportation services. As a result of this feedback loop, there is a global association between the amount of air travel and Gross Domestic Product (GDP). Despite the fact that air passengers and GDP have increased in all regions over the last thirty years, there is significant variation in growth rates (IshutkinaM. &Hansman, 2008).This is due to the fact that the nature of the link between air transportation and economic activity varies.

Because of its specific characteristics, air transportation has a different impact on economic activity than other modes of transportation: speed, cost, flexibility, reliability, and safety. It is sometimes the only means of access to geographically inaccessible locations and is the only practicable long-distance transportation mode for high-value perishable items and time-sensitive people. However, for short-haul routes, air travel has limited benefit over other modes of transportation, particularly high-speed rail (Ishutkina M. &Hansman, 2009). Different mechanisms dominate the relationship between air transportation and economic activity depending on the combination of distinct economic and air transportation qualities. The nature of air transportation flows varies by economy due to these specific characteristics. International tourists account for the majority of travelers in some nations, whereas domestic traffic patterns dominate in others.

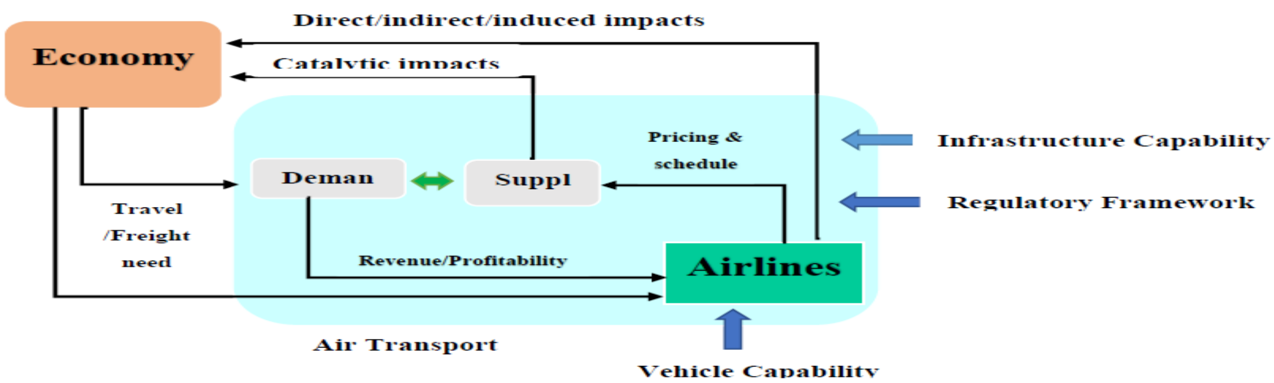
Figure 1.4 below depicts a high-level feedback model of the interaction between an economy and an air transportation system. Infrastructure, regulatory framework, vehicle, and airline capability all define the air transportation system. The supply and demand relationship within the air transportation system is where airlines provide supply by pricing and scheduling flights based on the revenue and profitability of a certain route (Ishutkina M. & Hansman, 2008). At the macroeconomic level, air transportation has an impact on the economy by creating jobs and facilitating access to markets, people, capital, ideas, and knowledge, as well as labor supply, skills, opportunity, and resources. In turn, the economy produces capital and demand for passenger and freight transit. The relative commercial and leisure attractiveness of an economy to the rest of the globe determines its travel and freight demands (Porter, 2011). The causation direction of the air transportation and economic activity link may differ depending on the economic segment, which this paper explores for Ethiopia, a developing country.

The majority of the growth in air traffic demand is due to global economic growth. While demand for air travel has increased as countries have progressed, it is possible that air travel is both a cause and a facilitator of economic expansion. The aviation business is not only a big industry in and of itself, employing a vast number of highly qualified persons, but it is also an important part of the world's rapidly growing economy. By boosting market access, developing internal and external business contacts, and increasing access to resources and international financial markets, more access to the global air transportation network can increase economies' productivity and growth. Air travel has the potential to play a substantial role in long-term economic success and growth. It facilitates a country's integration into the global economy, providing users with both immediate and indirect benefits, as well as broader economic benefits through greater productivity and growth (Russell, M, 2017).

International commodity and service trade is one of the key drivers of global economic growth and development. People's and businesses' ability to trade with people and businesses all over the world is one of the most important characteristics of our modern, globalized civilization. The internet and other modes of mobility, such air travel, are important enablers of the global economy. Transporting business and tourism passengers, facilitating FDI, speeding the import and export of commodities, lowering trade costs, accommodating international organizations, and facilitating humanitarian assistance are all responsibilities of the air transport services. Changes in air transportation demand follow changes in income. The disaggregated approach reveals that lower income groups have little air travel participation, whereas middle income groups represent high growth, and higher income groups exhibit air transportation maturity (Kiboi, J.W et.al 2017).

In conclusion, the interaction between Air transport and economy displayed on Fig 4 below:-

Figure 2.4: Interaction between Economy and Air Transportation



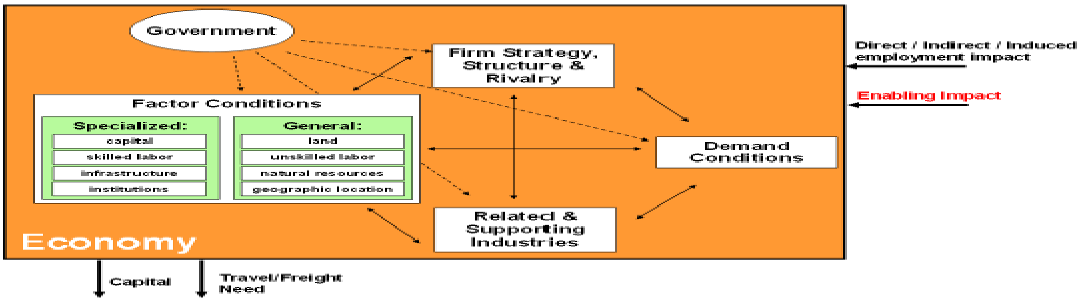
Source: Adopted from (IshutkinaM. &Hansman, 2008; 2009)

Airlines, airports, and related services produce both direct and indirect economic jobs, as shown in Figure 2.4. Furthermore, air transportation businesses' services facilitate commercial activity. The economy provides capital and demand to air transportation businesses in exchange. The strength of this relationship is determined by exogenous factors such as infrastructure capability, regulatory framework, aircraft sizes, and reliability (Button, K. & Taylor, S., 2000).

The relative commercial and leisure attractiveness of an economy to the rest of the globe determines its travel and freight demands. Four criteria based on Porter's theory of competitive advantage can be used to explain this measure of attractiveness and overall competitiveness in the global context, as shown in Figure 5. The first sets of traits are the factor conditions, often known as the factors of production in traditional economic theory. There are two types of factor conditions: general and specialized. Land, unskilled labor, and natural resources are all inherited general factors. Specialized factors are developed and are crucial to the country's competitiveness. They are made up of three components: capital, skilled labor, and infrastructure (Porter M, et.al 2007).

The model by porter was modified by Ishutkina M. &Hansman, (2008&2009) to include geographical position as one of the general factor requirements, because a country's location and connectivity to the world's major markets affects its competitiveness and institutions as a specialized factor condition. Demand conditions, the presence of linked and supporting industries, business strategy, structure, and rivalry are among the other characteristics. Only domestic demand for goods and services is included in Porter's original definition of demand conditions. This concept is broadened to incorporate foreign demand for goods and services produced in the local economy. These four characteristics combine to generate a feedback system in which government and exogenous influences play a significant impact. Changes in management techniques, such as globalization of manufacturing and service trade, discontinuities in input costs, such as oil shocks, technical innovation, political changes, and foreign government economic regulation, are examples of external variables. The sum of these characteristics impacts the country's competitive edge in the global economy and shapes the economy's travel and freight requirements. Air transportation, in turn, has an impact on these characteristics via a series of enabling processes.

Figure 2.5: The Economy's competitiveness is defined by four necessary attributes with government and chance playing an important role.



Source: Adopted from (IshutkinaM. & Hansman, 2008; M. A. Ishutkina and Hansman, 2009)

2.2 Empirical Literature Review

2.2.1 Impact of Air transport on Economic growth

A) Direct impacts

In 2019, the world's 1,478 airlines transported 4.5 billion passengers to 3,780 commercial airports around the world, as well as 61 million tons of freight. This activity resulted in the creation of 11.3 million direct employments and a $961.3 billion increase in global GDP (GDP). To put that in perspective, that's 1.1 percent of world GDP, or almost the same as the basic metals industry ($968 billion). In Africa, aviation directly supported 440,000 jobs and contributed USD 9 billion to GDP (ATAG, 2020).

The entire yearly impacts predicted for the air transport market are valued at $32 billion, according to ATAG's calculations (Wyanie A. Bright & Habte, 2015). This means that the air transportation services industry accounts for around 75% of Ethiopia's GDP. When the sector's contribution to revenue generation is examined, this conclusion is valid. Airlines, airport operators, airport on-site firms (restaurants and shops), aircraft manufacturers, and air navigation service providers directly employ 19,000 people in Ethiopia in 2018; contributing USD 0.52 billion in GDP value added (IATA, 2018).

B) Indirect Impact

The procurement of goods and services by enterprises in the air transportation industry generated little over 18.1 million indirect jobs globally. Global GDP was increased by $816.4 billion as a result of supply chain activity. Aviation's indirect contribution to Africa's GDP was 500,000 jobs and USD5.5 billion (ATAG, 2020). According to (Wyanie A. Bright & Habte, 2015), Ethiopian air transport services generate $5.2 billion in indirect revenue. In addition to direct contributions, the sector indirectly supported another 179,000 jobs and USD 0.52 billion in value added contribution by purchasing goods and services from local suppliers in 2018 (IATA, 2018).

C) Induced Impact

The estimated induced contribution to worldwide economic activity is $693 billion. Aviation's induced contribution to Africa's economy was 300,000 jobs and a USD 4 billion contribution to GDP (ATAG 2020). According to (Wyanie A. Bright & Habte, 2015), the induced contribution to Ethiopian GDP was $6.2 billion in 2014. The sector's induced impact is expected to support an additional 80,000 employment in Ethiopia in 2018 through wages paid to employees, some or all of which are then spent on consumer goods and services, and a USD 0.23 billion value added contribution (IATA, 2018).

D) Tourism Catalytic impacts

Tourism contributes significantly to the global economy by creating jobs and stimulating global economic activity. Tourism supported 319 million employments in 2018 and accounted for 10.4% of global GDP, or $8.8 trillion. The World Travel & Tourism Council predicts that the sector will continue to develop in the future, with an average annual growth rate of 3.7 percent projected through 2029. If these forecasts are accurate, tourism would contribute for 11.5 percent of world GDP ($13.1 billion) and 421 million jobs by 2029(11.7 percent of total employment). In Africa, aviation has a tourist catalytic impact of 6.6 million jobs and USD 44 billion in GDP output (ATAG, 2020).

Foreign visitors arriving in Ethiopia by plane are anticipated to support an additional 815,000 employment and generate USD 2.61 billion in value added to the local economy. Furthermore, the most significant benefits of air transportation go to passengers and shippers, as well as the spillover effects on their enterprises. The worth to passengers, shippers, and the economy may be shown in foreign tourist expenditure and export value (though note these figures include all modes of transport). Foreign direct investment, which creates productive assets that provide a long-term flow of GDP, is a vital economic flow that is aided by efficient air transport linkages (IATA, 2018).

2.2.2 Factors affecting air transport demand

Using the VAR approach, Kİrachi&Battal (2018), evaluated the link between air transport and macroeconomic factors in Turkey from 1983 to 2015. The analysis relied on three important air transportation indicators. Domestic passengers, international passengers, and international cargos were among them. Gross domestic product, interest rate, and consumer price index were used as explanatory prices for domestic and international air transport demand in this study, and the findings show that per capita income, gross domestic product, and consumer price index variables are quite significant for domestic and international passenger demand. Valdes (2015) also used static and dynamic panel data from 32 nations from 2002 to 2008 to investigate the factors that influence air travel demand in middle-income countries. According to the findings, 75 percent of total passenger growth is accounted for by income growth multiplied by income elasticity. The variables utilized were the gross domestic product (GDP) per capita as a proxy for income, foreign direct investment (FDI) as a proxy for international traffic drivers, the Consumer Price Index (CPI), the real exchange rate, and the price of jet fuel.

Suryan V, (2017) investigated Econometric Forecasting Models for Indonesian Air Traffic Passengers to find the economic variables that influence the number of airline passengers using an econometric projection model with a focus on time series data. The research methods employed in this study used both normal regression and panel data regression techniques. The anticipated GDP, population, and other independent variables are utilized to make the prediction. The findings demonstrate that GDP has a substantial relationship with the number of passengers, with an elasticity of 2.23 for time-series data and 1.889 for panel data. As evidenced by the elasticity value, the exchange rate variable is unrelated to the number of passengers. Furthermore, the overall population yields a low elasticity value. Furthermore, the dummy variable has an impact on the number of passengers (deregulation).

In Africa, Erraitab (2016) investigated the determinants of air travel demand in the Moroccan context, concluding that the model containing the consumer price index, the gross national product, per capita final household consumption expenditure, and international tourist arrivals are the most appropriate variables to represent air travel demand in Morocco. The findings show that whereas CPI has a negative and significant influence on air travel demand, and international tourism receipt, has a positive and significant impact.

Erraitab et al. (2016) used data from 1970 to 2012 to conduct a co-integration analysis of air travel demand in the example of international air travel demand between Morocco and the

European Union. In both the short and long run, an error correction model was calculated to explain the determinants of air travel demand between Morocco and the EU. The estimated VECM showed that the main factors affecting air travel demand in Morocco are European GDP, real exchange rate variability, and the regulatory environment. Researchers used variables such as real GDP (income per capita), real exchange rate, and dummies, and the long run result shows that GDP has a positive and significant impact on passenger travel demand, implying that economic growth in the EU is a key factor in increasing demand for inbound air travel from the EU to Morocco in the long run. The real bilateral exchange rate, on the other hand, is negatively related to the number of air passengers from the EU to Morocco, because its coefficient MAD) against the European currency (EURO) leads to higher travel and tourism costs in Morocco, reducing demand for inbound air travel from the EU to Morocco. Nonetheless, the impact of a fluctuating real exchange rate on a long-run connection is minimal. The results of the short-run analysis revealed that European GDP per capita is significantly and favorably related to air travel from the EU to Morocco, and that the impact of the bilateral real exchange rate nearly doubled in the short-run. In the long run, it was |0,44|, but in the short term, it rose to |0,80|. In terms of significance level, this variable became significant at a 5% significance level in the short run, but only at a 10% significance level in the long run relationship.

2.2.3 The relationship between air transportation and economic growth

According to Aderamo (2010), there is a strong positive relationship between air travel demand and GDP (GDP). The findings of Marazzo et.al (2010) also reveal that GDP and PAX are co-integrated, and impulse-response analysis shows that a positive change in GDP causes a strong positive reaction in PAX. Kim Seok and Shin Tae-(2019) study on the link between Economic Change and Air Passenger Demand discovered that, in general, as consumption rises or the economy improves, the number of international travelers rises. The overall economic situation is a primary determinant of passenger overseas travel, and it has been established that the economic environment in the past had a considerable impact on passenger demand for foreign travel. Boeing (2011) discovered that air travel stimulates economic activity, which in turn generates demand for air transportation services. Air travel connects markets and people, and it contributes a large portion of a country's GDP. The demand model for domestic air travel in Sweden was studied by Kopsch (2012), and finding signposts that GDP, as an independent variable, had a positive effect on demand. Panel data from China was used by Yao and Yang (2012) to uncover the primary factors of air travel. The findings revealed that air travel has a positive relationship with economic growth.

According to Madurapperuma, W. &Higgoda, R., (2020) when regional economic activity grows, so does demand for air travel and demand reaction to changes in GDP is projected to be stronger in developing or emerging countries (regions). To put it another way, economic growth (GDP) is playing a bigger role in driving up air travel demand in developing countries. Mehmood and Kiani (2013) investigated if aviation growth in Pakistan preceded economic growth. They looked for Granger causality between these factors and came to the conclusion that aviation demand aided economic growth. In the United States, Chi and Baek (2013) investigated the dynamic relationship between airline demand and economic growth. The study looked at the short- and long-term consequences of economic development and market shocks on air passenger and freight services (e.g., the 9/11 terrorist attacks, the Iraq war, the SARS outbreak, and the 2008 financial crisis).

2.2.4 The causal relationship between air travel demand and economic growth

The co-integration and causal links between economic growth and regular domestic and international passenger air transportation in Brazil was studied by Silva et.al, (2018). The findings support the hypothesis that passenger traffic series and economic growth are co-integrated, demonstrating a bi-directional Granger causal relationship between domestic traffic and economic development as well as a unidirectional impact of economic growth on international passenger air transport demand. The series' variance decomposition revealed that domestic air transport was significantly more important than international air transport in fostering Brazil's economic development. Aprigliano Fernandes et al, (2021), investigated the a short and long-term causal relationships between regular domestic air passenger transport links and the gross domestic product of small municipalities in this region, and the findings revealed, bi directional causality between gross domestic product and air transport.

In China, Hu et.al used heterogeneous panel data models to investigate the Granger causal link between domestic passenger traffic and GDP in 29 Chinese provinces, and granger causality tests revealed bidirectional causation between GDP and passenger movement. However, only domestic passenger traffic had a short-term causal influence on GDP. Although Mukkala &Tervo (2013) agreed that there is a general strong association between airplane traffic and economic growth, they found no net causality relationship between the variables. According to their findings, the causality processes are homogenous from regional growth to air traffic, and there is causality from air traffic to regional growth in peripheral regions but the causality is less evident in core regions.

In Sri Lanka, Air passenger movements and economic growth was investigated by Higgoda and Madurapperuma, (2020), and the findings confirmed that there is no long-run association between air transportation and economic growth in Sri Lanka. However, the findings reveal a short-run unidirectional Granger causality that connects economic development and overall passenger movements.

In European NUTS2-regions mutual and complex causal relationship between air passenger transportation and regional development were studied by Van De Vijver et.el, (2016), and the findings show that both directions of causality exist among European urban regions, albeit in a highly geographically fragmented manner. The Relationship between Air Transport and Economic Growth for High, Upper-Middle, Lower-Middle, and Low-Income Countries was investigated by Kirac, K, &Bakr, (2019) by using panel data, and the findings reveal that GDP has a degree of effect on air transport. They also show that the unidirectional or bidirectional causal links between GDP and air transport, as well as air transport and GDP, differ depending on a country's wealth level. As Hakim &Merkert (2016) investigated the causative relationship between economic growth and air transport in South Asia, and their findings support a long-run unidirectional Granger causality that goes from economic growth to both passenger and freight air transport demand.

In Africa, Abraham et.al, (2015), looked into the relationship between air transportation development and economic growth in Nigeria. The findings point to a favorable impact of air travel on economic growth, as well as a long-run equilibrium relationship and causal unidirectional relationships between air travel and economic growth. Tassew et.al,(2020), looked examined the causative relationship between air transport demand and economic growth in six Sub-Saharan African nations from 1981 to 2018, and found that the causal relationships were varied and context-specific. In the long run, causality runs from economic development to air transport demand in South Africa, Nigeria, and Kenya, and contrary to others, in Ethiopia, causality runs in the contradictory direction, with increased air transport demand encouraging economic development. In Senegal and Angola, the relationship is too weak to infer causal directions between economic growth and air travel demand. Differences in per capita income, low-cost carriers' participation in national aviation markets, the presence of significant home-based airlines, and comparative geographical advantage as a natural hub are all possible factors for this heterogeneity.

Chakamera and Pisa, (2021), used to explore the short-run and long-run relationships between air transport (air passenger traffic and air freight) and economic growth in Africa, and found a bi-directional causation between the two. Air passenger travel had a long-run beneficial effect, whereas air freight had a long-run negative effect. In the long run, economic expansion benefits both air passengers and freight. There were no signs of short-term consequences. Because of the bi-directional causality, both air travel and economic growth could be influenced at the same time.

Table 2.1: Summary of Results of Causality Test

Authors	Study Area	Year	Type of Causality	Direction Of Causality
Fernandes et.al	Brazil	2010	Unidirectional	Uni directional from GDP to Air transport
Mukkala and Tervo	European Region	2013	Mixed	Uni-directional, Bi-directional and No Causality
Van De Vijver et.el,	European NUTS2-regions	2014	Bi-directional	Causality from both Direction
Abraham et.al	Nigeria	2015	unidirectional	From Air travel to Economic growth
Baker et al.	Australia	2015	Bi-directional	Causality from both Direction
Hu et.al	China	2015	Bi-directional	Causality from both Direction
Brida et al.	Italy	2016	Uni directional	From Air travel to Economic growth
Hakim and Merkert	South Asia	2016	unidirectional	From Economic Growth to Passenger Movement
Tassew D	Ethiopia	2017	unidirectional	From Air travel to Economic growth
Silva et.al	Brazil	2018	Bi-directional	Causality from both Direction
Zapata Aguirre et al.	Mexico	2018	Bi-directional	Causality from both Direction

Source: Compiled from respective papers and Journals

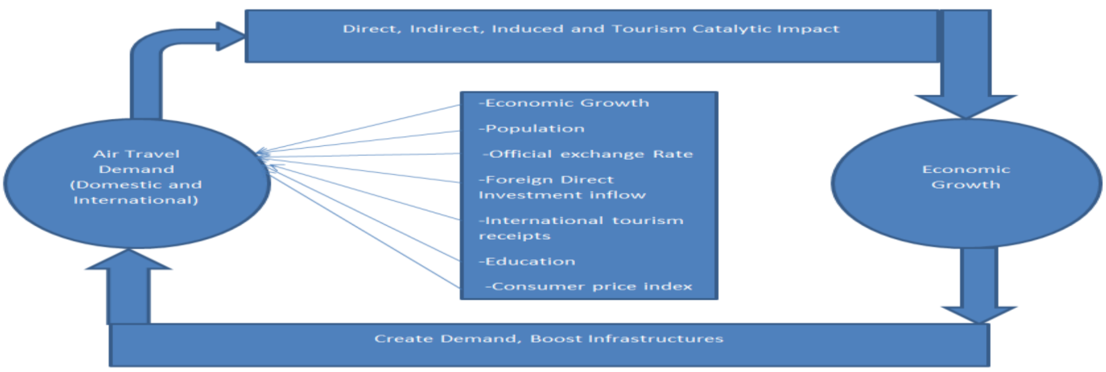
2.3 Summary and Research gap

As the above theoretical and Empirical literature shows, the result on causality analysis between air transport and economic growth is diverse. Based on the countries income, and economic status the relationship and causality between economic growth and Air transport demand varies. In high income countries the results suggesting bi-directional causality between air transport and economic growth. In contrast, causality results from middle-income countries such as Brazil and South East Asian showed strong causality run from economic growth to air transport but weak causality run from air transport to economic growth. Most importantly, the literature on a causal analysis between air transport and economic growth for low-income countries (with potential for very strong growth of air transport demand) is rare especially for African countries, which is a fundamental gap in context appears to matter to these relationships. In Ethiopia also, to the best of the researcher Knowledge there is no literature, on the relationship between Domestic and International passengers Air transport demand and Economic growth separately. This study will fill this gap by investigating and analyzing the relationship between air transport demand and economic growth in the low-income country, Ethiopia separately for both domestic and international passenger Air transport demand.

2.4 Conceptual Framework of the study

As shown on the above literature review, there exist feedback relationship between economic growth and Air travel demand and the direction of causality is still complex. Air transport demand can have direct, Indirect, Induced and Tourism catalytic impact on economy, and then the economy can create demand for the Air transportation sector. In addition to economic growth, demand for Air travel can be affected by Population, Foreign Exchange rate; Foreign Direct Investment, International Tourism receipts, Education, Fares (Consumer Price Index), and all this variables are highly related with the economic performance of the given nation. So, based on the above Theoretical and Empirical literature review the researcher developed the below Conceptual framework to analyze the nexus between economic growth and passenger's air transport demand in Ethiopia:-s

Figure 2.6: Conceptual Framework of the study



Source: Adopted by the researcher from theoretical and empirical Literatures.

CHAPTER THREE: ETHIOPIAN AIRLINE INDUSTRY

3.1 Ethiopian Airlines History

Ethiopian Airlines with headquarter in Addis Ababa is Ethiopia's flag carrier, and as of now it is fully owned by Ethiopian government. It was founded in 1945, and currently is Star Alliance member. Ethiopian Airlines began operations in 1946 with the first five C-47 aircraft, which were relics from World War II, on its inaugural journey to Cairo through Asmara. Since then, Ethiopian has continued to grow by leaps and bounds, introducing new aviation technology and systems, achieving numerous firsts in the history of African aviation, including providing the first jet service on the continent, deploying the first African B767, the first African B777-200LR in 2010, and the first African B787 Dreamliner in 2012, second only to Japan(ETG, 2021).

In 1962, the private sector began to participate in the air transportation industry. There were seven private air transport carriers operating in commercial aviation between 1962 and 1975. The government seized all private planes with Ethiopian registration on May 16, 1975, and Ethiopian Airlines was named custodian of the nationalized planes. Following that, and for the duration of the Derg government, Ethiopian Airlines was the exclusive provider of air transportation (Eyob, 2001; Helina, 2001).

Further, domestic air transportation was reopened to private sector participation in 1996, but only under certain circumstances. The FDRE investment proclamation No. 37/1996 declares the air transport industry open to investors, but with a few caveats: investors must be Ethiopian nationals and must be able to provide air transportation services using aircraft with a seating capacity of up to 20 passengers or a cargo capacity of up to 2,700 kg (Eyob, 2001). The sitting and cargo capacity of private airlines were amended in 2013 under Investment Proclamation No. 37/1996. According to the proclamation, the maximum seating capacity was 50 passengers, with no restrictions on freight operations.

In general, Ethiopian Airlines has won numerous awards from recognized organizations, and in 2011, the airline began implementing a 15-year growth strategy known as Vision 2025. Ethiopian International, Ethiopian Express (regional), Ethiopian Cargo, Ethiopian MRO, Ethiopian Catering, Ethiopian Aviation Academy, and Ethiopian Ground Handling are the seven profit centers of Ethiopian. In 2010, the airline transported three million people and earned $1.3 billion in revenue. Today, the airline travels more than 12 million passengers and earns $4 billion in revenue annually. After fulfilling the majority of the goals set out in

Vision 2025, management is now working on Vision 2035, a new growth strategy aimed at sustaining the airlines rapid expansion (ETG, 2019).

Ethiopian Airlines has come a long way from its humble beginnings to become a leading African aviation group during the last 75 years. Ethiopians, of course, age gracefully. The airline has established itself as an expert in all aspects of the aviation sector over the last seven decades, including technology leadership, network expansion, and aviation mentors. Ethiopian flies to over 125 passenger's destinations, from this 23 of which are domestic, and 44 freighter destinations. Ethiopian airline is Africa's largest airline not only in size of fleet, but also in terms of transported passengers, number of destinations served, and generated revenue. Ethiopian Airlines is also the world's fourth largest airline in terms of destinations served (ETG, 2020).

Ethiopian Airlines was the first airline in Africa to get the Airbus A350 XWB, bringing the additional effect to the African continent. Ethiopian Airlines, once again, set the standard by being the first African airline to fly the new Boeing 787-9 in 2017. Ethiopian presently operates more than 130 of the newest and most contemporary fleets, all of which are less than five years old, and has 38 fleets on order, which is well below the industry average (Table 3.1 below shows Fleet Summary).

Table 3.1:- ETG Fleet Summary

FLEET SUMMARY	
Operating Fleet	**Name**
Long Range Passenger Services	18- Airbus A350-900XWB
	19- Boeing B787-8
	8- Boeing B787-9
	4- Boeing B777-300ER
	6- Boeing B777-200LR
	3- Boeing B767-300ER
Medium Range Passenger Services	19- Boeing B737-800
	4 - Boeing B737 MAX
	10- Boeing B737-700NG
Regional and Domestic Passenger Services	30- Q400 Bombardier
Cargo and Non Scheduled Services	9- Boeing B777-200LRF (cargo)
	3- Boeing B737-800F (cargo)
Total Operating Fleet	133
FLEET ON ORDER	
Long Range Passenger Services	6- Airbus A350-900XWB
	2- Boeing B787-9
Medium Range Cargo Services	1- B737-800F
Medium Range Passenger Services	25- Boeing B737 MAX 8s
Regional and Domestic Passenger Services	2-Q400 Bombardier
Total Fleet on Order	36

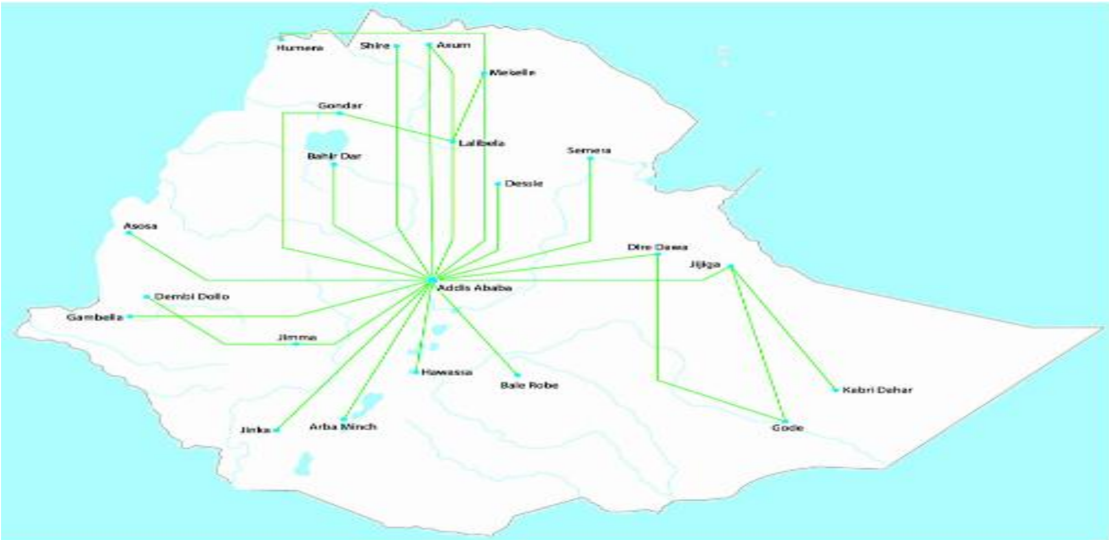
Source: - ETG Factsheet, 2022

3.2. Ethiopian Airlines Network

3.2.1 Ethiopian Airlines Domestic Network

Ethiopia's above 23 domestic scheduled destinations stretches across the country, joining provincial and administrative cities to the capital and regional economic areas (Figure, 3.1). A daily "Historic Route Service" is also available for travellers visiting the country's world-famous ancient historic sites of Axum, Bahr Dar, Gondar, and Labella, which feature obelisks and rock-hewn cathedrals. Addis Ababa, Arba Minch, Axum, Bahar Dar, and Jimma are among Ethiopian Airlines' domestic scheduled destinations (ETG, 2021).

Figure 3.1: Ethiopian Domestic Network



Source: ETG, 2021

Ethiopian Domestic Network

3.2.2 Ethiopian International Scheduled Service

Ethiopia's over 127 international route network stretches across the globe, connecting Africa and other continents together (figure 3.2). Ethiopian Airlines flies to 62 African destinations, including Nigeria, South Africa, and Angola. Ethiopian has 22 destinations in Europe, North and South America, including the United States, France, and England, as well as 26 in the Gulf, Middle East, and Asia, including China and India (ETG, 2021).

Figure 3.2: Ethiopian International Network

Source: ETG, 2021

3.3 Ethiopian Airlines Current Performance

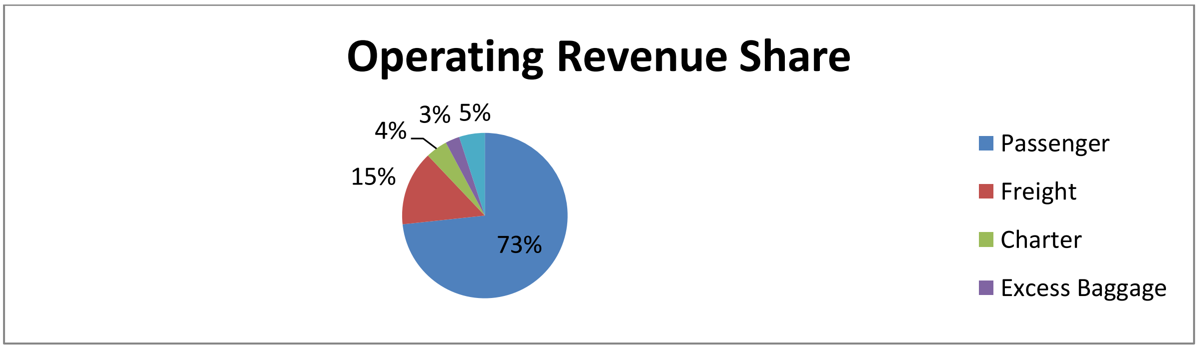
Ethiopian Airlines is Africa's quickest-growing airline. Ethiopian Airlines has grown into one of the continent's premier carriers, unrivaled in efficiency and operational success in its seventy-plus years of operation. The majority of the Pan-African passenger and cargo network were controlled by Ethiopian airlines, and by operating with the youngest and most modern fleet it is serving above 127 international passenger and cargo destinations on five continents. With an average fleet age of five years, Ethiopia's fleet comprises ultra-modern and ecologically friendly aircraft such as the Airbus A350, Boeing 787-8, and Boeing 787-9 Ethiopian Airlines is the first African airline to possess and operate these planes. Ethiopian International Services, Ethiopian Cargo & Logistics Services, Ethiopian MRO Services, Ethiopian Aviation Academy, Ethiopian ADD Hub Ground Services, Ethiopian Airports Services, and Ethiopian Express Services are all part of a 15-year strategic plan called Vision 2025, which successfully met the goal early by making Ethiopian the leading aviation group in Africa (Domestic). Ethiopian Airlines is a multi-award-winning airline that has grown at a rate of 25% per year for the past seven years. Currently, the airline is working toward its vision of 2035 by transforming its aviation academy into an aviation university and getting into the hotel industry as a new business unit (ETG, 2021).

Ethiopian has provided a missing link across its enormous African network, connecting 62 cities and more than 127 foreign passenger and cargo destinations with daily and more flights, with a minimum layover in Addis Ababa, living up to its tagline of "Bringing Africa Together and Beyond." Ethiopian Airlines, as a seasoned African carrier, has better positioned its enormous intra-Africa network than any other airline. In December 2011, Ethiopian Airlines became a member of Star Alliance, the world's largest airline alliance. Ethiopian Airlines has won numerous awards, including SKYTRAX Best Airline Staff Service in 2013 and 2016, 'Best Airline in Africa' in 2017, 2019, and 2020, and Four Star Airline Certification in 2017. Ethiopia has been growing at a rate of 25% per year on average for the past seven years (ETG, 2021).

3.3.1 Ethiopian Revenue Contributions by Business Segment

Over the last 25 years, revenue share of passengers, freight, charter, excess baggage, and other services has been shown in Figure 3.3(From 1995-2019). Passenger revenue accounts for more than 73 percent of overall revenue, which is the greatest percentage, followed by freight, charter, excess baggage, and other services, which account for 15 percent, 4 percent, 3 percent, and 5 percent of total revenue, respectively.

Figure 3.3:- Ethiopian Airlines Group Revenue Contributions by Business Segment

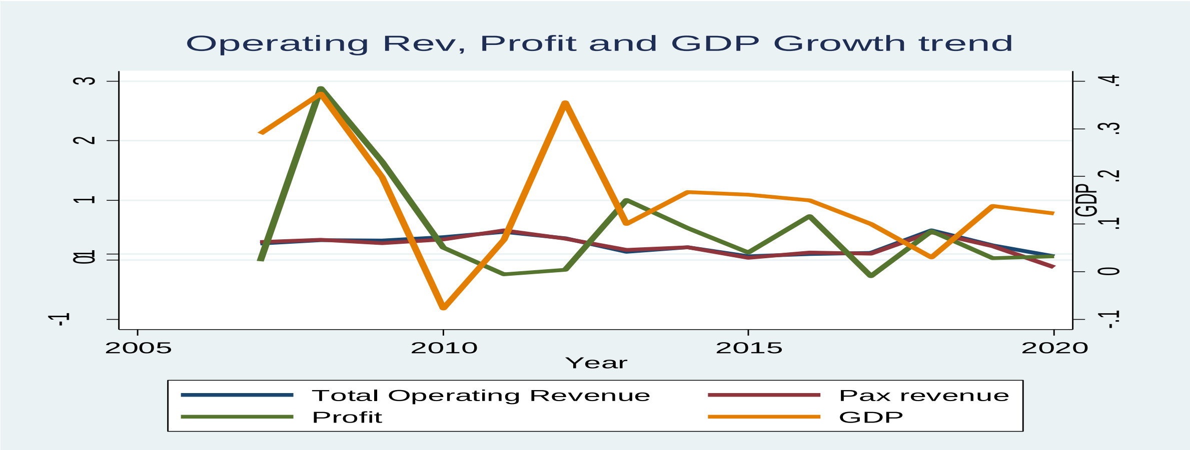


Source: - ETG Annual reports, 2003/04-2018/2019

3.3.2 Ethiopian Airlines Revenue, Profit and GDP trends

Over the last 14 years, the Ethiopian Airlines group's profit and income, as well as the country's GDP, have demonstrated consistent increase. Ethiopian Airlines' overall operational income and profit, as well as the country's GDP, were around ETB113 billion, ETB6.8 billion, and USD107.6 billion respectively at the end of 2019. These statistics have climbed by more than 20, 51, and 5 times in comparison to 2006. Over the last 14 years, Ethiopian revenue and profit, as well as the country's GDP, have been on the rise. Though there are fluctuations, Ethiopian Airlines Group revenue and profit growth has been tremendous over the last 14 years, with average growth rates of total revenue by 26 percent, passengers revenue by 24% and profit by 20 percent, respectively, and Ethiopia as a nation has experienced double-digit economic growth with an average nominal GDP growth rate of 16 percent (Figure 3.4).

Figure 3.4: Ethiopian Revenue, Profit and GDP growth Trends



Sources: - ETG Annual reports, 2003/04-2018/2019 and WB, 2022

3.3.3 Covid-19 impact and Performance of Ethiopian Airlines

African airlines going out of business would have disastrous economic effects. African airlines are expected to lose about $6 billion in revenue, and the aviation industry's contribution to the continent's GDP might plummet by $28 billion. Furthermore, 3.1 million employments in the business are under jeopardy in Africa. Air transport employs over 7 million people and generates over $70 billion in revenue for the continent's economy. Africa had roughly 76.6 million annual air travelers before to the COVID-19 issue, and passenger numbers were predicted to climb to 303 million by 2035. The continent's commercial aviation market has enormous growth potential. Despite the fact that Africa is home to 15% of the world's population and occupies 20% of the continent's geographical mass, its aviation industry is modest, accounting for only 3% of the global market. Before the outbreak of COVID-19, the top ten fastest-growing markets in the globe were expected to be in Africa: Sierra Leone, Guinea, Central African Republic, Benin, Mali, Rwanda, Togo, Uganda, Zambia, and Madagascar, listed in order of estimated growth rate. Over the following 20 years, each of these markets was predicted to increase at a rate of more than 8% each year (IATA, 2020; ICAO, 2020; and African Development Bank, 2019).

The estimated economic implications of covid-19 in the continent's largest aviation markets as of April 2020 are shown in Table 3.2 below. In this regard, the International Civil Aviation

Organization (ICAO) predicts a reduction in airline capacity of 42 to 59 percent, a decline in passenger numbers of 48 to 61 million, and a revenue loss of $10 billion to $13 billion in 2020 (ICAO, 2020). Due to the outbreak of Covid-19, Ethiopia, as the owner of Africa's largest and leading airlines, was one of the countries affected, and as shown in the table below (Table 7), the loss of airline revenue was 430 million USD, employment was at risk was around 500,521 people, and the loss of GDP contribution was 1903 million USD for the indicated period (UN, 2020).

Table 3.2: Economic impacts of Covid-19 in the largest African aviation markets

Country	Loss of airline revenue (millions of US dollar)	Employment Risk* (Full Time equivalents)	Loss of GDP contribution* (millions of US dollar)
South Africa	3,020	252,088	5,097
Nigeria	994	125,370	885
Ethiopia	430	500,521	1,903
Kenya	732	193, 342	1,578
UR of Tanzania	310	336, 182	1,513
Mauritius	544	73, 694	2,035
Mozambique	131	126, 418	199
Ghana	380	284, 255	1,575
Senegal	329	156, 224	634
Cape Verde	204	46, 652	478

Source: - UN, 2020

Despite the insecurity in the northern half of the country and the impact of the COVID-19 pandemic, Ethiopia's economy grew in 2020/21. Real GDP increased by 6.3 percent in the fiscal year under review, slightly higher than the 6.1 percent growth seen the previous year. Real GDP growth was 3.7 percentage points below than the Ten-Year Development Plan's average growth rate target, but much higher than the 3.4 percent growth prediction for Sub-Saharan African countries (IMF and WEO Update, June 2020). The service sector continued to dominate the economy in 2020/21, with a 39.6 percent share of GDP and a 38.3 percent contribution to GDP growth. Transport and communication accounted for 7.0 percent of the 6.3% growth in the service sector (NBE, 2021).

Due to the onset of COVID-19, the fiscal year 2019/20 was almost the most difficult for the worldwide aviation sector. In fact, due to the introduction of country-wide flight bans, travel restrictions, and border closures to stop the spread of the Coronavirus, the global pandemic has slowed air traffic around the world. COVID-19 has wreaked havoc on the world's airlines, causing them to be unable to continue their basic operations. The trends of Ethiopian airlines' ASK RPK, and LF increased from 1990 to 2020, until the global Covid-19 pandemic broke out. Before the outbreak on Covid-19, the average growth rate of ASK, RPK, and LF was 12 percent, 13 percent, and percent, respectively. However, due to the influence of Covid-19, the growth rates of ASK, RPK, and LF were -49, -64, and -29 percent, respectively, compared to the previous year, which was pre-Covid. As a result, a number of airlines have totally exited the aviation business; others have temporarily grounded their fleets and enacted wage cuts, headcount reductions, and contract terminations against their employees. Many others are still begging their governments for financial assistance. Covid-19 has had an impact on Ethiopian's overall operations, but the airline has maintained to operate without seeking government assistance by using various ways to adjust for income losses in its various business areas. Starting with the implementation of Covid-19 procedures and the conversion of 25 passenger aircraft to cargo aircraft, the company has been able to meet the high global demand for cargo transportation and repatriation charter flights to various parts of the globe. Ethiopian Carriers has shown to be one of the few worldwide airlines that have held up against COVID-19, and the only one that has stayed profitable. Ethiopian Airlines is one of the few international airlines that did not cancel flights due to the Pandemic. Furthermore, Ethiopian Airlines survived the epidemic without terminating a single person from its 17 thousand-plus employees, and as a result, the airline has garnered high praise and honors from world leaders and significant international organizations (ETG Annual Report, 2019/20). Table 3.3 below shows that, despite a significant drop in passenger revenue, the airline's strategy and adaptability throughout the crisis paid off, and revenue from freight and transportation increased dramatically, contributing significantly to the airline's profitability.

Table 3.3: Ethiopian Revenue growth on major business segment during Covid-19

Operating Revenue			
Year	**Passengers**	**Freight**	**Charter**
2019	80634372904	17769032811	4668117799
2020	70614227255	26393046749	13555605867
% Change	-12%	49%	190%

Source: - ETG, 2019/20 Annual report

CHAPTER FOUR: RESEARCH METHODOLOGY

4.1. Research Design

Explanatory research design was used to investigate a phenomenon that has not been thoroughly explored or described previously. Its major objective is to figure out why and what a subject is being investigated for. In a nutshell, it's a form of study design that focuses on determining the why of occurrences by establishing cause-and-effect correlations (Edu, T.L., 2021.

The researcher used explanatory research design owe to the fact that it allows the researcher to provide deep insight into a specific subject, which gives birth to more subjects and provides more opportunities for the researchers to study new things and questions new things. In addition to that, it is appropriate research design to increase the understanding of a researcher on a certain subject, and also it makes the researcher determine how and why things happen. So, by using explanatory research design the researcher devoted to increase the understanding on the nexus between economic growth and passenger’s air travel demand (Domestic and international) in Ethiopia.

4.2 Research Approach

Since it entails the collection of data in quantitative form that may be submitted to formal and rigid quantitative examinations, this research used quantitative approach.

4.3 Data Source, Type and Method of Data Collection

Reliability of a given study is greatly depends on the quality of data. The study used only secondary data spanning from 1991-2020. They were obtained from more reliable sources such as IATA; Ethiopian Airlines group (ETG), World Bank (WB), and different publications of national/central banks of Ethiopia (NBE). Secondary data were collected from mentioned credible sources database in order to analyze the relationship and causality between domestic and International air transport demand and Economic growth in Ethiopia. After data compilation to understand the relationship between the variables under discussions, simple descriptive statistical methods and inferential analysis were employed.

4.4 Method of Data Analysis

In this study, both descriptive and inferential statistical methods applied. Descriptive statistical methods such as measures of central tendency (mean, median and mode), percentage, table and graphs were used to present trends of Domestic and International passengers air transport demand, Economic growth and selected variables.

To examine the relationship and causality between domestic and International air transport demand and Economic growth, and other variables in Ethiopia an ARDL econometrics model and Granger and modified Wald causality tests were used. Before going to analysis, pre-estimation Diagnostic tests like unit root test, optimal lag length selection, ARDL-Bound co-integration test, and finally post–estimation tests like Normality, Serial Autocorrelation test, Hetroscedasticity and model stability tests were employed by using Eview-10 software.

4.5.1 Econometrics Model Specification

The ARDL bounds testing approach to cointegration was used by the researcher, and it determines the long run relationship between variables and then derives the error correction representation model for the estimation of short run coefficients of the variables if there is a long run relationship between them. In first difference regression, the F-statistic of the joint significance test (Wald test or long-run bound test) is used to assess if the lagged levels of the variables are significant and cointegrated (Conditional Error Correction Model Specification). Pesaran (1997), Pesaran and Shin (1999), and Pesaran et al. (2001) developed it, and when compared to other cointegration approaches such as Engle and Granger (1987) and Johansen and Juselius (1990), it has a number of advantages, some of which are stated below:

Firstly, the ARDL can be used even if the variables under study are not integrated in the same order, whereas Johansen cointegration approaches demand that all variables in the system be integrated in the same order. This means that the ARDL test can be used when the underlying variables are integrated to order one, zero, or fractionally integrated. Secondly, ARDL model is more efficient in the case of small and finite sample data sizes, whereas Johansen cointegration techniques require large data samples for validity. Thirdly, even in the presence of autocorrelation and endogeneity, the ARDL approach produces estimates and correct t-statistics (Harris &Sollis, 2003).Fourth, a simple error correction (ECM) model from ARDL model provides short-run coefficients along with long-run equilibrium without losing valid long-run coefficients. Finally, the last advantage is that the ARDL model can be regarded as the equal number of lag length for all variables or different orders of lag without affecting the asymptotic distribution of the test statistic (Pesaran et al., 2001).

To execute a regression analysis between a dependent series and k number of independent series, autoregressive DLMs are used. An ARDL model of orders p and q is indicated by

ARDL (p, q), which consists of p lags of independent and q lags of dependent series when there is only one independent series. The model is autoregressive due to the lags of the dependent series. We describe the ARDL model as Eq (3.1) where the number of lags of ith independent series is shown by pi, I = 1... K.

$Y_t = \mu_0 + \sum_{i=1}^{k} \beta_{0i} X_{ti} + \beta_i X_{(t-1)i} + \cdots \beta_{1i} X_{(t-1)i} + \gamma_1 Y_{t-1} + \cdots \gamma_q Y_{t-q} + e_t$ ………...4.1

Where μ_0 is the constant, Y_t and X_{ti} are respectively dependent and i^{th}independent series, p_i is the lag order of i^{th} independent series, q is the autoregressive order of the model, and $e_t$shows the innovations.

Pesaran et al. devised the ARDL limits test (2001), which is an effective method for cointegration analysis. Because of its advantages over other cointegration analysis approaches in a wide range of domains, this test is frequently utilized by practitioners. To do the analysis with this approach, we don't need a stationary (I (0)) or difference stationary (I(1)) series. We may easily derive an unlimited error correction model to observe the series' short and long-run dynamics. The ARDL limits test can also be applied to tiny samples.

To formulate the ARDL bounds test, we rewrite Eq (3.1) in the following conditional error correction form:

$\Delta Y_t = \mu_0 + \alpha_0 Y_{t-1} + \alpha_1 X_{1,t-1} + \cdots \alpha_k X_{k,t-1} + \sum_{i=1}^{q} \gamma_i \Delta Y_{t-i} + \sum_{j=0}^{p_1} \beta_{1,j} \Delta X_{1,t-j} + \cdots . \sum_{j=0}^{p_k} \beta_{k,j} \Delta X_{k,t-j} + e_t$……………………………………………………..4.2

Where μ_0 is the intercept and Δ is the first difference of the series. The error correction part of the model, ECT_{t-1} is

$EC_{t-1} = Y_{t-1} - \sum_{i=1}^{k} \frac{\alpha_i}{\alpha_0} X_{i,t-1}$……………………………………………………..4.3

The hypotheses of cointegration are written over the coefficients of the conditional error correction model given in Eq (3.2). Then, the test is applied with

$H_o: \alpha_0 = \alpha_1 = \cdots \ldots . = \alpha_k = 0$………………………………………………..……….4.4

If H_0 is rejected, we can conclude that cointegration between variables is significant. A Wald test statistic is calculated and compared to Pesaran et al. If $H_0$is not rejected if the test statistic is less than the provided lower limit, and insignificance of cointegration between variables is determined. H_0 Is rejected and the significance of cointegration between variables is concluded if the test statistic is greater than the set upper limit. There can be no conclusion if the test statistic falls within the provided lower and upper bounds.

Based on literatures and findings, Air travels demand (domestic and International) is a derived demand and it is a function of many economic, social, political, and demographic factors (Erraitab, (2016), Boeing (2016), Baikgaki&Daw, (2013), Vasigh et.al, (2018) and Tassew et.al 2020).

PAX(Domestic and International)=f(GDP,FDI,ITR,EDUC,CPI,OER,POP)…………..(3.5)

For this specific study, ARDL model specified as below both for Domestic and International passenger's air travel demand:-

Model 1:-Domestic Passengers demand and Economic Growth

$$\Delta \text{LNDPAX}_t = \delta_{01} + \sum_{i=1}^{p} \alpha_{1i}\, \Delta LNDPAX_{t-1} + \sum_{i=1}^{q1} \alpha_{2i}\, \Delta LNGDP_{t-1} + \sum_{i=1}^{q2} \alpha_{3i} \Delta LNFDI_{t-1} + \sum_{i=1}^{q3} \alpha_{4i} \Delta LNITR_{t-1} + \sum_{i=1}^{q4} \alpha_{5i} \Delta LNEDUC_{t-1} + \sum_{i=1}^{q5} \alpha_{6i} \Delta LNCPI_{t-1} + \sum_{i=1}^{q6} \alpha_{7i} \Delta LNOER_{t-1} + \sum_{i=1}^{q7} \alpha_{8i} \Delta LNPOP_{t-1} + \psi_1 LNDPAX_{t-1} + \psi_2 LNGDP_{t-1} + \psi_3 LNFDI_{t-1} + \psi_4 LNITR_{t-1} + \psi_5 LNEDUC_{t-1} + \psi_6 LNCPI_{t-1} + \psi_7 LNOER_{t-1} + \psi_8 LNPOP_{t-1} + \varepsilon_{1t} \ldots\ldots (4.6)$$

Where

LNDPAX=Natural log of Number of Domestic passengers at year t

LNIPAX= Natural log of Number of International passengers at year t

LNGDP= Natural log of gross domestic product at year t

LNFDI= Natural log of foreign direct investment inflow at year t

ITR= International tourism receipt at year t

LNEDUC= Natural log of education at year t

LNCPI= Natural log of consumer price index at year t

LNOER= Natural log of official exchange rate at year t

LNPOP= Natural log of total population at year t

$\alpha_{1i}, \alpha_{2i}, \ldots\ldots \alpha_{8i}$ =are the short term coefficients

$\psi_1, \psi_2 \ldots\ldots \psi_8$= are long term coefficients

$p, q_1, q_2, q_3, q_4, q_5,$ and q_6 =are optimal lag lengths of the ARDL model.

LN= is the logarithm operator.

Δ=is the first difference

ε_{1t} = are the error term assumed to be independently and identically distributed.

Where

$H_0: \psi_1 = \psi_2 = \psi_3 = \psi_4 = \psi_5 = \psi_6 = \psi_7 = 0$ against the alternative hypothesis

$H_1: \psi_1 \neq \psi_2 \neq \psi_3 \neq \psi_4 \neq \psi_5 \neq \psi_6 \neq \psi_7 = 0$

Model 2:-International passengers demand and Economic Growth

$$\Delta \text{LNIPAX}_t = \delta_{01} + \sum_{i=1}^{p} \beta_{1i}\, \Delta LNIPAX_{t-1} + \sum_{i=1}^{q1} \beta_{2i}\, \Delta LNGDP_{t-1} + \sum_{i=1}^{q2} \beta_{3i} \Delta LNFDI_{t-1} + \sum_{i=1}^{q3} \beta_{4i} \Delta LNITR_{t-1} + \sum_{i=1}^{q4} \beta_{5i} \Delta LNEDUC_{t-1} + \sum_{i=1}^{q5} \beta_{6i} \Delta LNCPI_{t-1} + \sum_{i=1}^{q6} \beta_{7i} \Delta LNOER_{t-1} + \sum_{i=1}^{q7} \beta_{8i} \Delta LNPOP_{t-1} + \delta_1 LNIPAX_{t-1} + \delta_2 LNGDP_{t-1} + \delta_3 LNFDI_{t-1} + \delta_4 LNITR_{t-1} + \delta_5 LNEDUC_{t-1} + \delta_6 LNCPI_{t-1} + +\delta_7 LNOER_{t-1} + \delta_8 LNPOP_{t-1} + \mu_{1t} \quad \text{......(4.7)}$$

Where

LNDPAX=Natural log of Number of Domestic passengers at year t

LNIPAX= Natural log of Number of International passengers at year t

LNGDP= Natural log of gross domestic product at year t

LNFDI= Natural log of foreign direct investment inflow at year t

ITR= International tourism receipt at year t

LNEDUC= Natural log of education at year t

LNCPI= Natural log of consumer price index at year t

LNOER= Natural log of official exchange rate at year t

LNPOP= Natural log of total population at year t

$\beta_{1i}, \beta_{2i}, \ldots \ldots \beta_{8i}$ =are the short term coefficients

$\delta_1, \delta_2 \ldots\ldots \delta_8$= are long term coefficients

$p, q_1, q_2, q_3, q_4, q_5$, and q_6 =are optimal lag lengths of the ARDL model.

LN= is the logarithm operator.

Δ=is the first difference

ε_{2t}= are the error terms assumed to be independently and identically distributed.

Where

H_0: $\delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = \delta_7$=0 against the alternative hypothesis

H_0: $\delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq \delta_5 \neq \delta_6 \neq \delta_7$=0

Where if cointegration is identified by ARDL-bound test, the rejection of H_o, the long run and short run coefficients of the variables are estimated in equation 4.8 to 4.12 respectively (Pesaran et al., 2001), and also an error-correction term is estimated (Narayan & Smyth, 2006; Morley, 2006).

Model 1:-Domestic Passengers demand long-run Relationships

$$\text{LNDPAX}_t = \delta_{01} + \sum_{i=1}^{p} \alpha_{1i}\, LNIPAX_{t-1} + \sum_{i=1}^{q1} \alpha_{2i}\, LNGDP_{t-1} + \sum_{i=1}^{q2} \alpha_{3i} LNFDI_{t-1} + \sum_{i=1}^{q3} \alpha_{4i} LNITR_{t-1} + \sum_{i=1}^{q4} \alpha_{5i} LNEDUC_{t-1} + \sum_{i=1}^{q5} \alpha_{6i} LNCPI_{t-1} + \sum_{i=1}^{q6} \alpha_{7i} LNOER_{t-1} + \sum_{i=1}^{q7} \alpha_{8i} LNPOP_{t-1}\, \varepsilon_{1t} \quad (4.8)$$

Model 2:-International passengers demand long-run Relationships

$$\text{LNIPAX}_t = \delta_{01} + \sum_{i=1}^{p} \beta_{1i}\, LNIPAX_{t-1} + \sum_{i=1}^{q1} \beta_{2i}\, LNGDP_{t-1} + \sum_{i=1}^{q2} \beta_{3i} LNFDI_{t-1} + \sum_{i=1}^{q3} \beta_{4i} LNITR_{t-1} + \sum_{i=1}^{q4} \beta_{5i} LNEDUC_{t-1} + \sum_{i=1}^{q5} \beta_{6i} LNCPI_{t-1} + \sum_{i=1}^{q6} \beta_{7i} LNOER_{t-1} + \sum_{i=1}^{q7} \beta_{8i} LNPOP_{t-1} + \mu_{1t} \quad (4.9)$$

Moreover, a dynamic error correction model (ECM) can be derived from the ARDL bounds test through a simple linear transformation. The short-run dynamic parameters by estimating an unrestricted ECM or conditional ECM associated with the long-run estimates are obtained:

Model 1:-Domestic passengers demand ARDL Short-run Specification

$$\Delta\text{LNDPAX}_t = \delta_{01} + \sum_{i=1}^{p} \alpha_{1i}\, \Delta LNDPAX_{t-1} + \sum_{i=1}^{q1} \alpha_{2i}\, \Delta LNGDP_{t-1} + \sum_{i=1}^{q2} \alpha_{3i} \Delta LNFDI_{t-1} + \sum_{i=1}^{q3} \alpha_{4i} \Delta LNITR_{t-1} + \sum_{i=1}^{q4} \alpha_{5i} \Delta LNEDUC_{t-1} + \sum_{i=1}^{q5} \alpha_{6i} \Delta LNCPI_{t-1} + \sum_{i=1}^{q6} \alpha_{7i} \Delta LNOER_{t-1} + \sum_{i=1}^{q7} \alpha_{8i} \Delta LNPOP_{t-1} + \lambda_1 ECM_{t-i} + \varepsilon_{2t} \quad (4.10)$$

Model 2:-International passengers demand ARDL Short-run Specification

$$\Delta\text{LNIPAX}_t = \delta_{01} + \sum_{i=1}^{p} \beta_{1i}\, \Delta LNIPAX_{t-1} + \sum_{i=1}^{q1} \beta_{2i}\, \Delta LNGDP_{t-1} + \sum_{i=1}^{q2} \beta_{3i} \Delta LNFDI_{t-1} + \sum_{i=1}^{q3} \beta_{4i} \Delta LNITR_{t-1} + \sum_{i=1}^{q4} \beta_{5i} \Delta LNEDUC_{t-1} + \sum_{i=1}^{q5} \beta_{6i} \Delta LNCPI_{t-1} + \sum_{i=1}^{q6} \beta_{7i} \Delta LNOER_{t-1} + \sum_{i=1}^{q7} \beta_{8i} \Delta LNPOP_{t-1} + \lambda_2 ECM_{t-i} + \mu_{2t} \quad (4.11)$$

Where

ECM_{t-1} , is the error correction term that should be negative and statistically significant because the speed of adjustment, that is to say, how quickly the variables return to the long-run equilibrium.

Equation 4.8 and 4.9 gives the coefficients of the level variables in the long run at optimal lag. It shows the impact of the level variables up to in the long run. Equation 4.10 and 4.11 is the ARDL short run specification; it is derived through the construction of an error correction model (ECM). In equation 4.10&4.11 is the coefficient of the ECM, it represents the speed of adjustment or re-equilibration to equilibrium position whenever there is deviation as a result of shocks, and thus it must be negative and significant. The ECM is therefore the error correction term and is lagged by one period to show the percentage of its speed of adjustment from a shock in the previous period to equilibrium in the current period. All coefficients in equation 4.10&4.11 reveals the short run impact of the independent variables on $\Delta LNDPAX_t$and$\Delta LNIPAX_t$. Finally to represent the speed of recovering from deviations ECM_twere developed for both models.

4.5.2 Estimation procedures

4.5.2.1 Pre-estimation Tests

- **Stationary and Non-stationary test**

In empirical study based on time series data, the underlying time series is thought to be stationary. If the data is non-stationary, the researcher will only look at the behavior of a non-stationary time series over the time period in question, and each piece of information will be for a single episode. As a result, extrapolation to other time periods is difficult, and the time series may only be useful for forecasting in limited circumstances. However, if a time series is stationary, its mean, variance, and auto covariance (at various lags) do not change regardless of where they are measured; they are time invariant (Brooks, 2008). Mean reversion occurs when a time series tends to revert to its mean and deviations around that mean (measured by variance) have a relatively constant amplitude (Guajarati, 1994).One of numerous tests that can be used to assess whether a series is stationary or non-stationary is the Dickey Fuller test (Hill et al. 2008). Although additional stationary tests exist, the researcher concentrated on the Dickey Fuller (DF) and Augmented Dickey Fuller (ADF) Unit Root Tests, which have been extensively studied in the literature.

The Unit Root Test

The general idea behind the unit root is that,

Let $Y_t = \rho Y_{t-1} + \mu_t$ $-1 \leq \rho \leq 1$ …………………………………………...4.12

Where $\mu_t$is a white noise error term, and (3.1) becomes a random walk model without drift if ρ=1, that is, in the case of the unit root (non-stationary Stochastic Process). Why don't you just regress Y_t on its (one period) lagged value Y (Y_{t-1}) and see if the estimated ρ is statistically equal to 1? If that's the case, Y_t isn't stationary.

We can alter (3.1) as follows for theoretical purposes: To get (3.1), subtract Y_{t-1} from both sides:

$$Y_t - Y_{t-1} = \rho Y_{t-1} - Y_{t-1} + \mu_t$$

$$= (\rho\text{-}1)\ Y_{t-1} + \mu_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 4.13$$

This can also be expressed as

$$\Delta Y_t = \delta Y_{t-1} + \mu_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 4.14$$

Where $\delta = (\rho - 1)$ and Δ is the first-difference operator, as is customary.

In practice, we estimate (3.3) instead of (3.2) and test the (null) hypothesis that $\delta = 0$. If $\delta = 0$, then $\rho = 1$, indicating that we have a unit root, indicating that the time series in question is non-stationary. Before estimating (3.3), it's worth noting that if $\delta = 0$, (3.3) will become

$$\Delta Y_t = (Y_t - Y_{t-1}) = \mu_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 4.15$$

Because μ_t is a white noise error term, it is stationary, implying that the first differences of a random walk time series are also stationary, as it is previously shown.

The DF test is computed in three different forms, which are under three alternative null hypotheses, to account for the many possibilities.

Y_t-is a random walk: $\Delta Y_t = \delta Yt{-}1 + ut$ ……………………………………………… (4.16)

Y_t-is a random walk with drift: $\Delta Y_t = \beta_1 + \delta Y_{t-1} + \mu_t$ …………………………………….(4.17)

Y_t-is a random walk with drift around a stochastic trend: $\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \mu_t$ ..(4.18)

The time or trend variable is denoted by the letter t. The null hypothesis in each case is that $\delta = 0$; that is, the time series is non-stationary since there is a unit root. The other possibility is that is less than zero, implying that the time series is stationary. If the null hypothesis is rejected, Y_t is a stationary time series with zero mean in the case of (4.3), a stationary time series with a nonzero mean [$= \beta 1/(1 - \rho)$] in the case of (4.4), and a stationary time series around a deterministic trend in the case of (4.5).

Decision Rule

The null hypothesis (H_o) states that the series has a unit root (non- stationary)

If t-values (absolute or positive) exceed critical levels at 1%, 5%, and 10%, the null hypothesis (H_o) is rejected, indicating that the series does not have a unit root (it is stationary).

- **The Augmented Dickey–Fuller (ADF) Test**

The error term μ_t was believed to be uncorrelated while conducting the DF (3.3), (3.4), or (3.5). However, in the event that the $\mu_t$are correlated, Dickey and Fuller devised the augmented Dickey–Fuller (ADF) test. The lagged values of the dependent variable Y_t are added to the preceding three equations to "augment" the test. To be more explicit, let's say we utilize (21.9.5). In this case, the ADF test entails computing the following regression:

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta Y_{t-i} + \varepsilon_t \qquad (4.19)$$

Where ε_t is a pure white noise error term,$\Delta Y_{t-1} = (Y_{t-1} - Y_{t-2})$, $\Delta Y_{t-2} = (Y_{t-2} - Y_{t-3})$, and so on. The number of lagged difference terms to include is frequently set empirically, with the goal of having enough terms to make the error term in (3.6) serially uncorrelated. We still test if = 0 in ADF, and because the ADF test has the same asymptotic distribution as the DF statistic, we may use the same critical values.

- **Lag Length Selection**

It is crucial to decide on the maximum lag length before estimating a time series equation. Braun and Mittnik (1993) establish the importance of lag length determination by showing that estimates of a VAR with a lag length that differs from the true lag length, as well as impulse response functions and variance decompositions derived from the estimated VAR, are inconsistent. According to Lütkepohl (1993), over fitting (choosing a greater order lag length than the genuine lag length) increases the VAR's mean-square forecast errors, whereas under fitting induces autocorrelated errors. The accuracy of VAR model forecasts varies significantly for different lag lengths, according to Hafer and Sheehan (1989).

How many lagged components should be included in causality testing is a major practical question. Because the amount of lag items included in the analysis could have a considerable impact on causality direction. When determining lag length, the concepts of AIC, HQIC, FPE, and SBIC are critical. A specification error arises when there are too many lagged terms, degrees of freedom are exhausted, and there are too few delays. As a result, one alternative for answering this question is to use a lag time set by the majority criterion.

- **ARDL Bound Test of Co-integration**

The ARDL limits test assumes that the variables are I(0) or I(1), however if any series are integrated to order I(2) or above, the F-statistic calculated becomes erroneous (Ouattara, 2004). As a result, we use unit root tests to determine the order of integration of all variables before running this test. To avoid erroneous results, the fundamental goal is to guarantee that the variables are not I(2). We cannot comprehend the values of F statistics supplied by Pesaran et al. (2001) and Narayan (2001) in the presence of variables integrated of order two.

- **ARDL and Direction of Causality**

We derive the short-run dynamic parameters by estimating an error correction model linked with the long-run estimations, as described in Odhiambo (2009) and Narayan and Smyth (2008). The F-statistic and the lagged error-correction term show that there is Granger-causality in at least one direction, as indicated by the long-run relationship between the variables. The ARDL F-statistic on the explanatory variables shows the short-run causal influence, while the t-statistic on the coefficient of the lagged error-correction component represents the long-run causal relationship (Odhiambo, 2009; Narayan & Smyth, 2006). The Granger Causality test, introduced by Granger, is used to determine the direction of causation between the series (1969, 1988). The Wald test, commonly known as the joint significance test, is conducted by equating all of the lag variables' coefficients to zero. The short-run causal effects are indicated by the F-Statistics and t-statistics of the repressors, as well as the t-statistics of the explanatory variables. Furthermore, the F-statistics from the Granger and Wald tests reveal the causal effects in the short run. The long-run causal effect can be checked by using the error-correction term's t-statistics (applicable to error correction Model Only) (Gujaratti & Porter, (2009); Wooldridge, Jm(2009)).

$$Y_t = \varphi_0 + \sum_{z=1}^{p} \theta_z Y_{t-z} + \sum_{i=1}^{q} \delta_i X_{t-1} + \cdots + \varepsilon_t$$

$$X_t = \varphi_0 + \sum_{z=1}^{p} \varphi_z X_{t-z} + \sum_{i=1}^{q} \rho_i Y_{t-1} + \cdots + \mu_t$$

Where Y_t and X_t are the variables that have been tested, ε_t and μ_t are the error terms, t is the time period, and i is the number of lags.

- **Short-Run and Long-run Causal Effect**
  - **The 3 ways causality Checks**

Causality can be deduced from regressors-statistics if they are statistically significant.

- **Wald Coefficient test:**

H_0: Coefficient(s)=0

H_1: Coefficient(s)≠0

Decision Criteria: If the F-prob-value statistic's is less than 0.05, reject the null hypothesis.

- **Pair-wise Granger Causality test on the direction of causality**

H_0: no Granger − Causality

H_1: Null Hypothesis is not true

Decision Criteria: If the F-statistics prob-value is less than 0.05, reject the null hypothesis.

In the second step this study used the Modified Wald test (MWALD) as a confirmation in addition to the pairwise granger causality test in order to understand the cause and effect direction among those variables in general, and with particular reference to the relationship between economic growth and air travel demand (domestic and international), as suggested by Toda and Yamamoto (1995). Toda and Yamamoto devised the Modified Wald test, which is an enhanced granger causality test (1995), it uses a typical VAR model with levels instead of initial differences (unlike the Granger causality test), reducing the possibility of incorrectly identifying the sequence of integration of the series (Mavrotas and Kelly, 2001). Ordinary Least Squares (OLS) estimation is used to estimate the VAR (k) models, and p= [k+d(max)] is the optimal lag duration. Toda and Yamamoto's (1995) causality test is represented as follows in the case of a bivariate (Y, X) relationship:

$$Y_t = \varphi_0 + \sum_{z=1}^{p} \theta_{1i} Y_{t-z} + \sum_{i=1}^{p} \delta_{2i} X_{t-1} + \varepsilon_{1t}$$

$$X_t = \varphi_0 + \sum_{z=1}^{p} \varphi_{1i} X_{t-z} + \sum_{i=1}^{p} \rho_{2i} Y_{t-1} + \varepsilon_{2t}$$

H_0:No causality

H_1:Causality exist

Decision: We reject the null hypothesis of no causality in favor of the alternative if the chi-square (X^2) is significant; otherwise, we fail to reject the null hypothesis.

4.5.2.2 Post-estimation Tests

To ensure the goodness of fit of the model, diagnostic and stability tests are conducted. Diagnostic tests examine the model for, non-normality, serial correlation, Hetroscedasticity and model Stability test.

- **Normality Test**

The assumption of normality is that the underlying residuals are regularly distributed, or nearly so. While a residual plot or a normal plot of the residuals can detect non-normality, the Jarque-Bera test and its rivals test can be used to formally evaluate the hypothesis. With tiny sample numbers, violations of the normalcy assumption become an issue Because of the central limit theorem and the fact that the F- and t-tests used for hypothesis testing and constructing confidence intervals are quite resistant to minor deviations from normality, the assumption is less significant for large sample sizes (Gujarati, 2004). The following are the null and alternate hypotheses:

$\mathbf{H_o}$**:** Residuals are normally distributed.

$\mathbf{H_1}$**:** Residuals are not normally distributed.

Decision: You can reject the null hypothesis and conclude that the residuals are not from a normal distribution if the test p-value is less than the present significance level (5%). The null hypothesis cannot be rejected if the p-value is greater than the predefined significance level (5%).

- **LM Autocorrelation test**

The LM test is used to compare the null hypothesis of serially independent errors to the alternative hypothesis of AR(m) or MA errors (m). The calculated model's errors must be serially independent. This condition may also influence our ultimate choice of maximum lags for the variables in the model, as Pesaran et al. (2001) point out. One of the key assumptions in linear regression is that the residuals have no association, i.e. they are independent. A Durbin-Watson test can be used to check for first-order autocorrelation. If we want to check for autocorrelation at higher orders, we'll need to use the Breusch-Godfrey test.

When comparing the null hypothesis of serially independent mistakes to the alternative hypothesis of AR(m) or MA errors, the LM test is used . The errors in the estimated model must be serially independent. As Pesaran et al. (2001) point out; this requirement may also influence our final choice of maximum delays for the variables in the model. One of the most important assumptions in linear regression is that the residuals are unrelated, or independent. To check for first-order autocorrelation, utilize the Durbin-Watson test. We'll need to utilize the Breusch-Godfrey test to check for autocorrelation at higher orders.

This test uses the following hypotheses:

$\boldsymbol{H_0}$: **(Null hypothesis):** There is no autocorrelation at any order less than or equal to p.

$\boldsymbol{H_a}$: **(Alternative hypothesis):** There exists autocorrelation at some order less than or equal to p.

Decision: - We can reject the null hypothesis and infer that autocorrelation occurs among the residuals at some order less than or equal to, p if the p-value that corresponds to this test statistic is less than a particular significance level (5% or 0.05).

- **Hetroscedasticity Test**

Hetroscedasticity is a condition in which the variance of the residuals is unequal over a wide range of values (Brooks, 2008). Hetroscedasticity is a violation of the linear regression modeling assumptions, and as a result, it might have an impact on the study's validity (Hayes, 2020). As a result, having homoscedasticity in our model is crucial. Otherwise, as the fitted values of the response variables increase, the residuals may increase. The Breusch-Pagan test is used to determine if a regression model is hetroscedastic or not. The test uses the following null and alternative hypotheses:

Null Hypothesis ($\boldsymbol{H_0}$): Homoscedasticity is present

Alternative Hypothesis ($\boldsymbol{H_a}$): Hetroscedasticity is present

Decision: - We reject the null hypothesis and conclude that Hetroscedasticity is present in the regression model if the p-value of the test is less than the significance level (i.e. 5% or 0.05).

- **Specification Error test (RESET test)**

Misspecification in econometric model estimate can result in significant bias and inefficiency. Ramsey (1969) created the RESET regression error specification test to check for misspecification in regression models. RESET is a widely used test for detecting omitted variables and erroneous functional form in linear regression models. It employs an artificial regression to assess the statistical significance of the anticipated value of the dependent variable y and its higher powers among the regressors. The idea behind RESET is fairly simple. If the original model is

$$y = \beta_0 + \beta_1 x_1 + \cdots + \beta_k x_k + \mu \quad \text{………} (4.20)$$

Satisfies MLR. Then no non-linear functions of the independent variables should be significant when added to equation (3.20). RESET adds polynomials in the OLS fitted values to equation (3.12) to detect general kinds of functional form misspecification. Let $y^{\wedge}$ denote the OLS fitted values from estimating (3.20). Consider the expanded equation

$$y = \beta_0 + \beta_1 x_1 + \cdots + \beta_k x_k + \delta_1 y^{\wedge 2} + \delta_2 y^{\wedge 3} + error \quad \text{………} (4.21)$$

The null hypothesis is that (4.12) is correctly specified. Thus, the RESSET is the F-statistics for testing $H_0: \delta_1 = 0, \delta_2 = 0$ in the expanded model (4.21) a significant F-statistics suggests some sort of functional problem.

- **Stability Test**

The presence of cointegration as a result of the model does not always imply that the estimated coefficients are stable. As a result, Pesaran and Pesaran (1997) and Pesaran et al. (2001) proposed utilizing Brown et al. (1975) tests to examine parameter stability in estimated models, which are known as cumulative sum (CUSUM) and cumulative sum of squares (CUSUMQ) (Stamatious & Dritsakis, 2014). The null hypothesis of all coefficients in the given regression is stable and cannot be rejected if the plots of the CUSUM and CUSUMSQ statistics stay within the critical bounds of a 5% level of significance.

4.5.3 Definitions of variables, measurement and hypothesis

PAX is the total number of air passengers embarking and disembarking using scheduled flights at airports in Ethiopia via Ethiopian Airlines, and data were collected from IATA and Ethiopian Airlines Group.

DPAX-Represent Domestic Passenger number and

IPAX- Represent international passenger number

Number of passenger was used by different researchers like Hu et.al, (2014), Francois, B. and Darpeix, (2016), Suryan V, (2017), Silva et.al, (2018), Kİrachi&Battal, (2018), Erraitab et.al, (2016), and Baltaci N, et.al, (2015), as a proxy for air transport demand.

GDP- gross domestic product is used as a proxy to economic activity in the country, and it is a major explanatory variable to Air travel demand and the study by Abraham et.al, (2015), , Hu et.al, (2014), Francois, B and Darpeix, (2016), Suryan V, (2017), Silva et.al, (2018), Kİrachi&Battal, (2017), Baltaci N, et.al, (2015), and Erraitab et.al, (2016), also confirmed that.

Population (POP)

Total population size of a country is represented by POP, and in principle, state with higher population size may have greater air transport demand, ceteris paribus. But, this reflects not only just population trends over time, but also the old-age dependency ratio. IATA in 2016 also underlined that, younger and working-age populations are typically more likely to fly than older populations. Baltaci N, et.al, (2015) used population size as one of the determining factor of air travel demand.

Foreign Direct Investment (FDI)

With an aim to attract FDI, improving air transport capacity through investment and strategies to attract airlines (both traditional and low-cost airlines) is critical to regional policies(Banno&Redondi, 2014), and for this study Foreign direct investment(FDI) represents foreign investors' participation in domestic economic activities. Valdes, (2015), Tassew D et.al (2020), Erraitab et.al, (2016), and Erraitab, (2016) used foreign direct investment as a determining factor for Air transport demand.

Official Exchange Rate (OER)

Official exchange rate represent exchange rate of domestic currency to USD. Big happenings in exchange rates affect airlines through different channels (IATA Economics, 2015). In addition to Tassew D et.al (2020), Suryan V, (2017) also used exchange rate as a determinant factor of air travel demand.

International Tourism receipts (ITR)

ITR represent international tourism receipts, and tourist's uses air transport as a core means of transportation, and in another way tourism is a driving factor and enabler of air transport sector development (Spasojevic et al., 2017). Moreover, destination accessibility is an incentive for tourists. As noted by Pisa N, (2018), travelling becomes nearby due toavailability and accessibility of air transport, and in return, tourism has become more commercialized, with important direct, indirect and induced effects on other sectors. Erraitab, (2016) used international tourist receipts as a determining factor of Air travel demand.

Education (EDU)

Represent education index and secondary and tertiary school enrollment rate is used as a proxy. It is understood that, nations with better education will have more involvement in national and international business, for which air transport is a key means of timely travel (ATAG, 2020). In addition to Tassew D et.al (2020), Baltaci N, et.al, (2015) also used education as explanatory variables.

Consumer Price Index (CPI)

The variable CPI represents the price of air ticket or represents air fare. Due to non-availability of data on airfares, consumer price index (CPI) was used as a replacement. The consumer price index (CPI) is the official measure of inflation in Ethiopia. Changes in CPI are used to assess price changes associated with the cost of living. The weighted average prices of a basket of consumer goods and services, such as transportation, food and medical care and others were measured by CPI. CPI was used as a determining factor of air travel demand by Valdes, (2015), Erraitab, (2016), Kİrachi&Battal, (2018).

Table 4.1: List of variables, measurement and hypothesis

Variables	Name	Unit Of Measurement	Hypothesis Based On Empirical Literature
Economic Growth(gross Domestic product)	GDP	GDP in US dollars	Positive and Statistically Significant
Population	POP	Total number of population	Positive and Statistically Significant
Foreign Direct Investment	FDI	FDI in US dollar	Positive and Statistically Significant
Official Exchange Rate	OER	Exchange rate of local currency to US Dollars	Negative and Statistically Significant
International Tourist Receipt	ITR	International Tourist Receipt (USD)	Positive and Statistically Significant
Education	EDUC	Secondary and tertiary School Enrollment	Positive and Statistically Significant
Fares(consumer price Index)	CPI	CPI in US dollar	Negative and Statistically Significant

CHAPTER FIVE: RESULTS AND DISCUSSION

Both descriptive statistics and the results of the infernal analysis were provided and analyzed in depth in this chapter. All pre and post estimations of the ARDL-Model, such as Unit-root test, ARDL Bound-Test, ARDL long and short run estimations, Pair wise Granger and modified wald causality Tests, Wald Coefficient Tests, Autocorrelation test, Hetroscedasticity test, Model specification bias tests, and Model stability tests, were undertaken, and all results were interpreted and explained in detail.

5.1 Descriptive Statistics Result

The summary descriptive statistics of all variables presented below (Table 5.1). Results indicate that the overall mean of domestic passenger was 552,148 with a standard deviation of 546,011and this indicates high variations in domestic passengers. The minimum and maximum values of domestic passengers for the period 1990 to 2020 were 112,185and 2,030,947respectively. The overall mean of International passengers were 2,565,477 with a standard deviation of 2,638,085 and this indicates high variations in international passengers also. The minimum and maximum values of international passengers for the period 1990 to 2020 were 473,332 and 10,109,350 respectively. The overall mean of gross domestic product were 3.16e+10 with a standard deviation of 3.06e+10and this indicates low variations in gross domestic product. The minimum and maximum values of gross domestic product for the period 1990 to 2020 were 6.93e+09and 1.08e+11respectively.

Further, the overall mean of official exchange rate was 12.82093with a standard deviation of 8.336772 and this indicates high variations in official exchange rate. The minimum and the maximum values of official exchange rate for the period 1990 to 2020 were 8.336772and 34.92717respectively. The Mean of consumer price index was 106.7466 and had a standard deviation of 101.9555indicating a small variability in the CPI over time. The minimum and maximum values were 25.15128and 398.65respectively.The Mean international tourist receipt (ITR) was 1.11E+09 and had a standard deviation of 1.08E+09 indicating a wide variability in the ITR over time. The minimum and maximum values were 1.4E+08 and 3.55E+09 respectively. The Mean number of Education (EDUC) gross enrollment rate was 27.704 and had a standard deviation of 13.00637 indicating a wide variability in the EDUC over time. The minimum and maximum values were 11.08258 and 45.80074 respectively. The Mean number of foreign direct investment inflow (FDI) was 9.09e+08and had a standard deviation of 1.26e+09indicating a wide variability in the FDI over time. The minimum and maximum values were 125000and 4.14e+09respectively. Further, results indicated that the mean of total population for the period 1990 to 2020 was 7.93e+07while its standard deviation was 1.97e+07. Its minimum and maximum values were 4.96e+07and 1.15e+08respectively.

Table 5.1: Descriptive statistics Summary

Variables	DPAX	IPAX	GDP	FDI	EDUC	CPI	ITR	OER	POP
Mean	552147.9	2565477	3.16E+10	9.09E+08	27.83704	106.7466	1.11E+09	12.82093	79289288
Median	304419.5	1307495	1.44E+10	2.83E+08	30.11236	47.60314	5.86E+08	8.682529	77417758
Maximum	2030947	10109350	1.08E+11	4.14E+09	45.80074	398.65	3.55E+09	34.92717	1.15E+08
Minimum	112185	473332	6.93E+09	125000	11.08258	25.15128	1.4E+08	2.07	49609976
Std. Dev.	546010.6	2638085	3.06E+10	1.26E+09	13.00637	101.9555	1.08E+09	8.336772	19656695
Skewness	1.534984	1.432125	1.13827	1.465847	-0.055625	1.282917	0.81025	1.002669	0.22587
Kurtosis	4.079768	4.144515	2.988398	3.774079	1.366345	3.703882	2.447287	3.119879	1.869329
Jarque-Bera	13.23825	11.8923	6.478456	11.49254	3.351508	8.848688	3.664391	5.044693	1.853109
Probability	0.001335	0.002616	0.039194	0.003195	0.187167	0.011982	0.160062	0.080271	0.395916
Sum	16564437	76964324	9.47E+11	2.73E+10	835.1113	3202.399	3.32E+10	384.6279	2.38E+09
Sum Sq. Dev.	8.65E+12	2.02E+14	2.72E+22	4.61E+19	4905.8	301452.8	3.37E+19	2015.551	1.12E+16
Observations	30	30	30	30	30	30	30	30	30

Source: (ETG, 2021; WB, 2021; NBE; 2021)

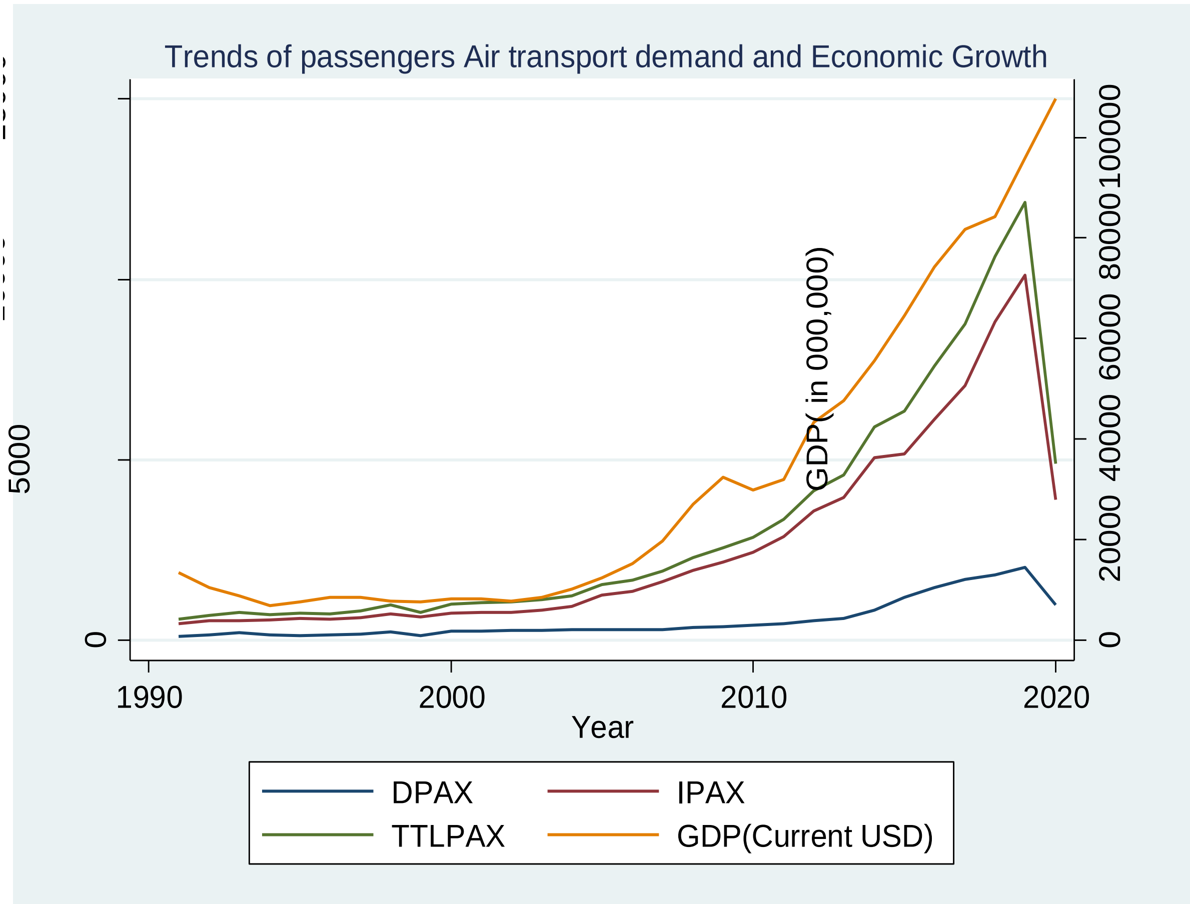
5.2 Trend Analysis

5.2.1 Trends passengers Air transport demand and Economic Growth in Ethiopia

Over the last three decades, Ethiopia's overall performance in terms of passenger air traffic and economic growth has improved (figure 5.1). The total number of passengers and GDP reached 12,686,795 (Domestic and international passengers was 2,030,947 million and 10,655, billion US dollars, respectively) million and 95,912,590,628 billion US dollars, respectively, by the end of 2019. Despite the fact that both passenger air traffic and economic growth have tiny bases, their trends have shown progress over time (Figure 5.1). However, in 2020, when GDP reached 107,645,054,312 billion US dollars, passenger traffic fell to 4,899,240 million as a result of the global Covid-19 pandemic, which halted the aviation industry's expansion.

In 2020, the Covid 19 outbreak wreaked havoc on the airline industry. Border closures and travel restrictions have resulted in a significant decline in traffic in all regions. Globally, both capacity and traffic decreased: ASKs and RPKs decreased by 55 and 65 percent, respectively. The Covid19 crisis had a significant influence on Africa's airline operations. The traffic was severely impacted. The impact was significantly larger for African airlines, whose financial status was already shaky. The reduction in passenger revenue for 2020 is anticipated to be USD 10.21 billion. African Airlines is expected to reduce the number of scheduled passengers it transports from 95 million in 2019 to 34.7 million in 2020, a 63.7 percent decrease year over year. The Asks and RPKs of African airlines followed the same pattern as the global sector. The bulk of airlines grounded their planes at the end of March, resulting in a massive decline in ASKS and RPK of 85 percent and 94 percent, respectively, in April (AFRAA, 2020).

Figure 5.1: Trends of Passengers Air transport demand and economic growth



Source: - ETG 2021, WB, 2021

For the specified time domestic and international passengers air travel demand accounts for 18 and 82 percent of total air transport demand in Ethiopia respectively. The growth of Ethiopia's air transport business is heavily reliant on international passengers and less on domestic traffic, as seen in Figure 9. The gross domestic product (GDP) or gross national income (GNI) of a country is used to quantify its level of income, and as income, business and overall economic activities increases air travel demand and propensity to fly rises, so, the driving factors for international air travel demand are international trade, investment; the country's tourism activities and the availability of direct flight links to source markets. Exceptionally, countries with big hub airports and high proportions of transfer traffic as opposed to origin/destination traffic are also more likely to have a high proportion of transfer traffic (Anon, 2020).

Currently, domestic air travel has increased over the research period, but it is currently slowed by unrest in the northern portion of the nation and the Covid-19 outbreak, and Low share of domestic passenger traffic could be attributed to impoverished living standards associated with low-income level which is about 936.34 USD per capita in 2020, according to World Bank, (2020), absence of competent low cost carrier in the country, and also Ethiopia is the least urbanized country in Africa, with only 22.8% of its population living in Urban area (NBE, 2020/21).

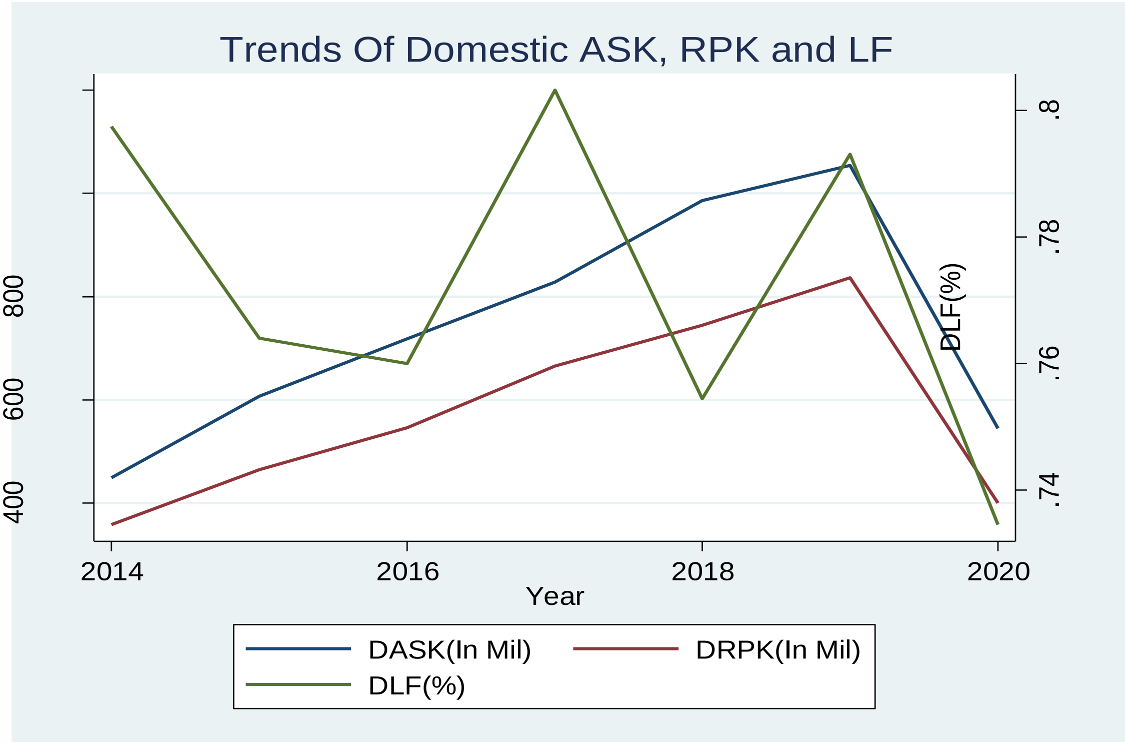
Although urbanization and economic growth has not complemented one another in Africa, the relationship between level of urbanization and GDP per capita from 1960 to 2010 is positive with a moderate correlation. Low income countries have a very low level of urbanization; concomitantly high-income economies are highly urbanized. There is a strong link between airport development and the growth of metropolitan regions, and urban mobility has an impact on the flow of passengers, freight, and mail, as well as meters and greeters. Due to the huge web of transportation networks permeating the city, such as airports, roads, cycle paths, railroads, metros, cable ways, and pedestrian pathways, transportation accounts for one of the biggest shares of land use allocation in urban and regional planning. As a result, airports have long been important development nodes in urban planning, with a particular function in supporting transportation and distribution networks as part of the urban and regional planning framework (UN-Inhabitant, 2014).

LCCs offer affordable fares that increase air traffic by targeting and capturing this customer segment, thereby increasing connections between people and places. Ceteris paribus, potential drivers of LCC are the availability of short-haul air travel markets and potential travelers' willingness to pay. An aviation market with a reputable LCC will charge individuals affordable airfares, and passengers' willingness to pay (travel demand) will also rise, and contrary to Ethiopia which air-travel markets largely dominated by Ethiopian Airlines, in South Africa, about 46% of domestic air passenger demand is served by low-cost airlines (Paelo, 2016; SACAA, 2018).

5.2.2 Trends and Performance of Domestic Stations, ASK, RPK and LF

Ethiopian Airlines currently serves over 22 destinations around the country, linking key cities through its hub at Bole International Airport in Addis Ababa (ETG, 2022). Figure 5.2 below illustrates the ASK, RPK, and LF trends from 2014 to 2020, and as the figure demonstrates, the ASK and RPK trend shows a consistent increase from year to year until the outbreak of Covid-19 in 2020, but with ups and downs over time, the load factor of the domestic sector also shows an increase until 2020.

Figure 5.2:- Trends of Domestic ASK, RPK and LF (2014-2020)



Source: - ETG Factsheet, 2021

The demand of Domestic air travel demand in Ethiopia before and during the epidemic is summarized in the table below (table 5.2). Addis Ababa, Mekelle, Bahir Dar, and Gondar were the best-performing domestic stations in 2019, accounting for 49, 11, 08, and 05 percent of total domestic traffic, respectively, and also in 2020, Addis Ababa, Bahir Dar, Mekelle, Jijiga, and Dire Dawa showed better performance, with 49, 08, 08, 06, and 06 percent traffic, respectively. The performance of domestic air traffic in Ethiopia has been substantially impacted by the pandemic and unrest in the northern part of the nation, because the instability in the north will affect Ethiopia's major domestic air travel markets, such as Mekelle, Bahir Dar, and Gondar.

Table 5.2: Performance of Domestic Stations

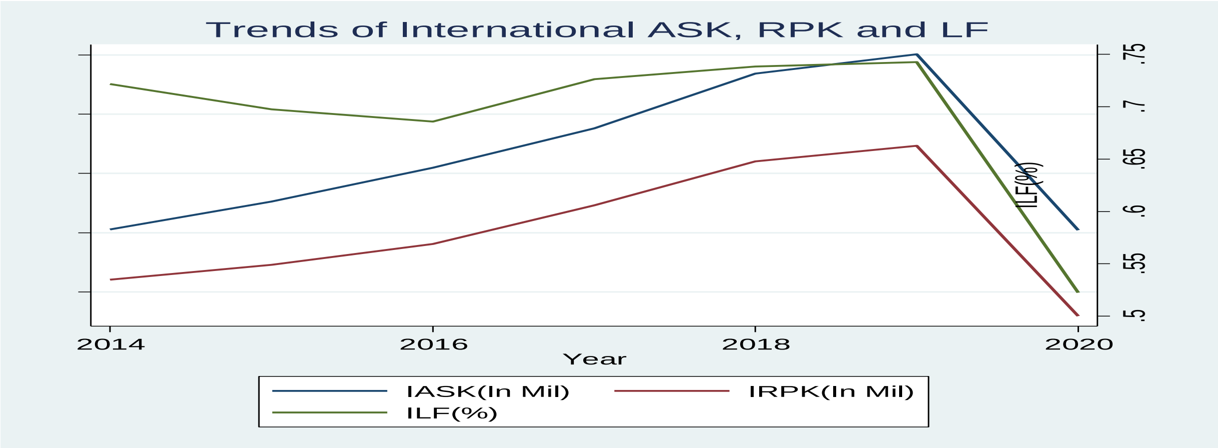
Number of Passengers				Contribution (%)	
Major Cities	**2019**	**2020**	**YOY Var (%)**	**2019**	**2020**
ADDIS ABABA	986069	487242	-51	49	49
ARBA MINTCH	20115	8928	-56	1	1
ASOSA	26126	17374	-33	1	2
AWASSA	38760	19954	-49	2	2
AXUM	70277	23072	-67	3	2
JINKA	10283	5348	-48	1	1
BAHAR DAR	165364	83854	-49	8	8
DIRE DAWA	81227	57885	-29	4	6
DESSIE	37864	18227	-52	2	2
GODE	9809	5369	-45	0	1
GONDAR	93221	43663	-53	5	4
GAMBELA	32893	21002	-36	2	2
GOBA	4778	2334	-51	0	0
HUMERA	7675	2634	-66	0	0
JIJIGA	74148	58557	-21	4	6
JIMMA	43565	21337	-51	2	2
KEBRI DEHAR	1170	257	-78	0	0
LALIBELLA	51547	17616	-66	3	2
MEKELE	227865	77242	-66	11	8
INDASELASSIE	27357	11667	-57	1	1
SEMERA	20834	9986	-52	1	1
Grand Total	2030947	993548	-52	100	100

Source: - ETG, 2021

5.2.3 Trends and Performance of international ASK, RPK and LF in Ethiopia

Figure 5.3 below summarizes trends in ASK, RPK, and LF for Ethiopian Airlines international air transport from 2014 to 2020, and as the figure shows, ASK, RPK, and LF trend shows continuous increment from year to year at a steady rate until the outbreak of Covid-19 in 2020, when the trend showed a sharp decline due to the pandemic.

Figure 5.3: Trends of international ASK, RPK and LF (2014-2020)



Source: - ETG, 2021

Domestic air travel market in Ethiopia is almost mainly dominated by Ethiopian Airlines without any fierce competition, and this is due to Ethiopian government laws that restrict entrance of foreign carriers on domestic market by regulation. But contrary to that, international travel demand is highly competitive and the competition is also tough with well-known global carriers like EK, LH and others. But, with all this competition, Ethiopian airlines still largely dominates Ethiopia's international Air travel demand (Table 5.3). To from Ethiopia, Ethiopian Airlines holds 83% market share on average from 2018-2020, and Emirates (EK), Kenyan Airways (KQ), Saudia Airlines (SV), Turkish Airlines(TK), Lufthansa(LH),Qatar Airways(QR) and others have 6%, 3%, 3%, 1%,1%,1% and 3% share respectively. Ethiopian Airlines share to-From Addis was 81% and 86 % respectively for the last three years.

Table 5.3: Dominant Operating Carriers in Ethiopian International Air travel Market

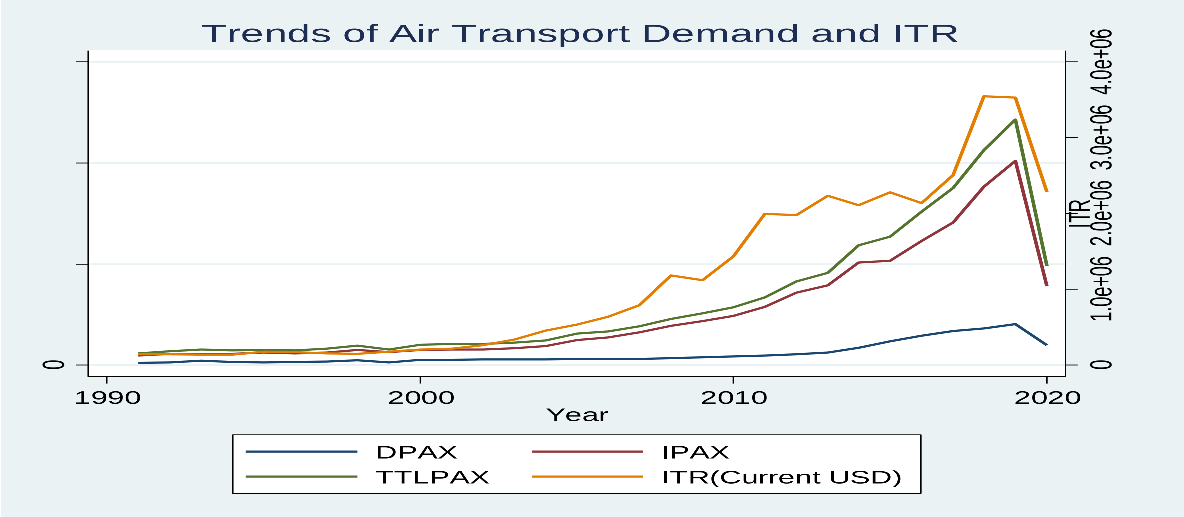
Dominant Carriers in Ethiopia Market				
Year	**2018**	**2019**	**2020**	**Grand Total**
ET	82%	83%	87%	83%
EK	7%	6%	4%	6%
KQ	2%	3%	3%	3%
SV	4%	3%	1%	3%
TK	1%	1%	1%	1%
LH	1%	1%	1%	1%
QR	1%	0%	1%	1%
Others	3%	3%	3%	3%

Source: - ETG (Extracted From Direct Data Solution (IATA Database)), 2022

5.2.4 Trends of Air transport demand and ITR

Tourism is one of the most affected sector by Air-transportation, and as the below figure shows (Figure 5.4), the trends of both Air-transport demand and international tourism receipt shows increment in Ethiopia until the out-break of Covid-19, and due to the pandemic the sector affected greatly due to traffic ban all over the world.

Figure 5.4: Trends of Air transport demand and ITR

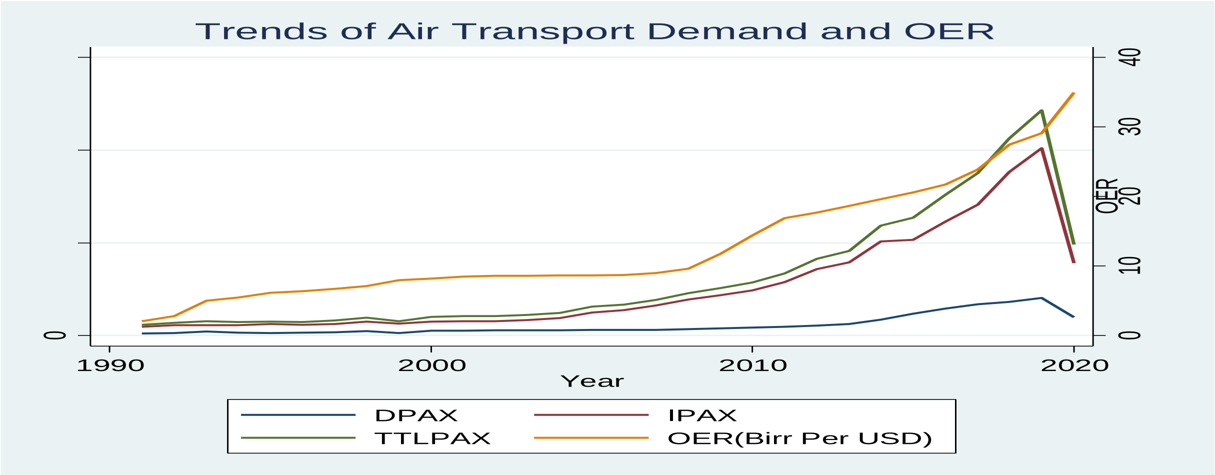


Source: - ETG 2021, WB, 2021

5.2.5 Trends of Air transport demand and Official Exchange Rate

Due to devaluation of currency at different time, the trends of official exchange rate (birr-per USD) shows continuous incremental trend in Ethiopia(Fiseha, 2019) and air travel demand also shows incremental trends during the study period (figure 5.5).

Figure 5.5: Trends of Air transport demand and OER

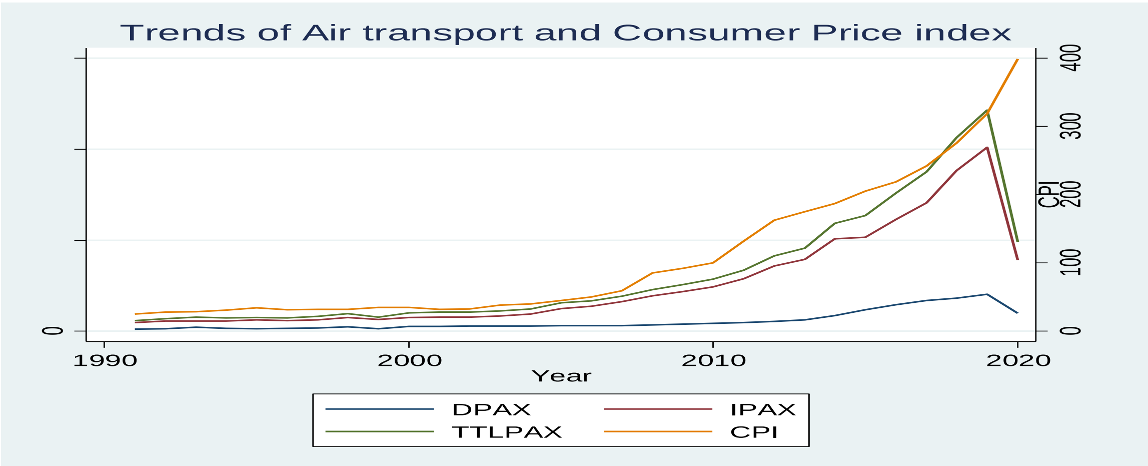


Source: - ETG 2021, WB, 2021

5.2.6 Trends of Air transport demand and CPI

Figure 5.6 below shows trends of air travel demand and consumer price index in Ethiopia, and as the trend shows, during the study period the overall trends of both air travel demand and consumer price index shows continuous increment in Ethiopia.

Figure 5.6: Trends of Air transport demand and CPI

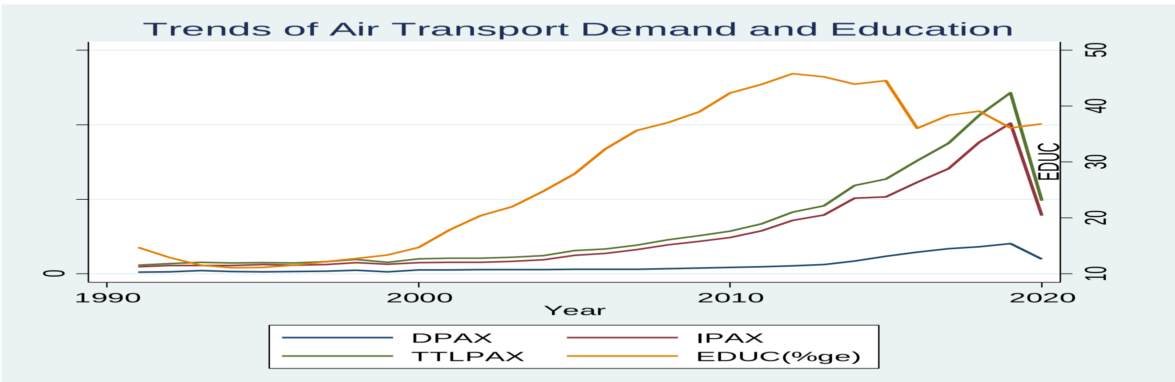


Source: - ETG 2021, WB, 2021

5.2.7 Trends of Air transport demand and Education

Figure 5.7 below shows trends of air travel demand and Education in Ethiopia, and as the trend shows, during the study period the overall trends of air travels demand shows continuous increment, but thought the overall trends of education(Secondary and tertiary enrollment)shows increment, the recent trends shows decrement.

Figure 5.7: Trends of Air transport demand and Education

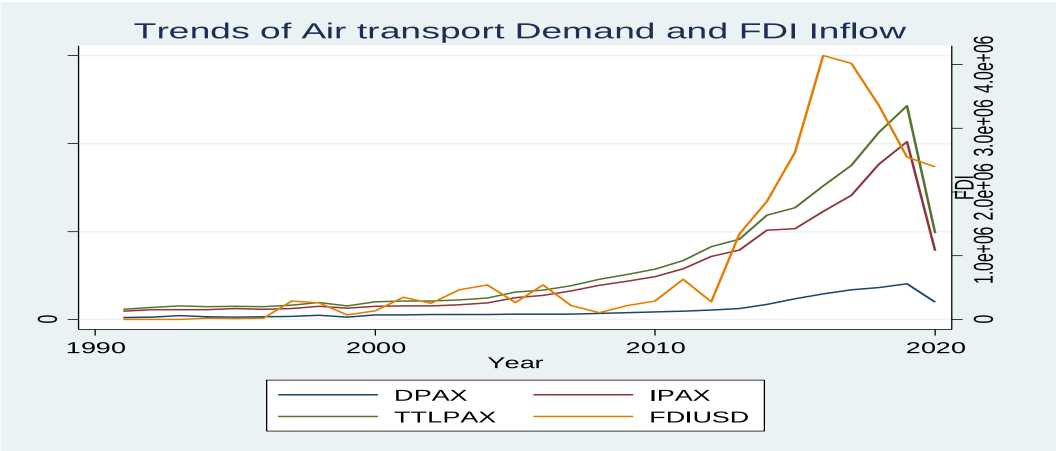


Source: - ETG 2021, WB, 2021

5.2.8 Trends of Air transport demand and FDI

Figure 5.8 below shows trends of air travel demand and foreign direct investment inflow in Ethiopia, and as the trend shows, during the study period the overall trends of air travel demand shows continuous increment in Ethiopia, and the trend of FDI inflow shows fluctuations until 2010, but after that the trend shows continuous increment until the outbreak of Covid-19 pandemic.

Figure 5.8: Trends of Air transport demand and FDI inflow

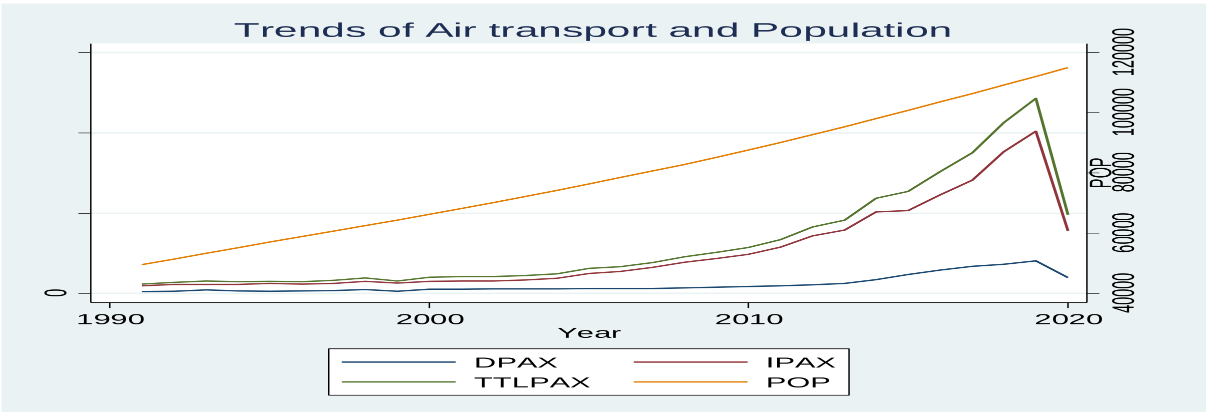


Source: - ETG 2021, WB, 2021

5.2.9 Trends of Air transport demand and Population

Figure 5.9 below shows trends of air travel demand and population in Ethiopia, and as the trend shows, during the study period the overall trends of both air travel demand and population shows continuous increment during the study period.

Figure 5.9: Trends of Air transport demand and Population



Source: - ETG 2021, WB, 2021

5.2.10 Growth Rate trends of Air transport demand, Economic Growth and Other Variables

Table 5.4 below summarized year over year growth rate trends of all variables from 2001-2020. During the study period, the average growth rate of domestic passenger air travel demand was 12 percent, but due to the influence of the Covid-19 epidemic, the average growth rate has been decreased to 9% in the last 20 years. Due to the pandemic domestic Air-travel demand reduced by -51%. The average growth rate of international travelers was 15% over the study period. However, due to the impact of covid-19, the average annual growth rate over the last 20 years has been decreased to 11%, which means during the pandemic international air travel suffer more with 64% traffic decrement from the pre-Covid period. The overall traffic growth rate is 14% in the last 20 years, due to the outbreak of Covid-19 total traffic growth reduced by 60% from pre-Covid period. The average economic growth rate is 14%, during the study period.

Table 5.4: Summary of Growth Rate Trends of Variables

Year	DPAX	IPAX	TTLPAX	GDP	OER	CPI	ITR	EDUC	FDI	POP
2001	2%	3%	3%	0%	3%	-8%	6%	22%	160%	3%
2002	5%	0%	1%	-5%	1%	2%	20%	14%	-27%	3%
2003	0%	8%	6%	10%	0%	18%	29%	8%	82%	3%
2004	5%	11%	10%	17%	0%	3%	36%	13%	17%	3%
2005	5%	33%	26%	22%	0%	13%	16%	13%	-51%	3%
2006	1%	9%	8%	23%	0%	12%	20%	16%	106%	3%
2007	-1%	19%	15%	29%	3%	17%	24%	10%	-59%	3%
2008	15%	20%	19%	37%	7%	44%	50%	4%	-51%	3%
2009	11%	12%	12%	20%	23%	8%	-5%	5%	104%	3%
2010	10%	12%	12%	-8%	22%	8%	28%	9%	30%	3%
2011	9%	19%	17%	7%	17%	32%	39%	4%	118%	3%
2012	17%	24%	23%	36%	5%	23%	-1%	4%	-56%	3%
2013	13%	10%	11%	10%	5%	7%	13%	-1%	382%	3%
2014	37%	28%	29%	17%	5%	7%	-6%	-3%	38%	3%
2015	39%	2%	7%	16%	5%	10%	8%	1%	42%	3%
2016	23%	19%	20%	15%	6%	7%	-6%	-19%	58%	3%
2017	16%	15%	15%	10%	10%	11%	17%	7%	-3%	3%
2018	6%	25%	21%	3%	15%	14%	42%	2%	-16%	3%
2019	12%	15%	14%	14%	6%	16%	-1%	-8%	-24%	3%
2020	-51%	-61%	-60%	12%	20%	25%	-35%	2%	-6%	3%

Source: - ETG 2021, WB, 2021

5.3 Econometrics analysis

5.3.1 Result of Unit root Test

Pesaran et al. (2001) critical bonds are based on assumption such variables should be stationary at I (0) or I (1). Therefore, application of unit root tests is still necessary to ensure that no variable is integrated at I (2) or beyond. The results of the stationarity tests show that all variables are non-stationary at level except FDI and EDUC (Table 5.5, below). When we convert all the data in the first difference, all the variables are become stationary except for POP. Thus, it is therefore, worth concluding that FDI and EDUC are integrated of order zero (I (0)), and DPAX, IPAX, GDP, CPI, OER, and ITR variables are integrated of order one (I (1)). Both tests demonstrate that some series are stationary at level or at first difference, or the series contains unit root. In conclusion, all series are mix of I(0) and I(1) except for POP. When the data are of mixed order of integration, the study cannot proceed for Johansen Co-integration test. So, it is preceded for Auto-regressive Distributive Lag (ARDL) model for further processing. According to Ouattara (2004), if any variable is integrated at I(2) then computation of F-statistics for ARDL cointegration becomes senseless, and based on that, LNPOP ignored from further analysis in the next estimations.

Table 5.5: Unit-root Test Result

UNITROOT TEST RESULTS TABLE(ADF)										
Null Hypothesis: the variable has a unit root										
AT LEVEL										
Variables		**LNDPAX**	**LNIPAX**	**LNGDP**	**LNFDI**	**LNEDUC**	**LNCPI**	**LNITR**	**LNOER**	**LNPOP**
With Constant	**t-Statistics**	-1.0932	-0.9128	0.2224	-3.2711	-4.3786	2.0911	-0.5348	-0.8062	-2.4299
	Prob.	0.7047	0.7696	0.9692	0.0258	0.0023	0.9998	0.8702	0.8018	0.1446
		No	No	No	**	***	No	No	No	No
With Constant & Trend	**t-Statistics**	-2.5791	-1.8124	-2.6872	-3.1310	-2.3210	-1.0551	-1.4584	-3.5735	-0.0472
	Prob.	0.2916	0.6725	0.2488	0.1182	0.4079	0.9196	0.8207	0.0507	0.9928
		No	No	No	No	No	No	No	*	No
Without Constant & trend	**t-Statistics**	1.7596	1.7334	2.0086	1.4659	1.2429	5.9988	2.9114	1.6545	0.2937
	Prob.	0.9771	0.9771	0.9871	0.9612	0.9415	1.0000	0.9985	0.9731	0.7629
		No	No	No	No	No	No	No	No	No

AT FIRST DIFFERENCE										
Variables		**d(LNDPAX)**	**d(LNIPAX)**	**d(LNGDP)**	**d(LNFDI)**	**d(LNEDUC)**	**d(LNCPI)**	**d(LNITR)**	**d(LNOER)**	**d(LNPO**
With Constant	**t-Statistics**	-5.8114	-2.4823	-3.2436	-5.1227	-3.3156	-3.4153	-3.3895	-3.4191	-0.5284
	Prob.	0.0000	0.1303	0.0278	0.0003	0.0237	0.0189	0.0201	0.0188	0.8695
		***	no	**	***	**	**	**	**	no
With Constant & Trend	**t-Statistics**	-5.6477	-2.0147	-3.3544	-5.4431	-3.3862	-4.2103	-3.1778	-3.2160	-2.7807
	Prob.	0.0004	0.5684	0.0783	0.0008	0.0736	0.0129	0.1092	0.1017	0.2180
		***	no	*	***	*	**	no	no	no
Without Constant & Trend	**t-Statistics**	-5.3426	-2.2771	-1.8830	-4.5574	-1.3714	-0.4403	-2.8050	-2.6542	-1.5417
	Prob.	0.0000	0.0244	0.0581	0.0001	0.1539	0.5139	0.0068	0.0099	0.1134
		***	**	*	***	no	no	***	***	no

Source: Eviews-10 output calculated by the Researcher

5.3.2 Results of Lag Order Selection

After finding the integrating order, the two-step ARDL cointegration procedure has been employed. In the first stage, AIC, SBC and likelihood ratio (LR) criteria are utilized to select the optimal lag length of vector autoregressive (VAR). The results are being presented below (table 5.6) for both models respectively. By using AIC criteria, lag length 2 was selected for both models. The selection criteria for the optimal lags are mostly used to determine the order of the ARDL model. For annual data, one or two lags usually suffice. For monthly data, we might include twelve lags. But there are no hard rules to follow in any case (Wooldridge, 2005).

Table 5.6: Lag Order Selection Results Result

VAR Lag Order Selection Criteria Result						
Domestic Air Travel Demand: Endogenous variables: LNDPAX LNGDP LNFDI LNEDUC LNCPI LNITR LNOER						
Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-603.9224	NA	2.11e+10	43.63732	43.97037	43.73913
1	-420.0617	262.6583	1550009.	34.00440	36.66881*	34.81894
2	-340.0396	74.30619*	361190.0*	31.78854*	36.78431	33.31580*
International Air Travel Demand : Endogenous variables: LNIPAX LNGDP LNFDI LNEDUC LNCPI LNITR LNOER						
Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-601.8977	NA	1.83e+10	43.49269	43.82575	43.59451
1	-402.5914	284.7233	445029.5	32.75653	35.42094	33.57107
2	-301.5354	93.83767*	23083.24*	29.03825*	34.03401*	30.56550*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Source: Eviews-10 output calculated by the Researcher

5.3.3 Domestic Air travel demand and Economic Growth

5.3.3.1 Domestic Air Travel Demand ARDL-bound test of Co-integration Results

The results of the ARDL bound test of cointegration are displayed in table 5.7 below for domestic air travel demand. The F-statistics has a higher value (10.05475 for Model one) than the upper bound critical values (1%, 2.5%, 5% and 10%), provided by Pesaran et.al (2001), hence we have sufficient reasons to reject the null hypothesis of no long-run relationship at 5% significance level for the first model and perhaps the existence of cointegration among the studied variables. This result is consistent with the result of Marazzo et.al (2010) and Silva et.al (2018) who found that, GDP and PAX are co-integrated.

Table 5.7: ARDL Long-run Form and Bounds Test Result

Model One ARDL-Bound Test Result				
Test Statistics	**Value**	**Significance**	**I(0)**	**I(1)**
F-Statistics	10.05475	**10%**	2.12	3.23
K	6	5%	2.45	3.61
		2.5%	2.75	3.99
		1%	3.15	4.43

Source: Eviews-10 output calculated by the Researcher

5.3.3.2 Domestic Air Travel Demand Long-run Relationship Result

The long-run results are presented in table 5.8 below for domestic air travel demand. The estimated coefficients of the long-run relationship are significant for all variables except for official exchange rate and education and also, the result displayed positive and significant impact of economic growth, foreign direct investment inflow, and International tourism receipts on domestic air travel demand in Ethiopia. This result is consistent with the findings of Erraitab, (2016), and Baikiagi, (2014) who found positive impact of GDP, FDI and ITR on air travel demand. The finding of Madurapperuma, W. &Higgoda, R., (2020) also confirm that, when economic activity grows, so does demand for air travel, and demand reaction to changes in GDP is projected to be stronger in developing or emerging countries (regions). Other thing remains constant; the coefficient of GDP is 1.92 and it is statistically significant which implies that 1% increase in GDP will lead to 1.92% increase in domestic air travel demand in the long run. The coefficient of FDI is 0.20 and it is statistically significant which implies that 1% increase in FDI will lead to 0.20% increase in domestic air travel demand in the long run. The coefficient of ITR is 0.48 and it is statistically significant which implies that 1 % increase in ITR inflow will lead to 0.48 percent increases in domestic air travel demand in the long run. The coefficient of CPI is -2.34 and it is statistically significant which implies 1% increase in CPI will lead to -2.34% decreases in domestic air travel demand in the long run, and this result is consistent with the finding of Krachi et.al (2018), and Baikgagi (2014), who found that negative and significant effect of CPI on air travel demand. In addition, the coefficient of OER is 0.809 which is positive but not significant, and this is due to publication of fares in the local currency of the country for domestic air travel demand in Ethiopia, and the coefficient of EUDC is -0.0898 and it is statistically insignificant, and this finding is against the findings of global business travel association(GBTA), (2011), which reveals that a high share of business travelers has a college education (71 per cent), and a higher education level often correlates with a higher income level and hence a higher propensity to use air transport for leisure purposes as well. In Ethiopian case existence of cheaper land transportation, low income level, low rate of urbanization and still low secondary and tertiary education is attributed for this insignificant relationship to exist.

Table 5.8: Domestic Air Travel Demand ARDL-Long-run relationship Results

Domestic Air Travel Demand ARDL Model long-run Relationship Result				
Dependent Variable: D(LNDPAX)	**Selected Model: ARDL(2, 2, 0, 0, 0, 0, 0)**			**Prob.***
Variable	**Coefficient**	**Std. Error**	**t-statistics**	**Prob.***
LNGDP	1.92	0.446	4.31520	0.0005**
LNFDI	0.20	0.051	3.920966	0.0011**
LNEDUC	-0.08	0.146	-0.614457	0.5471
LNCPI	-2.34	0.628	-3.726568	0.0017**
LNITR	0.48	1.114	3.432420	0.0032**
LNOER	0.80	0.478	1.693828	0.1085
Note: *, and *** represent 1%, 5% and 10% significance respectively**				

Source: Eviews-10 output calculated by the Researcher

5.3.3.3 Model-One Short-run Relationship and ECT Result

The short run results are presented in Table 5.9 below for domestic air travel demand, and existence of a short-term relationship between D (LNGDP) and D (LNGDP (-1)) of the DPAX model is evident from the outcome of the error correction model. It is evident that D (LNGDP) has a positive and statistically significant impact on Domestic air travel demand at the 95% confidence level, and but D (LNGDP (-1)) has negative and significant impact on D (LNDPAX). This showed that, the positive and significant effect of the current economic growth on domestic Air travel demand in short-run, and the remaining variables have stable long-run impact on DPAX, and this result is consistent with the finding of Kİrachi&Battal (2018), and Kopsch, (2012). In the short-run, passenger's air travel demand is responsive only to the growth of GDP, and it implies economic growth can boost domestic air travel demand, and the finding is consistent with the finding of Chi, J. &Baek, J., (2013).

Moreover, the coefficient of $ECT_{t-1}$is negative, as expected, and statistically significant. The significance of the lagged error correction term implies a long-term causality from all variables in the first model towards domestic air travel demand. The coefficient of error correction term is around -0.911471 and which indicates that, other thing remains constant, around 91.147 % of the disequilibrium in the domestic air travel demand in the short-term. To be more specific, it takes less than one year to correct short-term disequilibrium and to restore long-term equilibrium of Ethiopia's previous year's shock adjust back to the long-term equilibrium of domestic air travel demand.

Table 5.9: Domestic Air Travel Demand Short-run relationship and ECM Results

Domestic Air Travel Demand Short-run (ARDL-ECM) Relationship Result				
Dependent Variable: D(LNDPAX)	**Selected Model: ARDL(2, 2, 0, 0, 0, 0, 0)**			
Variables	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.***
C	-26.22	2.698	-9.718242	0.0000*
D(LNDPAX(-1))	-0.20	0.117	-1.727640	0.1022
D(LNGDP)	1.98	0.345	5.736344	0.0000*
D(LNGDP(-1))	-0.90	0.257	-3.506850	0.0027**
CoinEq(-1)*	-0.91	0.093	-9.758297	0.0000*
Note: *, and *** represent 1%, 5% and 10% significance respectively**				

Source: Eviews-10 output calculated by the Researcher

5.3.3.4 Domestic Air Travel Demand Causality Test results

The results of the causality tests are summarized in table 5.10 below for domestic air travel demand, and as the result shows, there is a bidirectional relationship between domestic air travel demand and economic growth in the short run because t-statistics and wald-F-statistics are significant for both variables (LNDPAX and LNIPAX). Furthermore, as shown by the pair-wise granger causality test and modified Wald test results, there is a bi-directional relationship between domestic air travel demand and economic growth in Ethiopia in the long run. This result is in line with Aprigliano et al., (2021), Hu et al., (2015), and Silva et al., (2018), who discovered a bi-directional Granger causal link between domestic traffic and economic growth.

This finding are in line with the stated hypothesis and indicates that both air travel demand and economic growth can be influenced at the same time (Chakamera& Pisa, 2021), and that a strong feedback relationship exists between domestic passengers air travel demand and economic growth in Ethiopia, which is also consistent with the findings of aircraft manufacturer Boeing, (2011), a theory by Ishutkina M. &Hansman, (2008), and ATAG (2020). Air travel has a direct, indirect, induced, and tourism catalytic effect on economic activity and the economy generates demand for air transportation services.

Table 5.10: Domestic Air Travel Demand Causality Result Summary

Domestic Air Travel Demand Short-Run and Long-run Causality Test results		
Dependent Variable	**Short-run causality**	
	t-statistics	**Wald F-statistics**
LNDPAX	LNGDP: Significant	LNGDP: Significant
LNGDP	LNDPAX: Significant LNDPAX(-1): Significant	LNDPAX and LNDPAX(-1): Significant

Long-run Causality: Pair-wise Granger F-test Result			
Null Hypothesis:	**Obs**	**F-Statistic**	**Prob.**
LNGDP does not Granger Cause LNDPAX	**28**	3.46581	0.0483
LNDPAX does not Granger Cause LNGDP	**28**	4.02256	0.0318

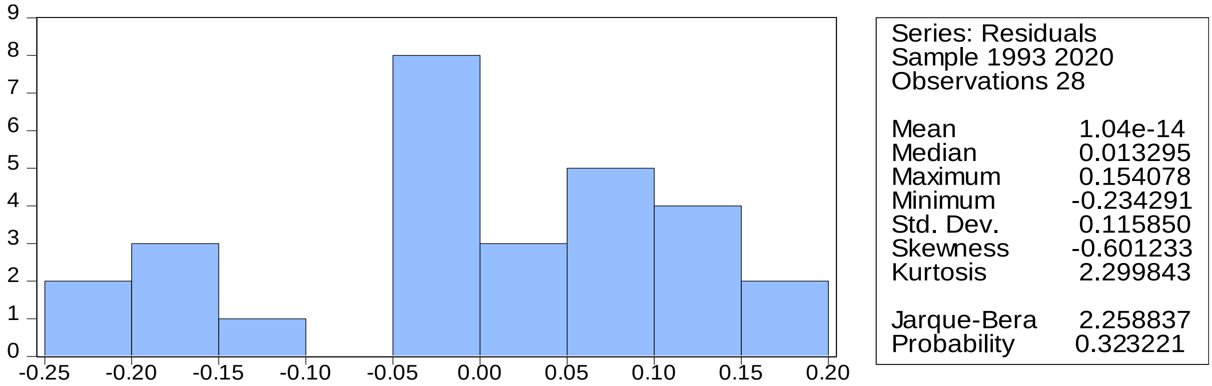
Long-run Causality: Modified Wald test(Toda-Yamamato causality Test) Result			
Dependent Variable	**Excluded**	**Chi-sq**	**Prob.**
LNDPAX	**LNGDP**	6.931612	0.0312
LNGDP	**LNDPAX**	8.045128	0.0179

Source: Eviews-10 output calculated by the Researcher

5.3.3.5 Domestic Air Travel Demand Normality Test Result

Figure 5.10 below shows the results of normality tests, and as the result showed, for domestic air travel demand model, based on Jarque-Bera tests, we don't reject null hypothesis of normal distribution because for the model probability exceeds 5% critical values.

Figure 5.10: Domestic Air Travel Demand Normality Test result For Model One



Source: Eviews-10 output calculated by the Researcher

4.3.3.6 Domestic Air Travel Demand Autocorrelation Test Result

The Autocorrelation result for domestic air travel demand is shown below (Table 5.11), and as the result demonstrates, we do not reject the premise of no serial Autocorrelation at the 5% level.

Table 5.11: Model One Breusch-Godfrey Serial Correlation LM Test Result

Domestic Air Travel Demand Breusch-Godfrey Serial Correlation LM Test Result			
F-Statistics	0.759440	Prob. F(2,15)	0.4851
Obs*R-squared	2.574547	Prob. Chi-Square(2)	0.2760

Source: Eviews-10 output calculated by the Researcher

5.3.3.7 Domestic Air Travel Demand Hetroscedasticity Test Result

The Hetroscedasticity test result for domestic air travel demand (Table 5.12) is shown below, and because Prob values surpass 5% crucial values, the null hypothesis of Homoscedasticity in the model is not rejected.

Table 5.12: Model One Hetroscedasticity Test: Breusch-Pagan-Godfrey Result

Domestic Air Travel Demand Hetroscedasticity Test: Breusch-Pagan-Godfrey Result			
F-Statistics	0.455806	Prob. F(10,17)	0.8956
Obs*R-squared	5.930295	Prob. Chi-Square(10)	0.8211
Scaled explained SS	1.420755	Prob. Chi-Square(10)	0.9992

Source: Eviews-10 output calculated by the Researcher

5.3.3.8 Domestic Air Travel Demand Model Specification Bias Test Result

Table 5.13 below shows that the value of F-test is 0.170280 with a probability of 0.6853. Since the computed p-value is greater than the alpha which is 0.05. Therefore the researchers fail to reject the null hypothesis that the true specification is linear. This means that there is no misspecification error in the domestic air travel demand model.

Table 5.13: Model One Ramsey RSSET Test Result

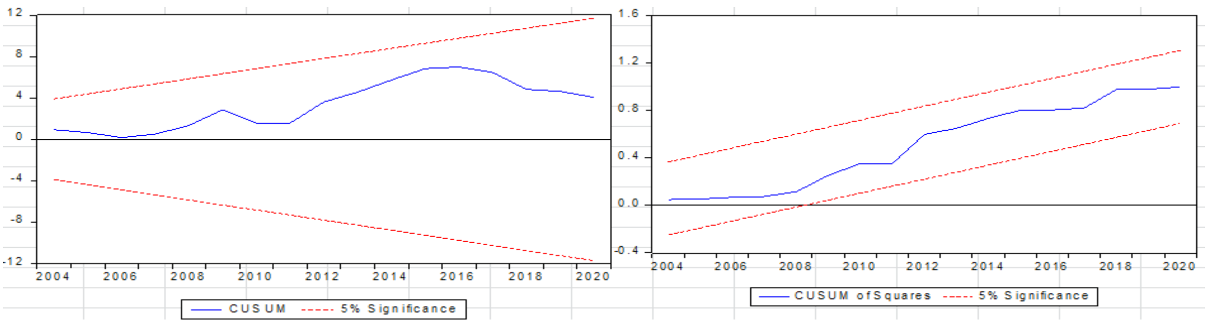
Domestic Air Travel Demand Ramsey RESET Test Result			
	Value	**df**	**Probability**
t-statistic	0.412650	16	0.6853
F-statistic	0.170280	(1,16)	0.6853

Source: Eviews-10 output calculated by the Researcher

5.3.3.9 Domestic Air Travel Demand Stability Test Results

As it is observed in the figure 5.11, it can be seen that the lines are between the significant of 5 percent. It implies that, the diagnostic tests confirm that the model have the desired econometric properties, and it is structurally stable, so, long run and short run coefficients are acceptable over the study period 1991-2020.

Figure 5.11: Model One Stability Test Results



Source: Eviews-10 output calculated by the Researcher

5.3.4 International Air travel demand and Economic Growth

5.3.4.1 International Air Travel Demand ARDL-bound test of Co-integration Results

The results of the ARDL bound test of co-integration for international air travel demand are shown in table 5.14 below. We have sufficient reasons to reject the null hypothesis of no long-run relationship at the 5% significance level for model two and possibly the existence of co-integration among the studied variables because the F-statistics has a higher value (44.87121 for Model two) than the upper bound critical values (1 percent, 2.5 percent, 5 percent, and 10 percent) provided by Pesaran et al (2001). This result is in line with those of Silva et al. (2018) in Brazil, Marazzo et al. (2010) in Italy, and Mukkala &Teryo (2013) in the United States, who observed long-run cointegration between passenger air travel demand and economic development/growth.

Table 5.14: International Air Travel Demand ARDL-bound Test Result

International Air Travel Demand ARDL-Bound Test Result				
Test Statistics	**Value**	**Significance**	**I(0)**	**I(1)**
F-Statistics	**44.87121**	**10%**	2.12	3.23
K	6	5%	2.45	3.61
		2.5%	2.75	3.99
		1%	3.15	4.43

Source: Eviews-10 output calculated by the Researcher

5.3.4.2 International Air Travel Demand Long-run Relationship Result

International air travel demand long-run results are reported in Table 5.15 below. The estimated long-run relationship coefficients are significant for all variables, and the result shows that economic growth, foreign direct investment inflows, education, international tourism receipts, and the official exchange rate have a positive and significant impact on the development of international air travel demand in Ethiopia, while the consumer price index has a negative and significant effect, as expected. Other thing remains constant; the LNGDP coefficient is 1.01 and statistically significant, implying that a 1% increase in GDP will result in a 1.01 percent increase in international air travel demand over time. This positive relationship between air travel demand and economic growth is consistent with findings by Krachi et al (2018), Kim Seok& Shin Tae, (2019), Baltaci N, et al, (2015), and Erraitab et al, (2016), and suggests that in the long run, international air travel demand in Ethiopia tends to increase with economic growth. The coefficient of LNFDI is 0.02, and it is statistically significant, implying that a 1% increase in FDI will result in a 0.028 percent increase in D (LNIPAX). This result is consistent with Valdes, (2015) and Erraitab et al. (2016), and it implies that foreign direct investment inflow can play crucial role in improving international air travel demand, and also according to Banno&Redondi, (2014), improving air transportation capacity and service is one pillar of attracting foreign direct investment in a country.

The coefficient of LNEDUC is 0.13, and it is statistically significant, implying that a 1% increase in LNEDUC will result in a 0.130 percent increase in international air travel demand in the long run. This result is consistent with the findings of Baltaci N, et.al, (2015) and

GBTA, (2015), implying that higher education often correlates with higher income, and thus a higher propensity to use air transportation services. Despite Ethiopia's low economic level, this positive and significant link can be attributed to out-migration due to international students (secondary and tertiary education), unemployment, brain drain, and the desire to avoid persecution and violence (WENR, 2018).

The coefficient of LNCPI is -0.42, which is statistically significant, implying that a 1% increase in LNCPI will result in a 0.42 percent decrease in international air travel demand in the long run. This result is consistent with the findings of Valdes, (2015), Krachi et al (2018), and Erraitab et al (2016), implying that rising costs of living will have a negative impact on air travel demand. The coefficient of ITR is 0.15 and statistically significant, implying that a 1% increase in ITR will result in a 0.15 percent increase in international air travel demand in the long run. This finding is consistent with Erraitab's (2016) finding, implying that traveling has become easier due to the availability of air travel demand (Pisa N, 2018). Finally, the coefficient of LNOER is 0.24 and statistically significant, implying that a 1% increase in LNOER will result in a 0.24 percent increase in international air travel demand in the long run, contrary to the findings of Suryan V, (2017) who concluded that, exchange rate and number of passengers are unrelated for Indonesia air traffic demand and Erraitab et al (2016), who found negative significant effect and this is due to global carrier ownership, which is associated with sales in foreign currency. Furthermore, big intra-African network, a robust hub with numerous wave permutations for on-ward connecting traffic, and extensive strategic connections with regional African carriers in the world (Meichsner et al., 2018).

Table 5.15: International Air Travel Demand ARDL-Model long-run relationship results

International Air Travel Demand ARDL-Model long-run Relationship Result				
Dependent Variable: D(LNIPAX)	**Selected Model: ARDL(2, 2, 2, 0, 2, 1, 2)**			
Variable	**Coefficient**	**Std. Error**	**t-statistics**	**Prob.***
LNGDP	1.01	0.065	15.62628	0.0000*
LNFDI	0.02	0.008	3.328337	0.0076**
LNEDUC	0.13	0.016	7.767107	0.0000*
LNCPI	-0.42	0.087	-4.918352	0.0006**
LNITR	0.15	0.057	13.40856	0.0000*
LNOER	0.24	0.068	3.626894	0.0046**
Note: *, **, and * represent 1%, 5% and 10% significance respectively**				

Source: Eviews-10 output calculated by the Researcher

5.3.4.3 International Air Travel Demand Short-run Relationship and ECT Result

International air travel demand short run results are shown in Table 5.16 below. The error correction model shows that there is a short-term statistically significant relationship between D(LNIPAX(-1)), D(LNGDP), D(LNGDP(-1)), D(LNFDI), D(LNFDI(-1)), D(LNCPI), D(LNCPI(-1)), D(LNITR), D(LNITR(-1)), D(LNOER), and D(LNOER(-1)) of the IPAX model(Model two). International air travel demand from the previous period (D (LNIPAX (-1)) has a positive and considerable impact on present air travel demand. In the short run, GDP has a positive and statistically significant effect on international air travel demand at the level (D (LNGDP), while it has a negative and statistically significant impact at the delays (D (LNGDP (-1)). This result is consistent with Kİrachi&Battal (2018) findings, which found a positive and significant relationship between international air travel demand and economic growth (GDP), as well as Kim and Shin (2019) findings, which stated that as the economy improves, the number of international travelers rises, and the overall economic situation is a primary determinant of passenger's overseas travel.

International tourist receipts (D (ITR) and D (ITR (-1)) have a positive and significant effect on IPAX, which is consistent with Erraitab et al. (2016)'s findings, and the implication is that, expansion of the tourism industry plays a critical role in the development of air travel demand in Ethiopia. Furthermore, D(LNFDI), D(LNFDI(-1), D(LNOER), D(LNOER), and D(LNCPI) have a negative and statistically significant impact on international air travel demand in the near term at the 95 percent confidence level. However, D (LNCPI (-1)) has a short-term negative and considerable influence on international air travel demand. The existence of these negative associations matches the findings of Valdes, (2015), Erraitab, (2016), and Kİrachi&Battal, (2018), which discovered a negative and substantial link between air travel demand and CPI. It implies that, price change associated with cost of living can influence air travel demand negatively. Foreign direct investment has negative effect on International Air travel demand in Ethiopia in the short-run and this finding is against the finding of Abraham et.al, (2015) and Erraitab, (2016). This is due to the fact that, in addition to availability of air transport demand different factors including the level of economic development of an economy, the policy regime in place, social and political factors may play a role in determining the inflow of foreign direct investment (Getinet, A., & Hirut, A. (2006)). The finding that the official exchange rate has a negative and statistically significant influence on air travel demand is also consistent with Erraitab et al. (2016) and

Suryan.V. (2017), this means that an increase in the exchange rate might affect airlines in a variety of ways (IATA Economics, 2015).

Furthermore, for Model 2, the ECT (t-1) coefficient is negative, as expected, and statistically significant. The relevance of the lagged error correction term implies that all factors in the first model have a long-term relationship with international air travel demand. The coefficient of error correction term is roughly -3.380712, indicating that the short-term disequilibrium in international air travel demand is around 338 percent. To be more exact, it takes more than three years to restore long-term equilibrium of Ethiopia's previous year's shock to the long-term equilibrium of international air travel demand.

Table 5.16: International Air Travel Demand Short-run (ARDL-ECM) Relationship Result

International Air Travel Demand Short-run(ARDL-ECM) Relationship Result				
Dependent Variable: LNIPAX	**Selected Model: ARDL(2, 2, 2, 0, 2, 1, 2)**			
Variable	**Coefficient**	**Std. Error**	**t-Statistics**	**Prob.***
C	-32.61	1.456	-22.39918	0.0000*
D(LNIPAX(-1))	0.89	0.095	9.298704	0.0000*
D(LNGDP)	1.09	0.103	10.60293	0.0000*
D(LNGDP(-1))	-1.60	0.078	-20.53991	0.0000*
D(LNFDI)	-0.04	0.008	-5.681592	0.0002**
D(LNFDI(-1)	-0.13	0.013	-10.29362	0.0000*
D(LNCPI)	-1.53	0.090	-16.87407	0.0000*
D(LNCPI(-1))	0.27	0.107	2.578220	0.0275**
D(LNITR)	0.22	0.164	16.93447	0.0000*
D(LNOER)	-1.78	0.115	-15.48083	0.0000*
D(LNOER(-1))	-0.94	0.095	-9.966643	0.0000*
CoinEq(-1)*	-3.38	0.150	-22.41780	0.0000*
Note: *, **, and * represent 1%, 5% and 10% significance**				

Source: Eviews-10 output calculated by the Researcher

5.3.4.4 International Air Travel Demand Causality Test results

The results of the causality test are summarized in table 5.17 below, and we conclude that there is a bidirectional relationship between international air travel demand and economic growth in the short run which is against the hypothesis because t statistics and wald-F statistics are significant for both variables (LNDPAX and LNIPAX). Also, the pair-wise and modified wald causality test results shows, there is unidirectional causality from international air travel demand to economic growth in Ethiopia in the long-run, and it is in line with the stated hypothesis and it implies that air transportation expansion provides an incentive and inducement for economic growth. This findings are in line with the stated hypothesis is consistent with Tassew D, et.al, (2020) and Abraham et.al, (2015) findings, as well as the assumption of uni-directional causality from air travel demand to economic growth for low-income countries, but it contradicts Silva et.al, (2018) findings, which found long-run uni-directional causality from economic growth to international passengers air travel demand in Brazil, a middle-income country.

Table 5.17: International Air Travel Demand Causality Result Summary

<table>
<tr><th colspan="3">International Air Travel Demand Short-Run and Long-run Causality Test results</th></tr>
<tr><th rowspan="2">Dependent Variable</th><th colspan="2">Short-run causality</th></tr>
<tr><th>t-statistics</th><th>Wald F-statistics</th></tr>
<tr><td>LNIPAX</td><td>LNGDP(-2): Significant</td><td>LNGDP,LNGDP(-1) and LNGDP(-2): insignificant</td></tr>
<tr><td>LNGDP</td><td>LNIPAX: Significant
LNIPAX(-1): Significant</td><td>LNIPAX and LNIPAX(-1): Significant</td></tr>
</table>

<table>
<tr><th colspan="4">Long-run Causality Pair-wise Granger F-test result</th></tr>
<tr><th>Null Hypothesis:</th><th>Obs</th><th>F-Statistic</th><th>Prob.</th></tr>
<tr><td>LNGDP does not Granger Cause LNIPAX</td><td rowspan="2">28</td><td>0.77943</td><td>0.4704</td></tr>
<tr><td>LNIPAX does not Granger Cause LNGDP</td><td>4.67262</td><td>0.0198</td></tr>
</table>

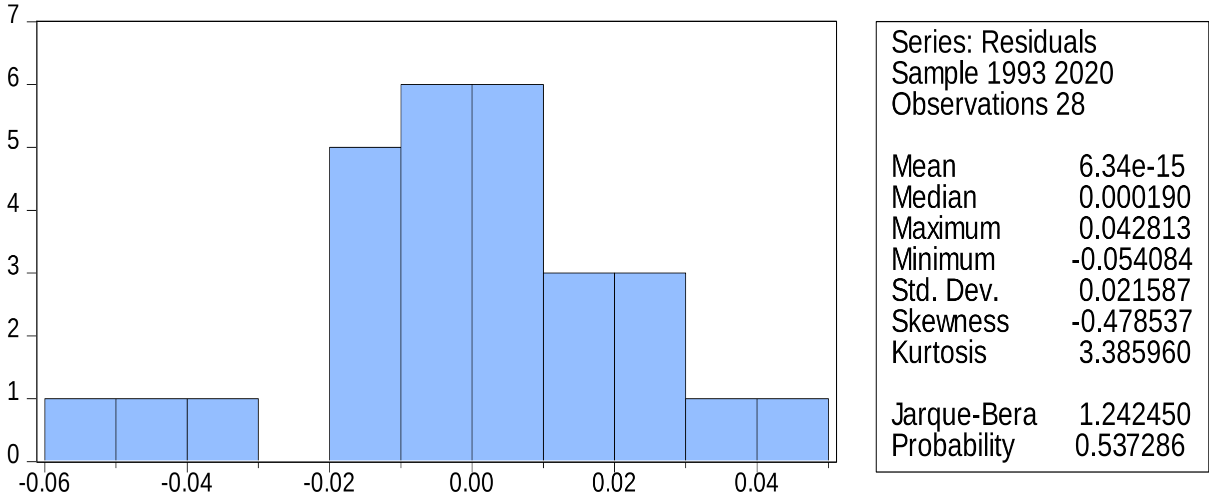
<table>
<tr><th colspan="4">Long-run Causality: Modified Wald test(Toda-Yamamato causality Test) Result</th></tr>
<tr><th>Dependent Variable</th><th>Excluded</th><th>Chi-sq</th><th>Prob.</th></tr>
<tr><td>LNIPAX</td><td>LNGDP</td><td>1.558855</td><td>0.4587</td></tr>
<tr><td>LNGDP</td><td>LNIPAX</td><td>9.345235</td><td>0.0093</td></tr>
</table>

Source: Eviews-10 output calculated by the Researcher

5.3.4.5 International Air Travel Normality Test Result

Figure 5.12 displays the results of normality tests, and as shown, we do not reject the null hypothesis of normal distribution for international air travel demand model based on Jarque-Bera tests because probability surpasses 5% critical values.

Figure 5.12: International Air Travel Normality Test Result



Source: Eviews-10 output calculated by the Researcher

5.3.4.6 International Air Travel Autocorrelation Test Result

The F-statistic value up to lag 2 is insignificant at the 5% level of significance for model two, indicating that there is no autocorrelation in the model residuals, according to the Breusch-Godfrey Serial Correlation LM test (table 5.18).

Table 5.18: International Air Travel Breusch-Godfrey Serial Correlation LM Test Result

International Air Travel Breusch-Godfrey Serial Correlation LM Test Result			
F-Statistics	0.612840	Prob. F(2,8)	0.5654
Obs*R-squared	3.719949	Prob. Chi-Square(2)	0.1557

Source: Eviews-10 output calculated by the Researcher

5.3.4.7 International Air Travel Hetroscedasticity Test Result

Time series data is expected to display variability across time, and residuals may be hetroscedastic. As a result, the Breusch-Pagan-Godfrey Hetroscedasticity test is used to determine if the conditional variances of residuals are the same or fluctuate with time. The probability values for selected lags are more than 5% level of significance, indicating that the null hypothesis cannot be rejected and that it is homoscedastic, as shown in table 5.19.

Table 5.19: International Air Travel Hetroscedasticity Test: Breusch-Pagan-Godfrey Result

International Air Travel Hetroscedasticity Test: Breusch-Pagan-Godfrey Result			
F-Statistics	0.839323	Prob. F(17,10)	0.6390
Obs*R-squared	16.46241	Prob. Chi-Square(17)	0.4913
Scaled explained SS	2.505016	Prob. Chi-Square(17)	1.0000

Source: Eviews-10 output calculated by the Researcher

5.3.4.6 International Air Travel Model Specification Bias test Result

The F-test value is 0.015 with a probability of 0.902, as shown in Table 5.21. Because the computed p-value exceeds the alpha of 0.05, the researchers are unable to reject the null hypothesis that the true specification is linear. This indicates that the model is free of misspecification errors.

Table 5.20: International Air Travel Ramsey Test Result

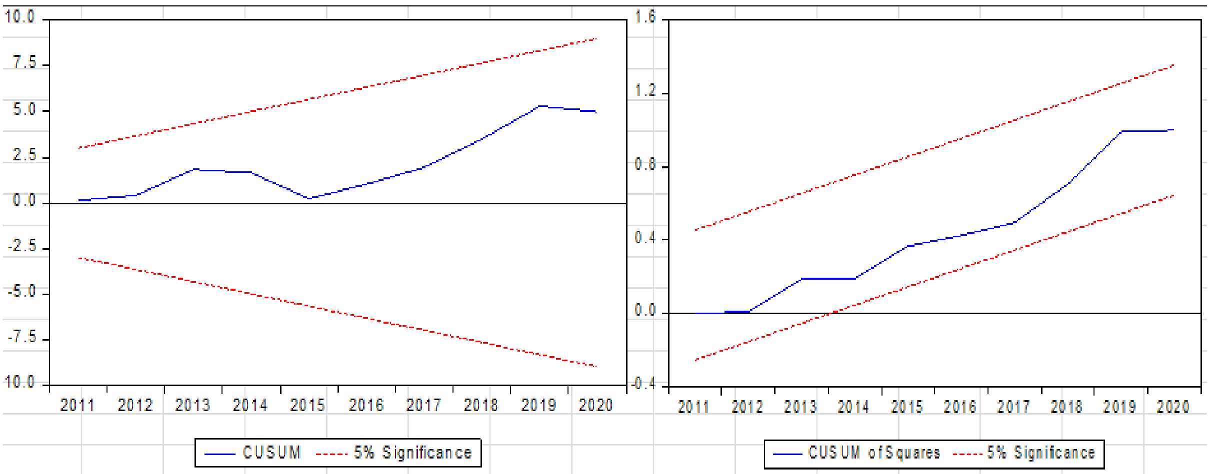
Model Two Ramsey RESET Test			
	Value	**df**	**Probability**
t-Statistic	0.125656	9	0.9028
F-statistic	0.015789	(1,9)	0.9028

Source: Eviews-10 output calculated by the Researcher

5.3.4.8 International Air Travel Stability Test Results

Calculating the cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUM) was used to test the model's stability (CUSUMSQ). Both graphs in Fig. 5.13 are inside the crucial boundaries at the 5% significance level, indicating that the estimated model has remained stable throughout the study.

Figure 5.13: Model-Two Stability Test Results



Source: Eviews-10 output calculated by the Researcher

CAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The study's overall goal is to determine the relationship between Ethiopian economic growth and passenger air travel demand (domestic and international). This study also sought to establish empirical data on the short- and long-run links in Ethiopia between economic growth, domestic and international passenger air travel demand, and other variables. For the data set from the previous 30 years, appropriate estimate approaches (ARDL, ARDL-Bound Test, ARDL-ECM, Wald-Coefficient Estimates, and pair-wise granger and modified Wald causality tests) were used to achieve the study's aims (from 1991-2020).

The result obtained suggests the existence of long-run cointegrating relationship between Domestic and international air travel demand and economic growth in Ethiopia, and passengers air travel demand is mainly dominated by international air travel demand (18% share for domestic and 82% for international) in the country, and this is due to the fact that low propensity to fly associated with rising but still low per-capita income level, low urbanization rate and absence of many competent low cost carriers in the country.

In Ethiopia, the study discovered bidirectional causality in both the short and long runs for domestic air travel demand, but only in the short run for international air travel demand, as well as unidirectional causality in the long run for international air travel demand, which goes from passenger air travel demand to economic growth. This result of causality can be attributed primarily to recent economic growth and the resulting increase in per-capita income, the presence of a dominant operating carrier, and comparative advantage in the country's geographical location and Ethiopian Airlines can be considered an important element in causal relationships in Ethiopia. According studies having a big home-based carrier allows the host country to take advantage of economies of scale, cutting prices on densely used routes and enabling economically sustainable commercial operations, and Ethiopian Airlines is also the largest and biggest airline in Africa in terms of destinations served, revenue, and profit. Furthermore, in addition to having a big home carrier, a strategic geographical location might facilitate the establishment of air transportation hubs in a certain region. Poor quality airports, low ranking in airport-per-person, low propensity to travel, and still a small number of international airports(only four international airport as of now), on the other hand, are a barrier for international air transport demand in Ethiopia, in addition to rising costs and worldwide competition. However, if political and economic policies change, the causal direction may shift.

The long-run and short-run links between passenger air travel demand and economic growth are obvious, with coefficient estimates of 1.92 and 1.98 for domestic air travel and 1.01 and 1.09 for international air travel demand. This indicates that domestic air travel demand in Ethiopia is more responsive to economic growth than international air travel demand, which is due to the fact that, in addition to its geographic advantage, Ethiopian airlines' success is built on a large intra-African network, a strong hub with multiple wave permutations for onward connecting traffic, and deep strategic partnerships with regional African carriers.

The result for the consumer price index shows that an increase in consumer price has a negative and significant effect on air travel demand (-2.34 for domestic in the long run and stable, and -0.42 and -1.53 for international air travel demand in the long and short runs, respectively), and domestic air travel is more responsive and sensitive to this change. Foreign direct investment and international tourism receipts have a positive and significant long-run effect on both domestic and international air travel demand; with domestic air travel demand is more responsive to both variables than international air travel demand. The effect of the official exchange rate on domestic air travel demand is minimal, but it has a negative short-term impact and a favorable long-term impact due to the desire to travel and the motivations behind it. Education has a positive effect on international air travel demand due to out-migration of intellectuals and students abroad, but it has a negative effect on domestic air travel demand due to the availability of cheap land transportation, limited air transportation in rural areas, and low income levels, which are associated with the absence of many low cost carriers in the country, and theoretically, the economic principle underlying LCC is that an important part of the demand is from individuals whose income level is relatively low, and it will increase willingness to pay of customers by publishing the lowest fare than full service airlines.

6.2 Recommendations

The paper's empirical findings have substantial policy implications for policymakers, airlines and airport managements, aviation linked colleges and universities, urban planners, the tourism sector, and other direct and indirect beneficiaries of the air transportation sectors. As a result of the study's findings, the researcher advised:

- Because domestic air travel demand has bi-directional causality in the short- and long runs, and only in the short-run for international air travel demand, boosting economic growth through increased economic activity is an alternative policy option in the short-run. This increased economic activity, in turn, can boost air travel demand and increase propensity to fly by increasing income levels through poverty alleviation, job creation, investment, and a variety of other means.
- There is a long-run unidirectional causality from international air travel demand to economic growth, and this benefit could be expanded by establishing a strong link between airlines, concerned government bodies (local and global civil aviation authority and ministries of transportation), business owners, and the international community, as well as maintaining and upgrading Ethiopia's fertile ground for international air transport traffic by providing the necessary infrastructure. As a result, policymakers must consider that this sector is income elastic and has multiplier effects on economic activities, and thus maintain and increase airline competitiveness by expanding international destinations, working on multiple bilateral and multilateral agreements, increasing the number and quality of international airports in Ethiopia, pushing for the implementation of open skies in Africa, and closely monitoring the sector.
- To boost air travel demand, the country must increase economic activity, increase the number and quality of tourism sites, reduce bureaucracies for foreign investors, improve the quality of education and employment opportunities, reduce consumer goods inflation, closely monitor official exchange rate growth, and maintain peace and security.
- Domestic air travel demand is still low in Ethiopia, and the aviation industry is often defined by high capital investment needs and time-intensive infrastructure developments in order to raise its share. As a result, capital and infrastructure constraints in the air transportation industry should be gradually reduced in order to improve the nation's competitiveness, which might lead to a rise in local and foreign

investments, promoting economies of scale. To accomplish so, a well-managed urban concentration might stimulate air transport demand, which, in addition to boosting economic growth and increasing the rate of urbanization, requires the expansion, development, and integration of the air transport sector into urban policy planning and development.

- Policymakers and airline executives should be aware of appropriate measures of the likely effects of changes in economic activity and other discussed variables on domestic and international air transportation demand when making decisions about long-term strategic planning, marketing, and business planning for air transportation service expansion and airport upgrades.

6.3 Limitations and Future Area of research

The air transportation industry is a less researched area in developing countries like Ethiopia, and this study attempted to fill the gap in empirical literature by analyzing the short- and long-run relationship and causality between air travel demand (domestic and international) and Ethiopian economic growth using empirical evidence from Ethiopian airlines. However, the share of existing private airlines and their importance in Ethiopia's air transport industry is not examined. Second, the short- and long-run causation and link between freight demand and economic growth are not independently examined. Third, in addition to passenger demand for air travel and economic growth, some selected variables were also examined, but the impact of environmental and social issues such as economic shock, rising prices (fuel price), and global pandemics such as Covid-19 was not examined experimentally. Finally, because Ethiopian Airlines is a global competitor whose total operations are influenced by global economic and social issues, the relationship between Ethiopian Airlines and global or regional economic growth is not examined. As a result, the researcher feels that future researchers should include other industry factors and sectors that were not included in this study to make the research more comprehensive.

References

Abraham, A., Saheed, S. and Chinyere, I. (2015). Air Transportation Development and Economic Growth in Nigeria. Journal of Economics and Sustainable Development, 6(2222-1700), pp.2222-2855.

Aderamo, A. J. (2010). Demand for air transport in Nigeria. *Journal of Economics, 1*(1), 23-31. doi:10.1080/09765239.2010.11884921

AFRAA.,(2019). African Airunes Association. Annual report 2020. Nairobi, Kenya.

Alperovich, G. and Machnes, Y., (1994). The role of wealth in the demand for international air travel. Journal of transport economics and policy, pp.163-173.

Aprigliano Fernandes, V., Pacheco, R. R., Fernandes, E., Cabo, M., Ventura, R. V., & Caixeta, R. (2021). Air Transportation, economy and causality: Remote towns in Brazil's Amazon Region. *Sustainability, 13*(2), 627. doi:10.3390/su13020627

ATAG. (2018). Aviation Benefits beyond Borders.Air Transport Action Group. Karakas, Switzerland. Geneva

ATAG. (2019). Aviation Benefits beyond Borders.Air Transport Action Group. Karakas, Switzerland. Geneva.

ATAG. (2020). Aviation Benefits beyond Borders.Air Transport Action Group. Karakas, Switzerland. Geneva

Baikgaki, O. A., & Daw, O. D. (2013). The determinants of domestic air passenger demand in the Republic of South Africa. *Mediterranean Journal of Social Sciences*. doi:10.5901/mjss.2013.v4n13p389

Baker, D., Merkert, R., & Kamruzzaman, M. (2015). Regional Aviation and Economic Growth: Cointegration and causality analysis in Australia. *Journal of Transport Geography, 43,* 140-150. doi:10.1016/j.jtrangeo.2015.02.001

Baltaci, N., & ., G. A. (2015). The relationship between Air Transport and economic growth in Turkey: Cross-regional Panel Data Analysis Approach. *Journal of Economics and Behavioral Studies*, *7*(1(J)), 89-100. doi:10.22610/jebs.v7i1(j).566

Bannò, M., Redondi, R., 2014. Air connectivity and foreign direct investments: economic effects of the introduction of new routes. Eur. Transp. Res. Rev. 6 (4), 355–363. https://doi.org/10.1007/s12544-014-0136-2.

Belobaba, P. (n.d.). The airline planning process. *The Global Airline Industry,* 153-181. doi:10.1002/9780470744734.ch6

Bhadra, D., & Wells, M. (2005). Air Travel by State :Its determinants and contributions in the United States. *Public Works Management & Policy, 10*(2), 119-137. doi:10.1177/1087724x05284016

Boeing. (2011). Boeing current market outlook 2011-2030.

Bourguignon, F., Darpeix, P.-E. (2016). Air Traffic and Economic Growth: The Case of Developing Countries. France, HAL, Paris.

Breusch TS. (1978). Testing for autocorrelation in dynamic linear models. Australian Economic Papers; 17(31):334–355. https://doi.org/10.1111/j.1467-8454.1978.tb00635.x

Breusch, Trevor S., and Adrian R. Pagan., 1980. The Lagrange multiplier test and its applications to model specification in econometrics. The Review of Economic Studies 47: 239–53. [CrossRef]

Brida, J. G., Brindis, M. A., & Aguirre, S. Z. (2016). Causality between economic growth and air transport expansion: Empirical evidence from Mexico. *World Review of Intermodal Transportation Research, 6*(1), 1. doi:10.1504/writr.2016.078136

Brooks, C., 2008, Introductory Econometrics for Finance, 2nd edition, Cambridge, Cambridge University Press.

Button, K., & Taylor, S. (2000). International Air Transportation and Economic Development. *Journal of Air Transport Management, 6*(4), 209-222. doi:10.1016/s0969-6997(00)00015-6

Carson, R.T., Cenesizoglu, T., Parker, R.. (2011). Forecasting (aggregate) demand for US commercial air travel. Int. J. Forecast. 27, 923e941.

Chakamera, C., & Pisa, N. M. (2021). Relationship between Air Passenger Transport, tourism and real gross domestic product in Africa: A longitudinal mediation analysis. *African Journal of Hospitality, Tourism and Leisure, 10(4)*(10(4)), 1200-1214. doi:10.46222/ajhtl.19770720-157

Chi, J., & Baek, J. (2013). Dynamic relationship between air transport demand and economic growth in the United States: A new look. *Transport Policy, 29*, 257-260. doi:10.1016/j.tranpol.2013.03.005

Dargay, J. and Hanly, M. (2001).The determinants of the demand for international air travel to and from the UK. Paper presented at the 9th World Conference on Transport Research, Edinburgh, Scotland, May.

Demirsoy, C. (2012). *Analysis of Stimulated Domestic Air Transport Demand inTurkey. What are the drivers?* (Unpublished doctoral dissertation). Erasmus University.Rottedam.

Dempsey, N. (2008). Quality of the built environment in urban neighbourhoods. *Planning Practice and Research, 23*(2), 249-264. doi:10.1080/02697450802327198

Dennis, N., 1994. Airline hub operations in Europe. J. Transp. Geogr. 2 (4), 219–233. https://doi.org/10.1016/0966-6923(94)90047-7.

Dobruszkes, F., Lennert, M., & Van Hamme, G. (2011). An analysis of the determinants of air traffic volume for European metropolitan areas. *Journal of Transport Geography, 19*(4), 755-762. doi:10.1016/j.jtrangeo.2010.09.003

Edu, T. (2022, January 24). Research design. Retrieved May 27, 2022, from https://leverageedu.com/blog/research-design/

Engle, R.F. and Granger, C.J. 1987. "Cointegration and Error-correction - Representation, Estimation and Testing", Econometrica 55, 251-78.

Erraitab, E. (2016). An econometric analysis of air travel demand: The Moroccan case. *European Scientific Journal, ESJ, 12*(7), 367. doi:10.19044/esj.2016.v12n7p367

Erraitab, E., Hefnaoui, A., & Moutmihi, M. (2016). A cointegration analysis of air travel demand: The case of international air travel demand between Morocco and European Union. *INTERNATIONAL JOURNAL FOR TRAFFIC AND TRANSPORT ENGINEERING, 6*(1), 104-120. doi:10.7708/ijtte.2016.6(1).09

ETG, (2020). Ethiopian Airlines: Annual reports. Acceced on 10/10/2021. . Internet Source available at https://corporate.ethiopianairlines.com/media/Performance-Report

ETG. (2021), Overview on Ethiopian Airlines. Ethiopian Airlines Group. Accesses on 10/11/2021. Internet Source available a https://corporate.ethiopianairlines.com/AboutEthiopian/Overview

ETG. (2021), Overview on Ethiopian Airlines. Ethiopian Airlines Group. Accesses on 10/11/2021. Internet Source available at https://corporate.ethiopianairlines.com/AboutEthiopian/Overview

Eyob Estifanos (2001), Demand for Domestic Air Transport in Ethiopia, Degree of Master of Science (MSc.), Department of Economics, Addis Ababa University, Ethiopia.

Fernandes, E., & Pacheco, R. R. (2010). The causal relationship between GDP and domestic air passenger traffic in Brazil. *Transportation Planning and Technology, 33*(7), 569-581. doi:10.1080/03081060.2010.512217

Fikre, M., 2015. Factors Affecting Profitability in the Airlines Industry: An Empirical Study on Major airlines in Sub-Saharan Africa. Graduate. Addis Ababa.

Fiseha, H. (2019). The exchange rate: Why it matters for structural transformation and growth in Ethiopia. 2-20. doi:10.1596/1813-9450-8868

François Bourguignon, Pierre-Emmanuel Darpeix. 2016. Air traffic and economic growth: the case of developing countries. ⟨ halshs-01305412⟩

GBTA. (2011, August 04). GBTA International Convention & Exposition. Retrieved March 31, 2021, from https://www.hospitalitynet.org/event/3002585.html

Getinet, A., & Hirut, A. (2006). Determinants of Foreign Direct Investment in Ethiopia: A time-series analysis (pp. 1-2). London, England: Policy Studies Institute.

Graham, A. (2000). Demand for leisure air travel and limits to growth. *Journal of Air Transport Management, 6*(2), 109-118. doi:10.1016/s0969-6997(99)00031-9

Graham, A. (2006). Have the major forces driving leisure airline traffic changed? *Journal of Air Transport Management, 12*(1), 14-20. doi:10.1016/j.jairtraman.2005.09.002

Gujarati, D. N., (1994), Basic Econometrics, 4th edition, Boston, McGraw-Hill.

Gujarati, D. N., (2003), Basic Econometrics, 4th edition, Boston, McGraw-Hill.

Gujarati, D. (2004), Basic Econometrics, Fourth Edition, the McGraw−Hill Companies

Gujarati, D. N., & Porter, D. C. (2009). Basic econometrics (5th ed.). New York etc.: McGraw-Hill.

Hafer, R. W., & Sheehan, R. G. (1986). *How robust is policy inference using VAR models: The effects of alternative lag structures*. St. Louis: Federal Reserve Bank of St. Louis.

Hakim, M. M., & Merkert, R. (2016). The causal relationship between air transport and economic growth: Empirical evidence from South Asia. *Journal of Transport Geography, 56*, 120-127. doi:10.1016/j.jtrangeo.2016.09.006

Halpern, N., & Bråthen, S. (2011). Impact of airports on regional accessibility and Social Development. *Journal of Transport Geography, 19*(6), 1145-1154. doi:10.1016/j.jtrangeo.2010.11.006

Harris, R. and Sollis, R. 2003. "Applied Time Series Modelling and Forecasting". Wiley, West Sussex.

Hayes-Conroy, A., & Hayes-Conroy, J. (2020). Visceral geography. *International Encyclopedia of Human Geography,* 171-174. doi:10.1016/b978-0-08-102295-5.10231-8

Helina Teferra Ed.(2001), Tiret vol. 5 No. 2, the MIDROC Ethiopia Group Magazine.

Higgoda, R., & Madurapperuma, W. (2020). Air passenger movements and economic growth in Sri Lanka: Co-integration and causality analysis. *Journal of Transport and Supply Chain Management, 14*. doi:10.4102/jtscm.v14i0.508

Hu, Y., Xiao, J., Deng, Y., Xiao, Y., & Wang, S. (2015). Domestic air passenger traffic and economic growth in China: Evidence from heterogeneous panel models. *Journal of Air Transport Management, 42,* 95-100. doi:10.1016/j.jairtraman.2014.09.003

IATA (International Air Transport Association). (2015). Exchange Rates and Aviation: Examining the Links. IATA, Montreal, Canada. https://bit.ly/3cYCcqv.

IATA (International Air Transport Association). (2016). IATA Forecasts Passenger Demand to Double over 20 Years. IATA, Geneva. http://tiny.cc/js77jz.

IATA, 2018, The Importance of Air Transport to Ethiopia. International Air Transport Association.Montreal, Canada

Ishutkina, M. & Hansman, R.J. (2009). Analysis of the Interaction Between Air Transportation and Economic Activity: A Worlchvide Perspective. Doctoral dissertation. Massachusetts Institute of Technology.

Ishutkina, M. & Hansman, R.J. (2009). Analysis of the Interaction Between Air Transportation and Economic Activity: A Worlchvide Perspective. Doctoral dissertation. Massachusetts Institute of Technology.

Ishutkina, M., & Hansman, R. J. (2008). Analysis of interaction between air transportation and economic activity. *The 26th Congress of ICAS and 8th AIAA ATIO*. doi:10.2514/6.2008-8888

James, G. W. (1982). Airline Demand Revenues, Costs and Productivity. In *Airline economics*. Lexington/Mass.: Lexington Books.

Johansen, S. (1988). Statistical Analysis of Cointegration vectors. *Journal of Economic Dynamics and Control, 12*(2-3), 231-254. doi:10.1016/0165-1889(88)90041-3

Johansen, S. and Juselius, K. (1990). "Maximum likelihood estimation and inference on cointegration-with application to the demand for money". Oxford bulletin of economics and statistics, 52: 169-210.

Johansen, S. (1991). Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models. Econometrica 59 (6), 1551–1580. https://doi.org/10. 2307/2938278

Kağan Albayrak, M. B., Özcan, İ Ç, Can, R., & Dobruszkes, F. (2020). The determinants of air passenger traffic at Turkish airports. *Journal of Air Transport Management, 86*, 101818. doi:10.1016/j.jairtraman.2020.101818

Kenton, W. (2021). Revenue Passenger Mile (RPM). [online] Investopedia. Available at: <https: www.investopedia.com="" terms="" r="" revenue-passenger-mile-rpm.asp=""> [Accessed 10 December 2021]. <div></div></https:>

Kenton, W. (2021). Revenue Passenger Mile (RPM). [online] Investopedia. Available at: <https: www.investopedia.com="" terms="" r="" revenue-passenger-mile-rpm.asp=""> [Accessed 10 December 2021]. <div></div></https:>

Kiboi, J. W., Katuse, P. P., & Mosoti, P. Z. (2017). Macroeconomic determinants of demand for Air Passenger Transport among selected airlines. *Journal of Business and Strategic Management, 2*(3), 101-118. doi:10.47941/jbsm.173

Kiboi, J. W., Katuse, P. P., & Mosoti, P. Z. (2017). Macroeconomic determinants of demand for Air Passenger Transport among selected airlines. *Journal of Business and Strategic Management, 2*(3), 101-118. doi:10.47941/jbsm.173

Kim, S., & Shin, T. (2019). Study on the relationship between economic change and air passenger demand: Focus on Incheon International Airport. *Journal of the Korean Society for Aviation and Aeronautics*, *27*(4), 52-64. doi:10.12985/ksaa.2019.27.4.052

Kopsch, F. (2012). A demand model for domestic air travel in Sweden. *Journal of Air Transport Management*, *20*, 46-48. doi:10.1016/j.jairtraman.2011.11.006

Kothari, C.R., 2004. Research Approaches. In Research methodology: Methods and techniques. New Delhi, Banglore: New Age International (P) Limited, Publishers, pp. 5–5

Kwakkel, J. H., Walker, W. E., & Marchau, V. A. (2008). Adaptive policymaking for airport strategic planning. *2008 First International Conference on Infrastructure Systems and Services: Building Networks for a Brighter Future (INFRA)*. doi:10.1109/infra.2008.5439665

KİRACI, K., & BATTAL, Ü. (2018). Macroeconomic determinants of Air Transportation: A VAR analysis on Turkey. *Gaziantep University Journal of Social Sciences, 17*(4), 1518-1539. doi:10.21547/jss.391041

LaverageEdu, 2021.Explanatory Research Design. Internet Source available athttps://leverageedu.com/blog/types-of-research-design/ , accesses on 25/11/2021.

Lijesen, M., Nijkamp, P., Pels, E., Rietveld, P. (2005). The home carrier advantage in civil aviation. Tinbergen institute discussion paper no. TI 05-011/3. University of Amsterdam, Netherlands. https://doi.org/10.2139/ssrn.652983.

Madurapperuma, W., & Higgoda, R. (2020). Air-transportation, tourism and Economic Growth Interactions in Sri Lanka: Cointegration and causality analysis. *International Journal of Business and Management, VIII*(1). doi:10.20472/bm.2020.8.1.005

Mavrotas, G., Kelly, R. (2001). Old wine in new bottles: testing causality between savings and growth. Manch. Sch. 69, 97–105.

Mehmood, B., Shahid, A., & Younas, Z. I. (2013). Interdepencies between aviation demand and Economic Growth in India: Cointegration equation estimation. *Economic Affairs, 58*(4), 337. doi:10.5958/j.0976-4666.58.4.017

Meichsner, N. A., O'Connell, J. F., & Warnock-Smith, D. (2018). The future for African Air Transport: Learning from Ethiopian Airlines. *Journal of Transport Geography, 71*, 182-197. doi:10.1016/j.jtrangeo.2018.06.020

Mitchel, A. J., & James, M. (2016). Management and leadership challenges in a VUCA world, with regard to outsourcing and offshoring decisions in the airline sector. In *Management and leadership challenges in a VUCA world, with regard to outsourcing and offshoring decisions in the airline sector.* (DLCC ed., Vol. 8). Southampton, UK: Southampton University Business School.

Morley, B. (2006). “Causality Between Economic Growth and Migration: An ARDL Bounds Testing Approach”, Economics Letters 90, 72-76.

Mukkala, K., & Tervo, H. (2013). Air Transportation and regional growth: Which way does the causality run? *Environment and Planning A: Economy and Space, 45*(6), 1508-1520. doi:10.1068/a45298

Narayan, P.K. and Smyth, R. (2006). “Higher Education, Real Income and Real Investment in China: Evidence From Granger Causality Tests”, Education Economics 14, 107-125.

NationMaster. (2017, May 11). Countries compared by Transport Airports per capita. international statistics. Retrieved May 28, 2021, from https://www.nationmaster.com/country-info/stats/Transport/Airports/Per-capita

Odhiambo, N. M. (2009). Energy consumption and Economic Growth Nexus in Tanzania: An ARDL bounds testing approach. *Energy Policy, 37*(2), 617-622. doi:10.1016/j.enpol.2008.09.077

Ouattara, T., Couture, R., Bobrowsky, P. T., & Moore, A. (2004). Remote Sensing and geosciences. 15-41. doi:10.4095/214995

Paelo, A. (2016). Barriers to entry for low cost carriers in the south African airline industry: competitive dynamics and the entry, expansion and exit of 1time airline. In: CCRED working paper no. 2016/8, Centre for Competition, Regulation & Economic Development. University of Johannesburg, South Africa. https://doi.org/10.2139/ ssrn.2926806.

Perron, P. (1997). ‘Further evidence on breaking trend functions in macroeconomic variables’, Journal of Econometrics, 80, 2, pp. 355-385.

Pesaran, M.H., and Pesaran, B (1997). “Working with Microfit 4.0: Interactive Econometric Analysis,” Oxford University Press.

Pesaran, M.H., Shin, Y. (1999). An autoregressive distributed lag modeling approach to cointegration analysis. In: Strom, S. (Ed.), Econometrics and Economic Theory in the 20th Century.

Pesaran, M.H., Shin, Y., Smith, R.J. (2001). Bounds testing approaches to the analysis of level relationships. Journal of Applied Econometrics 16, 289–326

Pisa, N. (2018). Causal relationship between air transport, tourism and economic growth: Joinpoint regression and Granger causality analysis. Eur. Econ. 37 (2), 164–176.

Porter M. E., K. Schwab., and X. Sala–i–Martin. (2007). The Global Competitiveness Report: 2007-2008. World EconomicForum, New York, NY.

Porter, M. E. (2011). Competitive advantage of nations: creating and sustaining superior performance: Simon and Schuster.

Pu, Z. (2017). Time-spatial convergence of air pollution and regional economic growth in China. *Sustainability*, *9*(7), 1284. doi:10.3390/su9071284

Ramsey JB. ,1969.,Tests for specification errors in classical linear least-squares regression analysis. Journal of the Royal Statistical Society: Series B. 31(2):350–371.

Royal, H. (2020, March 06). A closer look at Africa’s propensity to fly. Retrieved November 15, 2021, from https://www.royalhaskoningdhv.com/en-gb/south-africa/propensity-to-fly/news/a-closer-look-at-africas-propensity-to-fly/10630

Russell, M. (2017). Economic productivity in the air transportation industry: Multifactor and Labor Productivity Trends, 1990–2014. *Monthly Labor Review*. doi:10.21916/mlr.2017.9

SACAA (South Africa Civil Aviation Authority), 2018. Annual Report 2017/18. SACAA, Pretoria, South Africa. http://tiny.cc/hla8jz.

Silva, M. , Fernandes, E. , Pacheco, R. , Pires, H. 2018, 'Economic Growth Relations to Domestic and International Air Passenger Transport in Brazil', World Academy of Science, Engineering and Technology, Open Science Index 142, International Journal of Transport and Vehicle Engineering, 12(10), 1476 - 1481.

Sivrikaya, O., & Tunc, E. (2013). Demand forecasting for domestic air transportation in Turkey. *The Open Transportation Journal, 7*(1), 20-26. doi:10.2174/1874447820130508001

Spasojevic, B., Lohmann, G., & Scott, N. (2017). Air Transport and tourism – A systematic literature review (2000–2014). *Current Issues in Tourism, 21*(9), 975-997. doi:10.1080/13683500.2017.1334762

Stefan, T. (2022, March 24). Education in Ethiopia. Retrieved May 27, 2022, from https://wenr.wes.org/2018/11/education-in-ethiopia

Steiner, S., Bozicevic, A. and Mihitec, T., 2008. Determinants of European airtraffic development. Transport Pro b/ems.

Sterman, J. D. (2001). System dynamics modeling: Tools for learning in a complex world. *California Management Review, 43*(4), 8-25. doi:10.2307/41166098

Suryan, V. (2017). Econometric forecasting models for air traffic passenger of Indonesia. *Journal of the Civil Engineering Forum, 3*(1), 303. doi:10.22146/jcef.26594

Swelbar, W., & Belobaba, P. (n.d.). Critical issues and prospects for the global airline industry. *The Global Airline Industry,* 467-478. doi:10.1002/9780470744734.ch16

Tassew, D. T., Bråthen, S., & Holmgren, J. (2020). Air Transport Demand and economic development in sub-Saharan africa: Direction of causality. *Journal of Transport Geography, 86*, 102771. doi:10.1016/j.jtrangeo.2020.102771

Tassew, D. (2017). Air Transport Demand and Economic Growth in Ethiopia (Cointegration and Causality Analysis). Graduate. Molde University College.

The African Logistics. (2021). Top 10 largest airlines in Africa. [online] Available at: <https: www.theafricalogistics.com="" 2020="" 06="" 22="" top-10-largest-airlines-in-africa-2="" ,=""> [Accessed 20 November 2021]. <div></div></https:>

Times aerospace. (2019, November 19). Ethiopian Plots Flight path to 2035. Retrieved December 10, 2022, from timesaerospace.aero/features/air-transport/ethiopian-plots-flightpath-to-2035

Toda, H.Y., Yamamoto, T. (1995). Statistical inference in vector auto regressions with possibly integrated processes. Journal of Econometrics, 66, 225-250.

Tsekeris, T., & Tsekeris, C. (2011). Demand forecasting in transport: Overview and modeling advances. *Economic Research-Ekonomska Istraživanja, 24*(1), 82-94. doi:10.1080/1331677x.2011.11517446

UK Essays, L. A. (2021, November 31). Airline supply demand curve. Retrieved May 28, 2022, from https://www.ukessays.com/essays/tourism/supply-demand-curve-in-the-airline-industry-tourism-essay.php?vref=1+%5BAccessed+14+December+2021%5D.

UN-Habitat, & ICAO. (2018). The State of African Cities 2008: A Framework for Addressing Urban Challenges in Africa: UN-HABITAT.

Valdes, V. (2015). Determinants of air travel demand in middle income countries. *Journal of Air Transport Management, 42*, 75-84. doi:10.1016/j.jairtraman.2014.09.002

Van De Vijver, E., Derudder, B., & Witlox, F. (2014). Exploring causality in trade and air passenger travel relationships: The case of asia-pacific, 1980–2010. *Journal of Transport Geography, 34*, 142-150. doi:10.1016/j.jtrangeo.2013.12.001

Vasigh, B., Fleming, K., & Tacker, T. (2018). *Introduction to air transport economics: From theory to applications*. Abingdon, Oxon: Routledge.

WB, 2021, Ethiopia Overview, internet Source available at https://www.worldbank.org/en/country/ethiopia/overview#1, accesses on 10/11/2021.

Wooldridge, J. M. (2009). Introductory econometrics: A modern approach. Peking: Cengage Learning.

Wooldridge, J. M. (2014). *Introduction to econometrics: A modern approach*. Andover: Cengage Learning.

Wyanie A. Bright, & Habte, M., 2015. Services Exports for Growth and Development: Case Studies from Africa. Air Transport Services: A Case Study of Ethiopia

Zapata Aguirre, S., Brida, J. G., & Monterubbianesi, P. D. (2018). Exploring causality between economic growth and air transport demand for Argentina and Uruguay. *World Review of Intermodal Transportation Research, 7*(4), 310. doi:10.1504/writr.2018.10015193

Zhang, F., & Graham, D. J. (2020). Air Transport and Economic Growth: A review of the impact mechanism and causal relationships. *Transport Reviews*, *40*(4), 506-528. doi:10.1080/01441647.2020.1738587

Appendixes

Appendix 1: Model one and Two ARDL model Results (Eviews-10 output)

Dependent Variable: LNDPAX
Method: ARDL
Date: 05/09/22 Time: 18:40
Sample (adjusted): 1993 2020
Included observations: 28 after adjustments
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (2 lags, automatic): LNGDP LNFDI LNEDUC LNCPI LNITR LNOER
Fixed regressors: C
Number of models evalulated: 1458
Selected Model: ARDL(2, 2, 0, 0, 0, 0, 0)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LNDPAX(-1)	-0.115193	0.169240	-0.680646	0.5053
LNDPAX(-2)	0.203722	0.164125	1.241259	0.2314
LNGDP	1.983214	0.535697	3.702115	0.0018
LNGDP(-1)	-1.127709	0.567575	-1.986889	0.0633
LNGDP(-2)	0.901324	0.395717	2.277696	0.0360
LNFDI	0.182584	0.044656	4.088672	0.0008
LNEDUC	-0.081927	0.136813	-0.598823	0.5572
LNCPI	-2.135027	0.519767	-4.107665	0.0007
LNITR	0.349610	0.100510	3.489096	0.0028
LNOER	0.738244	0.462519	1.596137	0.1289
C	-26.22191	6.917761	-3.790520	0.0015

R-squared	0.980081	Mean dependent var	12.92115
Adjusted R-squared	0.968364	S.D. dependent var	0.820841
S.E. of regression	0.146000	Akaike info criterion	-0.723695
Sum squared resid	0.362373	Schwarz criterion	-0.200329
Log likelihood	21.13173	Hannan-Quinn criter.	-0.563697
F-statistic	83.64453	Durbin-Watson stat	2.418569
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

Dependent Variable: LNIPAX
Method: ARDL
Date: 05/09/22 Time: 18:58
Sample (adjusted): 1993 2020
Included observations: 28 after adjustments
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (2 lags, automatic): LNGDP LNFDI LNEDUC LNCPI LNITR LNOER
Fixed regressors: C
Number of models evalulated: 1458
Selected Model: ARDL(2, 2, 2, 0, 2, 1, 2)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LNIPAX(-1)	-1.488285	0.164262	-9.060418	0.0000
LNIPAX(-2)	-0.892427	0.159327	-5.601222	0.0002
LNGDP	1.096113	0.208081	5.267728	0.0004
LNGDP(-1)	0.745123	0.224968	3.312129	0.0079
LNGDP(-2)	1.602812	0.183714	8.724481	0.0000
LNFDI	-0.049040	0.017205	-2.850301	0.0172
LNFDI(-1)	0.010604	0.016882	0.628125	0.5440
LNFDI(-2)	0.134897	0.018492	7.294866	0.0000
LNEDUC	0.442861	0.049602	8.928292	0.0000
LNCPI	-1.534348	0.169398	-9.057631	0.0000
LNCPI(-1)	0.365215	0.194473	1.877972	0.0898
LNCPI(-2)	-0.277586	0.193110	-1.437451	0.1811
LNITR	0.277410	0.215011	8.803411	0.0000
LNITR(-1)	0.253610	0.216711	4.894936	0.0006
LNOER	-1.789592	0.277381	-6.451746	0.0001
LNOER(-1)	1.683162	0.242734	6.934191	0.0000
LNOER(-2)	0.949821	0.222652	4.265934	0.0016
C	-32.61826	4.239665	-7.693594	0.0000

R-squared	0.999487	Mean dependent var	14.37132
Adjusted R-squared	0.998616	S.D. dependent var	0.953340
S.E. of regression	0.035472	Akaike info criterion	-3.584067
Sum squared resid	0.012582	Schwarz criterion	-2.727650
Log likelihood	68.17693	Hannan-Quinn criter.	-3.322251
F-statistic	1146.630	Durbin-Watson stat	2.278137
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

Appendix 2: Model one and Two Wald Test Results (Eviews-10 output)

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	7.841905	(3, 17)	0.0017
Chi-square	23.52571	3	0.0000

Null Hypothesis: C(3)=C(4)=C(5)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(3)	1.983214	0.535697
C(4)	-1.127709	0.567575
C(5)	0.901324	0.395717

Restrictions are linear in coefficients.

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	47.63512	(3, 10)	0.0000
Chi-square	142.9053	3	0.0000

Null Hypothesis: C(3)=C(4)=C(5)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(3)	1.096113	0.208081
C(4)	0.745123	0.224968
C(5)	1.602812	0.183714

Restrictions are linear in coefficients.

Appendix 3: Model one and Two ARDL Test Results (GDP Dependent) (Eviews-10 output)

Dependent Variable: LNGDP
Method: ARDL
Date: 05/09/22 Time: 18:52
Sample (adjusted): 1993 2020
Included observations: 28 after adjustments
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (2 lags, automatic): LNDPAX LNFDI LNEDUC LNCPI LNITR LNOER
Fixed regressors: C
Number of models evaluated: 1458
Selected Model: ARDL(2, 0, 0, 0, 0, 0, 2)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LNGDP(-1)	0.708227	0.105093	6.739074	0.0000
LNGDP(-2)	-0.261768	0.136167	-1.922412	0.0715
LNDPAX	0.175520	0.053446	3.284047	0.0044
LNFDI	-0.044656	0.018503	-2.413428	0.0274
LNEDUC	0.076948	0.039396	1.953203	0.0675
LNCPI	0.774393	0.146544	5.284371	0.0001
LNITR	-0.495011	0.366311	-1.350959	0.1944
LNOER	-0.456299	0.187883	-2.428632	0.0265
LNOER(-1)	-0.295227	0.164750	-1.791973	0.0910
LNOER(-2)	0.364179	0.151226	2.408173	0.0277
C	9.230637	2.386211	3.868324	0.0012

R-squared	0.998809	Mean dependent var	23.77204
Adjusted R-squared	0.998109	S.D. dependent var	0.968506
S.E. of regression	0.042117	Akaike info criterion	-3.210024
Sum squared resid	0.030155	Schwarz criterion	-2.686658
Log likelihood	55.94034	Hannan-Quinn criter.	-3.050026
F-statistic	1426.078	Durbin-Watson stat	2.580822
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

Dependent Variable: LNGDP
Method: ARDL
Date: 05/09/22 Time: 19:02
Sample (adjusted): 1993 2020
Included observations: 28 after adjustments
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (2 lags, automatic): LNIPAX LNFDI LNEDUC LNCPI LNITR LNOER
Fixed regressors: C
Number of models evaluated: 1458
Selected Model: ARDL(2, 2, 2, 0, 0, 1, 2)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LNGDP(-1)	-0.338073	0.191676	-1.763772	0.1032
LNGDP(-2)	-0.888298	0.163395	-5.436519	0.0002
LNIPAX	0.601386	0.090301	6.659823	0.0000
LNIPAX(-1)	0.946261	0.180067	5.255043	0.0002
LNIPAX(-2)	0.655931	0.123454	5.313144	0.0002
LNFDI	0.023688	0.013917	1.702048	0.1145
LNFDI(-1)	-0.011278	0.010522	-1.071915	0.3048
LNFDI(-2)	-0.081102	0.019248	-4.213614	0.0012
LNEDUC	-0.231592	0.060495	-3.828275	0.0024
LNCPI	1.029766	0.126558	8.136689	0.0000
LNITR	-0.166410	0.344011	-4.822968	0.0004
LNITR(-1)	-0178610	0.439611	-4.048716	0.0016
LNOER	0.763054	0.264198	2.888187	0.0136
LNOER(-1)	-1.105576	0.191184	-5.782794	0.0001
LNOER(-2)	-0.383481	0.167313	-2.291998	0.0408
C	20.88646	2.940721	7.102497	0.0000

R-squared	0.999674	Mean dependent var	23.77204
Adjusted R-squared	0.999266	S.D. dependent var	0.968506
S.E. of regression	0.026234	Akaike info criterion	-4.147962
Sum squared resid	0.008259	Schwarz criterion	-3.386702
Log likelihood	74.07147	Hannan-Quinn criter.	-3.915237
F-statistic	2452.487	Durbin-Watson stat	2.329459
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

Appendix 4: Model one and Two Wald Test Results (GDP Dependent) (Eviews-10 output)

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
t-statistic	3.284047	17	0.0044
F-statistic	10.78496	(1, 17)	0.0044
Chi-square	10.78496	1	0.0010

Null Hypothesis: C(3)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(3)	0.175520	0.053446

Restrictions are linear in coefficients.

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	16.05935	(3, 12)	0.0002
Chi-square	48.17805	3	0.0000

Null Hypothesis: C(3)=C(4)=C(5)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(3)	0.601386	0.090301
C(4)	0.946261	0.180067
C(5)	0.655931	0.123454

Restrictions are linear in coefficients.

Appendix 5: Model one and Two ARDL-Bound Test Results (Eviews-10 output)

ARDL Long Run Form and Bounds Test
Dependent Variable: D(LNDPAX)
Selected Model: ARDL(2, 2, 0, 0, 0, 0, 0)
Case 3: Unrestricted Constant and No Trend
Date: 05/09/22 Time: 18:43
Sample: 1991 2020
Included observations: 28

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-26.22191	6.917761	-3.790520	0.0015
LNDPAX(-1)*	-0.911471	0.150470	-6.057493	0.0000
LNGDP(-1)	1.756828	0.366749	4.790280	0.0002
LNFDI**	0.182584	0.044656	4.088672	0.0008
LNEDUC**	-0.081927	0.136813	-0.598823	0.5572
LNCPI**	-2.135027	0.519767	-4.107665	0.0007
LNITR**	0.491010	0.300510	3.489096	0.0028
LNOER**	0.738244	0.462519	1.596137	0.1289
D(LNDPAX(-1))	-0.203722	0.164125	-1.241259	0.2314
D(LNGDP)	1.983214	0.535697	3.702115	0.0018
D(LNGDP(-1))	-0.901324	0.395717	-2.277696	0.0360

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 3: Unrestricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNGDP	1.927464	0.446677	4.315120	0.0005
LNFDI	0.200318	0.051089	3.920966	0.0011
LNEDUC	-0.089884	0.146282	-0.614457	0.5471
LNCPI	-2.342396	0.628567	-3.726568	0.0017
LNITR	0.483510	0.114810	3.432420	0.0032
LNOER	0.809947	0.478176	1.693828	0.1085

EC = LNDPAX - (1.9275*LNGDP + 0.2003*LNFDI -0.0899*LNEDUC -2.3424
*LNCPI + 0.0000*LNITR + 0.8099*LNOER)

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	10.05475	10%	2.12	3.23
k	6	5%	2.45	3.61
		2.5%	2.75	3.99
		1%	3.15	4.43
			Finite Sample: n=35	
Actual Sample Size	28			
		10%	2.387	3.671
		5%	2.864	4.324
		1%	4.016	5.797
			Finite Sample:	

ARDL Long Run Form and Bounds Test
Dependent Variable: D(LNIPAX)
Selected Model: ARDL(2, 2, 2, 0, 2, 1, 2)
Case 3: Unrestricted Constant and No Trend
Date: 05/09/22 Time: 18:59
Sample: 1991 2020
Included observations: 28

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-32.61826	4.239665	-7.693594	0.0000
LNIPAX(-1)*	-3.380712	0.241943	-13.97318	0.0000
LNGDP(-1)	3.444048	0.301647	11.41749	0.0000
LNFDI(-1)	0.096461	0.030529	3.159689	0.0102
LNEDUC**	0.442861	0.049602	8.928292	0.0000
LNCPI(-1)	-1.446719	0.309483	-4.674631	0.0009
LNITR(-1)	0.530510	0.218011	10.22187	0.0000
LNOER(-1)	0.843392	0.255570	3.300036	0.0080
D(LNIPAX(-1))	0.892427	0.159327	5.601222	0.0002
D(LNGDP)	1.096113	0.208081	5.267728	0.0004
D(LNGDP(-1))	-1.602812	0.183714	-8.724481	0.0000
D(LNFDI)	-0.049040	0.017205	-2.850301	0.0172
D(LNFDI(-1))	-0.134897	0.018492	-7.294866	0.0000
D(LNCPI)	-1.534348	0.169398	-9.057631	0.0000
D(LNCPI(-1))	0.277586	0.193110	1.437451	0.1811
D(LNITR)	0.277610	0.225611	8.803411	0.0000
D(LNOER)	-1.789592	0.277381	-6.451746	0.0001
D(LNOER(-1))	-0.949821	0.222652	-4.265934	0.0016

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 3: Unrestricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNGDP	1.018735	0.065194	15.62628	0.0000
LNFDI	0.028533	0.008573	3.328337	0.0076
LNEDUC	0.130996	0.016866	7.767107	0.0000
LNCPI	-0.427933	0.087007	-4.918352	0.0006
LNITR	0.157210	0.057511	13.40856	0.0000
LNOER	0.249472	0.068784	3.626894	0.0046

EC = LNIPAX - (1.0187*LNGDP + 0.0285*LNFDI + 0.1310*LNEDUC -0.4279
*LNCPI + 0.0000*LNITR + 0.2495*LNOER)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	44.87121	10%	2.12	3.23
k	6	5%	2.45	3.61
		2.5%	2.75	3.99
		1%	3.15	4.43
			Finite Sample: n=35	
Actual Sample Size	28	10%	2.387	3.671
		5%	2.864	4.324
		1%	4.016	5.797
			Finite Sample: n=30	
		10%	2.457	3.797
		5%	2.97	4.499
		1%	4.27	6.211

t-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
t-statistic	-13.97318	10%	-2.57	-4.04
		5%	-2.86	-4.38
		2.5%	-3.13	-4.66
		1%	-3.43	-4.99

Appendix 6: Model one and Two ARDL-ECM (Short-run) Test Results (Eviews-10 output)

ARDL Error Correction Regression
Dependent Variable: D(LNDPAX)
Selected Model: ARDL(2, 2, 0, 0, 0, 0, 0)
Case 3: Unrestricted Constant and No Trend
Date: 05/09/22 Time: 18:44
Sample: 1991 2020
Included observations: 28

ECM Regression
Case 3: Unrestricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-26.22191	2.698215	-9.718242	0.0000
D(LNDPAX(-1))	-0.203722	0.117919	-1.727640	0.1022
D(LNGDP)	1.983214	0.345728	5.736344	0.0000
D(LNGDP(-1))	-0.901324	0.257018	-3.506850	0.0027
CointEq(-1)*	-0.911471	0.093405	-9.758297	0.0000

R-squared	0.824411	Mean dependent var	0.069490
Adjusted R-squared	0.793873	S.D. dependent var	0.276469
S.E. of regression	0.125520	Akaike info criterion	-1.152266
Sum squared resid	0.362373	Schwarz criterion	-0.914373
Log likelihood	21.13173	Hannan-Quinn criter.	-1.079540
F-statistic	26.99685	Durbin-Watson stat	2.418569
Prob(F-statistic)	0.000000		

* p-value incompatible with t-Bounds distribution.

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	10.05475	10%	2.12	3.23
k	6	5%	2.45	3.61
		2.5%	2.75	3.99
		1%	3.15	4.43

t-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
t-statistic	-9.758297	10%	-2.57	-4.04
		5%	-2.86	-4.38
		2.5%	-3.13	-4.66
		1%	-3.43	-4.99

ARDL Error Correction Regression
Dependent Variable: D(LNIPAX)
Selected Model: ARDL(2, 2, 2, 0, 2, 1, 2)
Case 3: Unrestricted Constant and No Trend
Date: 05/09/22 Time: 18:59
Sample: 1991 2020
Included observations: 28

ECM Regression
Case 3: Unrestricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-32.61826	1.456226	-22.39918	0.0000
D(LNIPAX(-1))	0.892427	0.095973	9.298704	0.0000
D(LNGDP)	1.096113	0.103378	10.60293	0.0000
D(LNGDP(-1))	-1.602812	0.078034	-20.53991	0.0000
D(LNFDI)	-0.049040	0.008631	-5.681592	0.0002
D(LNFDI(-1))	-0.134897	0.013105	-10.29362	0.0000
D(LNCPI)	-1.534348	0.090929	-16.87407	0.0000
D(LNCPI(-1))	0.277586	0.107666	2.578220	0.0275
D(LNITR)	0.224610	0.164611	16.93447	0.0000
D(LNOER)	-1.789592	0.115601	-15.48083	0.0000
D(LNOER(-1))	-0.949821	0.095300	-9.966643	0.0000
CointEq(-1)*	-3.380712	0.150805	-22.41780	0.0000

R-squared	0.990405	Mean dependent var	0.069800
Adjusted R-squared	0.983809	S.D. dependent var	0.220384
S.E. of regression	0.028043	Akaike info criterion	-4.012638
Sum squared resid	0.012582	Schwarz criterion	-3.441693
Log likelihood	68.17693	Hannan-Quinn criter.	-3.838095
F-statistic	150.1416	Durbin-Watson stat	2.278137
Prob(F-statistic)	0.000000		

* p-value incompatible with t-Bounds distribution.

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	44.87121	10%	2.12	3.23
k	6	5%	2.45	3.61
		2.5%	2.75	3.99
		1%	3.15	4.43

t-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
t-statistic	-22.41780	10%	-2.57	-4.04
		5%	-2.86	-4.38
		2.5%	-3.13	-4.66
		1%	-3.43	-4.99

Appendix 7: Model one and Two Granger-causality Test Results (Eviews-10 output)

Pairwise Granger Causality Tests
Date: 05/09/22 Time: 19:02
Sample: 1991 2020
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LNGDP does not Granger Cause LNIPAX	28	0.77943	0.4704
LNIPAX does not Granger Cause LNGDP		4.67262	0.0198

Pairwise Granger Causality Tests
Date: 05/09/22 Time: 18:49
Sample: 1991 2020
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LNGDP does not Granger Cause LNDPAX	28	3.46581	0.0483
LNDPAX does not Granger Cause LNGDP		4.02256	0.0318

Appendix 8: Model one and Two Modified Wald test (Toda-Yamamato causality Test Results (Eviews-10 output)

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 06/10/22 Time: 09:49
Sample: 1991 2020
Included observations: 28

Dependent variable: LNDPAX

Excluded	Chi-sq	df	Prob.
LNGDP	6.931612	2	0.0312
All	6.931612	2	0.0312

Dependent variable: LNGDP

Excluded	Chi-sq	df	Prob.
LNDPAX	8.045128	2	0.0179
All	8.045128	2	0.0179

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 06/10/22 Time: 09:45
Sample: 1991 2020
Included observations: 28

Dependent variable: LNIPAX

Excluded	Chi-sq	df	Prob.
LNGDP	1.558855	2	0.4587
All	1.558855	2	0.4587

Dependent variable: LNGDP

Excluded	Chi-sq	df	Prob.
LNIPAX	9.345235	2	0.0093
All	9.345235	2	0.0093

Appendix 9: Model one and Two Autocorrelation Results (Eviews-10 output)

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.759440	Prob. F(2,15)	0.4851
Obs*R-squared	2.574547	Prob. Chi-Square(2)	0.2760

Test Equation:
Dependent Variable: RESID
Method: ARDL
Date: 05/09/22 Time: 18:46
Sample: 1993 2020
Included observations: 28
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNDPAX(-1)	0.171921	0.229399	0.749442	0.4652
LNDPAX(-2)	-0.152129	0.246853	-0.616273	0.5470
LNGDP	-0.033758	0.544906	-0.061951	0.9514
LNGDP(-1)	0.055488	0.577557	0.096074	0.9247
LNGDP(-2)	-0.104774	0.440562	-0.237819	0.8152
LNFDI	-0.014314	0.048851	-0.293012	0.7735
LNEDUC	-0.022096	0.155308	-0.142273	0.8888
LNCPI	0.101635	0.583191	0.174275	0.8640
LNITR	-0.265311	0.104610	-0.254938	0.8022
LNOER	0.026532	0.470252	0.056421	0.9558
C	1.572489	7.972456	0.197240	0.8463
RESID(-1)	-0.276982	0.310398	-0.892344	0.3863
RESID(-2)	0.261692	0.431913	0.605891	0.5536

R-squared	0.091948	Mean dependent var	1.04E-14
Adjusted R-squared	-0.634493	S.D. dependent var	0.115850
S.E. of regression	0.148111	Akaike info criterion	-0.677292
Sum squared resid	0.329053	Schwarz criterion	-0.058768
Log likelihood	22.48208	Hannan-Quinn criter.	-0.488203
F-statistic	0.126573	Durbin-Watson stat	1.986349
Prob(F-statistic)	0.999549		

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.612840	Prob. F(2,8)	0.5654
Obs*R-squared	3.719949	Prob. Chi-Square(2)	0.1557

Test Equation:
Dependent Variable: RESID
Method: ARDL
Date: 05/09/22 Time: 19:00
Sample: 1993 2020
Included observations: 28
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNIPAX(-1)	-0.003943	0.199165	-0.019798	0.9847
LNIPAX(-2)	-0.035998	0.169037	-0.212959	0.8367
LNGDP	0.046990	0.231276	0.203176	0.8441
LNGDP(-1)	0.025856	0.271795	0.095130	0.9266
LNGDP(-2)	-0.023821	0.200282	-0.118940	0.9083
LNFDI	-0.002671	0.018123	-0.147391	0.8865
LNFDI(-1)	-0.001577	0.018516	-0.085174	0.9342
LNFDI(-2)	-0.000269	0.021661	-0.012404	0.9904
LNEDUC	-0.012868	0.055801	-0.230611	0.8234
LNCPI	0.024843	0.179867	0.138117	0.8936
LNCPI(-1)	-0.078857	0.218868	-0.360292	0.7280
LNCPI(-2)	0.013687	0.212756	0.064331	0.9503
LNITR	-0.882012	0.341511	-0.258486	0.8026
LNITR(-1)	0.216812	0.529411	0.037036	0.9714
LNOER	0.051050	0.320546	0.159260	0.8774
LNOER(-1)	0.047186	0.265662	0.177616	0.8634
LNOER(-2)	-0.024414	0.242692	-0.100598	0.9223
C	-0.473289	4.635278	-0.102106	0.9212
RESID(-1)	-0.308309	0.453419	-0.679965	0.5157
RESID(-2)	-0.394365	0.422860	-0.932612	0.3783

R-squared	0.132855	Mean dependent var	6.34E-15
Adjusted R-squared	-1.926613	S.D. dependent var	0.021587
S.E. of regression	0.036930	Akaike info criterion	-3.583759
Sum squared resid	0.010911	Schwarz criterion	-2.632184
Log likelihood	70.17263	Hannan-Quinn criter.	-3.292853
F-statistic	0.064510	Durbin-Watson stat	2.125368
Prob(F-statistic)	0.999999		

Appendix 10: Model one and Two Hetroscedasticity Results (Eviews-10 output)

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.456803	Prob. F(10,17)	0.8956
Obs*R-squared	5.930295	Prob. Chi-Square(10)	0.8211
Scaled explained SS	1.420755	Prob. Chi-Square(10)	0.9992

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 05/09/22 Time: 18:47
Sample: 1993 2020
Included observations: 28

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.056986	0.796579	-0.071538	0.9438
LNDPAX(-1)	-0.006283	0.019488	-0.322396	0.7511
LNDPAX(-2)	-0.011361	0.018899	-0.601135	0.5557
LNGDP	0.028652	0.061685	0.464490	0.6482
LNGDP(-1)	-0.043555	0.065356	-0.666427	0.5141
LNGDP(-2)	0.023255	0.045567	0.510342	0.6164
LNFDI	0.006531	0.005142	1.270071	0.2212
LNEDUC	-0.008475	0.015754	-0.537951	0.5976
LNCPI	0.004990	0.059851	0.083371	0.9345
LNITR	-0.031412	0.011511	-0.273235	0.7880
LNOER	-0.008705	0.053259	-0.163445	0.8721

R-squared	0.211796	Mean dependent var	0.012942
Adjusted R-squared	-0.251853	S.D. dependent var	0.015026
S.E. of regression	0.016812	Akaike info criterion	-5.046736
Sum squared resid	0.004805	Schwarz criterion	-4.523370
Log likelihood	81.65431	Hannan-Quinn criter.	-4.886738
F-statistic	0.456803	Durbin-Watson stat	1.966932
Prob(F-statistic)	0.895592		

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.839323	Prob. F(17,10)	0.6392
Obs*R-squared	16.46241	Prob. Chi-Square(17)	0.4913
Scaled explained SS	2.505016	Prob. Chi-Square(17)	1.0000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 05/09/22 Time: 19:00
Sample: 1993 2020
Included observations: 28

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.047842	0.089114	-0.536860	0.6031
LNIPAX(-1)	0.001946	0.003453	0.563657	0.5854
LNIPAX(-2)	0.001233	0.003349	0.368204	0.7204
LNGDP	-0.000633	0.004374	-0.144642	0.8879
LNGDP(-1)	-0.002007	0.004729	-0.424429	0.6802
LNGDP(-2)	0.003923	0.003862	1.016000	0.3336
LNFDI	-0.000553	0.000362	-1.530378	0.1569
LNFDI(-1)	-5.70E-05	0.000355	-0.160594	0.8756
LNFDI(-2)	-0.000339	0.000389	-0.872860	0.4032
LNEDUC	0.002068	0.001043	1.983232	0.0755
LNCPI	-0.005183	0.003561	-1.455725	0.1761
LNCPI(-1)	-0.000398	0.004088	-0.097433	0.9243
LNCPI(-2)	0.001534	0.004059	0.378001	0.7133
LNITR	-0.314614	0.662413	-0.047447	0.9631
LNITR(-1)	-0.351213	0.109912	-0.323896	0.7527
LNOER	-0.004811	0.005830	-0.825182	0.4285
LNOER(-1)	0.001837	0.005102	0.359999	0.7263
LNOER(-2)	0.004529	0.004680	0.967846	0.3559

R-squared	0.587943	Mean dependent var	0.000449
Adjusted R-squared	-0.112554	S.D. dependent var	0.000707
S.E. of regression	0.000746	Akaike info criterion	-11.30872
Sum squared resid	5.56E-06	Schwarz criterion	-10.45230
Log likelihood	176.3220	Hannan-Quinn criter.	-11.04690
F-statistic	0.839323	Durbin-Watson stat	2.553500
Prob(F-statistic)	0.639175		

Appendix 11: Model one and Two Ramsey RESET Test Results (Eviews-10 output)

Ramsey RESET Test
Equation: UNTITLED
Specification: LNDPAX LNDPAX(-1) LNDPAX(-2) LNGDP LNGDP(-1) LNGDP(-2) LNFDI LNEDUC LNCPI LNITR LNOER C
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.412650	16	0.6853
F-statistic	0.170280	(1, 16)	0.6853

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.003816	1	0.003816
Restricted SSR	0.362373	17	0.021316
Unrestricted SSR	0.358557	16	0.022410

Unrestricted Test Equation:
Dependent Variable: LNDPAX
Method: ARDL
Date: 05/09/22 Time: 18:47
Sample: 1993 2020
Included observations: 28
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (2 lags, automatic):
Fixed regressors: C

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LNDPAX(-1)	-0.248471	0.366646	-0.677687	0.5077
LNDPAX(-2)	0.490515	0.715088	0.685951	0.5026
LNGDP	4.604114	6.375096	0.722203	0.4806
LNGDP(-1)	-2.629769	3.686261	-0.713397	0.4859
LNGDP(-2)	2.051036	2.815557	0.728465	0.4769
LNFDI	0.416455	0.568599	0.732422	0.4745
LNEDUC	-0.264490	0.464123	-0.569870	0.5767
LNCPI	-4.926112	6.784773	-0.726054	0.4783
LNITR	8.230510	1.157509	0.713011	0.4861
LNOER	1.706455	2.393773	0.712873	0.4862
C	-68.68755	103.1538	-0.665875	0.5150
FITTED^2	-0.049044	0.118852	-0.412650	0.6853

R-squared	0.980290	Mean dependent var	12.92115
Adjusted R-squared	0.966740	S.D. dependent var	0.820841
S.E. of regression	0.149699	Akaike info criterion	-0.662853
Sum squared resid	0.358557	Schwarz criterion	-0.091908
Log likelihood	21.27994	Hannan-Quinn criter.	-0.488309
F-statistic	72.34465	Durbin-Watson stat	2.425765
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

Ramsey RESET Test
Equation: UNTITLED
Specification: LNIPAX LNIPAX(-1) LNIPAX(-2) LNGDP LNGDP(-1) LNGDP(-2) LNFDI LNFDI(-1) LNFDI(-2) LNEDUC LNCPI LNCPI(-1) LNCPI(-2) LNITR LNITR(-1) LNOER LNOER(-1) LNOER(-2) C
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.125656	9	0.9028
F-statistic	0.015789	(1, 9)	0.9028

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	2.20E-05	1	2.20E-05
Restricted SSR	0.012582	10	0.001258
Unrestricted SSR	0.012560	9	0.001396

Unrestricted Test Equation:
Dependent Variable: LNIPAX
Method: ARDL
Date: 05/09/22 Time: 19:01
Sample: 1993 2020
Included observations: 28
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (2 lags, automatic):
Fixed regressors: C

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LNIPAX(-1)	-1.887091	3.178504	-0.593704	0.5673
LNIPAX(-2)	-1.135635	1.942761	-0.584547	0.5732
LNGDP	1.400999	2.436220	0.575071	0.5793
LNGDP(-1)	0.937584	1.549870	0.604944	0.5602
LNGDP(-2)	2.053847	3.594642	0.571363	0.5817
LNFDI	-0.063149	0.113740	-0.555206	0.5923
LNFDI(-1)	0.012619	0.023943	0.527033	0.6109
LNFDI(-2)	0.171688	0.293435	0.585096	0.5729
LNEDUC	0.546349	0.825236	0.662051	0.5245
LNCPI	-1.975318	3.513872	-0.562148	0.5877
LNCPI(-1)	0.470283	0.860877	0.546284	0.5982
LNCPI(-2)	-0.358355	0.674185	-0.531538	0.6079
LNITR	0.359710	0.651510	0.550959	0.5951
LNITR(-1)	0.320510	0.538210	0.594796	0.5666
LNOER	-2.290702	3.998634	-0.572871	0.5808
LNOER(-1)	2.148761	3.714145	0.578535	0.5771
LNOER(-2)	1.223526	2.190791	0.558486	0.5901
C	-43.69098	88.23228	-0.495181	0.6323
FITTED^2	-0.009167	0.072950	-0.125656	0.9028

R-squared	0.999488	Mean dependent var	14.37132
Adjusted R-squared	0.998464	S.D. dependent var	0.953340
S.E. of regression	0.037358	Akaike info criterion	-3.514391
Sum squared resid	0.012560	Schwarz criterion	-2.610395
Log likelihood	68.20147	Hannan-Quinn criter.	-3.238030
F-statistic	976.3464	Durbin-Watson stat	2.289908
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.