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Analysis of the Interaction between Air Transportation and Economic Growth: Ethiopian Perspective

Prepared by

Samuel Mengistu Seyoum

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Declaration

I, the undersigned, declare that this project paper (Analyzing the interaction between air transportation and economic growth: an Ethiopian perspective: evidence from Ethiopia) is my original work and has not been presented for a degree in any other university, and that all sources of material used for the project have been duly acknowledged.

Declared by:

Name: Samuel Mengistu Seyoum Signature _____ Date _____

Confirmed by advisor:

Zelalem G/Tsadik (PHD) Signature _____ Date _____

School of Graduate Studies

This is to certify that the thesis prepared by Samuel Mengistu Seyoum entitled: Analysis of the Interaction Between Air Transportation and Economic Activity: Ethiopian Perspective: evidence from Ethiopia in partial fulfillment of the requirements for the Degree of Master of Science in International Business (Import/Export) complies with regulations of the University and meets the accepted standards with respect to originality and quality.

By: Samuel Mengistu Seyoum

Approved by board of examiners:

Advisor: Zelalem G/Tsadik (PHD) Signature _____ Date _____

Examiner: Tewodros W (PHD) Signature _____ Date _____

Examiner: Habtamu Endris (PHD) Signature _____ Date _____

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Acronyms/ Abbreviations

ADF	Augmented Dickey –Fuller
ATAG	Air Transport Action Group
BOP	Balance of payment
COMESA	Common Market for Eastern and Southern Africa
DGP	Data Generation Process
EA	Ethiopian Airport
EAG	Ethiopian Airlines Groups
ECAA	Ethiopian Civil Aviation Authority
ECT	Error Correction Term
EDCD	Education
FDI	Foreign Direct Investment
FRT	Freight
GDP	Gross Domestic Product
GTP	Growth and Transformation Policy
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
LCC	Low-Cost Carrier
LR	Likelihood Ratio
MNG	Emigration
NBE	National Bank of Ethiopia
OER	Official exchange rate
PAX	Passenger
$\boldsymbol{POPN}$	Population size
VAR	Vector Auto-Regression
VECM	Vector Error Correction Model

ABSTRACT

The general purpose of this paper is to investigate the relationship between air transportation and Ethiopia's economic performance. This study also aims to show the casual relationship and provides the short-term and long-term relationship between air transport demand and economic growth. In order to achieve these goals Ethiopian Airlines Group and World Bank data source used from 1991 to 2019. To achieve these goals the appropriate estimation methods (VECM, VAR, Granger causality test, and descriptive analysis) were used. Johansen's co-integration analysis shows that there is a co-integration vector between economic growth and air transport expansion, and the corresponding elasticity is positive. VECM results show that the fitting coefficient between economic growth and air traffic dynamics is approximately (ECT = -0.33). The outcomes of VECM evaluation additionally indicates that long-time period causality runs from air transport demand (passengers and cargo) to financial growth, and considering transport demand, a two-year delay seems reasonable. The empirical evidence obtained from VECM and the causality test (long-term, short-term, and Granger causality) shows that there is a unilateral causal relationship between the development of aviation (passenger and freight) to local economic growth. The results of this document have some political and commercial implications and may be important to Ethiopia's national air transport will create conditions for better air transport services, which will have a major long-term impact on economic growth. Therefore, policy makers should be aware that this sector is income elastic and has a multiplier effect on economic growth.

Keywords: Causality analysis, Cointegration, Air transport, Economic growth, Aviation industry, Ethiopia

CHAPTER ONE

1. INTRODUCTION

1.1. Background of the study

The relationship between air travel and economic activity is complex. In the past few decades, the uses of air transport and economic activities have increased all over the world. The year 2009 marked the prosperous era of commercial aviation. Between 2009 and 2019, the global aviation industry's air passenger revenue increased from approximately US$374 billion in 2009 to approximately US$612 billion in 2019 (Mazareanu, 2020). The structure of aviation demand is aimed to increase its customers' base in emerging markets. The aviation industry is expected to become the largest source of income for travelers in South America, the Middle East, and the Asia-Pacific region. Air travel is the only long-distance transportation method for transporting expensive fresh produce and time-sensitive agricultural products. As destination geography the only way to remote areas, air transportation provides access to markets, personnel, capital, knowledge and skills, opportunities and resources. Therefore, the availability of aviation services effectively increases geographic coverage and business cycle time.

The aviation industry can have a huge and powerful impact on monetary policy improvement and growth, and it can be a direct cause. Following this comment, the question is whether air travel will stimulate the growth and improvement of the money supply and vice versa, or whether it will stimulate aviation activities, and whether it can affect the growth of the money supply through multiple channels. Interest in air transport can boost the money supply through unusual channels. First, air transport is an important source of foreign exchange (Van De Vijver, Derudder, & Witlox, 2014). Second, aviation plays an important role in facilitating the financing of new infrastructure. Third, in view of the complexity of the distribution sector, aviation distribution provides impetus to various currency industries through direct, indirect, and inductive effects. Fourth, air transport creates tasks and increases profits (Özcan, 2013). Fifth, air transport provides amazing economies of scale and helps make more competitive. Finally, air transport is an integral part of sales of technical knowledge. On the contrary, the growth of the money supply will also have a huge impact on the expansion of air transport demand. For example, by improving the company's infrastructure including airports, it provides the possibility

of selling export activities including tourism, improving the operations and productivity of trading companies, and influencing the organization's location and financial decisions (Halpern, & Bråthen, 2011).

International literature on the link between air transportation demand and economic process is rising and still lacking (Green, 2007). Chang, and Chang, (2009) analyze the relationship between Taiwan' air load enlargement and economic growth. Their results indicate that air freight transport and economic growth are linked, suggesting that there's a two-way cause and impact relationship in each the short and long term. For Brazil, Fernandes, and Pacheco, (2010) and Marazzo, Scherre, & Fernandes, (2010) found a conjointly integrated relationship between air transport demand and economic growth, also as a unidirectional equilibrium relationship between them. Within the United States, Chi, & Baek (2013), analyze the short- and semi-permanent relationships between economic process and air transport in varied frameworks (dynamic models of changes in self-regressive variance). the most result's that traveller and load demand tend to extend with economic growth within the long term, whereas passenger transport activity in the short term is littered with external shocks. North American nation has an in depth air transport network and, like most countries, edges from the business' economic footprint. Shipping conjointly contributes considerably to Mexico' value in terms of demand through the price it creates. In 2010, the industry supported 158,000 jobs (direct, indirect, induction) in Mexico, conducive 0.4% to Mexico' value (IATA, 2009). Taking into consideration the indirect or "catalytic" impact of tourism, it contributes up to 2.0% of GDP.

A recent treaty (Brida, Lanzilotta, Brindis, & Rodríguez-Collazo, 2014) shows that demand for air transport has a positive impact on economic growth in Mexico. The physical property of real gross domestic product for air transportation demand (0.56) means a 100 percent increase within the variety of air passengers in Mexico can increase real financial gain by over 50%. The authors display that there is a long-run trade-off between the Mexican aviation enterprise and monetary growth, which there may be a two-manner causative relationship between them. However, recent research on tourism-oriented growth assumptions developed within the framework of a nonlinear methodology (Brida et al., 2013) is new in analyzing the relationship between regions, market sectors, and economic growth of the economy. In addition, air transport activity has experienced a number of important events we speculate that the relationship between industry and economic growth is running in a non-linear sense.

There are variety of empirical studies, emerged recently and continues to be scarce (Green, 2007), on the link between air transportation demand and economic process. These studies were principally conducted in developed countries (Baker, Merkert, & Kamruzzaman, 2015). Chang & Chang, 2009; Chi, and Baek, (2013) and better middle financial gain countries (Bourguignon, & Darpeix, 2016; Fernandes, & Pacheco, 2010; Hakim, & Merkert, 2016). These researchers reach different conclusions on the relationship between air transport demand and economic growth causalities for {various} income segmental countries. Although the findings of those studies are different for various countries and regions, two-way causalities in developed countries and one-way causalities in higher middle-income countries are the common findings. Recent research in Ethiopia, (Tolcha, 2017) final results of causality tests confirmed that there may be unidirectional causality entering into a wonderful path from air delivery development (passenger and freight) to monetary increase.

In this research, section four the causality evaluation among air delivery and monetary increase, the relationship between air transport and economic growth and short run and long run relationship in Ethiopia, might be investigated.

1.2. Statement of the problem

Over the last decade, Ethiopia has been one of the fastest-growing countries in the world averaging annual increases in real GDP of close to 10%.The pace of expansion is expected to slowdown in the near term but real GDP growth is likely to be around 7.5% in 2014-15, driven by public capital investment in critical infrastructure such as extended road and power networks, which benefit both industry and agriculture. The Africa location is visible as a destiny financial powerhouse with widespread capability for increase and will come to be a totally rewarding fulfillment tale for aviation and related deliver chain/logistics industries.

Facts have proved that assessing causality is crucial for insurance planners, airlines, airports, and various stakeholders. This is a good way to better understand whether there is a one-way, two-way relationship or no dating between making money and air travel extension. In addition, causality analysis is commonly used to determine whether there is any delay in the relationship between aviation and economic growth. Many empirical documents analyzing the causal relationship between air travel and economic growth are concentrated in high-income and middle-income countries, and little attention is paid to low- and middle-income countries such as

Ethiopia. There is little empirical evidence on the causal relationship between air transport and economic growth in Ethiopia (Tolcha, 2017). In the field of air transportation the literature needs more researches to investigate about the relationship between air transportation and economic development in low income country or developing country. To overcome these field research problem based on former studies investigation should be done. Ethiopia is one of low income or developing country which has strong air transport services considering African countries. This opportunity gives a chance to support the economic developments. The study of the relationship between air transport and economic growth helps the country development in many directions. The existence of Cointegration courting among air delivery and monetary increase indicating a long-term or short-term courting between them and also the short run and long run effect of air transport and economic growth identification helps the decision maker to give more attention to the development of air transport services. The remainder of this paper, which aims to investigate and show the contribution of air transport sector to the economic growth in Ethiopia. The study also contributes to the international literature shortage of empirical evidence on low income or developing countries.

1.3. Research questions

The goal of this paper is to research the short-run dynamics and long-run relationships among financial increase and air transport needs in Ethiopia. Air transport offerings normally created from passenger and freight offerings that have been analyzed on this examine. After causality course identified, the common effect of air transport and financial increase on every different will be analyzed each in short run and long run. Additionally, the responsiveness of financial increase to air shipping or the sensitivity of air shipping for financial increase of the country could be additionally investigated. Specifically, in this examine the subsequent studies query were analyzed:

- 1: What is the relationship between air transport and financial growth in Ethiopia?
- 2: What is/are the casual relationship between air transport and financial growth in Ethiopia?
- 3: What are the short-run dynamics and long-run relationships experienced and predicted exist between air transport and financial growth in Ethiopia?

1.4. Objective of the study

1.4.1. General objective

The overall objective of the study is to assess the relationship between air transport demand and economic growth in Ethiopian.

1.4.2. Specific objectives

The purpose of this paper

- To help understand the relationship between air transport and Ethiopian economic performance.
- To give understanding and helps guide development efforts, investments, and policy decisions regarding the use of air transport.
- To analyze the operation of passenger and freight services in terms of economic growth.

1.5. Scope of the study

In this research, the researcher is limited the study scope only on air transportation and economic growth of Ethiopian. The passenger traffic and cargo demand of all airlines frequently using Bole International Airport (Addis Ababa), and all exports goods by air are target of the study. The study focus on the air transport activities that contribute to the economic development or the economic development contribute to the air transport development of country. These point leads to investigate that it is unidirectional, bidirectional or no connection between them .All airlines including Ethiopian airlines operation are important to the contribution. The final aim of this study is that to give direction and advice to the policy makers and related industries to support the development of the sector. Based on the research question to reach the best conclusion we will use international research methods of econometrics Unit root, VAR (vector auto regression), VECM (Vector Error Correction Method) and Granger causality methods.

1.6. Significance of the study

To understand the trends of Ethiopian air transport service to the economic growth.

To have knowledge about the contribution between air transportation and economic growth in Ethiopian.

To give more attention for the concerned body on the level of aviation industry at what extent air transport contribute to the Ethiopian local economy growth. The results of this paper can be applied to the activities of Ethiopian airline groups, and civil aviation their participation and support for the sector to improvement further even well.

1.7. Operational Definition of Terms

1. **Interaction**:-If one thing interacts with another, or if two things interact, the two things have an effect on each other. On this research interaction refers air transport and economies have an effect on each other's. That means change in air transport has some effect on economy growth or vice versa.
2. **Short run**:-lasting or taking a small amount of time or less time than usual. On this research short run indicate lasting or taking a small amount of time casual relationships between air transport and economic growth and vice versa.
3. **Long run**:-lasting or taking a great amount of time or more time than usual. On this research long run indicate lasting or taking a great amount of time casual relationships between air transport and economic growth and vice versa.
4. **Unit root tests** can be used to determine if trending data should be first differenced or regressed on deterministic functions of time to render the data stationary. Moreover, economic and finance theory often suggests the existence of long-run equilibrium relationships among nonstationary time series variables. If these variables are I(1), then Cointegration techniques can be used to model these long-run relations.
5. **Cointegration**:- A set of non-stationary variables integrated of the same order, say I(1), are linked to form an equilibrium relationship spanning the long-run if they combine to form a lower order series integrated of the order I(0).
6. **Vector auto regression (VAR)** was introduced by Sims (1980) as a technique that could be used by macroeconomists to characterize the joint dynamic behavior of a collection of variables without requiring strong restrictions of the kind needed to identify underlying structural parameters. It has become a prevalent method of time-series modeling.
7. **Granger causality** can be used to shed light on the direction of possible causality between pairs of variables. The formal definition of Granger causality asks whether past values of x aid in the prediction of yt, conditional on having already accounted for the

effects on yt of past values of y (and perhaps of past values of other variables). If they do, the x is said to “Granger cause” y.

8. **Vector Error-Correction Models**: - In this model, the equation is differenced and an error-correction term measuring the previous period’s deviation from long-run equilibrium is included.

1.8. Organization of the paper

This study focuses on the relationship between Ethiopia's air transport and economic growth. This analysis is performed to verify that the reality between passenger and freight demand is consistent with the country's economic growth rate. This study aims to establish empirical evidence of the short-term dynamics and long-term relationships experienced and expected to exist between the Ethiopian economy and air transport demand. The rest of the survey consists of: Chapter 2 presents theoretical and empirical literature. Chapter 3 describes data and variable and methodology. Chapter 4 consist Results and Discussion. Chapter 5 shows the conclusions and impact on policy and Recommendation for further research.

CHAPTER TWO

2. LITERATURE REVIEW

Air delivery is an essential engine for monetary increase and development. Air delivery promotes integration into the worldwide economic system and affords vital connections at the national, regional and international levels. It creates commerce, promotes tourism and helps create jobs. Air transport itself is an important industry and provides important inputs to a wide range of economic, political and social processes. According to (Saheed & Iluno, 2015), most means of transport and the demand for its services are derivative services driven by the need and desire to achieve other end goals.

The International Air Transport Association (IATA) analyzes in a study that measures aviation's contribution to gross domestic product (GDP), employment, and sales taxes generated by the arena media and its supply chain, which are the industry's traditional economic footprint. In addition, the development of the aviation division provides foreign direct investment (FDI), specialization and other event effects. Oxford Science-Economics is one of the main attempts to evaluate these shipping-related real estate advantages (Perovic, 2013). The Working Group (Borders, A.A.B.B. 2018) reported that aviation can play an important role in promoting economic growth, especially in developing countries.

On the other hand, economic development also has had a significant impact in air transport demand (Bourguignon & Darpeix, 2016; Hakim & Merkert, 2016). In this section, the empirical evidence on the causal relationships between air transport and the financial increase was provided. On the second section interaction between air transport and economic growth theoretical review is presented. On the last section of this topic the economic impact of aviation will be discuss.

2.1. The casual connection between air transport and economic growth: empirical review

The literature contains direct research on the relationship between aviation and economic growth in order to understand the nature of rapid growth and economic development in the aviation industry. Due to differences in data fields, methodology, and research, as well as economic development status and analysis in different periods, the results are also quite different. In

addition, you should also consider the potential relationship between economic growth and the aviation industry in a particular region. We also tried to look at the various studies below.

Chang, and Chang, (2009) conducted the Granger causality test to observe a causal link between the expansion of air freight and the financial growth of Tai-wan. The effect of the information from 1974 to 2006 confirmed a bidirectional relationship between the two variables. Marazzo et al. (2010) examined the empirical relationship between Brazilian air transport and GDP. They struck a long-term balance between two variables by using water substitutes for air freight demand for passenger-kilometers. Their results suggest a strong and dominant causal relationship between GDP and air demand, but the alternative methods have a particularly weak causal relationship. Durability evaluations were performed using Hodric and Prescott preparations to understand series cyclic additives and their consequences. Their interpretation of positive and negative relationships indicates the existence of exponential effects. (Percoco, 2010) developed a framework to study the impact of airports on Italian provinces. In addition, the elasticity of employment of airport passengers in the service sector is 0.045 and the elasticity of spillovers from adjacent airports is close to 0.017.

A survey conducted by Indonesia (Dharmawan, 2012) examined the relationship between air travel frequency and economic growth; the evaluation uses data from the 2000-2010 periods. The analysis shows that there is a positive link between air transport and economic growth thanks to the tourism industry's contribution to aviation. In addition, (Van De Vijver, 2014) applied the Granger heterogeneous causality test to several Asian country pairs to study the causal relationship between trade and passenger air transport in Pacific Ocean. Interestingly, they found four types of causal relationships between different pairs of countries: independence, air traffic to trade, trade, and two-way air traffic. However, contrary to this claim, studies conducted on the same topic in Italy (JG Brida, Bukstein and Zapata-Aguirre, 2016) and Nigeria (Saheed and Iluno, 2015) show economic growth economy of air transport with different Level and regional composition.

Chi and Beck, (2013) studied the short-term and long-term effects of economic growth and market shocks on freight and air passenger’s services. Results of ARDL show the air passengers service affects economic growth in the short-run, whereas, positive effect of air passengers and freight services on economic growth in the long-run. Moreover, shocks like terrorism also;

negatively affects air freight demand and air passenger demand both in the long and short -run, with latter having more effect than the former.

Mehmood, et al. (2013), empirically look at the hypothesis for aviation-directed growth for India, as well by challenging causalities between economic growth and Air transport. They resorted to econometric test of co-integration (for long-run relationship) and tests like unit-root tests (for stationarity) purposed by Johansen and Juselius (1990). To estimate the co-integration equation for the time span of 1970 to 2012 Fully Modified OLS (FMOLS), Dynamic OLS (DOLS) and Conical Cointegration Regression (CCR) were used. The empirical results show the existence of relationship between aviation demand and the economic growth. Graphic methods, such as, Cholesky Impulse Response function and variance decomposition were also applied for rigorous analysis. All these three estimation techniques forced the same conclusion that demand for air transport contributes positively to economic growth. These findings help to know, as to how important the air transport industry is to economic growth for developing country, like India.

The empirical evidence in Ethiopia by (Tolcha, 2017), the results show that there is a co-integration relationship between air transport demand and economic growth, indicating that there is a long-term relationship between the two. In addition, the results of the causality test (long-term, short-term, and Granger causality) indicate that there is a positive one-way causality. Air traffic (passenger and freight) is developing in the direction of economic growth. These results show that the development of air transport is the driving force and engine of economic growth.

Table 1: Summary of empirical literature on air transport and economic growth reasons

Source	Countries/Regions	Mainly found
Chang and Chang (2009)	Taiwan (1974–2006)	The long-term two-way causal relationship between air transport expansion and economic growth.
Marazzo et al. (2010)	Brazil (1966–2006)	Air Passenger GDP Granger One-Way Causality.
Chi and Baek (2013)	US (1996–2011)	Long-run & Short-run unidirectional causality from economic growth to air passenger and freight service.
Van De Vijver et al. (2014)	Asia-Pacific(1980–2010)	Highly heterogeneous causal Relationships.
Percoco,M(2010)	Italy	Multiplier effect
Dharmawan,I(2012)	Indonesia	Positive Relationships
Zapata-Aguirre(2016)	Italy	unidirectional causality
Illuno & saheed,2015	Nigeria	unidirectional causality
Mehmood el al(2013)	India	long-run relationship
Tassew D,(2017)	Ethiopia	unidirectional causality

Source: Compiled from Reading paper

According to the annual report (NBE, 2019), Ethiopia's economy is dominated by services (39.8%) and agriculture (33.3%), followed by industry (28.1%). According to the report, the total transportation service provided by the country is about 11%. From the perspective of the relationship between aviation development and economic growth, Ethiopian Airlines' direct revenue accounts for approximately 5.7% of Ethiopia's GDP (IATA, 2019), accounting for more than half of the country's growth in the transportation sector. Figure 5 shows the revenue of Ethiopian Airlines from all operations in the country. In addition to Figure 1, Figure 2 also shows the development of Ethiopia's GDP.

Figure 1: EAL **income**

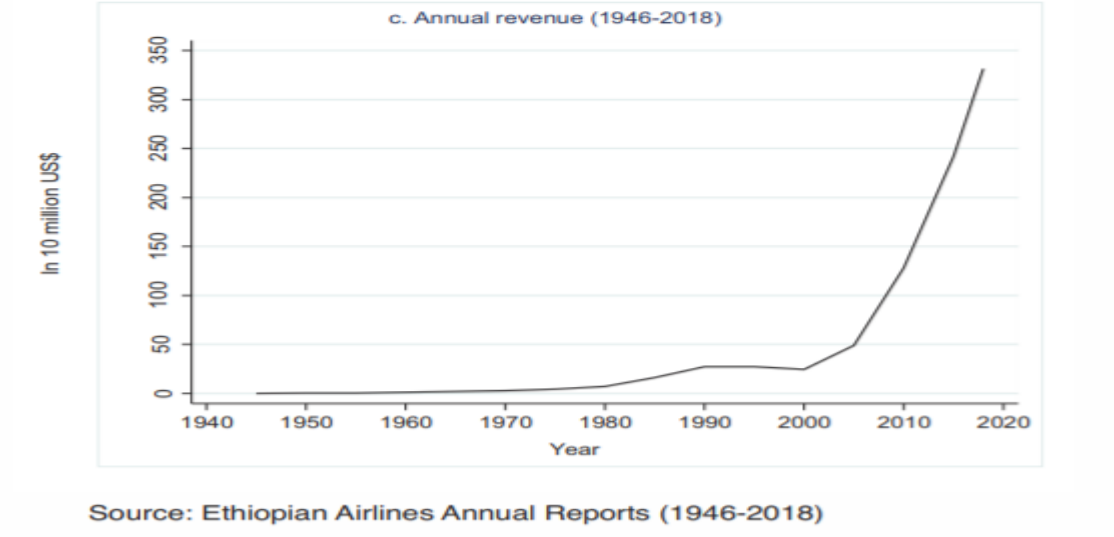
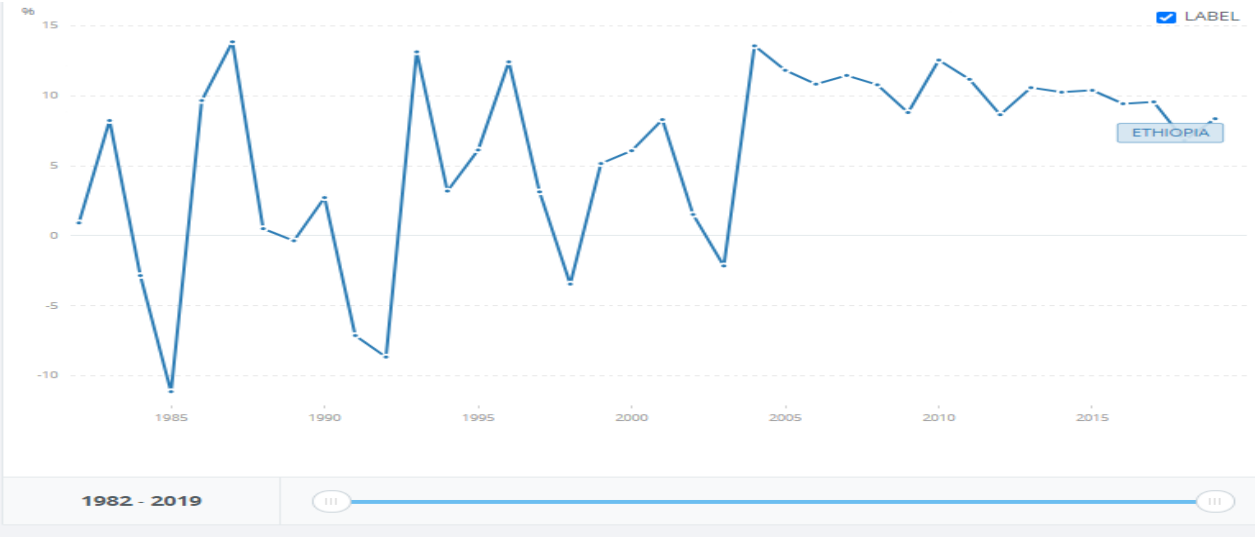


Figure 6 below shows that the trend of economic growth rates fluctuates in different ranges. The graph also shows that the average growth rate of revenue.

Figure 2: GDP growth (annual %) - Ethiopia



Source: World Bank national accounts data, and OECD National Accounts data files

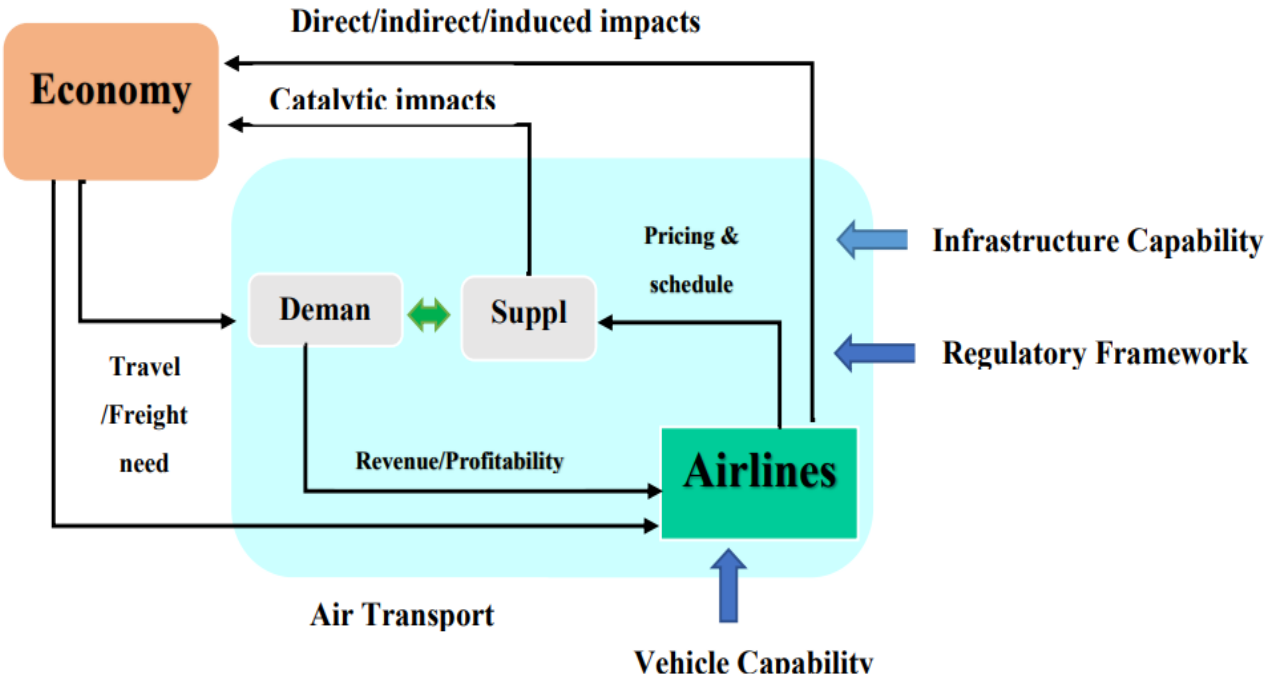
Most of the causal analysis documents between air traffic and economic growth target high-income countries (with frequently accumulated air markets) and results that propose bidirectional causality between air traffic and limited economic growth to this context. On the contrary, the causality of the results of the countries of the average income, such as Brazil and Southeast Asia,

has shown a strong causality of the economic growth of aviation, but the duration of the low causality of the Aviation for economic growth. More importantly, there is few literature in the causal analysis between air transport and the increase in the economy of low-income countries (with the possibility of a strong growth in air transport), which is a fundamentally empty context; it appears this relationship (Green, 2007). This is very few literature in particular on the African context, especially Ethiopia, which is not only a region with different culture (which influences behavior and reserves in the passage and reserves of people) but despite its large population, Characterized in relatively low income and even the low air content. This study which is the second would have tried to investigate and analyze the relationship between air transport demand and economic growth in Ethiopia.

2.2. Interaction between air demand and economic growth: theoretical reviews

Air transportation offerings and monetary improvement have interaction with every different via a sequence of mutual-causality remarks relationships. Air transportation offers employment with inside the aviation zone and creates wider socioeconomic benefits via its ability to allow sure styles of activities in a neighborhood economic activity. Therefore, the availability of air travel services effectively increases the size and duration of the economic cycle. In turn, the money interest in the region created demand for passenger and cargo travel and stimulated demand for air transportation services. Practically, we can accordingly pick out signs of neighborhood economic system in phrases of the monetary influences of air delivery and Gross Domestic Product (GDP) around the world country. There is substantial variability in the growth rates, even though GDP and in the past three decades, the number of passengers in all regions has increased. This shows that the variability in the nature of the interaction between economic activity and air transportation (Ishutkina & Hansman, 2008)

Figure 3: Feedback-based interaction between the air transport system and the economy.



Source: adapted from (Ishutkina, Hansman, 2008; Ishutkina, 2009)

The economic impact of aviation is different from that of other means of transportation due to its distinct characteristics such as Speed, cost, flexibility, reliability and safety. This is the only remote communication service transport for expensive spoiled goods and time-sensitive people, and the only way to reach geographically isolated areas. However, air transportation on short routes has little advantage over other types of transportation, especially high-speed trains (Ishutkina, 2009). According to the combination of economic and air traffic characteristics, different mechanisms determine the relationship between air transport and economic activities. A type of air traffic flow varies across economies due to these inherent characteristics. In some countries, foreign visitors make up the majority of tourist arrivals, but in other economies, domestic traffic predominates.

Having an influence between air transportation system and an economy is describing a high-level feedback model in Figure 3. The air transportation system is determined by its regulatory framework, vehicle and infrastructure capabilities, and airline capabilities. Airlines provide their products through pricing and flight plans based on the revenue and profitability of specific routes in the air transportation system in terms of supply and demand (Ishukina, & Hansman, 2008). At the macroeconomic level, aviation influences the economy through job creation and incentive

effects, aviation industry demand/supply, direct/indirect/inductive effects, catalytic effects and infrastructure options, as well as regulatory frameworks, travel/freight demand and Profitability. Aviation opportunities include access to people, ideas, markets, capital and knowledge, manpower, opportunities, skills and resources. Economical goods and passenger transport, in turn, receive capital supply and generate demand. The economy's relative commercial and entertainment appeal to the rest of the world are determined by the economy's travel and freight needs (Porter, 2011).The causal direction of economic activities and the relationship between aviation may vary depending on the different economic sectors studied in this study for developing countries.

2.3. The economic impact of aviation

Air transport is a modern mode of transport because it has a positive economic impact besides road and sea transport. Economic impacts can be divided into four categories: direct, indirect, induce and catalytic. Together they measure the importance of the aviation industry in terms of jobs and the creation of products and services. Ultimately, what they produce contributes to national income. "There are many ways to measure the economic impact of air travel. The airlines and distribution networks that make up these flows by customers of all airlines serving the region, the roles and costs created by trade, travel, sponsorship flows, water and intercity connections and focus on four factors. They all offer their own lighting angles, but they are important to the importance of air travel. (IATA, 2018)

Direct economic impacts: The direct economic impact is the result of the economic activity mainly carried out by local industry. In the airline industry, airports and airlines have a direct economic impact on the economy and communities. For example, airline staff salaries, fuel costs, are landing costs, airport staff salaries and other purchasing costs. Located in the United States, Memphis creates a job at the airport upon departure, according to one of the reports. This means additional flights once a day, creating around 365 new jobs in the area. This reinforces our view that the airline industry is seen as a potential generator of jobs. Observed Airlines, airport operators, airport companies (catering and retail), aircraft maintenance, and air navigation service providers employ 19,000 employees and generate $794 million in GDP in Ethiopia. (IATA, 2018, Borders, A.A.B.B. 2018)

Indirect impacts can be referred as off-site economic activity of air-transport industry. Indirect impacts include services provided by travel agencies, rental car companies, hotels, restaurants and retail activities. From this, it can be inferred that air-transport is one of the contributors in services sector of an economy. Usually, a causal relationship is found between an indirect impact and the industry, e.g., hotel industry has strong indirect economic impact relationship with aviation. For example, if there is a reduction in air travel for a community, the hotel industry in that community is likely to face a fall in occupancy rates, as well. In Ethiopia, in addition to around 179,000 jobs, purchasing goods and services from local suppliers also created 179,000 jobs in the sector and 516 million dollar to GDP. Use the wages you pay to employees, and all or part of the amount will be used for consumer goods and services. (IATA, 2018, Borders, A.A.B.B. 2018)

Induced economic impacts capture the multiplier effects that are caused by the direct and indirect economic impacts. Induced impacts accounts for increased employment and salaries which comes from the secondary spending, i.e., result of the direct and indirect economic impacts. Despite being highly capital intensive industry, air-transport employs a large number of people. It creates employment opportunities through numerous marginal jobs in the chain of supply and supports jobs in other industries through the induced impacts it generates. Air-transport supported jobs are more productive owing to the high capital intensity of this industry, because of high skill requirements in many job functions. As a result, people employed in the air-transport industry have relatively higher wages as compared to other sectors of the economy. Apart from the direct and induced economic impacts generated by aviation, the industry plays a significant role in tourism sector. Tourism sector is supported in two ways, i.e., through business and leisure. Air-transport leads to increase in cinemas, restaurants, hotels, and small businesses due to an increase in tourism sector. Public sector is also supported strongly through air-transport in the form of tax generation. Hence, the sector contributes toward government expenditures leading to development of an economy. In addition, the department has an estimated 80,000 jobs and 230 million dollar to GDP through the wages it pays its employees.

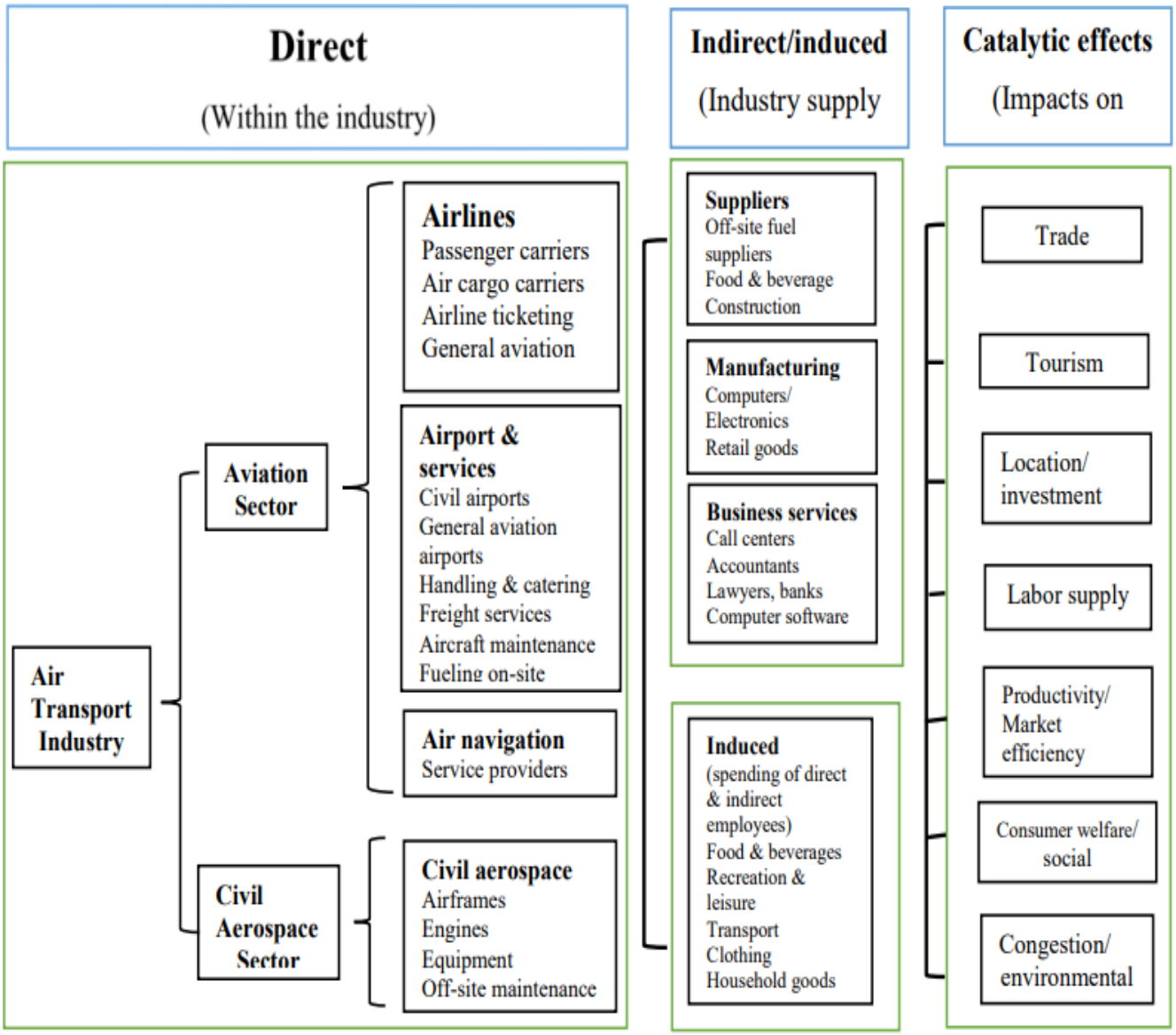
Moreover, this sector makes a vital contribution to trade openness, i.e., a large amount of export earnings is found through this sector. Movement of goods and services is accelerated which promotes competition in goods and services market. Ultimately, this phenomenon leads to

adoption of advance technology as a result of which high quality products are produced at low cost. (IATA, 2018, Borders, A.A.B.B. 2018)

Catalytic Impacts: Catalytic impact aviation industry's largest and most important financial contribution is due to their impact on the overall productivity of various industries and their growth engines. This will affect the operation of the global economy and increase the efficiency of other industries in the entire economic field (ICAO, 2016). Aviation contributes to economic growth, efficiency, poverty reduction and job creation through a series of catalytic effects on the economy. Economic catalytic effects are usually difficult to measure but are expected to be much more normal than direct effects. The catalytic efficiency of air transportation services in the Ethiopian financial system includes: Transportation services facilitate the transportation of business travelers to and from Ethiopia. It is estimated that foreign tourists flying to Ethiopia and spending money on the local economy have created 815,000 jobs. There is only one air travel and passengers created 1 million jobs. The consumption of overseas tourists also supported the country's GDP of 26.1 billion US dollars, equivalent to 41.5 billion US dollars. Classified by level, air transport and foreign tourists arriving by plane provide 7% of the country's total GDP. (IATA, 2018, Borders, A.A.B.B. 2018)

Figure 4 shows the mechanism of influence in the air transport sector. This figure examines how the air transport industry is contributing to economic and social development at various levels. The first four pillars below are included in this analysis. This does not include other economic benefits of aviation, such as jobs or economic activities that occur when the entire business or industry exists, as air transportation makes this possible. Exams (called "other support factors"). It also does not include the intrinsic value offered by air travel speed and connectivity or domestic and commercial travel. Including this doubles the number of jobs and the impact on the World Economy.

Figure 4: The aviation industry and its impact on the economy



Source: Excerpted from (Borders, A.A.B.B. 2018, Tolcha, 2017; Oktal, Durmaz, Küçükönal, Sarılgan, & Ateş, 2006)

In general, empirical and theoretical literature shows that there is a positive correlation between economic growth and air travel demand. The different global economic characteristics of different countries/regions may vary due to their sensitivity to changes in the combination of these variables. The cut-off effects of these variables are different for different groups of people. Most of the literature can be used in developed countries. Such research is rare in developing countries.

This research analyzes the following research questions:

- What is the relationship between Ethiopia’s air transport demand and economic growth?
- What is the causal relationship between Ethiopia's air transport demand and economic growth?
- What is the short-term dynamic and long-term relationship between Ethiopia’s air transport demand and economic growth?

The empirical analysis of this research partially solves these basic problems based on the available data sets. The results are also compared with similar studies on different occasions. It is more convincing than the empirical evidence of a case study with economic characteristics similar to Ethiopia. However, such empirical evidence is rare in developing countries. In addition to the existing empirical literature on economic development, data from industrialized countries can also be used for comparison with the results of this study.

CHAPTER THREE

3. Research Methodology

Research methodology simply refers to the practical "how" of any given piece of research. More specifically, it's about how a researcher systematically designs a study to ensure valid and reliable results that address the research aims and objectives. Quantitative methodology is typically used when the research aims and objectives are confirmatory in nature. For example, a quantitative methodology might be used to measure the relationship between two variables. In this research we use Quantitative methodology to measure the relationship between air transport services and economic growth.

3.1. Research Design

The design for this study includes explanatory design which show cause and effect relationships between air transport and economic growth. Air transport represented by passenger and freight and economic growth by growth domestic product. The Study of Causal relationship examine the facts in all possible directions between economic growth to Passenger volume and economic growth and air cargo volume, which constitute the four parts of relationship.

3.2. Research Approach

A deductive approach is concerned with "developing a hypothesis (or hypotheses) based on existing theory, and then designing a research strategy to test the hypothesis. It has been stated that "deductive means reasoning from the particular to the general. If a causal relationship or link seems to be implied by a particular theory or case example, it might be true in many cases. A deductive design might test to see if this relationship or link did obtain on more general circumstances (Wilson, 2010). In this study the hypotheses are that air transports are any effect on the economy or vice versa. And also it analyzes the relationship between air transport and economic growths. Air transport represented by air passenger and air cargo. The economy represented by Growth domestic product (GDP). The test will be conducted air passenger to GDP and air cargo to GDP. These are quantitative methods measured by descriptive analysis (mean, mode and median) and econometrics analysis (VECM, VAR, Granger causality test). Examining the outcome of the test, and thus confirming or rejecting the theory. When analyzing

the outcome of tests, it is important to compare research findings with the literature review findings.

3.3. Sampling Design

A sample design is the framework, or road map, that serves as the basis for the selection of a survey sample and affects many other important aspects of a survey as well. In a broad context, survey researchers are interested in obtaining some type of information through a survey for some population, or universe, of interest. One must define a sampling frame that represents the population of interest, from which a sample is to be drawn. Type of research is longitudinal studies gather data at several points in time. We use time series data which is set from 1991 to 2019 for all variables. The research variables are dependent, independent and control variable

3.4. Target Population

The target population for a survey is the entire set of units for which the survey data are to be used to make inferences. Thus, the target population defines those units for which the findings of the survey are meant to generalize. Target populations must be specifically defined, as the definition determines whether sampled cases are eligible or ineligible for the survey. The geographic and temporal characteristics of the target population need to be delineated, as well as types of units being included. In this study the following target populations are set.

Passenger traffic (PAX) and cargo volumes (FRT) are the variables of interest in this survey. PAX is the total number of air passengers to and from airports in the surveyed countries using scheduled flights, and FRT is the tonnage of cargo carried. This study examines the causal relationship between air transport demand (PAX and FRT) and economic development in Ethiopia.

Gross domestic product per capita (GDP) and foreign direct investment (FID): Causal's GDP approaches for national prosperity and FDI is the participation of foreign investors in internal economic activity. According to (Tyler, T. 2016), the country of the growth curve at approximately $ 20,000 per capita increases the number of flights acquired in the year. In countries with favorable courier services, the demand for air transport continues to increase considerably when GDP reached $ 5,000 per year to $ 10,000 per year (JADC, 2019). According to (Banno and Redondi, 2014) is given the FDI, improved aviation through investments and

strategies for the attraction of traditional and practical airlines for regional guidelines, which are oriented towards the attraction of FDI

Population (POPN) and education (EDUC): POP represents the total population size of Ethiopia. The procedure / regions with higher population groups can be mainly a superior aviation requirement, ceteris paribus. This reflects not only the trends of the population over time, but also the relationship between age dependence. According to (Tyler, T.2016), the population of a group of young people and age groups are more likely fly usually from elderly people. In addition, the best literacy rate (EDUC) has more participation in national and international aviation companies with a large type of traveler.

Balance of payments (BOP) and the official exchange rate (OER): BOP is a registration of international and financial transactions carried out in the residential screening (Mankiw & Reis, 2018). In the long term, a negative BOP is a network of consumption, and it must be debts to pay consumption and not invest in future growth, while the land of excess BOP has increased investment activity and less on consumption (Rogoff and Obstfeld, 1996) net Economic growth can cultivate the appendix application. Regarding with (OER) what the large exchange rate movement influenced by three main channels, these are: consumer decisions (demand), airline decisions (supply) and financial impacts. Among them, the reaction to consumption (demand) can be fast for significant movement's relative prizes quickly and require an answer from airlines, including possible adjustments.

Emigration (MNG) refers to out-migration number of labor force from Ethiopia.

3.5. Sample Size and Sampling Determination

In some situations, the increase in precision for larger sample sizes is minimal, or even non-existent. This can result from the presence of systematic errors or strong dependence in the data, or if the data follows a heavy-tailed distribution. Sample sizes may be evaluated by the quality of the resulting estimates. The sample size and sampling determination is set using time series data which set from 1991 to 2019 for all variables.

3.6. Sampling Technique

There are several different sampling techniques available, and they can be subdivided into two groups: probability sampling and non-probability sampling. In this study the sampling technique

is using time series data which set from 1991 to 2019 for all variables that test all yearly selected data within the allocated time.

3.7. Source and Methods of Data Collection

Data is a collection of facts, figures, objects, symbols, and events gathered from different sources. Organizations collect data to make better decisions. Without data, it would be difficult for organizations to make appropriate decisions, and so data is collected at various points in time from different audiences. The data source of this study is from Ethiopian Airlines group (Ethiopian Airports and Ethiopian Airlines group)

The data types used in this study include some panel data for descriptive analysis and time series data for econometric analysis. For descriptive analysis number of domestic and international passengers, total air cargo demand (domestic and international), gross domestic product, passenger traffic and cargo demand of all airlines using Bole International Airport (Addis Ababa) will be used.

Airlines that frequently use Bole International Airport are included in the descriptive analysis include Ethiopian Airlines, Egyptian Airlines, Kenya Airways, Lufthansa, Saudi Arabian Airlines, Sudan Airlines, Yemen Airlines, Emirates, Turkey Airlines and other airlines that use the airport. These data are the cumulative passenger volume and freight demand data of the Ethiopian Airlines (Ethiopian Airports and Ethiopian Airlines) group, the GDP data of the National Bank of Ethiopia and the World Bank, and the export position data of the United Nations Commodity Trade Statistics database 10. The data for these variables range from 2009 to 2019.

Time-series data for econometrics analysis are gross domestic product, immigrant size, official US dollar exchange rate, foreign direct investment, total passenger traffic, total air freight demand (tons km), payment balance, population size and students enrolled in secondary and higher education facilities summarize the number. This survey covers 28 years of Data from 1991 to 2019. Passenger demand (passenger traffic) and air cargo demand (ton kilometers) are collected and supplemented by the Ethiopian Airlines Group (Ethiopian Airport and Ethiopian Airlines). Gross domestic product (GDP) is used as a measure of national economic growth and is taken from World Bank data on indicators of global development. High school, tertiary and higher level education, the balance of payment in US dollar and the official exchange rate

between countries, the population size were used as control variables to control fluctuations of the dependent variable. All variables are expressed as natural logarithms and interpreted accordingly.

3.8. Measurement Scale

Measurement scale, in statistical analysis, the type of information provided by numbers. Each of the four scales (i.e., nominal, ordinal, interval, and ratio) provides a different type of information. This study measurement refers to the assignment of value in a meaningful way, and understanding measurement scales is important to interpreting the numbers assigned to people, objects, and events. Each variables measure according to the characteristic of events and the following table summarizes the variables with units of measurements included in the analysis.

Table 2: Lists of variables and their units of measurements

Variable	Name	Units of measurement	Data source
Population	POPN	Total population(number)	World Bank
Education	EDUC	Education Number of students in vocational schools and higher education and above	World Bank
GDP per capita	GDP	GDP per capita in US dollars	World Bank
Foreign direct investment	FDI	FDI in US dollars	World Bank
Balance of payments	BOP	BOP in US dollars	World Bank
Official exchange rate	OER	Exchange rate of local currency to US Dollars	World Bank
Emigration	MGN	Emigration refers to out-migration number of labor force	World Bank
Passenger number	PAX	Number of air passengers in millions	EAL Groups
Cargo volumes	FRT	Air freight in million km-tons	EAL Groups

As a result, the factors expect the creation and impact on the aviation attachment, identifying and containing in the model. The parameters evaluated by natural logarithm models can also be interpreted as elastic branches.

3.9. Method of Analysis

In this research we use secondary data to measure the relationship between air transport services and economic growth. Research goals can be solved by appropriate analysis methods and available data and variables. In this paper we use two methods which are descriptive and econometric analysis methods to show reality in the country. More, can be investigated mainly to invest descriptive analyzes would be made to control the reality between passenger and freight applications for a country's economic growth. In addition, econometric methods are mainly related to research topics.

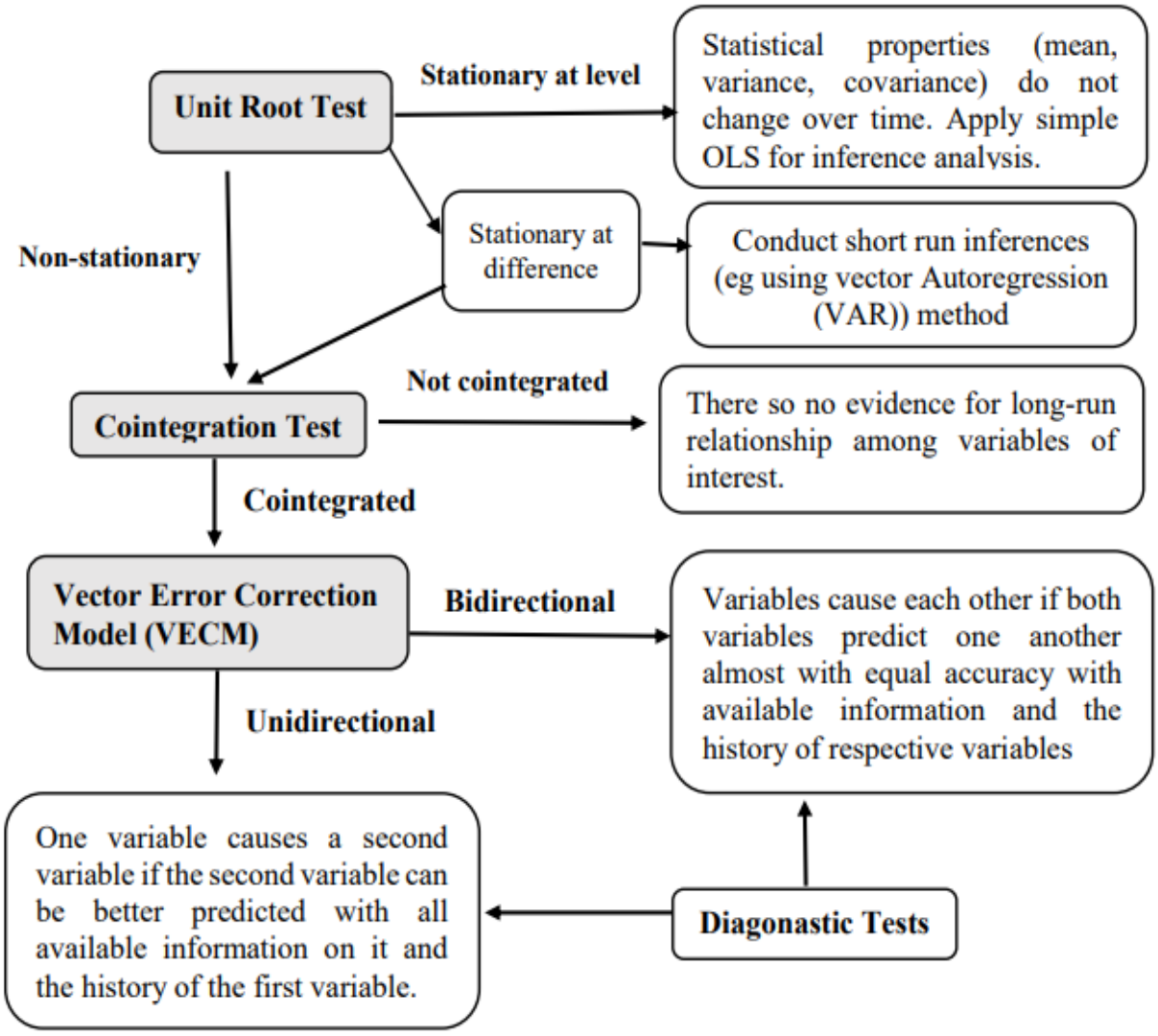
3.9.1. Descriptive Analyses

In this section, the relationship between economic growth and air traffic demand is illustrated with graphs. Compare and describe the percentages, and tables are used for air cargo demand and passenger demand (domestic and international) variables. This subsection also appears in the competent airlines of the Ethiopian air transport system with their respective market share of, in particular the international demand for air transport. Although the domestic demand for airlines transport is significantly lower, it has been fully occupied by the Ethiopia airlines and there are no rival airlines. It is also possible to analyze the contribution of aviation to a country's economic growth. This analysis completes the econometric analysis and provides some causal clues to the increase in air demand.

3.9.2. Econometric Model Analysis Framework

Several additional econometric models are used in this document for the Cointegration vector and the causal direction between the demand for the air transport and economic development in Ethiopia. It is also necessary to analyze growth response to the expansion of air travel. As part of the deployment, causality can be one-way or two-way, and cannot depend on each other. The Study of Causal relationship examine the facts in all possible directions between (i) economic growth and Passenger volume and (ii) economic growth and air cargo volume, which constitute the four parts of causality. The figure below shows the main econometric method framework of this research.

Figure 5: The econometric method framework of the study.



Source: Adopted from (Tolcha, 2017)

The above diagram evaluation techniques, which allow keeping away from deceptive conclusions from spurious results, might be offered in element with inside the following section.

3.9.3. Unit root test

Traditional models of static correlation and cross-regression provide limited evidence of causality. We use in this study, the methods of the chronological series, with which the concepts such as the population and the causality of the Granger, have developed to allow causal interconnection between certain variables (Maparu and Mazumder, 2017). An important aspect of transportation inquiries is transportation demand, which is determined by other factors such as

transportation, that is, most things depend on prices in other markets. Renouncement Specific requirements for the offer - this is the fact that the consumption of transport services does not generate the benefits itself. The tool that should create and influence the air transport demand and identified in the model.

The long-term and short-term relationship between air transport demand and economic development can be modeled using the following general Cointegration equation:

$$\Delta y_t = \varnothing + \delta y_{t-1} + \sum_{i=1}^{k} \alpha_t \Delta y_{t-i} + x_t' \beta + \epsilon_t \qquad (1)$$

Where Δyt is the vector of the intrinsic variables (GDP, PAX, and FRT), ∅ is the estimation constant, δyt-1 is the error correction period vector, $\sum_{i=1}^{k} \alpha_t \Delta y_{t-i}$ the short-term dynamic vector of the intrinsic variable xt′ β is the vector of control variables (OER, BOP, FDI, EDUC, POPN and MNG), ϵt is the white noise error term with a mean of zero and a constant variance, and k is the maximum length of the delay. A detailed representation of the model of the intrinsic variable is given by equations (3), (4) to (9), (10).

3.9.3.1. Order of integration

Before you run Granger causality and Cointegration tests, it is important to know if the data generation process (DGP) is always for the variables allowed in the command integration. In the stochastic stationary process, the average and deviation is constantly over time and the self-compressor is consistent for each prejudice between two constant and does not depend on the real time in which the covariance is calculated (Shin,2017). The non-stationary series can be converted by distributing colors into a stationary series by differencing d times, denoted by I (d) (pickup, 2015, Wooldridge, 2015, Enders, 2014). Increasing the Test Augmented Dickey Fuller (ADF) is a popular technique for checking the order of integration variables. ADF regulates the problem of serial correlation by including additional lags, and tests the following equation:

$$\Delta y_t = x_t' \beta + \delta y_{t-1} + \sum_{i=1}^{k} \alpha_t \Delta y_{t-i} + \epsilon_t \qquad (2)$$

Where β, δ and α are evaluation parameters and Δ is a difference operator. The null hypothesis H0: δ = 0 is black based on the alternative hypothesis H1: δ <0. If the null hypothesis is rejected, the sequence is in a stopped state and the true sequence has a root unit and is not fixed.

3.9.4. Cointegration

Time series Xt and Yt say that when both series are integrated and their linear combination is stationary I (0) (Shin, 2017, Enders, 2014, Barnett and Seth, 2014). This means that a long balance connects the variables, based on which temporary shots can separate them, return to their long-term distribution. This study uses Johansen (1991, 1995) a coherent approach. This leads to the maximum probability (maximum) tests on its tests and routes) to test the maximum number of vectors of the Convention. The zero integration hypothesis of verified against an alternative hypothesis on the designation between the variables. If two variables with the same integration order have long-term relationships, they are called cointegrated.

3.9.5. Granger causality and Vector Error Correction Model (VECM)

In the Granger causality test (Granger, 1969), the variable y is said to be the Granger causality of the variable x if the lagged value of y can improve the predictive power of x, ceteris paribus. Causation can be unidirectional, bidirectional (feedback), or absent. If one of the variables is modeled as the dependent variable and the other as the independent variable, there is a two-way causal relationship between x and y if the offset between the coefficients of xt and yt is different. Statistically different from zero is by (Enders, 2014; Wooldridge, 2015). Likewise, if yt is the dependent variable, the lag coefficient yt is not statistically zero, but if xt is the dependent variable, there is a one-way causal relationship from y to x. There is no causal relationship between the variables unless the lag yt and lag xt coefficients are statistically nonzero. Cointegration and sequence tests use VAR or VEC to determine whether Granger causality between air transport demand and economic development should be tested. Air transport demand can be explained by PAX and FRT. Here, to avoid the problem of multicollinearity, PAX and FRT are not modeled as the dependent and independent variables of the same equation, but the following matrices are placed respectively. The following matrix shows a test of the VAR model of Granger causality between GDP and PAX per capita.

$$InPAXt=\delta 1+\sum_{k=1}^{n} [\beta 11k \ \beta 12k] [lnPAXt-k)]+ xt'\mu+\varepsilon t \qquad (3)$$

$$InGDPt = \delta 2 + \sum_{k=1}^{n} [\beta 21k\ \beta 22k]\ [lnGDPt\text{-}k] + xt'\mu + \varepsilon t \quad (4)$$

Similarly, the causal relationship between GDP per capita and FRT can be represented as:

$$LnFRTt = \alpha 1 + \sum_{k=1}^{n} [\alpha 11k\ \alpha 12k][lnFRTt\text{-}k] + xt'\mu + \varepsilon t \quad (5)$$

$$LnGDPt = \alpha 2 + \sum_{k=1}^{n} [\alpha 21k\ \alpha 22k][InGDPt\text{-}k\ ] + xt'\mu + \varepsilon t \quad (6)$$

Where β, μ, and α are the estimated coefficients, n is the maximum delay length, xt'is the displacement vector of the control variables (OER, BOP, PONP, FDI, EDUC, and MNG), and ϵt is the noise of the white error term. Represents if the coefficient of the deferred variable is statistically non-zero, there is a causal relationship between the variables. If air demand is related to economic development, use VEC instead of VAR to investigate the causality. Otherwise, VAR is used as the standard causal test. The advantage of the VEC model over VAR is that it can distinguish between long-term and short-term causality (Kirchgassner et al., 2013; Maparu and Mazumder, 2017). Equations (7) and (8) show a VEC model for testing the causal relationship between PAX and GDP per capita.

$$\Delta lnPAXt = \theta 1 + \sum_{k=1}^{n} [\theta 11k\ \theta 12k][\Delta InPAXt\text{-}k] + \delta 1 ECTt\text{-}1 + xt'\mu + \varepsilon t \quad (7)$$

$$\Delta lnGDPt = \theta 2 + \sum_{k=1}^{n} [\theta 21k\ \theta 22k][\Delta InGDPt\text{-}k] + \delta 1 ECTt\text{-}1 + xt'\mu + \varepsilon t \quad (8)$$

Similarly, the VEC model to test the causal relationship between FRT and economic development is represented in eq. (9), (10).

$$\Delta lnFRTt = \sigma 1 + \sum_{k=1}^{n} [\sigma 11k\ \sigma 12k][\Delta InFRTt\text{-}k] + \emptyset 1 ECTt\text{-}1 + xt'\mu + \varepsilon 1t \quad (9)$$

$$\Delta lnGDPt = \sigma 2 + \sum_{k=1}^{n} [\sigma 21k\ \sigma 22k][\Delta InGDPt\text{-}k] + \emptyset 1 ECTt\text{-}1 + xt'\mu + \varepsilon 1t \quad (10)$$

The estimated parameters are σ′s and θ′s and ECTt-1 are the delay error correction period (calculated from the linear combination residuals of the variables), the long-term economic development between air transport demand and national development. The short-term causality is estimated by the coefficients of the delayed (and discriminant) independent variable, while the

long-term causality is statistically zero and the adjusted proportions are negative (δ and ∅). The system is said to exist in different cases ($-1 \leq \emptyset \leq 0$) and ($-1 \leq \delta \leq 0$), so it converges to equilibrium. The absolute value of the speed setting indicates how quickly the equilibrium recovers or a new long-term equilibrium is reached.

3.10. Validity and Reliability

Reliability and validity are concepts used to evaluate the quality of research. They indicate how well a method, technique or test measures something. Reliability is about the consistency of a measure, and validity is about the accuracy of a measure. In this research the reliability which the results repeated under the same conditions and by checking the consistency of results across time can be checked referring different studies in the literature. And also validity which the results really measure what they are supposed to measure and by checking how well the results correspond to established theories and other measures of the same concept.

3.11. Research Ethics

In this research the permission is granted to access data from Ethiopian Airlines Groups and confidentiality of data would be maintained. Research ethics provides guidelines for the responsible conduct of research. In addition, it educates and monitors scientists conducting research to ensure a high ethical standard. The following is a general summary of some ethical principles: Honesty: Honestly report data, results, methods and procedures, and publication status, objectivity, integrity Keep your promises, Carefulness avoid careless errors, openness Share data, respect for Intellectual Property honor patents, Confidentiality Protect confidential communications, Responsible Publication Publish in order to advance research and scholarship, etc. This research will be maintains research ethics as much as possible.

CHAPTER FOUR

4. Data Presentation, Discussion and Analysis

4.1. Results of Descriptive Analyses

This section describes the appearance of variables related to the observed trend over time and its marginal trend over time. The nature of the available data and models of the relationship between air transport demand and economic growth can supplement part of the econometric analysis. The results of descriptive analysis can also reveal the causality of the variables introduced in the following sections. The relationship between air transport demand (passenger and freight demand) and economic processes can be represented by table and graphs. Table 3 below shows the statistical descriptive of main variables explanations and conclusions based solely on the mean and variance of the variables may not be convincingly recommended; because the mean and standard deviation will naturally be affected by outliers.

Table 3: Descriptive Statistics – yearly Average

Variable	Mean	Std. Deviation	Minimum	Maximum
POPN	78,059,149	18,792,723	49,609,969	112,078,730
OER	12.0586	7.34364	2.07	29.07
FDI	769,966,144	1,216,792,762	0	4,142,937,496
GDP	28,941,567,012	27,530,535,401	6,927,950,565	95,912,590,628
FRT	524,817,473	690,371,606	68,400,002	2,450,272,960
PAX	3,359,675	3,483,764	635,600	12,631,216
BOP	-3,923,505,025	4,058,324,724	-12,056,904,316	0
MGN	59,008	289,304	-155,577	1,457,943
EDUC	1,701,592	1,680,374	0	5,028,678

Source :(EAG, 2020; NBE, 2020; World Bank, 2020)

4.1.1. Passenger Traffic and Economic Growth

Passenger performance and economic growth in Ethiopia have particularly improved in the past decade. By the end of 2019, passenger numbers and GDP reached approximately 12.6 million

and US$95.9 billion, respectively. As of 2009, these numbers have more than quadrupled in ten years. The following table (Table 4) shows the trend of increasing passenger demand and economic growth in the past ten years. Increased over time, but initially economic growth slowed down, and its trend improved over time.

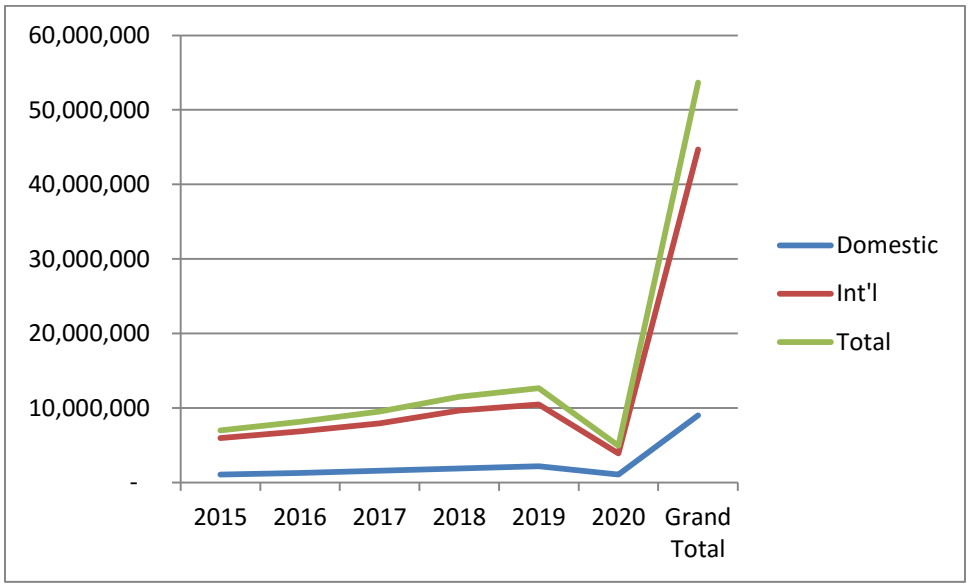
Table 4 Trends in economic growth and total number of passenger (2009-2019)

Year	Numbers of passenger	GDP
2009	2,914,056	32,437,389,116
2010	3,347,022	29,933,790,334
2011	4,440,918	31,952,763,089
2012	5,001,122	43310721414
2013	5,671,501	47648211133
2014	6,274,582	55612228234
2015	7,074,779	31952763089
2016	8,242,114	74296618481
2017	9,566,378	81770791971
2018	11,501,244	84269348327
2019	12631216	95912590628

Source: (EAG, 2020; World Bank, 2020)

During this period, domestic and international passengers accounted for an average of 13% and 15% of Ethiopia's total air travel demand, respectively. Figure 5 below shows that the growth of Ethiopia's aviation industry is heavily dependent on international demand. In addition, according to the people living in the country (World Bank, 2020), the small proportion of domestic passenger traffic can only be related to the low standard of living and the still low income (around $855 per capita in 2019) 20% of the total population are urban residents. The amount and growth rate of air transport demand in Ethiopia have been improving over time.

Figure 6; Trends of domestic and international passenger growth



Source: EAG (2020)

4.1.2. Air Freight Demand and Economic Growth

Air freight demand and economic growth Bole International Airport is a highly competitive air travel market and the main entry airport for Ethiopia and a transit point for other destinations. The data from the Global Air Cargo Forecast Organization (Crabtree, Hoang, Tom and Gildemann, 2015), Ethiopia is one of the five largest African countries with international air traffic and South Africa, Egypt, Kenya and Nigeria: fresh cut flowers exports have increased Ethiopia's international air traffic volume, especially in Europe (UN, 2016).

The development of Ethiopian air transport mainly depends on international demand and domestic demand. Ethiopia is a landlocked country that seems to focus on exporting perishable goods and on-time delivery. Including foods that are sensitive to time and temperature, such as flowers, fruits, meat, and vegetables. The growth trend of the flower industry is one of the country's strategic initiatives. Developed in the late 1990s, the country is now Africa’s largest flower exporter, according to (Workman, 2017).

Table 5: Trends of total Freight and Economic growth (2009-2019)

Year	Air transport, freight (million ton-km)	GDP
2009	424.472	32,437,389,116
2010	407.062	29,933,790,334
2011	505.565	31,952,763,089
2012	703.644	43310721414
2013	790.74339	47648211133
2014	950.1573	55612228234
2015	1228.73832	31952763089
2016	1500.14753	74296618481
2017	2076.18502	81770791971
2018	2089.27754	84269348327
2019	2450.27296	95912590628

Source: (EAG, 2020; World Bank, 2020)

Table 5 shows that Ethiopia's air freight traffic decline 0.04% in the beginning and increase on average rate of about 19% per year in between 2009-2019. Considering GDP growth in the beginning also decrease by 8% and increase on average rate of about 9% per year between 2009-2019.

4.1.3. Discussions on the Results of descriptive analysis

Descriptive analysis shows the trends of causal relationship between air transport demand and economic growth. Ethiopia's air transport demand (passenger and cargo) and economic growth have more than quadrupled in the past ten years (2009-2019). In order to clarify the relationship between the expansion of air transport and economic growth, the demand for passenger transportation and air cargo in the environment of economic growth shows relationships. The growth rate is low, and the trend has improved over time. Ethiopia's air passenger traffic and air freight grew on average at a robust rate of about 13% and 9% per year in between 2009-2019

respectively. This relationship shows that there is some connection trend between air transport and economy growth.

4.2. Results of Econometric analyses

This section will introduce an empirical analysis of this work. The extended Dickey-Fuller method (ADF) was used to check the evidence of the existence of a unified root, which paved the way for further analysis. The relationship between air transport demand and economic growth is also discussed. The following subsections will use the concept of the Vector Error Correction Model (VECM) to conduct a long-term analysis of the causal relationship between air transport demand (passengers and cargo) and economic growth. This section also introduces short-term dynamics and Granger root cause analysis. Through this transformation, all the coefficients obtained can be directly interpreted as elasticity.

4.2.1. Unit root test

Regressions that provide misleading statistical evidence of linear relationships between non-stationary independent variables are called false regressions. If the variables in the regression model are not stationary, then the quality assumptions of asymptotic analysis are usually not applicable. In other words, the standard "t ratio" does not match the t distribution, so we cannot perform effective hypothesis testing on the regression parameters. If the mean and variance of the process remain constant over time, the variables are stationary, and the covariance value between the two periods depends only on the difference between the periods, not the actual point in time when it is considered, Kind of covariance. If one or more of the above conditions are not met, the method is temporary. Use time series data to get meaningful regression results, which need to be tested as described above.

The unit roots of all continuous variables involved in the model. The variables used in the analysis must be stationary and/or cointegrated at the same level in order to be able to arrive at a meaningful relationship between VAR (vector autoregressive) and VECM (vector error correction model). The unit root test provides an integral sequence in which the variables are usually stationary. In this study, the extended Augmented Dickey-Fuller test (ADF) was used as a formal test procedure for unit root identification and variable integration order. An important practical aspect of performing ADF testing is to determine the optimal delay. If the delay length is too short, the remaining wrong order correlation will distort the test. If the delay length is too

large, the simplicity of the test will be affected. The ADF test uses parametric auto regression to approximate the autoregressive moving average (ARMA) structure of the error in the test regression to eliminate order correlation.

Table 6: Augmented Dickey-Fuller test for unit root – STATA output

	1% Critical Value I(0)	5% Critical Value I(1)	10% Critical Value I(2)
Variables	Constant	Constant	Constant
InGDP	-3.736***	-2.994**	-2.628*
InFRT	-3.736***	-2.994**	-2.628*
InPAX	-3.736***	-2.994**	-2.628*
InBOP	-3.736***	-2.994**	-2.628*
InFDI	-3.736***	-2.994**	-2.628*
InEDUC	-3.736***	-2.994 **	-2.628*
InOER	-3.736***	-2.994**	-2.628*

*Note: t statistics on parenthesis *** p<.01, ** p<.05, * p<.1*

Source: output (EAG, 2020; World Bank, 2020)

Table 6 above shows the hypothesis of the variables of the ADF results at its level, all results is critical. The test shows that all variables accept the hypothesis and have unified roots, and the order of integration of the variables is valid. Population (POPN) and immigration (MGN) were not included in the unit root results because their hospitalizations in the first difference may cause incorrect regression results and were therefore excluded from further consideration in this study. Therefore, when using the VAR and VECM methods, the integration order should be the same first-order integration process, with a critical value of 1% (Toda and Peter, 1993). In

addition, as already mentioned (Johansen and Juselius, 1990), the variable I (1) cannot have a long-term relationship with the variables I (0) and I (2), that is, the equation is not in equilibrium.

4.2.2. Cointegration test

Once the result of the stationarity test is known, the next step is to check the existence of the linear combination I (0), which is a sufficient condition for assuming that the sequence is not alone stationary, but if it is indeed an element of interest is combined, i.e. there is a long-term relationship that keeps them on the same path. The null hypothesis I (0) to be tested means that there are a given number of Cointegration equations. After determining I (0), the linear combination of variables is dominant. The next step is to use the Johansen maximum likelihood method to estimate the long-term relationship between air transport demand and economic growth. Likelihood ratio (LR), in the unit root test, it is reasonable to assume a constant but not record the trend. Therefore, the deterministic trend assumption excludes trends and includes constants. When choosing a delay sequence, information standards and theoretical facts are used as a guide.

Figure 7: VAR Lag Order Selection Criteria– STATA output

Selection-order criteria
Sample: 1993 - 2019 Number of obs = 27

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	36.1296				.008059	-2.0096	-1.88116	-1.57766
1	38.0834	3.9075	1	0.048	.007588	-2.08025	-1.93754	-1.60031
2	40.0379	3.9091*	1	0.048	.007164*	-2.15096*	-1.99397*	-1.62302*

Endogenous: InGDP
Exogenous: InPOPN InOER InFDI InFRT InPAX InBOP InMGN InEDUC _cons

* Indicates the delay order of LR standard selection:

LR: series test statistics (each test is at the 5% level)
FPE: final prediction error
AIC: Akaike information standard
HQIC: Hannan Quinn information standard
SBIC: Schwartz Information Criteria

In addition to LR, the lag selection criteria (FPE, AIC, HQIC, and SBIC) indicate it as the best lag order. Although the LR information standard has an inconsistent delay length, (Brooks, 2014) explains this problem with a small sampling error. Helps you find out how many items are used in sequence related tests. Sequence correlation is the relationship between a given variable and itself at different time intervals. Sequential correlation usually appears in a repetitive pattern, where the expansion of the variable will affect its future level. Ethiopia's economic performance is not a perfect basis for determining the ability to predict future economic growth in the past. The length of the delay is usually determined by the frequency (and sample size) of the information. The delay is usually sufficient. For annual data, one or two delays are typically sufficient. For month-to-month data, we will encompass twelve delays. But there aren't any hard and fast rules under any circumstances (Wooldridge, 2005). In addition to the results of most information standards (see Figure 7) and theoretical views, considering that there are annual pending orders data, this is a reasonable pending order option for a small industry like Ethiopia. Therefore, the Johansen Cointegration test can assume that there is no trend in the sequence, but a constant with delayed order selection. The concept of Cointegration can also be applied to the linear combination of two or more variables I (1). Moreover, if there is a linear combination of variables corresponding to I (0), we say that a set of statistical variables I (1) is cointegrated.

The first-order integral series can represent linear stable combination I (0)), so we need to check the possible existence of Cointegration relationship. It provides a general method (Johansen & Juselius, 1990) to determine whether a variable is a co-integrated variable or a co-integer. By integrating the equation, both the orbit test and the maximum eigenvalue test are used in this study. The results of Johansen's Cointegration test are shown in Figure 8, indicating that there is a Cointegration vector.

Figure 8: Test results of the number of Cointegration vectors- – STATA output

Johansen tests for cointegration

Trend: constant — Number of obs = 27
Sample: 1993 - 2019 — Lags = 2

maximum rank	parms	LL	eigenvalue	trace statistic	5% critical value
0	42	126.96085	.	170.9893	94.15
1	53	168.07043	0.95241	88.7702	68.52
2	62	191.62036	0.82526	41.6703*	47.21
3	69	202.65328	0.55836	19.6045	29.68
4	74	209.55478	0.40024	5.8015	15.41
5	77	212.32055	0.18525	0.2699	3.76
6	78	212.45551	0.00995		

Figure 8 above shows that the null hypothesis that there is no Cointegration vector is rejected, and the existence of a Cointegration vector is supported. Both the eigenvalue and the maximum value of the trace indicate that there is a co-integration relationship between the variables at 83% eigenvalue.

4.2.3. The Vector Error-Correction Model (VECM)

After determining whether there is a long-term relationship, the next step is to evaluate the dynamics of vector error correction, which is an important part of the policy implications. In the error correction model, the first delay approximates the short-term imbalance to an estimated long-term linear combination. The method chosen for the evaluation is Hendry's general specific modeling method (Adam & Hendry, 2000). In this method, the large model is evaluated first, include as many explanatory variables as possible and their lags. All insignificant explanatory variables are continuously discarded until an economic model with few explanatory variables is obtained, but it is acceptable in terms of significance, economic explanation and diagnostic reliability. Show how short-term adjustments of variables are carried out, and provide fertile soil for policy analysis and implementation.

The VECM test can not only show the long-term direction of causality, but also show the importance of the correction rate (ECT coefficient) and the reliability of the measured value for the long-term equilibrium ratio, obviously a negative value, but an absolute value. A value between 0 and 1 represents a long-term equilibrium relationship (Baker et al., 2015). Figure 9

and 10 summarize the VECM results of the causal relationship between PAX-GDP and FRT-GDP. According to (Holtz Eakin, Newey and Rosen, 1988), the choice of lag length is necessary to determine the causal relationship, and it should be less than one-third of the time, otherwise there will be over-identification problems. This study conducted a two-year lag study of all models. VECM results show the long-term causal relationship and marginal effects between PAX and GDP and FRT and GDP.

4.2.3.1. Long-Run Causality between PAX and GDP

As mentioned in the co-integration section, PAX and GDP have a long-term relationship. This section introduces the direction of the causal relationship between them and their side effects. Figure 9 below shows the results of the long-term passenger causality test. The long-term causal correlation coefficient of the model (ECT = -0.33) is negative and significant, confirming the existence of causal correlation in the long-term range from passenger transport demand to economic growth. There is no significant causal relationship between economic growth and air transport demand.

Figure 9: Long-term causal results output by PAX/FRT and GDP-STATA

Johansen normalization restrictions imposed

beta	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
_ce1						
InGDP	1	.	.	.	.	.
InOER	-1.11e-16	.	.	.	.	.
InFDI	-.2349132	.016433	-14.30	0.000	-.2671213	-.2027051
InFRT	-.6548957	.1135267	-5.77	0.000	-.877404	-.4323874
InPAX	-.3269886	.177593	-1.84	0.066	-.6750645	.0210873
InBOP	-2.488137	1.251093	-1.99	0.047	-4.940234	-.0360395
InEDUC	-.0555158	.0094754	-5.86	0.000	-.0740872	-.0369444
_cons	51.18643	.	.	.	.	.

Ethiopia's economy is not enough to stimulate passenger demand growth, especially the sluggish domestic passenger demand. According to (World Bank, 2020) Ethiopia is still a low-income country, (approximately US$855 per capita in 2019), so it cannot meet the higher demand of passengers. The two-year delay seems reasonable because air travel requires a category

(especially international passengers) and it takes time to filter economic growth (in terms of effect size). The results indicate that the increase in demand for air travel is from in the long run, an average of about 1% will lead to a proportional decrease in economic growth of about 0.33%.

4.2.3.2. Long-term causal relationship between FRT and GDP

The analysis results shown in Figure 9 above indicate that there is a long-term one-way causality, ranging from aviation to economic growth (significant ECT). If two years are allowed, increase (ECT = -0.65), it takes a reasonable amount of time (two years here) to observe the impact of aviation's contribution to a country's economic growth. The personal income of workers in the industry and all other related impacts require a reasonable time to evaluate their impact on economic activities.

Empirically, the magnitude of 1% increase of growth in air freight ton-kilometer would lead to roughly 0.7% per year economic growth in the long run. The demand for air travel is usually determined by the value of the cargo rather than the weight. This fact may not only be important, but also significant. With the transportation infrastructure of neighboring countries, timely and expensive products are exported to the Middle East and Europe through the air transportation system. Generally speaking, the long-term impact of air travel demand (passengers and cargo) is consistent with the work of the new economic geography "base multiplier" model (Krugman, 1996; Schmutzler, 1999). Based on the findings of these researchers, it is believed that the scale of goods and services sold to "bases" in other parts of the world depends on external factors such as global demand or slowly changing regional interests. In contrast, the scale of non-core activities depends on the size of the local economy.

The location of Ethiopia, the horn of Africa, has strategic air transport route benefits by connecting the Middle East and South East Asian countries with sub- Sahara African countries. The long run benefits of Ethiopian economy from this air transport traffic advantage are significant enough per passenger and per ton-Km each year as evidenced by the above empirical analysis. Indirectly this advantage also implies that the local economy is still not considered as a centrifugal point for air transport demand in the country. But in both cases, the local economy has been benefited from increasing air transport demand of the world and the region.

4.2.4. Short-term dynamics

In addition to long-term causality, the short-term dynamic test also confirmed that there is a positive causal relationship between Ethiopia's economic growth and air transport demand. Table 7 shows the causal relationship between PAX and FRT and GDP in the short term. The short-term causality test shows that there is a one-way causal relationship, from air transport (passenger and freight) demand to economic growth. Economic growth is not enough to stimulate the country's air transport demand. From a long-term perspective, Ethiopia's demand for air transportation is driven by international customers (global and regional advantages), who are the incentives and stimulus factors for the local economy. The local economic base is too small to generate and sustain demand for air transportation. But as assumed (Krugman, 1996; Schmutzler, 1999), the positive external economic injection into the local small economy has a multiplier effect on the country's economic activities, so Ethiopia not only benefits significantly, but also from the sector.

Table 7: Short-term trends between economic growth and air transport demand-STATA production

Variables	chi-square (χ 2)	statistics $Prob > chi2$
PAX ⇒ GDP	52.72	0.640**
GDP ⇒ PAX	109.33	0.722
FRT ⇒ GDP	29.84	0.0013*
GDP ⇒ FRT	109.33	0.447

*,** Represent significant p-values at 5% and 10% significance level

Since the Cointegration test statistically declares a single Cointegration vector and GDP as the endogenous variables of the model, InGDP can be explained by a linear combination of independent variables. Figure 10 shows the short-term impact of air transport demand on Ethiopian economic activity. Therefore, for every 1% increase in passenger demand, economic

growth will increase by about 0.12%. In the short term, air cargo demand is also positively correlated with economic growth. For every 1% increase in air cargo volume, the country's economic growth will increase by about 0.31%.

Figure 10: Results of short-term air transport demand and economic growth-STATA output

```
Vector autoregression

Sample:  1993 - 2019                            Number of obs     =         27
Log likelihood =   184.1378                     AIC               =  -5.862062
FPE            =   1.81e-11                     HQIC              =  -4.363594
Det(Sigma_ml)  =   2.81e-15                     SBIC              =  -.8226963

Equation           Parms      RMSE     R-sq      chi2     P>chi2
------------------------------------------------------------------
InGDP                 15     .070475   0.9974    10197.7   0.0000

.
------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
D_InGDP      |
        _ce1 |
         L1. |  -.4469133   .1130413    -3.95   0.000    -.6684701   -.2253565
             |
        _ce2 |
         L1. |  -.8035191   .2204263    -3.65   0.000    -1.235547   -.3714915
             |
       InGDP |
         LD. |  -.0387636   .1692389    -0.23   0.819    -.3704657    .2929385
             |
       InOER |
         LD. |  -.2110455   .2634898    -0.80   0.423     -.727476    .3053851
             |
       InFDI |
         LD. |  -.0105984   .0138025    -0.77   0.443    -.0376508     .016454
             |
       InFRT |
         LD. |  -.3065328   .1230261    -2.49   0.013    -.5476595   -.0654061
             |
       InPAX |
         LD. |   .1162267   .2485866     0.47   0.640    -.3709941    .6034474
             |
       InBOP |
         LD. |  -2.472896   1.176469    -2.10   0.036    -4.778732   -.1670603
             |
      InEDUC |
         LD. |   -.006965   .0043107    -1.62   0.106    -.0154139    .0014838
             |
       _cons |   .0545956   .0283699     1.92   0.054    -.0010084    .1101996
------------------------------------------------------------------------------
```

The impact of air transport demand on economic growth is more appropriate in the long run than in the short term, because it may take longer to convert the impact of air transport demand into economic activity. Air freight demand is greater than the impact of passenger transport demand on economic growth. Table 8 illustrates the comparison of the elasticity of these parameters with the corresponding variables. This elasticity is calculated based on the long-term and short-term

dynamic assessments given earlier in this section. The value in parentheses represents the p-value at 10% and 5% significance level.

Table 8: Comparison of short-term and long-term results compiled from STATA output

Explanatory factors	$\Delta lnGDP$	
	Short run	Long run
$\Delta lnPAX$	.12% (0.640)	0.33% (0.066)
$\Delta lnFRT$	.31% (0.013)	0.70% (0.000)

The short-term impact of air travel on economic growth has direct and direct benefits. These have brought obvious benefits to the local community in the form of wages and other related income from workers and companies, which are subsequently consumed in the area. But the long-term impact is more far-reaching. In addition to direct benefits, long-term benefits also include the indirect impact of airline operations on the continuous income of the local economy. These effects may be important to the local economy in terms of employment, income, and local government taxation. One of the long-term effects of aviation on economic growth is that companies and individuals that have air transportation services in their home countries stimulate the local economy. Therefore, the response of economic growth to long-term development and changes in air traffic is more reasonable than short-term dynamics.

4.2.5. Granger causality test

Granger causality test in addition, the VEC Granger Wald causality test is used to assess the causal direction between economic growth and air traffic demand. Equation VECM, if one variable is correctly excluded from the model, Granger will not call another variable. The null hypothesis tested is the non-Granger causality of the variables. The rejection of the null hypothesis is interpreted as evidence of Granger variables.

Table 9: Granger causality Wald tests from STATA output

Equation	Excluded	chi2	df	Prob>Chi2
InGDP	InFRT	21.358	2	0.000
InGDP	InPAX	42.878	2	0.000
InFRT	InGDP	0.700	2	0.705
InPAX	InGDP	2.296	2	0.317

Similar to the results of the short-term and long-term causality tests, the Granger test also shows that the demand for air transportation (passenger and freight) and the level of economic growth. The country's economic activity is not enough to increase the demand for air transportation in the short term and under registered conditions. Table 9 above summarizes the two causality directions of the data set and the Granger causality test. The non-zero value shows no relationship between economic growths to air transport demand. It is the zero value causal direction, ranging from passenger traffic or air cargo traffic to economic growth. Significant chi-square statistics were obtained using the standard Wald test, and the results support the idea of short-term one-way air causality, improve transportation services to promote economic growth. The results further support the long-term one-way causality associated with air travel. The conversion of fictitious and air freight volumes into GDP is delayed by up to two years.

Table 10 shows In general, the analysis of causality between economic growth and air transport demand considers three different characteristics: short-term, long-term, and Granger causality standards. The results of these three dimensions are similar in terms of empirical evidence of unilateral causality. The evolution of air traffic to economic growth, the one-way causal relationship between air traffic and economic growth means that the expansion of air traffic will support and stimulate economic growth. In addition, this finding means that changes in airspeed will actually lead to significant changes in economic growth with the stated confidence level; however, this result does not mean that economic growth does not affect the growth of the aviation industry, it simply indicates any Economic growth at a specific point in time is not a reliable indicator of the level of economic activity in the aviation industry transport department later.

Table 10: Summary of causality and causality direction output by STATA

Causality directions	Long-run causality (ECT)	Short-run causality (Chi-square statistic)	Granger causality (Wald tests)
PAX ⇒ GDP	.7480**	4.92**	42.878**
GDP ⇒ PAX	-.0696	0.15	2.296
FRT ⇒ GDP	.0582*	3.57*	21.358*
GDP ⇒ FRT	.2946	-0.77	0.700

*,** Represent significant p-values at 5% and 10% significance level

4.2.6. Model diagnostic test

In order to verify the applicability of the VECM/VAR modeling structure, necessary diagnostic tests were performed on residual autocorrelation, normality and model stability. The verification of the estimated stability conditions and the specification errors of missing variables is also tested by applying the eigenvalue conditions (see appendix 2) or model stability test (see appendix 3). All eigenvalues are within the unit circle and satisfy the stability of the estimated model. There is no problem of missing variables when building the mode.

Figure 11: Suspected VECM diagnostic **Autocorrelation test** – STATA output

Lagrange-multiplier

Lag	chi2	df	Prob>Chi2
1	49.321	49	0.460
2	62.852	49	0.088

H0: no autocorrelation at lag order

In order to test the effect of sequential autocorrelation/correlation, the Lange multiplier method was used for testing. Perform a Jarque-Bera test to identify anomalous issues in the model. The violation of the model's stability test hypothesis is verified. For all three tests, the null hypothesis

is that the model is well-defined. The model in the residuals has no serial autocorrelation/correlation, normality or stability tests. As shown in Figure 11 and the appendix, the null hypothesis cannot be rejected in all three tests, which means that the model's assumptions are correct and VECM fully maps the underlying data generation process.

4.2.7. Discussion on the Results Econometrics analysis

The analysis of time series data sets should start by checking the stationary of each variable and the combined linearity (Cointegration) of all variables of the VECM/VAR modeling framework, because regression is performed using no stationary or non-cointegrated variables. Cointegration can lead to incorrect regression results. Not only is the return misleading, it also overturns the recommendation to withdraw.

ADF test results show that InGDP, InPAX, InFRT, InBOP, InEDUC, InFDI and InOER are first-order integral variables I (1). These variables are not only stable at the first differentiation, but also linearly combined, cointegrating I (0). Cointegration variables have long-term relationships, keeping them on track. All analyses in this chapter include these variables, but lnPOPN and lnMGN are not stationary or cointegrated, so they are excluded from further analysis in this study. First-order differentiation does not remove the non-stationarity of these variables, but they still have serial correlation problems. Obviously, regressing variables that do not solve the sequence correlation problem will lead to errors.

In order to assess the long-term relationship between air transportation demand (including passenger and freight) and economic growth, the Johansen maximum likelihood method is used, so that the trace and the maximum eigenvalue prove that there is a co-integration relationship between the variables. It is an endogenous variable, so GDP can be expressed as a linear combination of other exogenous variables.

VECM results show that the rate adjustment coefficient between economic growth and air traffic dynamics is about (= -0.33), a negative coefficient, between 0 and -1, and statistically significant at the 5% level of significance. The annual ratio of short-term imbalance to long-term equilibrium, there is a long-term causal relationship, from the demand for air transport (passenger and cargo) to economic growth, and a significant lag of two years indicate by the results of VECM analysis. The two-year delay seems reasonable because air traffic at the “support” level (especially international passengers) takes time to integrate with economic

growth. This sector and any other related influences may take some time to amplify their impact on economic activity.

In the long run, the VECM regression results show that an average increase in passenger aviation demand by 1% will lead to a proportional decline in economic growth of about 0.33%. (FSC), its fare is higher than that of low-cost airlines (LCC). Although the scope is different, the reasons for the impact of air transport on the local economy and the contribution of these currencies to Ethiopia's economic growth are the same. The short-term impact of aviation expansion on Ethiopia's economic growth will be consistent with the new economic geography concept and the base multiplier. Ethiopia's air transportation needs are based on the international market (global and regional). Benefits, which ultimately contributes to the growth of the local economy and gradually promotes its development; however, the local economy is at the lowest level and is not enough to promote and increase the demand for air transportation. Ethiopia is located in the Horn of Africa and has strategic air transportation routes connecting the Middle East and Southeast Asia with sub-Saharan Africa. As the above analysis shows, the long-term benefits of this aviation advantage to the Ethiopian economy are significant per passenger and per ton-kilometer per year.

Long-term reasons, short-term dynamic results, and Granger Cause tests also show that there is a one-way street that ranges from demand for air travel (passenger and freight) to economic growth. The growth of air transportation is driving the growth of the local economy, and local economic activities are not enough to increase the country's demand for air transportation. In the short term, every 1% increase in passenger demand will drive an increase of about 0.12%. Economic growth and a 1% change in air cargo volume have increased the country's economic growth by approximately 31%. The local economic base is too small to generate and strengthen the demand for air transportation. But as suggested (Krugman, 1996; Schmutzler, 1999), the positive external economic injection into the local small economy has a multiplier effect on the country's economic activities, so Ethiopia's benefits from the development of air transport go beyond it is the causal relationship between the two.

The causal directions between air transport demand economic growth are similar both in long run and short run analysis, the long run impacts outweigh the short run contribution (refer Table 8). The short-run impacts of air transport traffic on economic growth are the direct and immediate benefits. These are clear gains to the local community in terms of wage and other associated

incomes of workers and companies subsequent spend in the area. However, the long-run impacts are broader and have multiple aspects. In the long run, the benefits are not only direct and immediate but also indirect, induced and catalytic benefits that injected into the local economy. In the long run, air transport service development can lead to the crossing of important thresholds in terms of economies of scale, scope, and density of economic activities. An area can acquire an important knowledge base that fosters local research and development and hence increase economic growth of the country. Therefore, the response of economic growth to change of air transport development in long run has been more reasonable than short-run dynamic. Moreover, the effects of air freight demand on economic growth have been more reasonable than the effects of air passenger demand on economic growth.

The analysis results obtained from this study are consistent with the works of (Brida, Bukstein, & Zapata, 2016; Coto, Agüeros, Casares, & Pesquera, 2013; Shed & Iluno, 2015) who found an evidence for positive influences of air transport development and airline consortia to the local economic growth of the country. Specifically, (Brida, Bukstein, & Zapata, 2016), in Italy for the period 1971-2012 investigated the dynamic relationship between air transport and economic growth. They conclude that there was unidirectional causality running from air transport to economic growth and according to their estimation, an increase in 1% in air transport is associated with an increment of 0.17% in economic growth. Additionally, (Coto et al., 2013) also conduct their studies on the impacts of logistics on the world economic growth (2007-2012). They investigate that a 1% increase in the performance of logistics index and the most important sub-indexes can generate an increase of world economic growth ranging between 0.011% and 0.034%. Similarly, (Saheed & Iluno, 2015) analyzed the relationship between air transportation development and economic growth in Nigeria over the period 1981-2012. Their results support that air transport expansion Granger cause gross domestic product but the gross domestic product does not granger cause air transport. However, the result of their estimation seems unrealistic (an increase of 1 percent in air transport expansion will lead to 4557.89 per cent increase in GDP).

The results of this paper and results of the following studies are not consistent (Baker et al., 2015; Chang & Chang, 2009; Hu, Xiao, Deng, Xiao and Wang, 2015) found that two-way economic growth, air traffic expansion and the causal relationship between them. In particular (Baker et al., 2015) used causality and Cointegration analysis methods to provide empirical data on the relationship between air traffic and economic growth in the Australian region. This series

of data sets cover 28 fiscal years from 1986 to 2013. The results show that there is a short-term and long-term two-way causal relationship between regional air traffic and economic growth. In Taiwan, a study (Chang & Chang, 2009) is about the relationship between the expansion of air cargo volume and economic growth from 1974 to 2006. Their analysis and research show that there is a long-term relationship between the expansion of air transport and Taiwan's economic growth. Similarly (Hu et al., 2015) studied the relationship between Taiwan's domestic air travel in China, Passenger and economic growth from 2006 to 2012. A strong two-way Granger causality was discovered between the two series. A 1% increase in passenger traffic means a 0.943% increase in the real gross domestic product (GDP).

The conclusions of this article are inconsistent with the analysis results (Marazzo et al., 2010, Chi & Baek 2013; Fernandes & Pacheco 2010; Hakim & Merkert, 2016), which found that there is a one-way causal relationship between economic growth to air transport expansion. Chi and Beck (2015) studied the dynamic relationship between U.S. air transportation demand and economic growth and showed that there is a short-term and long-term one-way causal relationship from economic development to air traffic expansion. The results show that 1% economic growth means a 1.37% change in air transport demand. The research (Fernandes & Pacheco 2010; Marazzo et al., 2010) focuses on the relationship between Brazilian air transport demand and economic growth. The analysis of causality shows that there is a long-term one-way relationship between economic growth and air transportation. A 1% increase in economic growth leads to an increment of about 0.76% of the demand is for air transportation. Similarly, (Hakim and Merkert, 2016) studied the causal relationship between air traffic and economic growth in South Asian countries. They used 42 years (1973-2014) of panel data and used Johnson's Cointegration. Their results confirmed Granger's long-term, unilateral causality, which ranges from GDP to passenger traffic. The increase **a1%** in GDP will lead to an average proportional increase in the number of passengers by 1.2%.

The results of this paper and results of the following studies are consistent but has some differences(Tolcha, 2017) Johansen's co-integration analysis shows similarity that there is a co-integration vector between economic growth and air traffic expansion, and the corresponding elasticity is positive. But there is a different on VECM results show that the fitting coefficient between economic growth and air traffic dynamics is approximately (ECT = -0.25) but in this paper is ECT=-0.33. The graph shows the ratio of short-term imbalance to long-term equilibrium

each year. The results of VECM analysis also shows that long-term causality runs from air transport demand (passengers and cargo) to economic growth are the same, but considering transport demand, a three-year delay ,but in this paper two years delay was records. The other differences on the regression results of VECM showed that a 1% increase in air traveller traffic demand, within the long run, can on the average results in a proportionately lower growth in economic process regarding 0.77% that is differ 0.33% on this paper. On the other hand, the magnitude of 1% increase of growth in air freight ton-kilometer would result in roughly 0.6% that of 0.7% economic growth in this paper on the long run .Within the short run, a rise of 1% in passenger demand causes an increment of about 0.4% compare 0.12% in the economic growth and 1% modification in air freight traffic improves economic growth in the country with about 0.018% compare 0.31% in this paper respectively. The other dissimilarity is that on the effects of air passenger demand on economic growth have been more reasonable than the effects of air freight demand on economic growth, but on this study it is reversed.

Many empirical literatures that analyze the causality between air travel and economic growth are concentrated in middle- and high-income countries, and seldom focus on low- and middle-income countries such as Ethiopia. Among these developing countries, this study tries to fill the gaps of countries which give very little attention on the literature. Ethiopia is a one low-income country, with a per capita income of US$855 in 2019. This research also supplements empirical research on the low incomes country causal relationship between air travel revenue and economic development.

Generally, Ethiopia's demand for air transportation is closely related to economic growth. The analysis of this study will be largely consistent with the results of case studies in developing countries.

CHAPTER FIVE

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

The overall goal of this research is to analyze the relationship between air traffic (passengers and cargo) and economic growth in Ethiopia. This paper also aims to provide empirical evidence on tested and expected short-term dynamics and long-term relationships. Appropriate estimation methods (VECM descriptive analysis, VAR, and Granger causality test) were used between Ethiopia's economy and aviation demand to achieve these goals in the 1991-2019 data sets. There is a co-integration relationship between air transport demand and economic growth, indicating that there is a long-term relationship between the two. In addition, the results of causality tests (long-term, short-term and Granger causality) show that there is a positive one-way causality from the development of air transportation (passenger and freight) to economic growth. These results indicate that the development of air transport is an incentive and stimulus factor for Ethiopia's economic growth. This finding is consistent with work (Beyzatlar, Karacal, and Againer, 2014), which found statistically significant causality, starting from transport in general, not just air transport, the economic growth of some EU countries, in particular, the results of these authors show that there is a one-way causal relationship between the development of aviation and the economic growth of low- and middle-income countries, but there will also be two-way or one-way causality for high-income countries. It ranges from economic development to the growth of air traffic. Ethiopia is a low-income country, and the development of air transport is vital to economic growth.

The empirical evidence had been failed to show that the local economy could make a difference in air transport demand in Ethiopia but indicates that the development air transport sector has multiplier effects on the local economy.

As a limitation of our analysis, we recognize that the Aviation sector will change in the future and may grow faster as development increases. However, based on all the information available to us, we believe that certain development patterns can be predicted of traffic growth (as confirmed by a growing literature in this field). Therefore, our research is the best way we can provide information to decision makers.

The empirical results of this document have some political and commercial implications and may be important to the government, airlines, airports, logistics companies, freight forwarders, politicians, transportation planners, the Ethiopian Civil Aviation Authority and Ministry of Transport. First, the outcome of the study suggests that the long-run benefits of the Ethiopian economy would be enhanced by improving the performance of air transport. Second, the capital and infrastructure constraints of the aviation sector must be minimized to improve the country's competitiveness. Domestic and foreign investment realizes economies of scale. Third, in order to improve and stimulate local economic activities, it is necessary to maintain and highlight the national aviation service in order to expand the national aviation service base that brings sustainable benefits from economic growth. In the final analysis, the fertile land for interaction should be protected and improved. Ethiopia's national air transport will create conditions for better air transport services, which will have a major long-term impact on economic growth. Therefore, politicians should be aware that this sector is income elastic and has a multiplier effect on economic growth.

5.2. Recommendations

Based on the analysis and limitations of this article, some important related areas may be suggested for further research in the future. This study examines the impact of air traffic development on Ethiopia's economic growth from the perspective of airlines. The analysis also reflects the contribution of airlines to economic growth, but the impact of air transport demand on economic growth may include the contribution of airlines, airports and Ethiopian civil aviation (Air Navigation Service). The impact of airlines, airports and civil aviation (Air Navigation Service) on national economic growth will be an interesting area for future research. Another potential area for future research of this work is the relationship between the aviation sector and the tourism industry. Some researchers such as Duval (2013) believe that the growth of the aviation industry will affect the willingness of adults and travelers to travel, thereby reducing the contribution of the tourism industry to the total GDP, thereby having an impact on the contribution of the aviation industry to economic growth. Finally, you can use innovative methodological methods and consider various alternatives that represent the aviation sector to evaluate and verify the empirical results of this article.

5.3. Limitation and future research direction

As a limitation of analysis, we recognize that the Aviation sector will change in the future and may grow faster as development increases. However, based on all the information available to us, we believe that certain development patterns can be predicted of traffic growth (as confirmed by a growing literature in this field). Therefore, our research is the best way we can provide information to decision makers. The other limitations of the study include unavailability of enough literature on low income or developing country. Directions for future research are, thus, based on the set of limitations discovered and organized around these two fields. When testing these empirical results, future researchers can also consider the possible nonlinear relationship between the evolution of air transportation and economic growth.

Reference

Adam, C., & Hendry, S. (2000). The M1 vector-error-correction model: some extensions and applications. Money, Monetary Policy, and Transmission Mechanisms, 151-80.

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.

Bannò, M., & Redondi, R. (2014). Air connectivity and foreign direct investments: economic effects of the introduction of new routes. European Transport Research Review, 6(4), 355-363.

Barnett, L., & Seth, A. K. (2014). The MVGC multivariate Granger causality toolbox: a new approach to Granger-causal inference. Journal of neuroscience methods, 223, 50-68.

Beyzatlar, M. A., Karacal, M., & Yetkiner, H. (2014). Granger-causality between transportation and GDP: A panel data approach. Transportation Research Part A: Policy and Practice, 63, 43-55.

Borders, A.A.B.B. (2018). Air Transport Action Group: Geneva

Bordoloi, P., & Desk, I. F. B. (2020, September 21). How did Ethiopian Airlines make it happen? International Finance. https://internationalfinance.com/how-did-ethiopian-airlines-make-it-happen/.

Bourguignon, F., & Darpeix, P. E. (2016). Air traffic and economic growth: the case of developing countries.

Brida et al, (2013), introduce a new perspective for the analysis of the relation between tradable sectors and the economic growth of the economies: Mexico.

Brida, G., Lanzilotta, B., Brindis, M., & Rodríguez-Collazo, S. (2014). Long-run relationship between economic growth and passenger air transport in Mexico. Serie DT (14/04);

Brida, J. G., Bukstein, D., & Zapata-Aguirre, S. (2016). Dynamic relationship between air transport and economic growth in Italy: a time series analysis. International Journal of Aviation Management, 3(1), 52-67.

Chang, Y. H., & Chang, Y. W. (2009). Air cargo expansion and economic growth: Finding the empirical link. Journal of Air Transport Management, 15(5), 264-265.

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.

Coto-Millán, P., Agüeros, M., Casares-Hontañón, P., & Pesquera, M. Á. (2013). Impact of logistics performance on world economic growth (2007–2012). World Review of Intermodal Transportation Research, 4(4), 300-310.

Crabtree, T., Hoang, T., Tom, R., & Gildemann, G. (2017). Boeing world air cargo forecast 2014-2015. Boing Commercial Airplanes.

Dharmawan, I. G. N. I. (2012). The effect of air transport to economic development in Indonesia. Erasmus University.

Duval, D. T. (2013). Critical issues in air transport and tourism. Tourism Geographies, 15(3), 494-510.

EAG. (2020). Ethiopian Airlines Groups Data sources. Sitefinity trial version. http://www.ethiopian-airports.com/.

Enders, W. (2014). Applied econometric time series, 2nd John Wiley & Sons. New York, NY.

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.

Granger, C. W. (1969). Investigating causal relations by econometric models and cross-spectral methods. Econometrica: journal of the Econometric Society, 424-438.

Green, R. K. (2007). Airports and economic development. Real estate economics, 35(1), 91-112.

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.

Halpern, N., & Bråthen, S. (2011). Impact of airports on regional accessibility and social development. Journal of Transport Geography, 19(6), 1145-1154.

Hansman, R. J., & Ishutkina, M. (2009). Analysis of the interaction between air transportation and economic activity: a worldwide perspective.

Holtz-Eakin, D., Newey, W., & Rosen, H. S. (1988). Estimating vector auto regressions with panel data. Econometrica: Journal of the econometric society, 1371-1395.

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.

IATA, I. (2016). IATA forecasts passenger demand to double over 20 years.

IATA. (2018). International Air Transport Association Annual Review 2018.

IATA. (2019). International Air Transport Association Annual Review 2019.

ICAO. (2016). Economic contribution of civil aviation, ripple of prosperity. International Civil Aviation Organization. Home. http://www.icao.int/Pages/default.aspx.

Ishutkina, M., & Hansman, R. J. (2008, July). Analysis of Interaction between Air Transportation and Economic Activity. In The 26th Congress of ICAS and 8th AIAA ATIO (p. 8888).

JADC (Japan Aircraft Development Corporation), (2019). Worldwide Market Forecast 2019–2038. Tokyo, Japan.

Johansen, S. (1991). Estimation and hypothesis testing of Cointegration vectors in Gaussian vector autoregressive models. Econometrica: journal of the Econometric Society, 1551-1580.

Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on Cointegration—with amputations to the demand for money. Oxford Bulletin of Economics and statistics, 52(2), 169-210.

Johansen, S. (1995). Likelihood-based inference in Cointegrated vector autoregressive models. Oxford University Press on Demand.

Kirchgässner, G., Wolters, J., & Hassler, U. (2013). Autoregressive conditional heteroscedasticity. In Introduction to Modern Time Series Analysis (pp. 281-310). Springer, Berlin, Heidelberg.

Krugman, P. (1996). Urban concentration: the role of increasing returns and transport costs. International Regional Science Review, 19(1-2), 5-30.

Mankiw, N. G., & Reis, R. (2018). Friedman's presidential address in the evolution of macroeconomic thought. Journal of Economic Perspectives, 32(1), 81-96.

Maparu, T. S., & Mazumder, T. N. (2017). Transport infrastructure, economic development and urbanization in India (1990–2011): Is there any causal relationship?. Transportation research part A: policy and practice, 100, 319-336.

Marazzo, M., Scherre, R., & Fernandes, E. (2010). Air transport demand and economic growth in Brazil: A time series analysis. Transportation Research Part E: Logistics and Transportation Review, 46(2), 261-269.

Mazareanu, E. (2020). Worldwide revenue with passengers in air traffic 2005-2021. Statista. http://www.statista.com/statistics/263042/worldwide-revenue-with-passengers-in-air-traffic.

Mehmood, B., Shahid, A., & Younas, Z. I. (2013). Interdepencies between aviation demand and economic growth in India: Cointegration equation estimation. Economic Affairs, 58(4), 337-347.

Mehmood, B., A. Shahid, and S. Ilyas, (2015), Cointegration regression estimation and causality testing of aviation demand and economic growth in Philippines, International Journal of Economics and Empirical Research, 3(6): 271-279.

NBE. (2019). National Bank of Ethiopian Annual Report 2018/19. Annual Report 2018/19. https://nbebank.com › uploads › pdf › annual bulletin.

NEB. (2020), National Bank of Ethiopian Annual Report 2019/20.Annual report https://nbebank.com › uploads › pdf › annual bulletin.

Oxley, D., & Buecking, N. (2015). Exchange rates and aviation: examining the links.

Oktal, H., Durmaz, V., Ateş, S. S., Küçükönal, H., & Sarılgan, A. E. (2006). Social and economic impact of air transportation: General Review. In International Conference on Business, Management & Economics Cesme, Izmir, Turkey May.

Özcan, İ. Ç. (2013). Air passenger traffic and local employment: Evidence from Turkey. European Journal of Transport and Infrastructure Research, 13(4).

Percoco, M. (2010). Airport activity and local development: Evidence from Italy. Urban studies, 47(11), 2427-2443.

Perovic, J. (2013). The economic benefits of aviation and performance in the travel & tourism competitiveness index. The Travel & Tourism Competitiveness Report 2013, 1(1).

Pickup, M. (2015).Quantitative Application in the social sciences: Introduction to Time Series Analysis. Thousand Oaks.CA, SAGE.

Porter, (2011). Analysis of the Interaction between air Transport and Economic growth. https://core.ac.uk/download/pdf/4407391.pdf.

Rogoff, K., Obstfeld, M., (1996). Foundations of International Macroeconomics. MA, MIT Press, Cambridge. SACAA (South Africa

Saheed, A. A. A., & Iluno, S. Z. C. (2015). Air transportation development and economic growth in Nigeria. Journal of economics and sustainable development, 6(2), 1-11.

Schmutzler, A. (1999). The new economic geography. Journal of Economic Surveys, 13(4), 355-379.

Schopohl, L., Wichmann, R., & Brooks, C. (2014). Stata Guide to Accompany Introductory Econometrics for Finance.

Shin, Y. (2017). Time Series Analysis in the Social Sciences. University of California Press.

Tchouamou Njoya, E. (2013). Air transport and destination performance–a case study of three African countries (Ethiopia, Kenya and South Africa).

Toda, H. Y., & Peter, C. B. P. (1993). Vector Auto regressions and Causality. Econometrics, 61(6), 1367-1393.

Tolcha, T. D. (2017). Air transport demand and economic growth in Ethiopia (Cointegration and causality analysis) (Master's thesis, Høgskolen i Molde-Vitenskapelig høgskole i logistikk).

Tolcha, T. D., Bathe, S., & Holmgren, J. (2020). Air transport demand and economic development in sub-Saharan Africa: Direction of causality. Journal of Transport Geography, 86, 102771.

Tyler, T. (2016). IATA Annual Review 2016. Recuperado de https://www. IATA. org/en/publications/annual-review.

UN. (2016). Download trade data | UN Comtrade: International Trade Statistics. United Nations. https://comtrade.un.org/data/.

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.

Vaugeois, M. (2019). International Civil Aviation Organization (ICAO). In Research Handbook on the European Union and International Organizations. Edward Elgar Publishing.

Wilson, J. (2010) “Essentials of Business Research: A Guide to Doing Your Research Project” SAGE Publications, p.7

World Bank. (2020). World Development Indicators Data, Ethiopia   Data. https://data.worldbank.org/country/ethiopia?locations=ET&view=chart.

Wooldridge, J. M. (2005). Introductory econometrics: A modern approach: Nelson Education.

Wooldridge, J. M. (2015). Introductory econometrics: A modern approach. Cengage learning.

Workman, D. (2017). Flower Bouquet Exports by Country, Ethiopia. World's Top Exports. http://www.worldstopexports.com/flower-bouquet-exports-country/.

Appendixes

Appendix1: Granger-Causality Wald tests

Granger causality Wald tests

Equation	Excluded	chi2	df	Prob > chi2
InGDP	InOER	36.499	2	0.000
InGDP	InFDI	15.563	2	0.000
InGDP	InFRT	21.358	2	0.000
InGDP	InPAX	42.878	2	0.000
InGDP	InBOP	14.139	2	0.001
InGDP	InEDUC	13.673	2	0.001
InGDP	ALL	110.02	12	0.000
InOER	InGDP	33.491	2	0.000
InOER	InFDI	8.7105	2	0.013
InOER	InFRT	8.4523	2	0.015
InOER	InPAX	3.3398	2	0.188
InOER	InBOP	1.4907	2	0.475
InOER	InEDUC	2.4468	2	0.294
InOER	ALL	334.6	12	0.000
InFDI	InGDP	1.757	2	0.415
InFDI	InOER	6.4166	2	0.040
InFDI	InFRT	12.807	2	0.002
InFDI	InPAX	.53808	2	0.764
InFDI	InBOP	4.4944	2	0.106
InFDI	InEDUC	15.414	2	0.000
InFDI	ALL	86.715	12	0.000
InFRT	InGDP	.69974	2	0.705
InFRT	InOER	2.5266	2	0.283
InFRT	InFDI	3.7561	2	0.153
InFRT	InPAX	2.0136	2	0.365
InFRT	InBOP	5.8811	2	0.053
InFRT	InEDUC	13.431	2	0.001
InFRT	ALL	54.351	12	0.000
InPAX	InGDP	2.2957	2	0.317
InPAX	InOER	1.8088	2	0.405
InPAX	InFDI	1.409	2	0.494
InPAX	InFRT	1.0542	2	0.590
InPAX	InBOP	1.5782	2	0.454
InPAX	InEDUC	2.4238	2	0.298
InPAX	ALL	17.55	12	0.130
InBOP	InGDP	5.4809	2	0.065
InBOP	InOER	5.1007	2	0.078
InBOP	InFDI	3.5846	2	0.167
InBOP	InFRT	3.8148	2	0.148
InBOP	InPAX	6.3853	2	0.041
InBOP	InEDUC	.27122	2	0.873
InBOP	ALL	13.207	12	0.354
InEDUC	InGDP	8.5159	2	0.014
InEDUC	InOER	5.9894	2	0.050
InEDUC	InFDI	8.8671	2	0.012
InEDUC	InFRT	3.1993	2	0.202
InEDUC	InPAX	4.7351	2	0.094
InEDUC	InBOP	7.0823	2	0.029
InEDUC	ALL	50.816	12	0.000

Appendix 2: Normality test

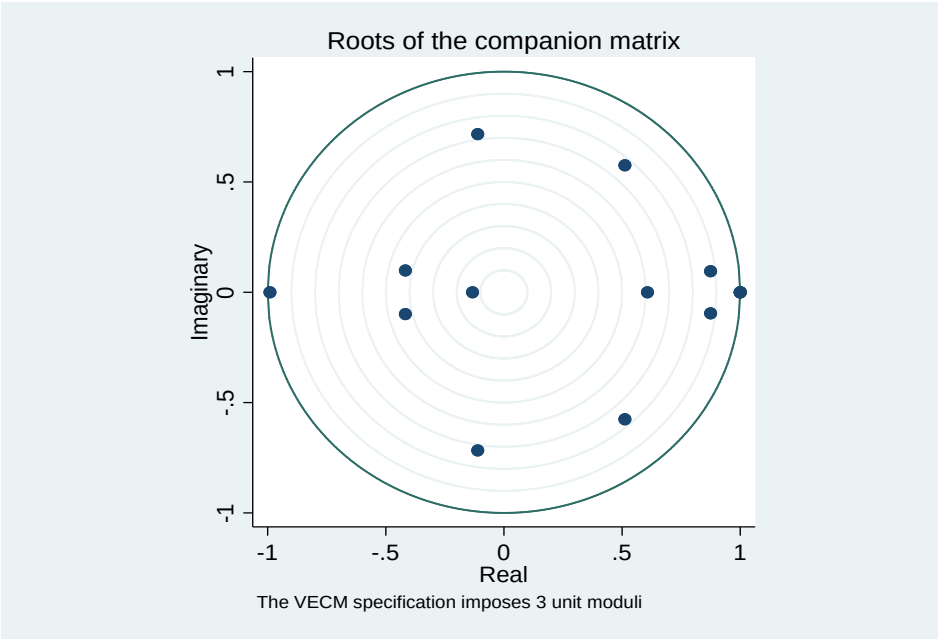
Jarque-Bera test

Equation	chi2	df	Prob>Chi2
D_InGDP	0.108	2	0.948
D_InOER	0.738	2	0.691
D_InFDI	0.521	2	0.771
D_InFRT	0.790	2	0.674
D_InPAX	0.391	2	0.822
D_InBOP	3.231	2	0.199
D_InEDUC	1.177	2	0.555
ALL	6.955	14	0.936

H0: the error term is normally distributed with mean zero and constant variance

Appendix 3: Model stability test

Roots of the companion matrix



Appendix 4: Data Source used

Year	POPN	OER	FDI	GDP	FRT	PAX	BOP	MGN	EDUC
1991	49609969	2.07	0	13463868357	68.40000153	635600	-303188405.8	0	866016
1992	51423585	2.8025	0	10492993078	94.40000153	756400	-822863188.4	1457943	782412
1993	53295566	5	170000	8830712714	92.5	752000	-507140000	0	720825
1994	55180998	5.465	3500000	6927950565	110.3000031	716400	-553684431.7	0	723009
1995	57047908	6.15833333	17210000	7663984568	114.6999969	749900	-669765712.7	0	756249
1996	58883530	6.351675	14140000	8547939731	118.0999985	743000	-585322041.4	0	819242
1997	60697443	6.70934167	21930000	8589211390	137.3999939	772300	-413356955.6	-155577	0
1998	62507724	7.11590833	288490000	7818224906	126.6999969	789900	-799447351.6	0	0
1999	64343013	7.94225	260670000	7700833482	101.5	861400	-919806054	0	1059753
2000	66224804	8.21725833	69980000	8242392104	78.254	944595	-645314899.4	0	1194701
2001	68159423	8.45749167	134640000	8231326016	79.223	1027528	-1117482834	0	1495445
2002	70142091	8.56775	349400000	7850809498	83.493	1103184	-904060850.3	-150001	1734131
2003	72170584	8.59968333	255000000	8623691300	93.469	1117329	-1398645851	0	1857817
2004	74239505	8.63558333	465000000	10131187261	117.155	1403293	-2090182495	0	2140751
2005	76346311	8.66644167	545100000	12401139454	132.601	1667316	-2783508632	0	2488465
2006	78489206	8.69861583	265111675.5	15280861835	157.184	1720306	-3050022984	0	2992589
2007	80674348	8.96595	545257102.2	19707616773	160.322	2290179	-3804850470	-50132	3430129
2008	82916235	9.59974167	222000573	27066912635	227.762	2715017	-5487749242	0	3696385
2009	85233913	11.7775997	108537544	32437389116	424.472	2914056	-5124371293	0	3882551
2010	87639964	14.4095898	221459581.4	29933790334	407.062	3347022	-4885032108	0	4206700
2011	90139927	16.8992258	288271568.3	31952763089	505.565	4440917.69	-5299492882	0	4541623
2012	92726971	17.7047614	628624806	43310721414	703.644	5001121.87	-7289316453	399997	4928710
2013	95385785	18.626629	278562822.2	47648211133	790.74339	5671501	-7776326921	0	0
2014	98094253	19.5857899	1343876024	55612228234	950.1573	6274582	-10349841945	0	0
2015	100835458	20.5768488	1855052154	64589334979	1228.73832	7074779	-12056904316	0	5028678
2016	103603501	21.7315472	2626517918	74296618481	1500.14753	8242114	-11917264575	0	0
2017	106400024	23.8661045	4142937496	81770791971	2076.18502	9566378	-11205951331	150002	0
2018	109224559	27.4293866	4017159565	84269348327	2089.27754	11501244	-11020751506	0	0
2019	112078730	29.06975	3360419369	95912590628	2450.27296	12631216	0	0	0