THE RELATIONSHIP BETWEEN AIR TRANSPORT EXPENDITURE AND ECONOMIC GROWTH IN ETHIOPIA

MSc. THESIS

BY: MISGANA KEBEDE

WOLKITE UNIVERSITY,WOLKITE,ETHIOPIA

AUGUST, 2020

THE RELATIONSHIP BETWEEN AIR TRANSPORT EXPENDITURE AND ECONOMIC GROWTH IN ETHIOPIA.

BY: MISGANA KEBEDE

MAJOR ADVISOR: WONDAFERAHU MULUGETA (PhD)

CO-ADVISOR: ABEBE MENGESHA (MSc.)

A THESIS SUBMITTED TO

THE SCHOOL OF GRADUATE STUDIES IN WOLKITE UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIRMENT OF DEGREE OF MASTERS OF SCIENCE IN ECONOMICS (DEVELOPMENT ECONOMICS)

AUGUST, 2020

WOLIKTE, ETHIOPIA

ADVISORS' APPROVAL SHEET

SCHOOL OF GRADUATE STUDIES

WOLKITE UNIVERSITY

This is to certify that the thesis entitled "**The Relation between Air transport Expenditure and Economic Growth in Ethiopia"** submitted in partial fulfillment of the requirements for the degree of Master's with specialization in Development Economics, the Graduate Program of the Department/School of Business and Economics, and has been carried out by Misgana Kebede **Id. No GSE/074/10,** under my/our supervision. Therefore I/we recommend that the student has fulfilled the requirements and hence hereby can submit the thesis to the department.

_____	_____	_____
Major Advisor	Signature	Date
_____	_____	_____
Co-Advisor	Signature	Date

EXAMINERS' APPROVAL SHEET

SCHOOL OF GRADUATE STUDIES

WOLKITE UNIVERSITY

We, the undersigned, members of the Board of Examiners of the final open defense by Amanuel Yosef Abraham have read and evaluated his/her thesis entitled "***The Relation between Air transport Expenditure and Economic Growth in Ethiopia***" and examined the candidate. This is, therefore, to certify that the thesis has been accepted in partial fulfillment of the requirements for the degree of **Masters in Development Economics.**

_____	_____	_____
Name of the Chair Person	Signature	Date
_____	_____	_____
Name External Examiner	Signature	Date
_____	_____	_____
Name Internal Examiner	Signature	Date
_____	_____	_____
SGS Approval	Signature	Date

Final approval and acceptance of the thesis is contingent upon the submission of the final copy of the thesis to the School of Graduate Studies (SGS) through the Department/School Graduate Committee (DGC/SGC) of the candidate's department.

Stamp of SGS Date: _____

DRCLARATION

I hereby declare that this thesis entitled “The relation between air transport expenditure and economic growth in Ethiopia” is outcome of my own effort and study and that all sources of materials used for the study have been suitably acknowledged.

To the best of my knowledge, this study has not been submitted for any degree in this University Or any other University. It is presented for the partial fulfilment of the degree of Masters of Development Economics.

_____ _____ _____

By Misgana Kebede Signature Date

ACKNOWELDGEMENT

First of all my, gratitude goes to the almighty God, the creator of the heavens and earth for life, provision of strength, wisdom, health and the opportunity to come far in life..

Next I would like to thank my advisor, Wondaferhu Mulugeta (PhD) who helped me very closely. The completion of this thesis would not have possible without the support of him. I recognize his most valuable guidance starting from conception to the final write-up of the thesis. I also express my deepest thanks to co-advisor Abebe Mengesha(MSc.) for his constructive advice and guidance to right point from the beginning of proposal up to the end of this thesis.

I am also very grateful to my beloved Wife Tsehaye Tsedeke for her practical & psychological support and motivation to the completion of my paper and the success of my learning process. And also I would like to extend my thanks to my best friends to Teshome Amado and others Development bank of Ethiopia staffs , who are always with me in help and wish for my success through their advice. Besides, I am keen to give special thanks to National Bank of Ethiopia, Ethiopian Airlines Enterprise and MoFEC by providing necessary data in preparation of this research thesis.

Lastly but not least, I thank our Economics Department of Wolkite University for good facilitation and adjusting of post graduate program that helped me and others became the holder of the second degree. Thoroughly, I express my deepest thankfulness to my family for their unlimited support by an idea and all time standing on my side from the beginning.

BIBLIOGRAPHY SKETCH

The author was born on December 17, 1994 G.C in Mahal Jarso rural kebeles of East Badewacho Woreda, Hadiya Zone of SNNPRS of Ethiopia. He attended his elementary at Jarso secondary school and senior secondary and preparatory school at Shone senior Secondary and preparatory School. After successfully completion of his preparatory level of education, he joined Dilla University in 2011 G.C College of Agriculture and Natural Resource Managements or his BA degree in Agricultural Economics and graduated in June, 2014. After graduation, he has been serving as loan officer in Development Bank of Ethiopia since 2015. By the year October 25, 2017, he joined Wolkite University, school of post graduate studies to pursue his M.Sc. degree in Economics (Development Economics).

CONTENTS

ADVISORS' APPROVAL SHEET ii
EXAMINERS' APPROVAL SHEET iii
DRCLARATION iv
ACKNOWELDGEMENT v
BIBLIOGRAPHY SKETCH vi
LIST OF TABLES ix
LIST OF FIGURE x
LIST OF ACRONYM AND ABBREVIATIONS xi
ABSTRACT xii
CHAPTER ONE 1
INTRODUCTION 1
1.1. Background of the Study 1
1.2. Statements of problem 2
1.3. Research Question 4
1.4. Objective of the Study 4
1.5. Significance of the study 4
1.6. Scope and Limitation of the Study 5
1.7. Organization of the paper 5
CHAPTER TWO 6
LITERATURE REVIEW 6
2.1 Theoretical literature 6
2.1.1 Concept of Air transport Industry 6
2.1.2 Transport infrastructure and economic growth 9
The Role of Air transportation industry 10
2.1.3 Social impact of the Air transport 15
2.2 Empirical Literature 15
2.3 Conceptual Framework 21
CHAPTER THREE 22
RESEARCH METHODOLOGY 22
3.1 Data type and source 22
3.2 Descriptive Statistics 23
3.3 Method of Data Analysis 23

3.4 Model specification 24
3.5 Estimation technique 31
CHAPTER FOUR 40
RESULT AND DISCUSSION 40
4.1 Descriptive statistics 40
4.1.1 Economic growth in Ethiopia 40
4.1.2 The Labor Force growth in Ethiopia 44
4.1.3 Trend of Net Capital Formation in Ethiopia. 44
4.1.4 The Trend of Air Transport Expenditure in Ethiopia 45
4.1.5 The Trend of Agriculture, Culture and sports, and Military expenditure in Ethiopia 47
4.1.6 The trend of trade openness growth rate in Ethiopia 48
4.2 Empirical Results 50
4.2.1 Unit Root Test 50
4.2.2 Lag order selection 52
4.2.3 Tests for Long Run Relationship (Bound testing approach to co-integration) 54
4.2.4 The Long-run ARDL Estimate 55
4.2.5 Dynamic Short run Error Correction Estimate 59
4.2.6 Diagnostic testing and model stability 62
4.2.7 The Pair Wise Granger Causality Results 65
CHAPTER FIVE 67
SUMMARY CONCLUSION AND RECOMMENDATION 67
5.1 SUMMARY 67
5.2 Conclusion 68
5.3 Policy Recommendation 69
REFRENCE 70
APPENDIX 1

LIST OF TABLES

Table 1 Summary of Explanatory variables expected sign.....30
Table 2 Descriptive Statistics of Variables.....49
Table 3 ADF Unit root test of Variables.....51
Table 4 the estimated F-bound test and Lower and Upper bound critical value 54
Table 5 Long run coefficient for ARDL Model (1, 1, 0, 0, 1, 0, 2, 2).....55
Table 6 Dynamic specification of ARDL growth model (1, 1, 0, 0, 1, 0, 2, 2).....60
Table 7 Breusch-Godfrey Serial Correction LM test result.....62
Table 8 Heteroskedasticity test Breusch -pagan Godfrey result.....63
Table 9 Ramsey RESET test of Functional Form test result 63
Table 10 The pair wise Granger Causality Results.....65

LIST OF FIGURE

Figure 1 Conceptual Framework 21
Figure 2 The Trend of RGDP growth in Ethiopia 42
Figure 3 The Trend Labor force growth in Ethiopia 44
Figure 4 The trend of Capital formation growth in Ethiopia 45
Figure 5 the trend of Air transport expenditure growth in Ethiopia 46
Figure 6 the trend of expenditure on Agriculture, Culture and Sport and Military expenditure 48
Figure 7 the trend of openness to trade growth in Ethiopia 49
Figure 8 The Optimal lag length 53
Figure 9 Jaque- Berra normality test result 64
Figure 10 Plot of CUSUM model stability test result 65

LIST OF ACRONYM AND ABBREVIATIONS

ACI	Airports Council International
ADB	Asian Development Bank
ADF	Augmented Dickey Fuller
AIA	Aerospace Industries Action
AIC	Akaike Information Criterion
ARDL	Autoregressive Airport Distributed Lag
ATAG	Air Transport Action Group
CAPA	Center for Aviation Partner
CEO	Chief Executive Officer
EAE	Ethiopian Airport Enterprise
EAL	Ethiopian Airlines
ECAA	Ethiopian Civil Aviation Authority
ECM	Error Correction Model
EEC	Ethiopian Economic Association
ENPC	Ethiopia National Planning Commission
GAMA	General Aviation Manufacturers Association
GDP	Gross Domestic Products
GTP	Growth and Transportation Plan
IBID	In the same source/Previously cited work/
ICAO	International Air transport Association
ICTs	Information and communication technologies
ILO	International Labor Organization
MoFEC	Ministry of Finance and Economic cooperation
NBE	National Bank of Ethiopia
ROA	Return on Asset
SDGS	Sustainable Development Goals
TGT	Transitional Government of Ethiopia
UNCTD	United Nations Conference on Trade and Development
VCEM	Vector Error correction model
WB	World Bank
WDI	World Development Indicator

ABSTRACT

This study investigates the relationship between air transport expenditure and economic growth in Ethiopia. It uses annual time series data, obtained from the national bank of Ethiopia, World Bank, MoFEC and annual report of the Ethiopian airlines Enterprise, which covers from the year 1986/87 to 2018/19. The study employs Auto Regressive distributive lag model (ARDLM) bond test to estimate the long run and short run parameters. The results show that in the long run domestic air transport expenditure ,expenditure on agriculture ,on culture& sport ,net capital formation and labor force are significantly and positively impact on economic growth in Ethiopia .While military expenditure and trade openness are a significantly and negatively affect economic growth in long run. On the other hand the result from error correction model (ECM) revealed that government expenditure on agriculture and labour force have significantly and positively affect economic growth whereas one lagged military expenditure and trade openness are significantly and negatively affect economic growth in short run. But air transport expenditure, expenditure on culture &sport and capital formation (investment) have weak/no significant effect on economic growth in short run.

Key Words: - Economic growth, Air transport expenditure, Time series and Ethiopia

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

The air transport industry is the global network of commercial aircraft operates, air ports, air navigator service provider and manufacturer of the aircraft and their components. It is responsible for connecting global economy, providing for millions of jobs and making the modern internationally quality of life possible (Dempsey, 2000). The air transport action group (ATAG) bring industry together to form strategies perspective on commercial aviation sustainable development and the role that the air transport can play in supporting the sustainability of the other sectors of the economy(ATAG, 2015). Air transportation also provides rapid worldwide transportation network, which makes it essential for global business and tourism sectors development. It plays a vital role in facilitating economic growth; contribute to the global economy by increasing access to international markets and allowing the globalisation of production particularly in developing countries (ATAG, 2018).

The aviation industry plays a critical role in sustainable development of nations. Although the core economic, social and environmental elements of sustainability have long been understood, the United Nation's Sustainable Development Agenda for 2030 set 17 more specific sustainable development goals (SDGs) that the world should aim to achieve by 2030 (ATAG, 2018). A number of these goals are based on improving the living conditions and economic prosperity of people all over the globe. To realise these ambitious goals, the international community vowed to work towards shared economic growth, creating jobs and boosting economic activity worldwide. The aviation, as a global transport sector, is playing an instrumental role in supporting this task and is committed to finding additional ways to contribute (ibid).

The ENPC (2016) report showed that the Ethiopian Airlines (EAL) or most popularly known as the Ethiopian flag carrier has been delivering an exemplary performance to other public enterprises at both national and continental levels. During the GTP I period (2010 – 2015), the EAL has purchased additional many modern airplanes and has become

owner of Dreamliner airplanes which makes Ethiopia the first country in the continent of Africa to own a dream liner .It has also increased the number of domestic and international flight destinations. These have enabled the Ethiopian Airlines to satisfy the needs of clients, to enhance service export earnings and to make the service balance of Ethiopia's current account positive (The Ethiopian Airlines, 2017).

Heading into the fiscal year 2019/2020, one can see incredible opportunities for the growth with continued economic development of the nation as well as Africa and the need for increased air connectivity. This in turn requires strengthening the pillars of its Vision 2025 strategic roadmap by purchasing -in new and modern fleet, expanding its global network, investing in human capital, and developing critical infrastructure, with the view to support Africa's economic development by availing critically essential air connectivity for economic integration and the flow of trade, tourism, and investment (RYTIS, 2019).

From the foregoing, it is important to stress the importance of air transportation in facilitating international trade and boosting investment in productive and tourism sectors. However, the effect that a nation's air transport industry will have on the productive sector of the economy is dependent on the development, competitiveness, dependability, and efficiency of the sector. In essence, fast and reliable international passengers and cargo transportation and delivery services are the vital functions of airline industry that accounts for a significant share in their operational activities. In this context, it is worthwhile to study how relevant investment/expenditure in the industry has been enhancing the performance of the aforementioned functions to the economic growth of Ethiopia in line with available theories and evidences in the field.

1.2. Statements of problem

Air transport, just like any other mode of transport, plays a crucial role in the economy of a country. It provides a necessary supporting role to international, regional, economic growth and local prosperity. It also enhances the quality of life by improving access to jobs, education, health care, markets as well as social and leisure activities (Ozcan, 2013). It also provides worldwide transportation network, which makes it essential for doing business globally as well as enhancing tourism sector and generation of ample hard currency.

The Ethiopian Airlines continued with its aircraft technology leadership in the continent with the introduction of new Boing 787s, Airbus 350s, and Boing 373-Maxs to support its fast expanding network in Africa, Asia, Europe, and the Americas ((Tewolde, 2019b).

Moreover, the very rapid growth has put series strains on its customer service delivery at Addis Ababa Bole International Airport, where on-ground service has not always been to customers' expectation, mainly due to facility limitations (Tewolde, 2019a:11). Though still remains a lot, on-ground customer service started to change only after mid-2019, when a brand new and expanded terminal at Bole International Airport put in place. The Ethiopian airlines effort to greatly enhances customers' on-ground experience and satisfaction also significantly boosted by the completion of a brand new 5 star Ethiopian Sky Light Hotel, within 5 minutes walking distance from the airport, with 373 guest rooms and able to accommodate 2,500 guests at once. More recently, RYTIS (2019) has also indicated that the EAL faced difficult operating conditions, especially after one of the four Boing 737 max jets crushed on March 10, 2019. As a result, though still positive the Ethiopian flag carrier net financial earnings have shrunk by June 2019 as compared to 2018 fiscal year. Yet, the impact one of the biggest crisis in aviation is still felt by the airlines.

More recently, Amanuel (2016) has also conducted a study on determinants of domestic air transport demand in Ethiopia whereas the study by Deribe (2016) and Abeynew (2019) analysed the profitability in the airlines industry and the effect of the leverage ratio on the airline profitability, respectively. And the study by Arkebe and Taffere (2019) on the journey on Ethiopia Airline concluded that the Ethiopian lacked the comparative advantage to adopt the latest aviation technologies.

Nevertheless, in the prevailing works described in the literature, none of them have incorporated the expenditure into air transportation in their study as a separate variable in order to investigate the relationship between air transport sector and economic growth in any country in the world. Thus, realizing the relation between air transportation expenditure and economic growth, this thesis attempts to investigate relative impact of air transport industry expenditure on economic growth as a contribution towards the existing stock of knowledge by identifying the gap to be filled up in literature.

1.3. Research Question

On the basis of theoretical literature and empirical studies on air transportation and economic growth, the following three research questions have been formulated for analysis purpose:

- ✓ What is the trend of air transport expenditure in Ethiopia?
- ✓ What is the relation between air transport expenditure and economic growth in the long run and short run in Ethiopia?
- ✓ What is the direction of the causality between air transport expenditure and economic growth in Ethiopia?

1.4. Objective of the Study

The general objective of this study is to examine the relation between the expenditure on air transport and economic growth in Ethiopia, while more specifically, the study attempts to

- ✓ Examine the trend of expenditure on air transport in Ethiopia
- ✓ Analyse the long run and short run impacts of expenditure in the air transport sector and economic growth of Ethiopia,
- ✓ Investigate the direction causality between expenditure in the air transport and economic growth and.

1.5. Significance of the study

This study will be helpful for providing enormous information to policymaker and development partners during planning and spending on area of air transport sector. It is also expect that the findings of this paper will have critical importance since it makes a contribution to both theoretical and empirical literature to researchers who would wish to carry out further research on the effect and/or relation between air transport expenditure on economic growth and its results are significance to the practice public financial operation specifically policy makers on controlling of public resources and decision making with regards to growth of GDP.

1.6. Scope and Limitation of the Study

This study focuses on the relation between air transport expenditure and economic growth in Ethiopia. The data covered in this study for the time period 1986/87 to 2018/19 .The study period doesn't include the Imperial era and Derge regime between 1974/75 to 1985/86 due to limitation of data. The data was collected on macroeconomic variable such as expenditure on agriculture, expenditure on culture and sport, military expenditure; gross capital formation, labour force and trade openness (proxy in export plus import) are also included in the econometric regression for same period.

1.7. Organization of the paper

This study is organized in five major chapters. Chapter one introduces the study which consists of background of the study, statement of problem, objective of study, significance of study, and scope of the study. Chapter two provides the literature review of the theoretical and empirical study about the air transportation and economic growth relationship. The third chapter incorporates the methodology and data source. Chapter four deals with the estimation results and discussion and the last chapter presents summary, conclusion and policy recommendation.

CHAPTER TWO

LITERATURE REVIEW

2.1 Theoretical literature

2.1.1 Concept of Air transport Industry

The Ethiopian Airlines is now recognised as the largest and fastest growing in Africa in all major parameters, modern fleet, and revenue or passenger number (Citation would be).Continuously enhanced products and service delivery, the EAL was named "Best Airline in Africa" by the SKYTRAX of African Airlines Association in 2017 fiscal year. The Ethiopian has also received a plethora of industry accolades including, Africa Airlines of the year for 2017 Award (for second year in row) by the African Airlines Association, African Cargo Airline of the Year Award for network Development, Bombardier's Airline Reliability Performance Award, and Outstanding food service by a carrier in Africa. The CEO of the airline acknowledged that the aforementioned successes as a testimony for the soundness of its strategic roadmap and hard work and dedication of all 12,000 plus employees (The Ethiopian, 2017).\

Ethiopian Airline was originally established in June 1945 and had its first scheduled flight in April 1946. The Ethiopian Airlines Enterprise was established as a public enterprise in Ethiopia in 1995 by Council of Ministers Regulations No. 216/1995, and is governed further by Council of Ministers Regulations No. 81/2003, 147/2008, 292/2013, and No. 389/2016. Its principal place of business is in Addis Ababa, Ethiopia, and it has area and station offices all over the world. The Enterprise is wholly owned by the Government of the Federal Republic of Ethiopia (The Ethiopian Airlines, 2017).

Africa has the smallest share of air transport services in the world due to its low income and absence of air transport infrastructure. Moreover, the aviation industry is the main transport mode in international flight in the continent and its importance relative to other modes of transport increased by 7.2 percent a year during the 2009s compared to an annual increase of 4.4 percent per annum in the use of road transport(Oxford Economic Forecasting 2013)).

The air transportation service provides employment in the aviation sector and creates wider socioeconomic benefits through its potential to enable certain types of activities in local economy. As a result, the availability of air transportation services effectively increases the scope and cycle time of economic activity. However, Africa's economic activity in turn generates the need for passenger travel and freight and drives the demand for air transportation services (Aunurrofik, 2018).

Transportation is important in order to have the great infrastructure, industrialisation, or massive production. The global society would not have experienced comfort and convenience life had it not been for advancements in the transportation sector such as trailers, cargo ships, or large aircrafts to carry them to different places. In short, transport is important since it enables trade between people, which in turn establishes civilizations (Hall, 2003). The wide modes of transport can be broadly divided into three categories based on the medium they exploit: land, water and air. Each mode of transport has a fundamentally different infrastructure, operations, and often has some unique regulations (Rodrigue et al., 2006). The most challenging issues in the transportation sector now days is how to improve the transportation system in line with the concept of sustainability development.

Transportation is a prime factor in shaping patterns of human social, economic and cultural existence. By attenuation the planet, air transport is a principal means of combination and integrating different economies and cultures and stimulating social and cultural cross-fertilization, economic growth, and diversity in an increasingly interdependent global environment. Whole economic sectors (e.g., hotels, automobile rental firms, and convention business and tourist destinations) depend on safe, reliable, efficient and reasonably priced commercial air transportation (Dempsey, 2000).

Air transportation is one of the most important components of the world's transportation system. Not only does it provides the major means of long-distance travel in the world, but its economic impacts on global and national economies is substantial. In addition, because of the very nature of aviation infrastructure (for example, airports) and the current technology for flight (for example, jet engines that consume fuel and emit air pollutants), air transportation plays an important role in efforts to improve environmental

quality and promote sustainable development. The major components of the air transportation system include airports, air traffic control systems, aircraft, and airlines. Changes in each of these components will have important consequences for the future of the aviation industry (Heppenheimer, 2012).

The aerospace industry comprises those firms engaged in research, development, and manufacture of all of the following: aerospace systems, including manned and unmanned aircraft, missiles, space-launch vehicles, and spacecraft propulsion, guidance, and control units for all of the foregoing and a variety of airborne and ground-based equipment essential to the testing, operation, and maintenance of flight vehicles. Virtually all of the major firms in the aerospace industry are members of the Aerospace Industries Association (AIA) or the General Aviation Manufacturers Association (GAMA). Founded in 1919 and based in Washington, D.C., the AIA is a trade association representing the nation's manufacturers of commercial, military, and business aircraft, helicopters, aircraft engines, missiles, spacecraft, and related components and equipment. GAMA, also based in Washington, D.C., is the trade association that represents the interests of manufacturers of light aircraft and component parts (Wensveen, 2007).

Airlines were among the first companies creating worldwide electronic networks, not only for the means of selling and distribution, but also for internal management and operations purposes. Also the other types of transport suppliers, car rentals as well as railways or the maritime industry fall into this category: they are all technologically advanced (Werthner, 2009).The concern of airlines is to transport passengers and freight from one geographical location to another, there by rendering efficient interaction of a country with the international world. This also helps in economic investment through tourism and trade (Oxford Economics, 2013).

The successes in the field of transportation and the formation of a new social middle class in the 19th century created the preconditions for affluent in tourism sector. The international development of transport links, an increase in the professionalism of tourism providers and a rapidly advancing technological development in both transport capacity and management were accompanied by a change in consumer behaviour characterized by an increase yearning for distant places (Egger, 2015). The appearance of

mass tourism made necessary the development of information and communication technologies (ICTs) in the field of transportation. This was essential in order to be able to manage the transport inventory and planning, to coordinate all the stakeholders involved in the transportation industry and to communicate the corresponding mass of information to the right person at the right time.

2.1.2 Transport infrastructure and economic growth

Transport infrastructure is critical to the creation and distribution of economic wealth. The case could be made that infrastructure in general and transport infrastructure in particular is more important to development than the specific case of transport infrastructure. But it should be fairly evident that while communications, health or educational infrastructures do aid development, these types of infrastructure do provide channels along which economic development can expand, growth does not appear everywhere and all at once. The implication is that if it appears in points or growth poles with variable intensity it spreads along various channels and has varying terminal effect for the whole economy (Adefolalu 1977).

When we think of the effect of transportation on economic growth, what makes to our mind is infrastructural development. Infrastructure comprises of "hard" and "soft" components. The "hard" and visible infrastructure in the transport sector such as roads, railways, airports, ports, electricity, information and telecommunications must be accompanied and supported by its "soft" component such as policies and regulation to enable the system to perform well and generate impact. The right mix and synergy of the two is important to ensure that the infrastructure system support inclusive growth and poverty reduction. Investment on transport infrastructures is very important to economic growth and societal development. Because such investment on transport infrastructures will open up new markets or destinations, create more education, health, etc., and enhances the mobility of people and other resources (physical goods, capital, intangible resources) from one country to another, which are vital to economic growth. Transportation infrastructure development and improvement also brings not only direct injections of cash into local economy throughout the construction process but provides multiplier effects that reverberate on a larger spatial and temporal scale (ADB, 2012).

The economic advantages from infrastructure investments includes the direct economic gain from the construction and maintenance which is related to accessibility change where transport enables larger markets and enables to save time and the indirect impacts is related to the economic multiplier effects where the price of commodities drop and or their variety increases. Furthermore there is socioeconomic development drawn from the newly available infrastructure such creation employment. Likewise if they are in deficit they will have economic costs in terms of reduced or missed opportunities (Button and Taylor,2012).

The economic returns of the transportation industry can also be considered from a macroeconomic perspective that is, the importance of transportation for the whole economy and the mobility it creates are linked to a level of output, employment, and income within a national economy and micro economic perspective that is, the importance of transportation for specific parts of the economy as it is linked to producer, consumers and production costs (Kockelman *et al.*,2013)

The Role of Air transportation industry

The role of air transport is divers. It ranges from promoting economic growth and development to improving social welfare. In this regard Hayle (1973) argued that there is great competence and value adding obtained by air transportation when long distances are involved and high value payloads are moved, although, the time and cost efficiencies obtained decreases as distances travelled is reduced. Air transport is often worthwhile even for relatively short distances. It also provides a communication link, which is sometimes vital, between the different groups of people involved. He stressed that transport development is precondition for economic development. He also acknowledged the fact that no industry thrives in the absence of transport, whether in the key areas of marketing of sourcing raw material, distribution of products, or movement of members of staff from home to factories.

In the same vein Filani (1986) lend support to Hayle (1973) and argued that for any economic progress, the aviation industry as an integral part of transport must be developed,

this is sine-qua-non to development. Adefolalu (1977) opined that air transportation has introduced the most effective method of overcoming the barrier imposed by physical distances and difficult topography and its speed is far superior to any other mode of transport.

According to Bijan et al (2008), the economic impact of air transport industry can be divided into three categories: direct, indirect, and induced. The direct economic impacts are the consequences of what might be termed first-tier economic activities carried out by an industry in the local area. In the air transportation industry, airports provide the greatest direct impact to local economies. Most direct impacts, like airport employment and fixed-based operations, occur at the airport; others, like the local production of goods and services for use at the airport, may occur off-site. Expenditures by airlines, fixed-based operators and tenants also generate direct impacts, but only those expenditures that lead to local business activity are relevant for a regional economic assessment.

On the other hand, the indirect impacts derive from off-site economic activities that are attributable to air transportation activities. For example, indirect economic impacts include services provided by travel agencies, hotels, rental car companies, restaurants, and retail establishments. These enterprises have a strong relationship to the air transportation industry and, like airport businesses, employ labor, purchase locally produced goods and services, and invest in capital projects. Indirect impacts differ from direct impacts because they originate entirely off-site. Typically, indirect economic impacts are generated by visitors to the area, who are traveling by air. For instance, Airlines provide economic benefits to the hotel industry by requiring hotel rooms for passengers who have business, or are vacationing, in a city. This increased demand for hotel accommodation in cities creates employment and may require the construction of more hotels, thereby creating more economic impact. As a result, the large demand for hotel accommodation caused by air transportation is one of the main reasons why areas around major airports almost always contain numerous hotels (Ibid).

More importantly**,** Bijan et al (2008) stressed that one of the economic impact of air transport industry is its induced impact, which is a multiplier effects that are caused by the increases in employment and income generated from the direct and indirect economic

impacts of air transportation. For instance, imagine a new airline employee who purchases a house in local community. The builder of the house then uses this income to purchase other goods and services from suppliers. This framework of expenditures is the basis behind the multiplier effect-that is, one transaction leads to multiple economic transactions.

Even though there are a variety of transportation means, such as automobiles, trucks, ships and railroads, perhaps no other mode has more significant impact on express trade and commerce than aviation. However, travel in the aviation system allows for intercontinental travel of large volumes of passenger and cargo in relatively short periods of time. Access to markets around the world has resulted in the largest of communities reaping extraordinary economic benefit. Therefore, the air transport become vigorous to the growth of business and industry in a community by providing air access for companies that must meet the demands of supply, competition and expanding marketing areas. Communities without airports or sufficient air service have limitations placed on their capacity for economic growth. (Wells, 2005).

Air transportation produces an economic activity by creating employment and by its enabling effect. Empowering effect is defined by (Ishutkina and Hansman, 2009) as "The total economic impact on employment and income generated by the economic activities which are dependent on the availability of air transportation services". Air transportation enables access to markets, people, capital, ideas, knowledge, labor supply, skills and opportunity and resources. Air transportation and economic activity are interrelated and have reflexive effect on one another. In other words, economic activities are somewhat stimulated by air transportation, and they, in turn, generate demand for air transport services. Air transport makes markets and people closer to each other.

The growth in air travel can be explained by rising incomes (Dargay and Hanly, 2001). Steiner (1967) beside the changing habits, discretionary income is the most important factor that is causing air traffic growth; that is, the consumer expenditure increases as an income increases. However, in some studies (e.g. Graham, 2000) GDP is referred to as an alternative measure of income together with disposable income and consumer expenditure.

As per Ishutkina and Hansman, (2009) argument of time and income shares allocated to travel are constant over time and space .When the individuals‟ incomes increase, they do not raise the proportion of expenditures for transportation, but along with the income increase their budget for the transportation expenses automatically grows. Thus, air transportation is becoming more desirable once higher income levels are achieved by individuals, prompting them to shift from slower and cheaper means of transport to the faster ones like air travel these statements explain why air transportation demand changes move together with income or GDP per capita growth.

Air transport has traditionally experienced higher growth than most other industries. Demand for air transport is closely linked with economic development; at the same time air transport is a driver in an economy. The contribution of air transport and related civil aviation industries to local, regional or national economies includes the output and jobs directly attributable to civil aviation as well as the multiplier or ripple effect upon other industries throughout the economy (ICAO 2002).

Aviation provides the only worldwide transportation network, which makes it essential for global business and tourism. It plays a vital role in facilitating economic growth, particularly in developing countries. Air transport plays a meaningful role in the social and economic developments of the world economy. This mode of travel is also very capital intensive and requires heavy investments (Aunurrofik, 2018).

Air transport also makes a major contribution to sustainable development by supporting and promoting international tourism. Tourism helps to reduce poverty by generating economic growth, providing employment opportunities, increasing tax collection, and by fostering the development and conservation of protected areas and the environment. In effect, protecting the environment attracts tourism and the development of the tourism industry, which in turn makes it possible to finance the protection of nature and cultural heritage, thereby increasing the benefits of protected areas to the country. Moreover, the promotion of nature-based tourism is an effective lobbying tool that favours nature conservation over non-sustainable agricultural activities. It can also increase the sense of ownership and responsibility for natural resources, among local communities (Haken et.al, 2014).

ATAG (2015) argued that air transport sector delivers the following activities for sustainable development of the countries by providing access to remote areas, transporting humanitarian aid, and facilitating trades. That is, air transport provides access to remote areas where other transport modes are limited, thus opening them up to contact with other communities, and providing a means for the delivery of essential supplies. Many essential services such as hospitals, education, post, etc. would not be available for people in such locations, without the presence of air services.

Aviation also plays a greater role in overcoming geographical and political barriers. Even a small increase in air transport activity can result in major improvements and economic growth. Some of the poorest nations in the world have raw materials that are in high demand by other counties. Aviation is used to fly personal and perishable supplies to the remote camps and to retrieve the acquired resource. Ethiopia produces Flowers and meat, as these products are perishable air transport was the only way to export those products (ATAG, 2005) .

Many scholars agree that travel and tourism provide substantial consumer welfare and social benefits by increasing understanding of different cultures and nationalities which facilitates closer international integration; improving living standards by widening choice: cheaper and more frequent access to air travel has increased the range of potential holiday destinations. Seasonal fruit and vegetables are now available year round at reasonable prices. The large number of overseas visitors has also helped widen the range of leisure and cultural activities available in many countries. The benefit that air transport has on business operations and trade is also very vital. Efficient transportation system is, thus, an essential factor when considering investment opportunities. It allows greater access to international markets; personal communication between clients becomes very simple; inventory costs can be minimized and production interruptions are more easily prevented. Sectoral efficiency is improved through fast and reliable delivery of products.

2.1.3 Social impact of the Air transport

The impact of the air transport industry is not just outcome of the economic activity it generates or facilitates. Air transport expands the range of consumer choices and opportunities to visit other countries and to experience new cultures. Availability of air services can be an important indicator of the quality of life - particularly for remote areas. These social and regional accessibility benefits are far more difficult to quantify. However, they are vital to the development of remote regions. Quite simply, without air service access, many regions would be denied participation in the modern world (ACI, 2004).

Air transport also contributes to people's quality of life in a number of other ways that are not captured in standard economic indicators: for example, by contributing to sustainable development, supporting remote communities and widening consumer choice (ATAG, 2005). Moreover, air services play an essential role in humanitarian assistance to countries facing natural disasters, famine and war – through cargo deliveries, refugee transfers or the evacuation of people trapped by natural disasters. Humanitarian assistance in such circumstances can only be delivered rapidly to those in need through the use of airports and air services. In certain circumstances when even the airports are damaged, 'air drops' are among the first response of aid agencies to stem a humanitarian crisis. Air transport also plays a vital role in the rapid delivery of medical supplies and organs for transplantation worldwide (ATAG 2015).

2.2 Empirical Literature

There are prior studies conducted in different countries which are associated to the air transport sector. In order to display the research gap and justify the significance of this study the following section presents review of the empirical evidence that have examined air transport expenditure.

Mariya (2009) conducted a study on the interaction between the air transportation and economic activities/sectors in World-wide perspective among 139 countries. To develop feedback model and describe and identify which sectors stimulate air transportation development he used an explanatory research method. His finding showed

the government intervention on economy has a stimulating role in changing air transport system development and impact on economic activities.

Shairil and Remail (2017), conducted a country specific study on the contribution of passengers' movement on economic growth in Malaysia. They used co - integration model and Granger Causality on time series data spanning from 1990 to 2015 in order to analysis the relation between the air transportation passengers' movement and economic growth, proxy by per capita income. Their finding showed that there is causal relation between passengers' movement handled by Malaysia airlines airport and economic growth .There is vice- versa causality between passengers' movement through air transportation and economic growth. The variables passenger movement and air transport expenditure do not have the same effect on the economic growth. Based on VAR model result, there exist the long run association between the air passengers' movement and economic growth.

The study by Ladan (2012) focused on the analysis air transportation in Nigeria and identification of factors militating against the efficiency of the aviation system. He used four years (2000 - 2004) data on arriving passengers, loaded freight and arriving aircraft solicited from the air transport sector of the country. By using descriptive analysis approach, he obtained and concluded that absence of a coherent air transport policy, bad management, decaying aviation facilities, loose security, closure of airports, and intermittent air crashes were the main factors that influence the efficiency of air transport sector in Nigeria.

Using the same approach, Nwaogbe et al (2013), also examined the impact of Air transport sector development on economic growth of Nigeria. The objective of their study was examining the impact of air transport to economic development by including income, international trade and social opportunity in Nigeria. Their finding showed that the air transport in Nigeria helped in stimulating economic growth and poverty alleviation program of the country by providing employment opportunities, and increasing taxes revenue collected from the aviation's services (passengers and cargo freight transportation), its employees, international trade, and supply chain. The employment opportunities were generated through supply chain transformation from the airports.

Compared to Ladan (2012) and Nwaogbe et al (2013), a rigorous study that examined the relationship between air transport sector development and economic growth in Nigeria was conducted by Alexander (2015) using a series of econometrics models including dynamic ordinary regression equation, co-integration, error correction model and granger causality techniques. His analyses suggested the existence of long-run equilibrium relationship with positive influence of air transport sector development on economic growth, and a unidirectional causal relations running from air transport to economic growth. The diagnostic test for normality of the model showed that the model functional form is adequate, stable with no serial correlation.

Dargay and Hanly (2011) investigated factors that affect international air transport demand to and from UK using pooled time-series cross-section approach (panel data) with fixed effects panel model specification, which allows them to have country specific effects. They prefer to use pooled time-series cross section approach because of the limited number of observations for time-series model. The explanatory variables included in the fixed effects panel model to investigate the factors that affect air transport demand to and from UK were income of individuals, airfares, foreign trade, exchange rates, and domestic price levels of alternative mode of transport. The Panel method was used for UK residents' leisure trips/ business trips to 20 countries and non-UK residents' leisure/business trips to and from the UK. Finally, the results indicate that while airfares affect passengers demand for international air transport negatively, individual income exerted positive effect on the UK air transport market/demand. Moreover, the income elasticity of UK international air travellers for leisure purpose was determined to be 0.43 in the short-run and 1.05 in the long-run, which implies that one unit change in individual income drives the number of international air travel to increase by 0.43 and 1.05 units, respectively.

Aunurrofik (2018) conducted a study on the effect of air transportation on regional economic development in Indonesia and developing country using regional level cross-section dataset and multiple regression analysis. His findings implied that the number of flights, air passengers, and cargo freights have positive and statistically significant impact on regional per capita income growth. However, the effect of air cargo freights was the strongest, implying that airports will have more substantial impact on regional economic growth if the air transportations are intended to stimulate trade and business activities.

A study conducted by Tsai (2012) focused on the impact of financial risk factors, including interest rate exposures, currency fluctuations, and fuel price changes on the airline industry in South Africa. It inspected risk exposures in the South African airline industry and uses data on South African Airways and Comair (Comair Limited Airline in South Africa that operate scheduled service) to calculate the effect of risk factors on exposure significance. Based on the financial ratio analysis of the airline characteristics, the results indicate that South African Airways shows better return on investment (ROI) better than Comair. Particularly, the South African Airways show progress in performance with an increase in revenues and stable cost bases, despites the unexpected increase in fuel and oil prices in dollar by 42 percent contributed to a large increase in returns.

Eric (2013) conducted study on air transport and destination performance in the case of three African counties (Ethiopia, Kenya and South Africa) and investigated the relationship between the air transport and tourism growth in those countries using both combination of literature review and case study analysis .On the basis of their findings, they concluded that an efficient air transport can act as a facilitator in the development of more diversified export-based industries away from over-reliance on natural resources, which in the presence of linkages with other domestic economic sectors can act as a stimulus for broadly based growth.

Tewodros (2016) conducted a study on the long-run and short-run used the ECM effects of government expenditure on road transport infrastructure on economic growth in Ethiopia. In order to realize the objective of the study, he applied both descriptive analysis and econometric model, mainly the Johansson co-integration method and used data the period from 1975 to 2015. The variables included in the model were disaggregated government expenditure on road transport infrastructure, human capital, defence, agriculture, and culture and sport along with economic growth variable (proxy by GDP) his finding indicates that, government expenditure on road transport infrastructure has positive and statistically significant effect on economic growth while expenditure on culture and sport has negative and significant impact on economic growth in Ethiopia in long run .Whereas agricultures and transport has significant positive effect on economic growth

while government expenditure on defence ,human capital ,culture and sport are insignificant effect on economic growth in short run.

The study conducted by Deribe (2016) emphasised on the profitability in the airlines industry (proxy by return on equity-RoE on Ethiopian airline and major subsaharan African airlines. To this end the study used a sample of top 20 world airlines by taking data from 2010 to 2014. Accordingly, the study selected explanatory variable as net profit margin, total asset turnover and efficiency, leverage ratio and their effect on airlines profitability. The finding of the study revealed that there was positive and statistically significant relationship between return on equity (a proxy to airline's profitability) and net profit margin, and leverage ratio both for the profitable and non-profitable airlines, while efficiency proxy by total asset turn over affected negatively profitability for non-profitable airlines.

May be the first study in Ethiopia related to air transportation was the one conducted by Eyob (2001). He examined factors that affect the demand for domestic air transportation in Ethiopia using Johansen Maximum Likelihood estimation procedure. The results indicated that airfare, individual's income, and access to alternative means of transport had positive and statistically significant effect on the demand for domestic air transport by passengers.

Using different data set and methodology to that of Eyob, Amanuel (2016) also investigated the determinants of Domestic air transport demand in Ethiopia for the period 2000/01-2013/14. He employed Autoregressive Distributed Lag (ARDL) Approach to Co-integration and Error Correction Model in order to investigate the long-run and short-run relationship between the number of domestic passengers travelled by the EAL and its determinants. His finding using Bounds test shows that there was stable long-run relationship between the dependent variable (i.e., number of domestic air transport passengers) and explanatory variables included in the model (households income, airfare, price of competing services (Buses), road length, and population). Moreover, the empirical results revealed that households income, price of competing services, and population were found to have strong positive and statistically significant impact on the demand for domestic air transport in the long-run whereas airfare had adverse effect. Hence, he

concluded based on his finding that the demand for demand air transport can be improved significantly when the price of competing service, population and individual's income increase and airfare decreases. In short run the income, price of competing services and population are found to have positive and significant impact on the domestic air transport. The coefficient of error correction term was -0.62 suggesting about 62 percent annual adjustment towards long run equilibrium.

Another study in the case of Ethiopian Airlines (EAL) is the one conducted by Elabeth (2018) on the financial risk management practices of Ethiopian Airlines (EAL) using descriptive analysis. In this study she analysed the financial risk management practices of the airlines by incorporating variables such as fuel price risk, foreign exchange risk, and interest rate risk as determinants. Based on her finding that the limited use, or non-availability of financial derivatives as a major tool for financial risk management an indication that the Airline is vulnerable to any fuel and oil cost, interest rate, and currency volatility.

More recently, Abaynew (2019) conducted a study on the effect of leverage ratio (proxy by Debt/equity ratio) on airlines profitability of seven selected African Airlines (which are, Ethiopian Airlines, South African Airways, Kenya Airways, Air Mauritius, Comair, Air Seychelles, and South Africa Express). Accordingly, secondary data were collected from audited annual reports of selected airlines for the period 2008 to 2017 and analysed through fixed effect panel regression model. His finding indicated that airlines degree of operating leverage ratio has positive and statistically significant effect on profitability (ROA). However, airlines degree of financial leverage ratio, operating efficiency, size of airlines, and exchange rate have negative and statistical significant effect on the selected airlines profitability (ROA).

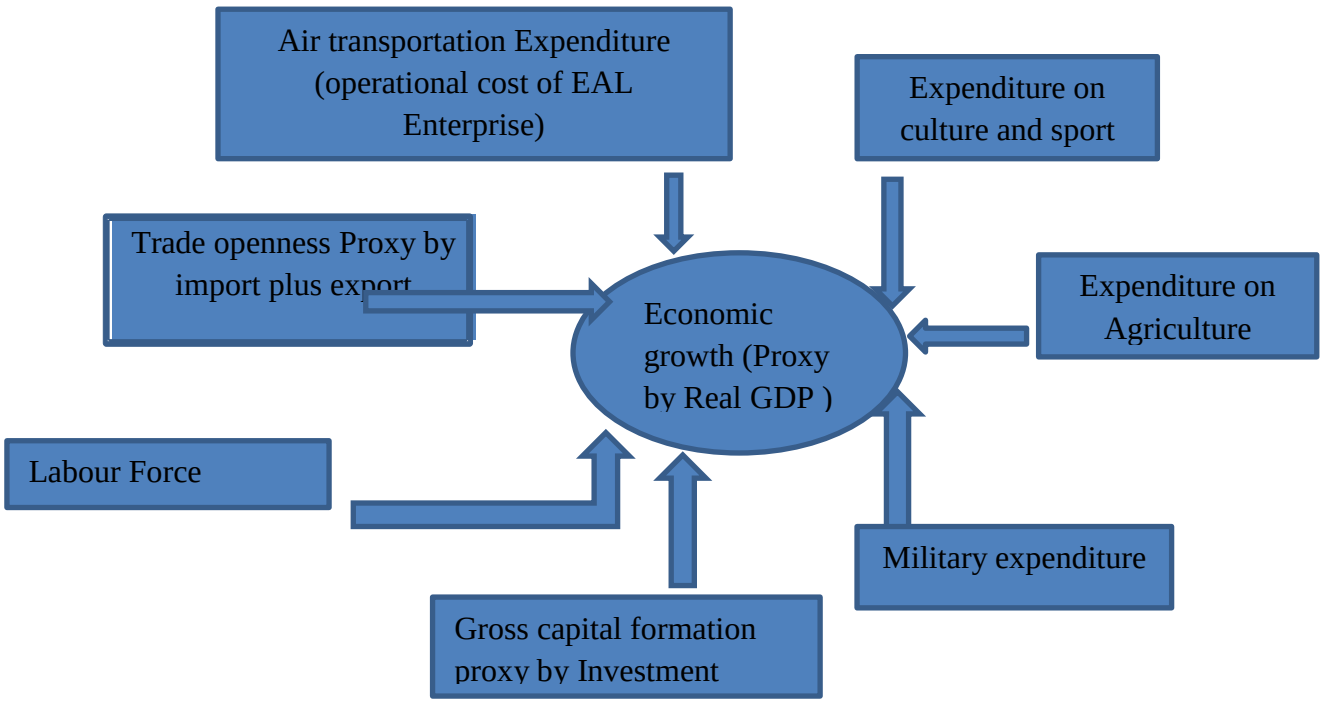
Thus, different prior study were conducted by the different researcher on the title related with air transport sector in Ethiopia but none of them have not incorporate the variable air transport expenditure on their studies. As discussed in the preceding sections of this paper, lack of research studies on the relation between air transport expenditure and economic growth were inspired the researcher to conduct this study. Therefore, as far as the knowledge of the researcher concerned, there are no studies that

have been conducted on the issue of the air transport expenditure and economic growth and this study attempt to fill the research gaps.

2.3 Conceptual Framework

A conceptual framework is a diagram which existent the research's main point by showing the relationship between the dependent and explanatory variables. According to the Keynesian macroeconomic public spending can contribute positively to economic growth. Thus, an upsurge in the government expenditure, particularly capital expenditure, is likely to increase in employment opportunity, performance, efficiency, and profitability of economic sectors, and reinvestment through multiplier effects on aggregate demand. Accordingly, the expenditure on air transport is investment endeavours that can increases and improve the overall operation of the sector which in turn stimulates the economic growth of the countries. As noted by Hakan, et.al, (2014), the air transport is an important vehicle in the economic and social integration of countries and an important indicator of quality of life. Thus, the study compiled the following (Figure 1.) conceptual framework based on theoretical and empirical literature reviewed in the preceding sections of this chapter.

Figure 1 Conceptual Framework



Source, Own Construction, 2020

CHAPTER THREE

RESEARCH METHODOLOGY

In this chapter, the type of data and sources, model specification and the estimation techniques used in the current study are presented. The main objective of this chapter is to outline this empirical framework employed so as to achieve the specific objectives of the study. This study adopts descriptive statistics and econometric methods to achieve the objectives of the study. The descriptive statistics is used mainly to analyse the trend of economic growth, expenses of air transport, labour force, capital stock, trade openness, and disaggregated government expenditure in three sectors – Agriculture, defence/military, and culture and sport expenditure between 1986/87 and 2018/19 based on availability of data.

Moreover, the study used the Autoregressive distributed lag Model (ARDL) shall predict the cumulative effects taking into account the dynamic response between air transportation expenditure and other examined variables in the model and Granger casualty test to examine the relationship between air transportation expenditure and economic growth and direction of causality between them in Ethiopia.

The chapter is divided into six sections. In section 3.1, the study is described and in section 3.2 the data used in this study and the sources of data are presented. Section 3.3 illustrates the descriptive statistics used to convert variables into growth rate techniques for the trend. Section 3.4 deals with the empirical model specification of the multivariate vector autoregressive (VAR) growth Model. Section 3.5 presents the techniques or procedures used in the estimation of the long-run and short-run dynamic growth model. Finally, section 3.6 describes the bivariate Granger-causality model used for identifying the direction of causality between air transportation expenditure and economic growth

3.1 Data type and source

The data used in this study are annual covering the period from 1986/87 to 2018/19 for Ethiopia regarding 2010/11E.C as a base year[1]. The data were sourced from the Ministry of

[1] *Fiscal year in Ethiopia begins July 1 and ends June 30*

Finance and Economic Cooperation (MoFEC), National Bank of Ethiopia (NBE), World Bank's World Development Indicators (WDI), and Ethiopian Airlines Enterprise (EAE).

The relevant economic growth variable is RGDP and the data for RGDP and labour force were obtained from Ministry of Finance and Economic Cooperation-MoFEC (2019) and WDI (2019), respectively. Due to absence of readymade physical capital stock data for Ethiopia, as in other African countries, net capital formation (investment) was used as its proxy, which was computed from gross capital formation obtained from MoFEC (2019). Moreover, disaggregated government expenditure figures (on agriculture, defence, and culture and sport were) and international trade variables data (exports and imports) were sources from MoFEC (2019) and NBE (2019), respectively. Except, labour force data, the value of all other variables are expressed in Ethiopian Birr.

3.2 Descriptive Statistics

This study used descriptive analysis to measure, describe and analyse the trend of variables included in the growth model for Ethiopia over the study period. The growth rates used for trend analysis were calculated from raw data of six variables and from their proxy for capital stock and trade openness variables. Hence, prior to calculating the growth rates, the two proxy variables were constructed as follows:

3.3 Method of Data Analysis

In this paper, the researcher used both descriptive and econometric methods to analyse the data collected from the respective organization. The descriptive statistics like graph, means and standard deviations. The econometric model employed such as Augmented Dickey-Fuller technique in testing the unit root property of the series (stationarity of variables), Granger causality test to check direction of causality among dependent and independent variables and other diagnostic test to check the feasibility of result of variable achieved by model. In this study Auto Regressive Distributive Lag (ARDL) model to bound test was employed to analysis the long-run growth model and Error Correction Model (ECM) for short run relation. The data was analysed using Eviews 10 version software.

3.4 Model specification

A number of recent studies have used endogenous growth theory to show the relationship between air transportation expenditure and economic growth. The general idea consists of assuming that expenditure on air transportation is a measure of investment on air transport infrastructure that develops the capacity and enhance the ability of aviation enterprise system to provide efficient transportation services, which in the context of endogenous model, implies higher long-run investment-led economic growth. These theoretical predictions were confirmed by large body of empirical evidence (Nurudeen and Usman, 2010), Thus, the multivariate co-integration and error correction models established by the work of (Makdad et al., 2014; Tewodros, 2016; and Naol, 2019 was considered for empirical analysis of the relationship between air transportation expenditure and economic growth in Ethiopia.

The capital stock series was constructed from gross capital formation using the perpetual inventory assumption with depreciation rate set equal to 5% of deducting from gross capital formation of each year as suggested by Wang and Yao (2003) and Barro and Sala-I-Marti (2004). That is,

$$k_t = \left(K_t - K_t 0.05\right)$$

Where, $k_t =$ is net capital formation, a proxy for capital stock, in current year (or t)

$K_t =$ is gross capital formation in the current year (or t)

$K_t 0.05 =$ is 5% of gross capital formation in the current year (or t)

Moreover, prior to computation of growth rate trade openness was measured as the sum total of exports and imports of goods and services .That is,

$$TOP_t = (X_t + M_t)$$

Where, $TOP_t =$ is the measure of trade openness variable in the current year (or t)

$X_t =$ is the value of exports and imports of goods and services in the current year (or t)

$M_t =$ is the value of imports and imports of goods and services in the current year (or t)

Finally, for all variables, whether raw or proxy data is used, the growth rate of a variable was computed for trend analysis using equation (3.1) below

$$gz_t = \left(\frac{z_t - z_{t-1}}{z_{t-1}} \right) * 100 \quad \text{---------- (3.1)}$$

Where, $z_t =$ is the value of a variable of interest in current year (or t)

$z_{t-1} =$ is the value of a variable of interest in the previous year(or $t-1$)

$gz_t =$ growth rate of a variable of interest from the previous year ($t-1$) to this year (t)

The objective of growth accounting is to decompose the economic growth rate of a country into contributions from different factors. Specific assumptions need to be made at the beginning, which provide a framework, a perspective from which economic data can be interpreted. In the most basic version of growth accounting, this perspective using t to denote time period (years) is provided by an aggregate Cobb-Douglas (C-D) production function:

$$Yt = At(K)^{\alpha} L^{1-\delta} ATEX^{1-\alpha-\delta} \quad \text{---------- (3.2)}$$

The aggregate production function links real output (GDP) Y_t in period t to two factors of production, the gross capital formation K_t and the size of the labour force L_t , as well as to total factor productivity (TFP) A_t .Whereas α and δ is a parameter showing the share of inputs in the production function[2]. Taking log transformation of equation (3.2) and denoting logs of real GDP, capital stock, and labour force yields.

$$\ln Y_t = \alpha \ln K_t + \delta \ln A_t L_t + (1-\alpha-\delta) ATEX_t \quad \text{---------- (3.3)}$$

Literature on air transport and economic growth relationship indicates that expenditure on air transport infrastructure can influence economic growth through its direct, indirect, and induced effects. That is, the aviation system play a role in the growth process because it integral to funding for infrastructure/capital accumulation and for the diffusion of new technologies that enhance the provision of efficient transport services.

[2] *Growth accounting can also be carried out if the underlying data come in per worker terms. In this case, the strategy is to transform the production function (3.2) into a per-worker production function by dividing by the labour force* L_t *on both sides:*

Assuming $\beta_1 = \alpha$, $\beta_2 = \delta$ and $\beta_3 = 1 - \alpha - \delta$

$$Yt = \beta 0 + \beta 1 Lt + \beta 2 Kt + \beta 3 ATEXt + ... + et \text{ ---------- (3.4)}$$

Rearranging for the order of the variables yields the following log-log estimable growth equation that capture the relationship between air transportation and economic growth as in Makdad et al., (2014), Naol (2019) and Tewodros (2016).

$$\ln Yt = \beta_0 + \beta_1 \ln L + \beta_2 \ln K + \beta_3 ATEX_t + \beta_4 \ln AGEX_t + \beta_5 \ln CSEX_t + \beta_6 \ln MEX_t + \beta_7 \ln TOP_t + e_t \text{ ---- (3.5)}$$

Where $\ln ATEX_t, \ln AGEX_t, \ln CSEX_t, \ln MEX_t,$ and $\ln TOP_t$ are the natural logarithm of air transportation expenditure, government expenditure (the sum of both recurrent and capital expenditure) on agriculture, culture and sport, and military, and trade openness (the sum of exports and imports), and random error term, respectively.

The eight variables used in the growth model (3.5) are describes as follows

Real GDP (RGDP):-Real Gross Domestic Product is a macroeconomic measure of the value of economic output adjusted for price variations (i.e., inflation or deflation). Most studies conducted on the relationship between any variable and economic growth used RGDP as a proxy of economic growth (Koch et al., 2005). Hence, this study also used RGDP, a proxy to economic growth, as a dependent variable

Labour Force ($\ln L_t$**):** Theoretically, labour force is considered as one of the major inputs or engine for sustainable rate of economic expansion of a country, particularly in labour intensive economies like Ethiopia. The International Labour Organization (ILO) defined labour force as the number of economically active population; that is people between the age of 15 and 59. However, the appropriateness of using labour force in growth models is an issue of controversy among scholars. Those against it, argue that the use total labour force in growth models in countries where their economy fails to create jobs equal to the growth rate of is labour force is inappropriate and suggested for the use of the number of people actually working instead (Bilal, 2014). It is obvious in Ethiopia that, the economy doesn't create jobs proportional to the growth rate of is labour force or economically active population, due to deficiency of aggregate demand, which leads to high unemployment, particularly in urban areas (about 19.1% urban unemployment, IMF, 2018). In this context, the use of the number of people actually working would have been appropriate than using

the total labour force in our growth model. Nevertheless, data on the total number of people actually working in Ethiopia is unavailable from domestic and international sources. In the absence of data on actual working force from any sources, Barro (2000) suggested to use the number of labour force in regression analysis.

Contrary to the ILO definition of labour force, however, the Central Statistics Authority (CSA) (various issues) and Ethiopia Demographic and Health Survey-HDS (2006 and 2016) indicated that most children between the age of 10 and 14 and old age people between the age of 60 and 64 also contribute to household labour like that of economically active or labour force population in Ethiopia. According to these surveys, those children between the age of 10 to 14, particularly in rural areas, contribute to family labour by working as shepherd, fetching water, taking care of younger brothers and sisters, and performing other house works while an overwhelming majority of old age people between the age of 60 and 64 engaged in agricultural sector, the most important source of employment for about 89% of rural population.

Hence, both the absence of data on the total number of people actually working and the engagement of children between the age of 10 and 14 and old age people between the age of 60 and 64 on family labour in Ethiopia, which can offset to some extent the number of unemployed within the economically active or labour force convince us to use labour force data in this study, as suggested by Barro (2000).

Therefore, following the widely accepted theoretical argument that labour force is an engine of growth and empirical findings that confirm the positive effect of labour force participation on economic growth positively (e.g., Bilal, 2014), labour force is expected to have positive impact on economic growth in Ethiopia. In other words, the expected sign of labour force in equation (3.5) is positive (i.e. $\beta_2 > 0$).

Net Capital Formation or stoke of capital ($\ln k_t$): It is indicated earlier in section (3.2) that this series was constructed from gross capital formation. Increase in capital stock overtime implies increase in investment or capital accumulation. Its effect on growth and development depends on investment spending, which intern is affected by the level of domestic saving in the economy. It follows from economic literature that domestic capital

accumulation will have positive impact on TFP and hence on and rapid and sustainable economic growth in the long run (Olawale, 2010). Hence, the expected sign of net capital accumulation or stock of capital on economic growth is positive (i.e. $\beta_2 > 0$).

Air transport Expenditures ($\ln ATEX_t$): -It is an important factor in the economic and social integration and indicator of quality of life. Improved access to international and domestic markets air transport links are regarded as "absolutely essential" to businesses making location decisions (Hakan et.al, 2014). Their study used expenditure on air transport sector proxy by operational expenditure incurred for maintenance, promotional expense, sales expense, etc. and found that higher expenditure on air transport improves the air transportation system more suitable. The expected sign for this variable to be positive implying air transport expenditure causes economic growth of country.

In the case of Ethiopia, the air transport operational expenses also indicate the importance of the role played by the EAL in the mobility of passengers and goods globally, which makes it the largest and fastest growing African airline in all major parameters for many years. The underlying assumption is that investment in air transportation infrastructure enhances the capacity, competitiveness, dependability, and efficiency of the sector globally thereby affecting the productive sector of the national economy significantly. It is also argued that improved quality of investment emanating from strategic evaluation of project viability is more significant for the aviation industry (Elabeth, 2018).Thus, the expected sign of Air transport expense in equation (3.5) is positive (i.e. $\beta_3 > 0$).

Expenditure on Agriculture ($\ln AGEX_t$): Agriculture is the backbone of Ethiopian economy. That is, agriculture play a crucial role in the economy like other developing countries, and it is the main source of food, income and employment for the rural population (Asain, 2012). Expenditure on agriculture in broad sense compromises the entire range of agricultural technology related production of plants and animals including crop production, soil cultivation and livestock (Yasin, 2014). Accordingly, government expenditure agricultural sector is expected to affect economic growth of Ethiopia positively (i.e. $\beta_4 > 0$).

.

Expenditure on Culture and Sport ($\ln CSEX_t$): Culture provide considerable consumer welfare and social benefits by increasing understanding of different cultures and nationalities which facilitates closer international integration; improving living standards by broadening choice. The government allocation of the resource to cultural aspects has a significant impact on the GDP (UNCTD, 2013).

On the other hand, the commercial sports and entertainment sectors nowadays are very much closer than ever before and one complements the other. Sports economics is playing more important role in our lives, which is associated with tickets, media rights, merchandising and sponsorship (Ieva and Liga ,2017). North America is ahead of the other countries in terms of having the world's largest sports market and it suggests that the role of sport will continue to grow and that sport not only contributes to better health, people's socializing and belonging to the particular team, but it also makes a significant contribution to the regional or national economics (Siegfried an Zimbalist 2016). Therefore, we expect the combined effect of expenditure on culture and sport to have positive effect on economic growth in Ethiopia (i.e., $\beta_5 > 0$).

Military expenditure ($\ln MEX_t$): This include the sum of recurrent and capital expenditure that the government spent on general government, internal order and national defence, justice, public order and security, and others related to it. The effect of military expenditure on economic growth is has been an issue of discussion and debate for long among economists. Some argue that, since these services are non-productive, they discourage the economic growth of a given country (Dunne, 2010). On the other hand, Barro (2000) found positive and statistically significant impact of military expenditure on economic growth for developed countries and argued that being a means to defence national sovereignty from foreign aggression and a means to ensure domestic law and order. Hence, we the expected sign of military expenditure in Ethiopia are indeterminate or ambiguous. That is, either $\beta_6 > 0$ or can be $\beta_6 < 0$.

Trade Openness ($\ln TOP_t$): Merliz (2003) posit that by opening up to international trade market share would be reallocate to the most productive as less productive one are forced to exit. Tybout (2001) looked at plant efficiency and shows that trade openness increases the competition from international trade, which in turn causes that market plant to expand

and intra plant efficiency to improve economic growth. Openness to trade lead to the adoption of institutions that protect property right, which crucial to the creation of the sustainable economy with faster growth. Moreover, trade openness is expected to raise productivity through increased competition and transmission of technology from the rest of the world (Levine and Zervos, 1998).

On the contrary, few theoretical and empirical studies stated that trade openness hinders economic growth. For instance, Batra and Slottje (1993) indicate that trade openness was associated with an increase in poverty, which is against the theory. Kind (2002) merged the new trade theory and endogenous growth models, and argued that there are ambiguous effects of trade liberalization on economic growth among countries due to difference in size of their home markets. According to him, especially trade liberalization in low purchasing power countries can reduce their economic growth as compared to high purchasing power countries. And also openness to trade has negative effect on growth in countries with low financial development but in countries with well-developed financial sector and lower inflation rated countries trade openness is conducive for economic growth (Hye.et.al 2016). The trade openness in developing countries which have poor quality of institution lead to weak exporting capacity, resulted negative economic growth (Deme 2015). In this study trade openness is expected sign to be either positive or negative. That is, either $\beta_7 > 0$ or can be $\beta_7 < 0$

Table 1 Summary of Explanatory variables expected sign

Variable	**Description**	**Expected Sign**
$\ln L_t$	Labor force	Positive
$\ln k_t$	Net Capital Formation	Positive
$\ln ATEX_t$	Air transport Expenditure	Positive
$\ln AGEX_t$	Expenditure on Agriculture	Positive
$\ln CSEX_t$	Expenditure on culture and sport	Positive

$\ln MEX_t$	Militarily expenditure	Indeterminate or ambiguous
$\ln TOP_t$	Trade openness	Indeterminate or ambiguous

3.5 Estimation technique

This section deals with the estimation procedures followed sequentially in this study in order to estimate the co integration (equation 3.5). Sub section 3.6.1 defines stationary and non stationarity and outlines the procedures for the estimation of unit root of the variables in the growth and domestic capital models. On the other hand, sub section 3.6.2 defines co-integration, discusses the different methods of co-integration, and provides justification for choosing the co-integration Auto Regressive Distributive Lag (ARDL) model in this study. Since the long-run equilibrium, the procedure for short-run dynamics of the variables under consideration is presented under sub-section 3.6.3. Finally, the Granger casualty test aiming at examining the direction of causation between Air transport expenditure and economic growth is presented in section 3.6.4.

3.6.1. Stationarity Test

Recent development in econometrics has shown that there are problems associated with time series analysis due to non stationarity (Gujarati, 1995)[3]. Empirical research in economics is based on time series has two central properties – the series are either non stationarity or stationarity (Wei, 2006).

Non stationarity is a property common to many applied time series. This means that a variable has no clear tendency to return to a constant value or linear trend and hence follow stochastic trends. With regards to stationary time series data, Harris (1995:15) noted that "… a data series is said to be stationary if its error term has zero mean, constant variance, and the covariance between any two-time periods depends only on the distance or lag between the two periods and not on the actual time at which it is computed." One major

[3] *The problem associated with non-stationary series is that all conventional techniques and statistical tests are spurious. Spurious in a sense the regression estimation will yield high R^2, statistically significant coefficients, and low Durbin-Watson'd' statistics (Gujarati, 1995:724).*

objective of empirical research in economics is thus to test hypotheses for the unit root the variables and estimate relationships derived from economic theory, among other such aggregated variables (Pfaff, 2006).

The classical statistical methods used in building and testing large simultaneous equation models, such as Ordinary Least Squares (OLS), were based on the assumption that the variables involved are stationary. The problem is that the statistical inference associated with stationary processes is no longer valid if time series are a realisation of non-stationary processes. If time series are non-stationary it is not possible to use OLS to estimate their long-run linear relationships because it would lead to spurious regression.

However, this is no longer the case because the technique of cointegration has been introduced according to which models containing non stationary stochastic variables can be constructed in such a way that the results are both statistically and economically meaningful (Gujarati, 1995). Hence, prior to the estimation of the long run model(s) the time series properties of the variables concerned should be distinguished between stationary and non-stationary variables.

3.6.1.1 Unit root

Any sequence that contains one or more characteristic roots that are equal to one is called a unit root process. The simplest model that may contain a unit root is the AR (1) model. Consider the autoregressive process of order one, AR (1), below:

$$Y_t = \phi Y_{t-1} + \varepsilon_t \quad \text{---------- (3.6)}$$

Where ε_t denotes a serially uncorrected white noise error term with a mean of zero and a constant variance. If $\phi = 1$, equation 3.6 becomes a random walk without drift model, that is, a nonstationary process. When this happens, we face what is known as the unit root problem. This means that we are faced with a situation of nonstationarity in the series. If, however, $\phi < 1$, then the series Y_t is stationary. The stationarity of the series is important because correlation could persist in nonstationary time series even if the sample is very large and may result in what is called spurious (or nonsense) regression (Gujarati, 1995). The unit root problem can be solved, or stationarity can be achieved, by differencing the data set (Wei, 2006).

3.6.1.2. The augmented Dickey-Fuller (ADF) test

The basic idea behind the ADF unit root test for nonstationarity is to simply regress Y_t on its (one period) lagged value Y_{t-1} and find out if the estimated ϕ is statistically equal to 1 or not. Equation 3.6 can be manipulated by subtracting Y_{t-1} from both sides to obtain

$$Y_t - Y_{t-1} = (\delta - 1)Y_{t-1} + \varepsilon_t \quad \text{---------- (3.7a)}$$

which can be written as

$$\Delta Y_t = \varpi Y_{t-1} + \varepsilon_t \quad \text{---------- (3.7b)}$$

where $\varpi = (\delta - 1)$, and Δ is the first difference operator.

In practice, instead of estimating equation 3.6, we shall estimate equation 3.7b and test for the null hypothesis of $\varpi = 0$ against the alternative of $\varpi \neq 0$. If $\varpi = 0$, then $\phi = 1$, meaning that we have a unit root problem and the series under consideration is non-stationary. The decision to reject or not to reject the null hypothesis of $\varpi = 0$ is based on the Dickey-Fuller (DF) critical values of the τ (tau) statistic. In practice, the DF test is based on an assumption that the errors of term ε_t are correlated.

To solve this problem, Dickey and Fuller have developed a test known as the Augmented Dickey-Fuller (ADF) test. In the ADF test, the lags of the first difference are included in the regression equation in order to make the error term ε_t white noise and, therefore, the regression equation is presented in the following form:

$$\Delta Y_t = \varpi Y_{t-1} + \alpha_i \sum_{i=1}^{m} \Delta Y_{t-1} + \varepsilon_t \quad \text{---------- (3.8)}$$

To be more specific, the intercept may be included, as well as a time trend t, after which the model becomes

$$\Delta Y_t = \alpha + \beta t + \delta Y_{t-1} + \alpha_i \sum_{j=1}^{p} \varpi_j \Delta Y_{t-j} + \varepsilon_{it} \quad \text{---------- (3.9)}$$

Where α is a constant, β the coefficient on a time trend series, δ the coefficient of Y_{t-1}. The ADF test can be tested on at least three possible models:

(i) A pure random walk without a drift. This is defined by using the constraint $\alpha = 0, \beta = 0, \& \delta = 0$ in equation 3.9. This leads to the equation

$$\Delta y_t = \Delta y_{t-1} + \varepsilon_t \text{ ---------- (3.10a)}$$

Equation 3.7b is a nonstationary series because its variance grows with time (Pfaff, 2006).

(ii) A random walk with a drift. This is obtained by imposing the constraint $\beta = 0, \& \delta = 0$ in equation 3.8, which yields to the equation

$$\Delta y_t = \alpha + \Delta y_{t-1} + \varepsilon_{it} \text{ ---------- (3.10b)}$$

(iii) A deterministic trend with a drift. For $\beta \neq 0$, equation 3.9 becomes the following deterministic trend with a drift model

$$\Delta y_t = \alpha + \beta t + \Delta y_{t-1} + \varepsilon_{it} \text{ ---------- (3.10c)}$$

Therefore, the discussion above entails that the pre-requisite of cointegration test is the stationarity of each individual time series over the sample period. Ever since the seminal paper by Engle and Granger (1987), cointegration analysis has increasingly become the favored methodological approach for analysing time series data containing stochastic trends. Hence, before turning to the analysis of the long-run relationships between the variables the unit root properties of the single series is checked, as non-stationary behavior is a prerequisite for including them in the cointegration analysis. The hypotheses for unit root or non stationarity are:

$H_0 : \alpha_2 = 0$, i.e., there is a unit root – the time series is non-stationary.

$H_1 : \alpha_2 \neq 0$, i.e., there is no unit root – the time series is stationary.

If the calculated ADF test statistic is higher than McKinnon's critical values, then the null hypothesis (H_0) is accepted this means that a unit root exists in Y_{t-1} and ΔY_{t-1}, implying that the series are non-stationary or not integrated of order zero, i.e., I(0). Alternatively, the rejection of the null hypothesis implies stationarity of the underlying time series. Failure to reject the null hypothesis leads to conducting the test on the difference of the time series, so further differencing is conducted until stationarity is achieved and the null hypothesis is rejected (Harris, 1995).

Hence, in order to determine the order of integration of a particular series, equation (3.10a) has to be modified to include second differences on lagged first and k lags of second differences. This is as follows:

$$\Delta^2 Y_t = \psi_1 \Delta Y_{t-1} + \sum_{i=1}^{p} \theta_i \Delta^2 Y_{t-i} + \xi_t \text{ ---------- (3.11)}$$

In this case, the hypotheses to be tested are:

$H_0 = \psi_1 = 0$, i.e., there is a unit root – the time series is non-stationary.

$H_1 = \psi_1 \neq 0$, i.e., there is no unit root – the time series is stationary.

If the time series are stationary in their first differences(that is $\psi_1 \neq 0$), then they can be said integrated of order one, i.e., I (1); if stationary in their second differences, then they are integrated of order two, i.e., I(2). The order of integration of the variables in equations (3.10a) and (3.10b) is investigated using the standard Augmented-Dickey-Fuller (ADF) [Dickey and Fuller, 1981] unit-root tests for the presence of unit roots.

An important aspect of empirical research based on cointegration is the choice of the lag order, since all inference in the model depends on the correct model specification. Hence, the optimal lags required in the cointegration test were chosen using the most common traditional information criteria being the Akaike Information Criteria (AIC), Schwarz Criterion (SC), Hannan and Quinn's (HQ) and the likelihood ratio (LR).

3.6.2. ARDL Cointegration Test

The necessary criterion for stationarity among non-stationary variables is called cointegration. Testing for cointegration is necessary step to check if our modelling empirically meaningful relationships (Gutierrez et.al, 2007). In other word, testing for cointegration implies testing for the existence of such a long-run relationship between economic variables. In economics, two variables are said cointegrated when they have long-term or equilibrium relationship between them (Engle and Granger, 1987).

The remedy for problematic regressions with integrated variables is to test for cointegration and then the error-correction model (VECM) to distinguish between short-run and long-run responses, since cointegration provides more powerful tools when the data sets are of limited length. This test can be done through the Engle-Granger procedure, the Johansen's cointegration procedure, Autoregressive Distributed Lag (ARDL) method of cointegration. This study employ ARDL model because the ARDL model enables us include stationary and non-stationary variables.

Then, the computed F statistic value is compared with the lower bound and upper bound critical values tabulated for different significant levels. That is, when the computed F-statistic is greater than the upper bound critical value, then the H_0 is rejected (the variables are co-integrated). If the F-statistic is below the lower bound critical value, then the H_0 cannot be rejected (there is no co-integration among the variables) (Nkoro and Uko, 2016). However, according to Narayan (2005), the existing critical values in Pesaran et al. (2001) cannot be applied for small sample sizes as they are based on large sample sizes. Hence, we need to use a set of critical values for small sample sizes, ranging from 30 to 80 observations, suggested by Narayan (2005).

The generalized ARDL (p,q) model can be shown as follows(Gujarati, 2004) .

$$Yt = C + Yt + \alpha_0 Yt + \ldots\ldots\ldots\ldots\alpha_p Y_{t-p} + \beta 0 X_t + \ldots \beta Xt - _q + Ut. \quad \text{---------- (3.12)}$$

Where, C, t and Ut are intercept, time trend and white noise error term respectively and Yt and Xt are stationary variables.

The above model is said ‘’autoregressive’’ since it includes *p* lags of dependent variable Yt At the same time it is also a “distributed lag” model because it includes ***q*** lags of explanatory variable Xt .

3.6.3. The error correction model (ECM)

Since the long run equilibrium (steady state) may rarely be observed the short run dynamics of the variables under consideration is considered. For this reason, an ECM is extended to the multivariate scenario by defining all the variables to be potentially endogenous.

The next step is thus to specify and estimate the short run including the error correction term to investigate dynamic behaviour of the model. The one period error correction term describes how the examined model is adjusting in each time period towards its long-run equilibrium state. The size of the error correction term indicates the speed of adjustment of any disequilibrium towards a long-run equilibrium state (Engle and Granger, 1987). For simplicity let us assume ARDL (1, 1).Then general form equation (13) will become:

$$Yt = \beta 0 Xt + \beta 1 Xt - 1 + Ut \quad \text{---------- (3.13)}$$

SubtractingY_{t-1} from both sides of the equation gives us:

$$\Delta Yt = \beta 0 Xt + \beta 1 Xt - 1 + (\rho - 1) Yt - 1 + Ut \text{ ---------- (3.14)}$$

By letting, $(\rho - 1) = \delta$, we can get the following equation:

$$Yt = \beta 0 Xt + \beta 1 Xt - 1 + \delta Yt - 1 + Ut \text{ ---------- (3.15)}$$

$\Delta Xt = Xt - Xt - 1$ Thus $Xt = \Delta Xt + Xt - 1$

Substituting Xt in to equation (3.14), we can write as:

$$\Delta Yt = \beta 0 \Delta Xt + \beta 0 Xt - 1 + \beta 1 Xt - 1 + \delta Yt - 1 + Ut$$

$$\Delta Yt = \beta 0 \Delta Xt + (\beta 0 + \beta 1) Xt - 1 + \delta Yt - 1 + Ut \text{ ---------- (3.16)}$$

Let $\phi = \beta 0 + \beta 1$ this gives:

$$\Delta Yt = \beta 0 Xt + \delta Yt - 1 + \phi Xt - 1 + Ut$$

$$\Delta Yt = \beta 0 X + \phi Xt - 1 + \delta Yt - 1 + Ut$$

$$\Delta Yt = \beta 0 \Delta Xt + [\phi Xt - 1 + \delta Yt - 1] + Ut \text{ ---------- (3.17)}$$

Multiplying the term $[\phi Xt - 1 + \delta Yt - 1]$ by δ / δ will give us:

$$\Delta Y = \beta 0 \Delta X + \delta [Yt - 1 + \phi / \delta Xt - 1] + Ut \text{ ---------- (3.18)}$$

Thus, the error correction model can be written as:

$$\Delta Yt = \beta 0 Xt + \delta [Yt - 1 - \alpha Xt - 1] + Ut \text{ ---------- (3.19)}$$

Where, $\alpha = -\vartheta / \delta = (\beta 0 + \beta 1) / \delta$ and $\delta = (\rho - 1)$

Therefore we can write the error correction model in the following form:

$$\Delta Y = \beta 0 Xt + (\rho - 1) + [Yt - 1 - (\beta 0 + \beta 1) / \delta * Xt - 1] + Ut$$

$$\Delta Y = \beta 0 Xt + \delta ECTt - 1 + Ut \text{ ---------- (3.20)}$$

Where, $\delta = \rho - 1$ is the error correction parameter that measures the speed of adjustment.

$[Yt - 1 - (\beta 0 + \beta 1) / \delta * Xt - 1] = ECTt - 1$ is error correction term lagged by one period.

Adding an intercept and time trend we can rewrite our ECM model in the following general form:

$$\Delta Yt = C + Yt + \beta 0 Xt + \delta ECTt - 1 + Ut \text{ ---------- (3.21)}$$

Therefore, following the ARDL approach proposed by Pesaran and Shin (1999) and Pesaran, Shin, and Smith (2001), the following model is specified in order to determine/test the long-run co-integration relationships between variables. The general ARDL real GDP growth equation is expressed as:

$$\Delta \ln Y_t = \alpha_0 + \lambda_1 \ln Y_{t-i} + \lambda_2 \ln L_{t-1} + \lambda_3 \ln k_{t-1} + \lambda_4 ATEX_{t-1} + \lambda_5 AGEX_{t-1} + \lambda_6 CSEX_{t-1} + \lambda_7 MEX_{t-1} + \lambda_8 \ln TOP_{t-1} + \beta_1 \sum_{i=1}^{n} \Delta \ln Y_{t-j} + \beta_2 \sum_{i=1}^{n} \ln L_{t-j} + \beta_3 \sum_{i=1}^{n} \Delta \ln k_{t-j} + \beta_4 \sum_{i=1}^{n} \Delta \ln ATEX_{t-j} + \beta_5 \sum_{i=1}^{n} \Delta \ln AGEX_{t-j} + \beta_6 \sum_{i=1}^{n} \Delta \ln CSEX_{t-j} + \beta_7 \sum_{i=1}^{n} \Delta \ln MEX_{t-j} + \beta_8 \sum_{j=1}^{n} \ln TOP_{t-j} + \gamma ECT_{t-1} + v_t \text{ ---- (3.22)}$$

*W*here Δ is the first difference operator, ECT_{t-1} is the error correction term lagged one period, γ is the short-run coefficient of the error correction term $(-1 < \gamma < 0)$, ε_t and v_t are the white noise terms of respective models.

3.6.4. The Granger casualty Test

In this sub-section the causality between air transport expenditure ($ATEX$) and economic growth in Ethiopia is tested using the Granger Causality test. The Granger procedure is selected because it consists the more powerful and simpler way of testing causal relationship (Granger, 1987). This test in the long-run framework formulates the null and alternative hypotheses as:

H_0 : No causal relation between air transport expenditure and real economic growth

H_1 : There is causal relationship between air transport expenditure and real economic growth

The above hypotheses are tested in the context of the VAR of the form:

$$\ln Y_t = \alpha_1 + \sum_{i=1}^{p} \beta_i \ln Y_{t-i} + \sum_{i=1}^{p} \delta_i \ln ATEX_{t-i} + \varepsilon_{1t} \text{ ---------- (3.23a)}$$

$$\ln ATEX_t = \alpha_2 + \sum_{i=1}^{p} \lambda_i \ln ATEX_{t-i} + \sum_{i=1}^{p} \psi_i \ln Y_{t-i} + \varepsilon_{2t} \text{ ---------- (3.23b)}$$

Where Y is the dependent and $ATEX$ (air transport expenditure) is the explanatory variable in log form and ε_t is the white noise error term in (3.23a) while $ATEX$ is the dependent and Y is the explanatory variable in (3.23b). Moreover, t is the sample size and p is the lag length of the unrestrictedmodel. According to Seddighi et. al (2000:310), there exists a unidirectional causality if only $\{\delta_{11}, \delta_{12}, ..., \delta_{1k}\} \neq 0$) and $\{\psi_{21}, \psi_{22}, ..., \psi_{2k}\} \neq 0$ in equation (3.23a) and (3.23b) and bi-directional causality if both $\{\delta_{11}, \delta_{12}, ..., \delta_{1k}\} \neq 0$ and $\{\psi_{21}, \psi_{22}, ..., \psi_{2k}\} \neq 0$ in the two equations, respectively. Similar formulation applied to examine the causal relation between other variables.

CHAPTER FOUR

RESULT AND DISCUSSION

4.1 Descriptive statistics

This section aims at analyzing the trend and growth rate of RGDP, expenditure (or investment) on air transport industry, and other explanatory variables included in the growth model using descriptive analysis techniques. This is to set the background for the empirical discussion of the impact of air transport expenditure on economic growth as well as the direction of causation between them in Ethiopia in section 4.2 and sub section 4.2.7, respectively. Accordingly, the following hypothesis is examined in this section:

Hypothesis 1: There is improvement in the trend of investment /expenditure in the air transport in Ethiopia

Sub section 4.1.1 presents the trend of RGDP growth (which is used as a proxy of economic growth in this study), which enable us to examine the size of economic growth in pre-reform (1986/87 – 1990/91) and reform periods (1991/92 – 2018/19), though disproportionate sample size. Section 4.1.4 discusses the trend of expenditure on air industry (proxy by operational expenses of the EAL) growth in Ethiopia, which is also an indicator of investment in Airline sector. Section 4.1.5 and 4.1.6, deals with analysis of how labour force, net capital accumulation, government expenditure on agriculture, culture and sports and defence, and trade openness grew during the study period (between 1986/87 and 2018/19) in Ethiopia respectively.

4.1.1 Economic growth in Ethiopia

Economic growth in Ethiopia has shown significant fluctuation not only between the Dergu regime (prior to 1991/92 and EPRDF regime (1991/92 – 2018/19) but also within a specific political regime. Change in government economic reform (from socialist to market economy) structure, which created problem in implementing economic and social policies of the previous regime was the main reason for disparity in economic growth between the two political regimes. However, being dependent on rain fed agriculture, sporadic recurrent

droughts and famines due to shortage of rainfall, which seems to occur within a decade interval since 1984 and government preparedness to curb its adverse effect on the economy, respective regime economic policies (both encouraging and discouraging) as well as wars, conflicts, and political instabilities that occurred during each political regime were liable for fluctuations in economic growth.

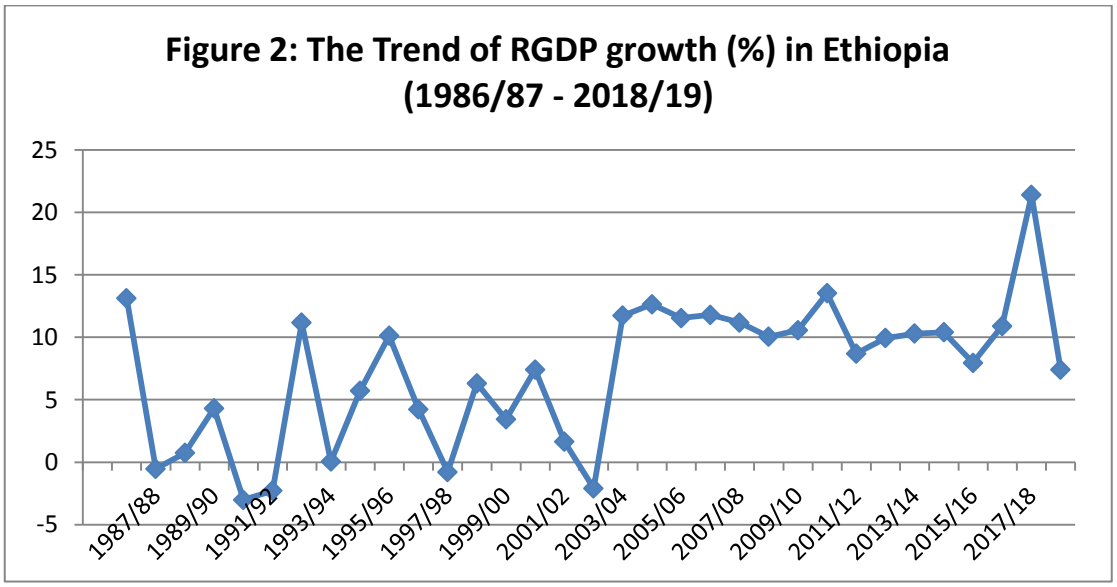
It is worth noting that agriculture was the dominant sector in terms of its contribution to RGDP until its position was taken by the service sector, which was the second most important sector next agriculture, in 2010. However, agriculture is still the back bone of the Ethiopian Economy, employing about 80% of the population and generating about 50% of the country's export earnings.

Average annual economic growth for the period between 1986/87 to 1990/91 was only 2.44%. Even in the years 1987/88 and 1990/91 the growth rate of RGDP was negative 0.5% and 3%, respectively. This was mainly due to the poor performance of agriculture, which was disrupted by the bloody civil war, which culminated with the overthrow of the Dergu in 1990. According to Abrar and Semira (1999), agriculture grew by an average of 1.4% in the1980s mainly due to the continuous fall of real price offered for products sold to the state through Agricultural Marketing Corporation (AMC). Haile (2000:53) also supported the poor performance of agricultural sector in 1980s as "…it seems, the traditional farming techniques, combined with inappropriate agrarian policies (pricing, farm input supply, etc.) during the Derg regime, and sporadic drought occurrences have kept the performance of the agricultural sector below its potential."

Another reason for low level of economic growth in the 1980s was the decline in the growth of value added of industrial sector by 2.7% due loss of confidence in the private sector to invest after the nationalization of major manufacturing establishments during the Derg regime and the extended role of the government interventions in economic decision-making. This feature was stated by Teshome (1993:80) as "…private entry into specific investment lines are barred (by law), credit rationing practice gives priority to government projects, licensing and permit procedures are cumbersome and frequent changes in investment laws and administrative red-tapes are discouraging to prospective private investors."

Moreover, the involvement of the government in direct production activity during the Derg regime was regarded by many as a shift of investment responsibilities from the private toward the public sector, without significant any noticeable change in the overall investment in the economy. For instance, by the time the new public enterprises law was issued in August 1992, there were 210 state owned industrial establishments in Ethiopia, of which 163 were manufacturing enterprises controlled by the Ministry of Industry (Taye,1994).

Figure 2 The Trend of RGDP growth in Ethiopia



Before the EPRDF has sized formal power in September 1995, following the first national election held in May 1995, the country was ruled by Transitional Government of Ethiopia (TGE) between 1991/92 and 1994/95. Though the growth rate of RGDP continued to decline by about 2.3% in the first year of the TGE, the economy recovered quickly and registered an annual average growth rate of 3.7% over the four years. Moreover, the economy continued to grow after 19995 (though the trend was reversed to negative 0.79% in 1997/98 due to the outbreak of Ethio-Eritrean war)[4], giving an average annual growth rate of about 4.22% between 1991/92 and 1999/2000 fiscal years. According to Wondaferahu (2003), this growth in the 1990s was triggered mainly by the recovery in the of growth of the service and industrial sectors by 7.8% and 6.5%, respectively following

[4] *According to EEA (2001) newsletter, the total cost of the war sustained by Ethiopia was estimated at 25.4 Billion Birr excluding the uncovered loan given by bank to deported Eritreans.*

the adoption of new economic policy program[5] in 1992 by TGE in order to address both the immediate need of the economic recovery and the long-term structural problem of under development in the country.

According to him, the recovery of the service and industrial sectors in the 1990s was due to the abolishing of entry constraints on the private sector and "relatively" favourable economic environment created and relative improvement in the availability of inputs and spare parts, which helped to rectify factor and product market distortion in industrial sector after the economic policy program of 1992. But, the growth rate of agriculture and allied activities in the 1990s was dismal about 1.8% partly due to the increase in the use of fertilizers.

As can be seen from Figure 2, the country has registered negative economic growth of -2.1% (in real term) since the turn of the 21st Century only in the year 2002/03. This was mainly due to two important factors: sporadic recurrent drought and political instability following the third national election. This in turn forced the government to adopt developmental state model like North Korea in 2004, guide the economy using two five years sectoral development plans until 2010, and since 2011 through GTP I and GTP II. As a result, it can be computed from Figure 2 that the average growth of RGDP from 2000/01-2009/10 and during GTP periods from 2010/11- 2018/19, were 7.6% and 10.35%, respectively.

In sum, the aggregate economic performance of the country for the past thirty three years expressed in terms of RGDP growth was 7.3%. The contribution of service, agriculture and industrial sector to RGDP in Ethiopia for the year 2018/19 was 44%, 38%, and 18%, respectively. Throughout the modern history of Ethiopia, however, the industrial sector lags behind agriculture and service sectors. This indicates the failure of economic policies and strategies the country pursued thus far to transform the country from agrarian to industry economy. Hence, as an agrarian economy the effect of any constraint, policy or otherwise, is transmitted to RGDP growth mainly through agriculture.

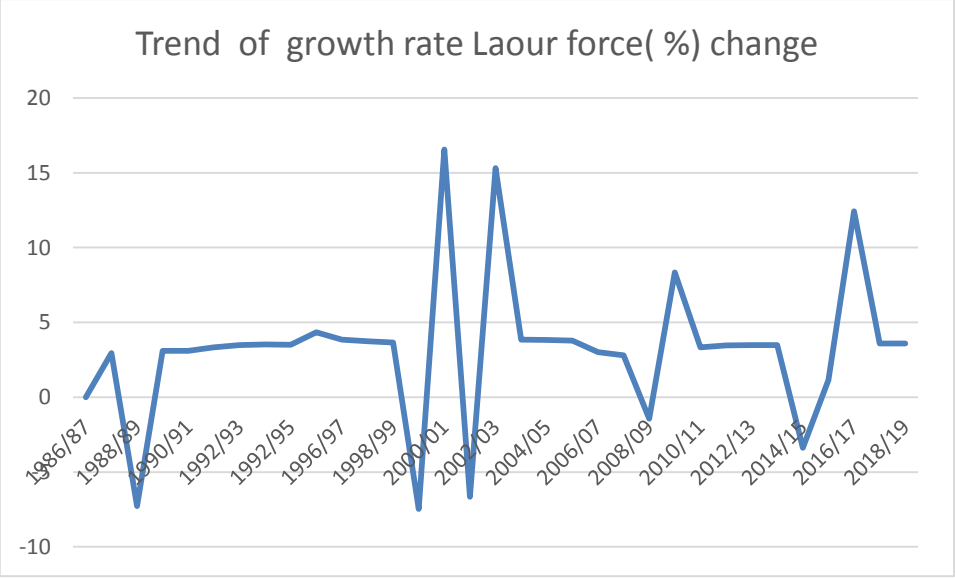
[5] *The economic policy program adopted by the TGE in 1992 had two components; namely Stabilization Program and Economic Reform Program (ERP). The latter program was, the IMF and World Bank sponsored, Structural Adjustment Program (SAP) (Ibid).*

4.1.2 The Labor Force growth in Ethiopia

The labour force, consisting of peoples either in the working or looking for work, grows overtime and thus provides one source of increased production. Increases in the availability of the factor of production the labour used in the production of goods and services thus account for part of the increase in real GDP.

The figure below shows the trend of the labour force in Ethiopia for the period under 1986/87 to 2018/19. In the beginning of 1986/87 the growth rate of labour force is 2.9 % and during period 1999/00 the growth rate is -7.4% and at the end of the study period the how rate of labour force in Ethiopia is 3.5% .The graph depicts that labour force in Ethiopia increases rapidly with the rapid growth of the population. Ethiopia's population is one of the largest in number in Africa and exhibits a higher growth rate. Hence, there is fluctuation of labour growth rate in Ethiopia and overall the labour force growth rate is an increasing trend in Ethiopia during studied period.

Figure 3 The Trend Labor force growth in Ethiopia

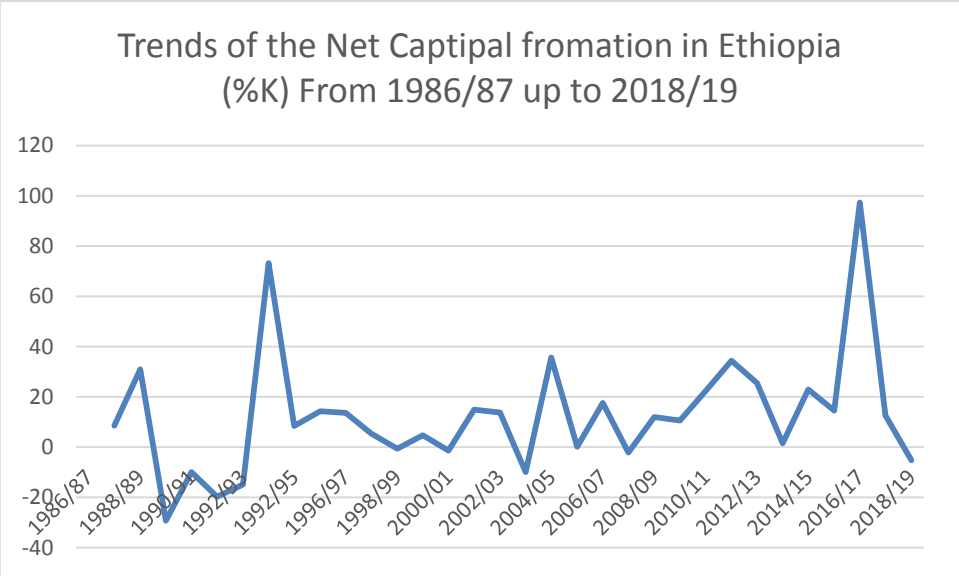


4.1.3 Trend of Net Capital Formation in Ethiopia.

Capital formation a term used to describe the net capital formation during an accounting period for a particular country. The term refers to addition of capital goods such as equipment, tools transportation asset and electricity .If a country cannot replace capital goods and service as they reach the end of their useful live production declines((Sala-I-

Martin ,2004). Increase in capital stock overtime implies increase in investment or capital accumulation. Its effect on growth and development depends on investment spending, which intern is affected by the level of domestic saving in the economy (Olawale, 2010).

Figure 4 The trend of Capital formation growth in Ethiopia



Based on the figure 4 presented that the trends growth rate of capital formation which proxy by investment between year 1986/87 up to 1996/97 on average raised is 4.3% and at the end of the year 2018/19 capital formation is declined by 5.2%. This may occurred due to political instability for the last three year among the some parts of the Ethiopia which discourage capital formation which is proxied by investment via diverting the attention of investor on saving rather than investing on the fixed asset.

4.1.4 The Trend of Air Transport Expenditure in Ethiopia

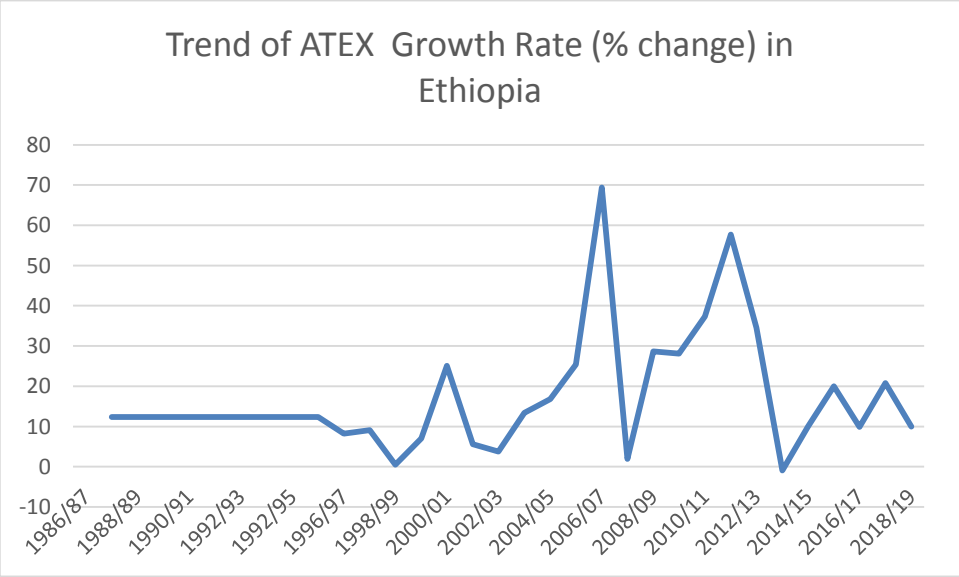
Ethiopian Airlines is the fastest growing and most profitable airline in Africa. As per IATA, (2014) report, they ranked Ethiopian Airline as the largest Airline in Africa on the basis of revenue and profit. In its operations in the past close to seven decades, Ethiopian has been a pioneer of African aviation as an aircraft technology leader.

One of the most recent shifts in the airline industry has been the increasing proportion of jet fuel costs to an airline's cost structure. According to IATA, the global airline industry's fuel bill is estimated to account for over 17% of operating expenses in 2017. However, there is a substantial variation in the percentage of costs of fuel from airline to airline. As the price of crude oil has continued progressively rising, airlines have been subjected to a

cost that has increased nearly sevenfold in just five years (Vasigh, 2008). This seven fold increase of fuel price is unparalleled with any ordinary increase of price in respect of other commodities.

Thus Ethiopian Airline adopts different strategies to enhance the continuous improvement and profitability such development of additional capacity, frequency cargo operation and expansion of various destination .The fuel and oil expenses are majorly contribute for increment of operational cost of Airline industry .

Figure 5 the trend of Air transport expenditure growth in Ethiopia



The figure 5 showed that, between year 1986/87 up to 1995/96 and 2001/02 up to 2018/19 the trends of air transport expenditure (proxy by operational cost) average growth rate in Ethiopia is 12.3% and 9.9% respectively. The average growth at air transport expenditure at end of year 2018/19 is 10%. Thus, general the air transport expenditure rate in each last three years is 9.9%,20.7% and 10% for year 2016/17,2017/18 and 2018/19 respectively . This may occurred fluctuation of price of oil and fuel at international market because the oil and fuel are the major expense for the aviation sector.

4.1.5 The Trend of Agriculture, Culture and sports, and Military expenditure in Ethiopia

Figure 6 below depicted the trend of the government expenditure on agriculture, culture and sport, and defence. During the Derg era, expenditure on agriculture increased from an average of 4% between 1986/87 and 1990/91 to 3.16% between 1991/92 and 1999/2000. However, the trend of growth reduced to an average of 17.5 % by the end of 2001/01 and further to 16.9% in 2010/11 reduced as compared to 1999/2000. However, it is down to note that despite being the back bone of the economy, the growth of expenditure on agriculture shows a declining trend while a government that pretends following ADLI as its leading development strategy is in power.

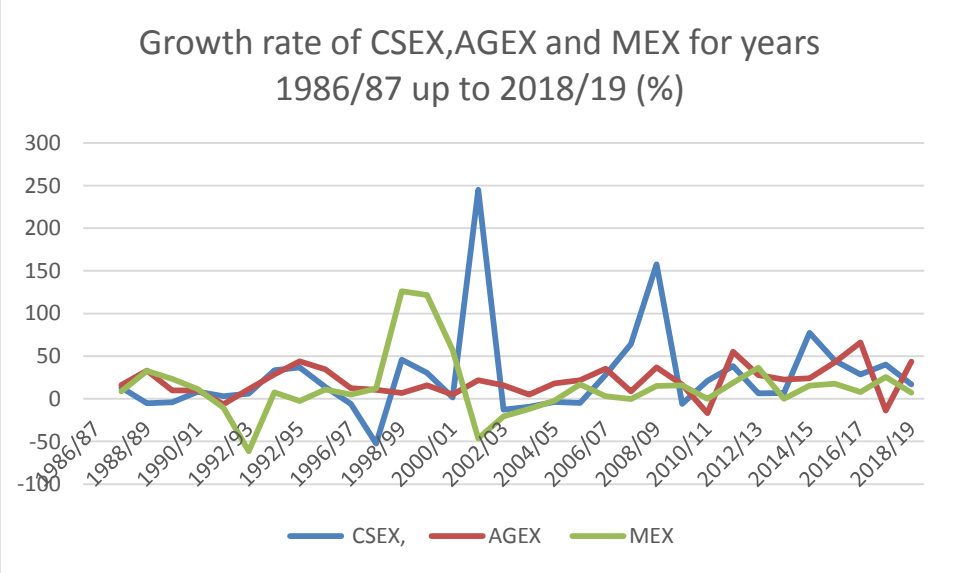
Some scholars, such as Wondaferahu (2003) has attached this decline of expenditure on agriculture to the pressure of the international community for liberalization and deregulation, shift in expenditure toward social services and away from economic services to enhance productivity, release resources from public to private control, and permitting a reduction in government financing since the downfall of the Derg regime. As a result, there was significant cut in capital expenditures related to agriculture and allied activities followed by significant increase in outlays to culture and sport since 1996.

On the other hand, expenditure on defence and security increased during the Derg regime due to the civil war in the country from 8.9 % in 1986/87 to 11.2% in 1990/91. Though structural changes have been made to reduce defense expenditure since 1992, measures taken to establish institutions that can help federal structure in the country, which intern led to an increase in expenditure on regional states police and security force wage bills; the outbreak of the Ethio-Eritrean war in 1997; and worsening terrorism in the Eastern part of Africa, among others, pushed up expenditure on defence and security in Ethiopia. For instance, expenditure on defence grew on average 23.1% between in 1991/92 to 1999/00, further to 17% in 2005/06 before reaching its highest level of 25.7% in 2017/18.

Regarding trend of expenditure on culture and sport for year 1986/87 up to 2018/19 .The expenditure on culture and sport has an increasing trend ,the growth rate for between 1986/87 up to 1990/91 on average 4% and in 1991/92 up to 1999/00 is average growth rate

is 3.1% which is slightly declined rate as compared in growth rate in 1900/91.From year 1900/91 up to 2018/19 the average growth rate of expenditure on culture and sport is 26.1%.Thus the average growth rate government expenditure on culture and sport has an increasing trend year between 1986/87 up to 2018/19.

Figure 6 the trend of expenditure on Agriculture, Culture and Sport and Military expenditure



4.1.6 The trend of trade openness growth rate in Ethiopia

Merliz (2003) posit that by opening up to international trade market share would be reallocate to the most productive as less productive one are forced to exit. Tybout (2001) looked at plant efficiency and shows that trade openness increases the competition from international trade, which in turn causes that market plant to expand and intra plant efficiency to improve economic growth. Other hands, openness to trade has negative effect on growth in countries with low financial development but in countries with well-developed financial sector and lower inflation rated countries trade openness is conducive for economic growth (Hye.et.al 2016). The figure 7 indicate that average growth rate of openness to trade between 1986/87 up to 1990/91 is 5.1% this grew by on average 28.2% between year 1991/92 up to 1999/00.This may occurred due to reformation of the immediate and long term structural economic policy after down fall of Dergue regime. At the end of the 2018/19 the growth rate openness to trade is 20.6% this may be the

government attention on the import substation and export promotion strategies this increases the openness to trade.

Figure 7 the trend of openness to trade growth in Ethiopia

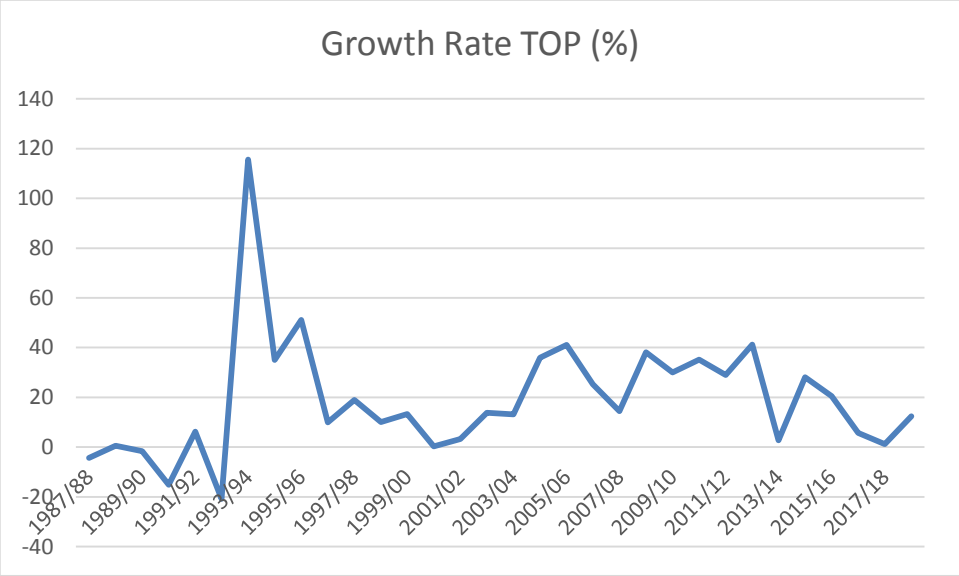


Table 2 Descriptive Statistics of Variables

Description	Observations	Mean	Median	Maximum	Minimum	Std. Dev.
LNRGDP	33	19.39875	19.10678	21.26431	18.53321	0.778792
LNATEX	33	15.22228	14.68209	17.95205	13.07892	1.564954
LNEXAR	33	13.69526	13.55067	16.80843	11.1462	1.647469
LNEXCLSP	33	11.4028	11.11543	15.02791	9.364777	1.841557
LNGCF	33	18.10056	17.76771	20.30735	16.63418	1.011442
LNMIE	33	14.79112	14.88709	16.36601	13.3598	0.900378
LNLF	33	10.33116	10.34837	10.88359	9.84915	0.323055
LNTROP	33	17.11859	16.698	19.96788	14.56275	1.791145

From the table above the mean value for the dependent variable (log value of real gross domestic product) is 19.398 with standard deviation 0.778 and its maximum and minimum value is 21.264 and 18.533 respectively.

From the explanatory variables, the log value of air transport expenditure has a mean value of 15.222 and maximum operational cost incurred for airlines enterprise is 17.95205 and the minimum one is 13.07892 as well as the standard deviation is 1.564954.

The log mean value for expenditure on agriculture, defense ,culture and sport ,net capital formation, trade openness and labor force for the study period is 13.69,14.79,11.40,18.10,17.11 and 10.33 respectively .On the other hand the maximum expenditure value for agriculture is 16.80,for defense 16.36 and for culture and sport 15.02 and the minimum expenditure for agriculture 11.14,for defense 13.35 and for culture and sport 9.36.

4.2 Empirical Results

This section presents the main results of the analysis. The results explain the relationship between Air transport expenditure and economic growth in Ethiopia for the period 1986/87 to 2018/19. In this section, a unit root test followed by co integration results and then the estimation results with their respective interpretation and the summary of the diagnostic checking results as well as causality of Air transport expenditure and economic growth are presented in the subsequent sections.

4.2.1 Unit Root Test

Before applying the unit root tests the logarithm of variables are taken because log variables give us elasticises and reduce the impact of outliers and smooth out the time series (Maddala, 1992). A necessary but not sufficient condition for cointegration to check the non-stationary behaviour of the individual time series is a test for unit root. Hence, prior to conducting the long run estimation among variables concerned, the time series characteristics of the data is examined using ADF test to the eight the variables in their both level and first difference.

In order to establish the order of integration of the variables concerned, this study first employs the conventional unit root tests widely known as the augmented Dickey-Fuller (ADF) unit root test. Generally, a variable is said to be integrated of order d, written as I (d), if it turns out to be stationary after differencing d times. The variable is integrated of order greater than or equal to 1 is non-stationary. According to Hall (2003), most economic variables are cointegrated of order 1, I (1) but in this study some of the variables such as

labour and trade openness are stationary at level and other are stationery at first difference. This test allows for three options in the conduct of the tests, that is, with intercept, with intercept and trend and without intercept and trend. This test is very important as it give insight into the structural breaks, trends and stationary of the data set (Gujarati, 2004). The result of the stationary test using Augmented Dickey Fuller Test is presented in Table 3 below.

Table 3 ADF Unit root test of Variables

Variables	**Included test**	**ADF test**	**Critical value**			**Prob.**	**Inference**
	Equation	**Statistics**	**1% level**	**5% level**	**10% level**		
$\Delta \ln Y$	Intercept only	-4.835701	3.661661	-2.960411	-2.61916	0.0005***	I(1)
	Intercept and Trend	-4.938112	-4.296729	-3.568379	-3.218382	0.0021***	
	No Intercept and Trend	0.492848	-2.64712	-1.95291	-1.610011	0.8157	
$\ln L$	Intercept only	0.899085	-3.661661	-2.960411	-2.619160	0.9941	I(0)
	Intercept and Trend	-4.779154	-4.273277	-3.557759	-3.212361	0.0029***	
	No Intercept and Trend	4.893227	-2.641672	-1.952066	-1.610400	1.0000	
$\Delta \ln k$	Intercept only	-5.23828	-3.661661	-2.960411	-2.61916	0.0002***	I(1)
	Intercept and Trend	-5.903578	-4.28458	-3.562882	-3.215267	0.0002***	
	No Intercept and Trend	-4.389007	-2.641672	-1.952066	-1.61040	0.0001***	
$\Delta \ln ATEX$	Intercept only	-4.348439	-3.661661	-2.960411	-2.61916	0.0018***	I(1)
	Intercept and Trend	-4.541192	-4.28458	-3.562882	-3.215267	0.0054***	
	No Intercept and Trend	-1.004717	2.64712	-1.95291	-1.610011	0.2754	
$\Delta \ln AGEX$	Intercept only	-6.195679	-3.661661	-2.960411	-2.61916	0.0000***	I(1)
	Intercept and Trend	-6.391676	-4.28458	-3.562882	-3.215267	0.0000***	
	No Intercept and Trend	-1.008088	-2.64712	-1.95291	-1.610011	0.2741	
$\Delta \ln CSEX$	Intercept only	-5.424962	-3.661661	-2.960411	-2.61916	0.0001***	I(1)
	Intercept and Trend	-5.769588	-4.28458	-3.562882	-3.215267	0.0003***	
	No Intercept and Trend	-4.420221	-2.641672	-1.952066	-1.610400	0.0001***	
$\Delta \ln MEX$	Intercept only	-3.782651	-3.661661	-2.960411	-2.61916	0.0074***	I(1)
	Intercept and Trend	-3.743657	-4.28458	-3.562882	-3.215267	0.0341**	
	No Intercept and Trend	-3.671808	-2.641672	-1.952066	-1.610400	0.0006***	
$\ln TOP$	Intercept only	0.665368	-3.65373	-2.95711	-2.617434	0.9894	I(0)
	Intercept and Trend	-3.655891	-4.296729	-3.568379	-3.218382	0.0416**	
	No Intercept and Trend	4.792664	-2.63921	-1.951687	-1.610579	1.0000	

Note:- *The rejection of the null hypothesis is based on MacKinnon (1996) critical values. Akaike information criterion (AIC) is used to determine the lag length while testing the stationarity of all variables. The ***, ** and * sign indicates the rejection of the null hypothesis of non- stationarity at 1%, 5% and 10% significant level respectively.*

Source: EVIEWS 10

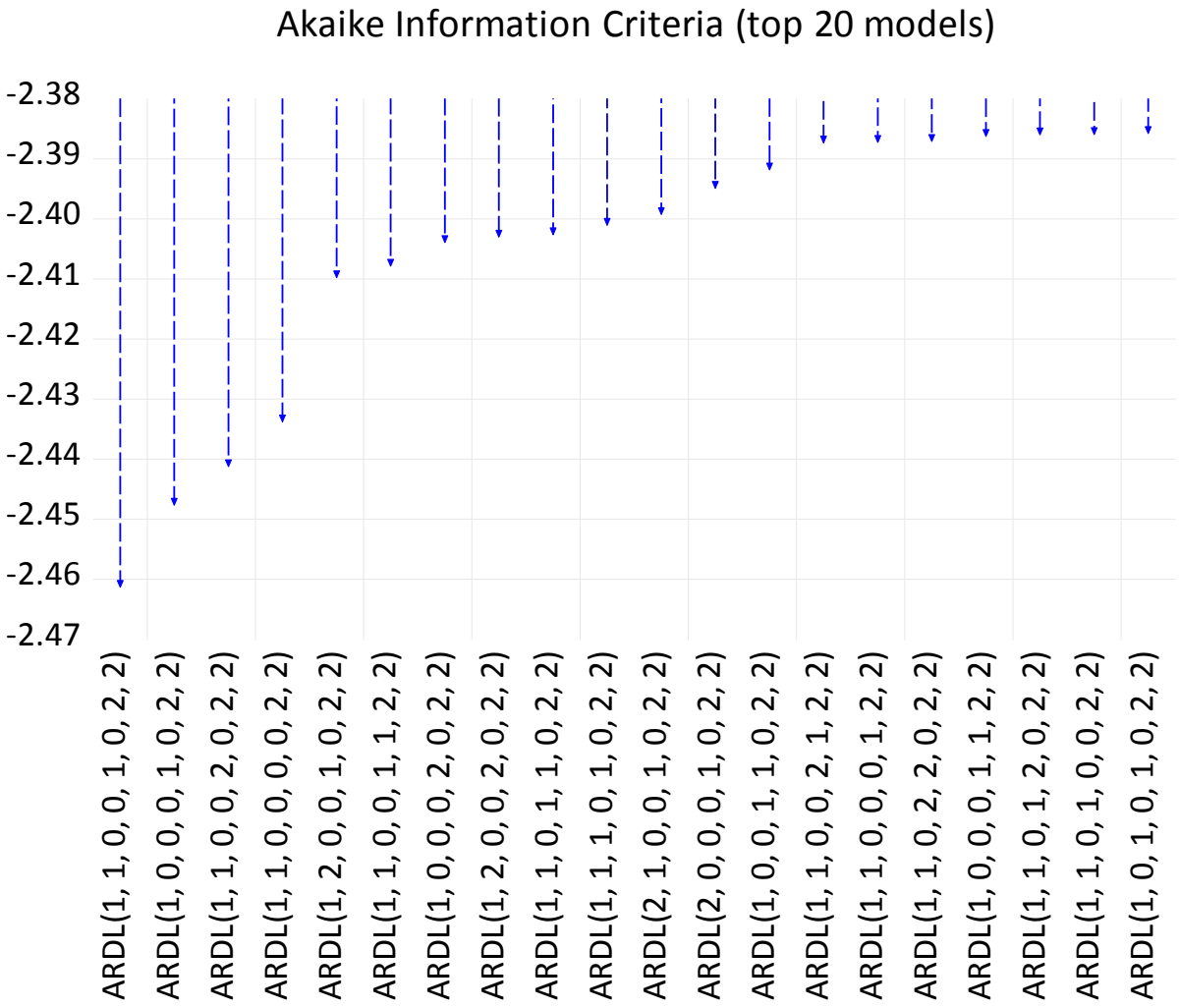
The results indicate that, for all the series in their level and first difference, the null hypothesis of a unit root is rejected at the 5 percent level significance. Because, when the trend term is included the null can be rejected also for labor force and trade openness variables at l and 5 percent significance level without differencing respectively. This indicates that including the trend term improves the stochastic nature of the data. Thus, we can conclude that all examined series are stationary and are integrated of order zero (level) and one, I (1), with a drift and trend term included. Such result of stationarity test would not allow applying the Johansen approach of co-integration. Thus, the most appropriate method for estimation is autoregressive distributed lags (ARDL) model developed by Pearson, Shin and Smith. This is one of the main justifications for using the ARDL approach (bounds test approach of co integration) we can used the ARDL model for integration zero and one and also it better for small sample sized data (Pesaran et al., 2001). Based on the results in Table 3, it can be inferred that both constant and trend terms should be included in the co-integration test for the growth model.

4.2.2 Lag order selection

The precondition to conduct a study that intends to examine the long run relationship among time series variables is the determination of appropriate lag length. There are different types of lag length selection criteria such as the Akaike's information criterion (AIC), Schwarz information criterion (SIC), Hannan-Quinn criterion (HQC), Final prediction error (FPE), and Bayesian information criterion (BIC). Out of these criteria the Akaike information criterion (AIC) is used to determine the optimal lag length of each variable automatically because it is a better choice for small sample size data. Moreover, according to Pesaran and Shin (1999), for the annual data a maximum of two lag length is recommended to choose the optimal lag for each variable. Therefore, in this thesis a maximum lag length of 2 was chosen for the conditional ARDL model, because, for small

sized annual data a maximum of two lag length is recommended to choose the optimal lag for each variable (Pesaran and Shin 1999). Finally, in this model, AIC selects the optimal lag length of each variable ($\ln Y$, $\ln L$, $\ln ATEX$, $\ln AGEX$, $\ln CSEX$, $\ln MEX$,and $\ln TOP$) respectively and it is ARDL (1, 1, 0, 0, 1, 0, 2, 2) This automatic determination of the lag length is to get the valid result and inferences.

Figure 8 The Optimal lag length



Source: EVIEWS 10 estimation of ARDL

4.2.3 Tests for Long Run Relationship (Bound testing approach to co-integration)

To apply the bounds test approach of cointegration, first estimating the ARDL model specified is needed. Then there is a need to conduct the bound test for the null hypothesis (H0) of no cointegration or no long run relationship exist against the alternative hypothesis (H1) of there is co-integration or long run relationship among the variables in the growth model.

Then, the computed F statistic value is compared with the lower bound and upper bound critical values tabulated for different significant levels. That is, when the computed F-statistic is greater than the upper bound critical value, then the H_0 is rejected (the variables are co-integrated). If the F-statistic is below the lower bound critical value, then the H0 cannot be rejected (there is no co-integration among the variables) (Nkoro and Uko, 2016). However, according to Narayan (2005), the existing critical values in Pesaran et al. (2001) cannot be applied for small sample sizes as they are based on large sample sizes. Hence, we need to use a set of critical values for small sample sizes, ranging from 30 to 80 observations, suggested by Narayan (2005).

The results in table 4 reveal that the calculated F-statistic value of 8.845 is greater than the upper bound critical values of both Pesaran et al., (2001) and Narayan (2005) tabulated for 1% significant level. As a result, the null hypothesis (H0) that states there is no cointegration or no long run relationship among the variables in the growth model is rejected. This indicates that there is strong evidence on the existence of long-run relationship or cointegration between real GDP growth rate and seven explanatory variables included in our growth model. After determination of the existence of cointegration among variables, the next step in the ARDL approach is to estimate the long-run coefficients of the explanatory variable.

Table 4 the estimated F-bound test and Lower and Upper bound critical value

Description	Value
Optimal lag length	2
Number of observation	32
F-Statistics	8.845
K(Number of explanatory variable)	7
Lower and upper bound critical	

Descriptions	1%		5%		10%	
	Lower Bound	Upper Bound	Lower Bound	Upper Bound	Lower Bound	Upper Bound
Pesaran et al. (2001)	3.60	4.90	2.87	4.00	2.53	3.59
Narayan (2005)	3.80	5.643	2.797	4.211	2.353	3.599

Source: Pesaran et al. (2001) and Narayan (2005)

4.2.4 The Long-run ARDL Estimate

Having detected the stationary behaviour of all the series based on the bound test cointegration approach and chosen the optimal lag length, the long run effect of the seven explanatory variables on real GDP growth was estimated using ARDL model. Table 5 shows the results obtained from applying the ARDL tests for the growth model.

Table 5 Long run coefficient for ARDL Model (1, 1, 0, 0, 1, 0, 2, 2)

Dependent Variable RGDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ln *L*	0.747959	0.413855	1.807296	0.0896*
ln *k*	0.517875	0.070512	7.344455	0.0000***
ln *ATEX*	0.282252	0.074966	3.765092	0.0017***
ln *AGEX*	0.310794	0.103626	2.999180	0.0085***
ln *CSEX*	0.139040	0.054667	2.543389	0.0217**
ln *MEX*	-0.177327	0.059031	-3.003983	0.0084***
ln *TOP*	-0.585710	0.095995	-6.101450	0.0000***
C	4.807775	2.913907	1.649941	0.1184

*Note: The signs ***, ** and * indicate the significance of the coefficients at 1%, 5% and 10% level of significance respectively.*

Source: Own computation using E views 10 on ARDL (1, 1, 0, 0, 1, 0, 2, 2)

The results in table 5 above indicate that labor force, net capital formation, air transport expenditure, government expenditure on agriculture, and expenditure on culture and sport, are positively related with the economic growth while military expenditure and trade openness have negative effect on economic growth. The air transport expenditure ,government expenditure on agriculture ,military expenditure, net capital formation and trade openness have significantly affect economic growth at 1% significant level whereas both government expenditure on culture and sport and labour force are significant effect on economic growth at 5% and 10% significance level respectively.

The size of the estimated coefficients in the growth model is quite reasonable indicating that variables in the model modestly determine the magnitude of real economic activity in Ethiopia. The results in Table 5 support the idea that the accumulation of domestic capital is important determinant of economic growth.

The coefficient of labor force ($\ln L$) is also positive as expected, implying the positive effect of labor force participation on economic growth as found by Bilal (2014). But despite the fact that, the level of labor force exerts a positive impact on real GDP in the long run, the relationship between them in term of statistical significance remains very weak, i.e., statistical significant only at 10% significance level. This indicates that labor force is weak determinant of economic growth in Ethiopia in long run .This may be occurred, the Ethiopia economy does not create job opportunity for labor force due that the most of the economically active labor force is not engaged in economic activities .

As expected, the net investment variable ($\ln k$) has positive sign. Moreover, the level of investment exerts not only positive and statistically significant impact on real GDP in the long run but also the relationship between them in term of elasticity remains strong i.e., a one percent increase in investment leads to a respective real GDP increase of 0.518 percent. This indicates that investment is an engine of economic growth in Ethiopia. Despite underdeveloped private sector investment which is still at its infant stage by any standard, this strong relationship between investment and growth is attributed mainly by the prevailing situations of relative political stability, confidence of foreign investors on the economy, and aggressive public investment in infrastructure and human capital development since the 1992 economic reform that derive fast and sustainable economic growth in the country. This finding supports the argument of Olawale (2010) where capital

accumulation affects the rapid and sustainable economic growth and development of a country in the long run positively through its impact on domestic savings and total factor productivity (TFP). Moreover, it is in line with Olawale (2010) for Nigeria and Barro and Sala-i-Martin (2004) for North America findings that capital formation is one of the determinant and engine for economic growth and increase in capital, means investment which brings economic growth.

The long-run effect of air transport expenditure, which is proxy by operational cost of the airline industry, on economic growth is positive (= 0.282) as expected and statistically significant at 1% significance level during the study period. This means that expenditure on air transport has positively influenced long-run economic growth in Ethiopia. That is, the result indicates that a 1% increase in expenditure on air transport increases economic growth significantly on average by about 0.28(0.3) percent. This might be due to the fact that, though the Ethiopian airline industry is a state owned enterprise, huge investment in air transportation infrastructure emanating from strategic roadmap of the EAL has enhanced its capacity, competitiveness, dependability, and efficiency in the mobility of passengers and freights globally, which makes it the largest and fastest growing African airline in all major parameters for many years. This finding also supports the Keynesian argument that government expenditure or intervention in an economy that improves inefficiencies that arise due to market failure will lead to higher economic growth. This finding is also consistent with some the country specific empirical findings by Shairil and Remail (2017) in Malaysia, Nwaogbe et al., (2013) and Alexander (2015) in Nigeria, and cross-sectional studies of Aunurrofik (2018) in Indonesia findings that air transport development has affected long-run economic growth positively and significantly.

The government expenditure on agriculture sector has positive impact on the economic growth as expected. The coefficient of the government expenditure on agriculture is 0.311and statistically significant at 1 percent level significance. This indicates that, holding other things constant, a one percent change in government expenditure on agriculture sector results that on average 0.31 percent change in economic growth of Ethiopia in the long run. This is due to currently the government focused on agriculture to improve the product and productivity of the sector. This allocation is aligned to government priorities of the sector, which include increasing production and productivity, as well as

commercialization and development of agro-based industries. This result also supports earlier findings of other researcher such as (Bazezew, 2014) and (Yasin, 2014).

Based on result showed that the coefficient of government expenditure on culture and sport is 0.139 which means there is positive relation between the government expenditure on culture and sport and economic growth. This implies that holding other things constant, in long run a one percent increases in government expenditure on culture and sport lead to on average 0.14percent increase on economic growth. The culture is one engine for urban economic development can fully gauged by considering its role in regenerating cities. This due to culture incorporates cultural heritages, visual arts architecture, libraries, book and press, performing arts, audio and audio multimedia. The improvements of this all activities bring the economic growth. Sports economics is playing more important role in our lives, which is associated with tickets, media rights, merchandising, and sponsorship. This finding is consistent with the finding of UNCTD (2013) and Ieva and Liga (2017) for North America .

On the other hand, the coefficient military expenditure is -0.177 which indicates that there is negative relation between the military expenditure and economic growth. This result showed that holding others things constant, in long run one percent increases on military expenditure brings decline of economic growth on average by about 0.18 percent. This further implies that the increasing military expenditure is not the best mean to attain long-run economic growth and development in Ethiopia. This is because it has the tendencies of diverting resource away from other productive sector of the economy such agriculture, transportation infrastructure etc. The military expenditure could crowding public and private investment. This finding is in line with the argument of Dunne (2010) that since military expenditures are non-productive, they discourage economic growth of a given country and the findings of Haile (1999) for Ethiopia, and Maingi (2015 for Kenya where they found negative impact of military expenditure on economic growth. But it is inconsistent with Barro (2000) finding of positive and statistically significant impact of military expenditure on economic growth for developed countries.

Finally, the result in table 5 indicated that there is negative relationship between trade openness and economic growth. The coefficient of the trade openness is -0.585 and

statistically significant at 1 percent level significance. This means that a one percent increases in trade openness lead to 0.59 percent decreases in economic growth in long run ,when other things constant. This implies that global integration through international trade affected the Ethiopian economy adversely and statistically significantly, because as a country exporting primary products, mainly agricultural and importing manufacturing products, the term of trade (ToT) is always against it. This in turn acute cause shortage of foreign currency and discourage the exporting capacity of the country thereby depress long-run economic growth.

Since, the low level of financial development, low purchasing power compared to its advanced countries treading partners, and poor quality of institution are evident in Ethiopia, the finding of negative and statistically significant effect of trade openness on economic growth in Ethiopia seems to support the argument of Hye.et al., (2016) that openness to trade will have negative effect on growth in countries with low financial development but it is conducive in accelerating economic growth in countries with financial development and low level of inflation rated . Moreover, this finding is line with the argument that trade openness in low purchasing power countries can reduce their economic growth as compared to high purchasing power countries Kind (2002); and in developing countries with poor quality of institution trade openness can lead to weak exporting capacity and adverse negative effect on economic growth (Deme 2015). On the other hand, it fails to support the argument of Levine and Zervos (1998) that trade openness is expected to raise productivity through increased competition and transmission of technology from the rest of the world.

4.2.5 Dynamic Short run Error Correction Estimate

Afterwards estimating the long-run coefficient, the next step in the ARDL approach is the analysis of error correction and estimation of short-run coefficients. Thus, to integrate the short run dynamics with long run model, the first difference of the variables to allow for delayed response. Moreover, the vector error term saved from the long run equation also entered in its first lag. This error correction term (ECM) provides information on how the speed adjustments are taking place towards long run equilibrium among the variables considered in the thesis. The results in Table 6 reveals that labor force, agricultural

expenditure, military expenditure and trade openness variables included in the dynamic short run model are significant in affecting economic growth in Ethiopia. Nevertheless, expenditure on air transport has weak effect on economic growth. However, capital accumulation and expenditure on culture and sport expenditure do not have any effect economic growth in the short run. Thus the air transport expenditure has positive and no/weak significant impact on economic growth in short run. This may need further study on why air transport expenditure has no significant impact on economic growth in short run in Ethiopia.

In the estimation of the dynamics short run model, the speed of adjustment has a negative sign and its magnitude is not greater than unity (-0.986). Moreover, it is statistically significant at 1percent level significance as expected. It implies that about 99% of the disturbance in the short run will be corrected each year.

Table 6 Dynamic specification of ARDL growth model (1, 1, 0, 0, 1, 0, 2, 2)

ECM (Short run) Regression				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
$D(\ln L)$	0.4725574	0.075354	6.271165	0.0000***
$D(\ln ATEX)$	0.152547	0.060384	2.526300	0.0225*
$D(\ln MEX)$	-0.017608	0.033493	-0.525706	0.6063
$D(\ln MEX(-1))$	0.290619	0.042869	6.779247	0.0000***
$D(\ln TOP)$	-0.471148	0.075435	-6.245752	0.0000***
$D(\ln TOP(-1))$	-0.298672	0.057989	-5.150501	0.0001***
$ContEq(-1)*$	-0.986902	0.090313	-10.92764	0.0000***

Note: ****, ** and * indicate the level of significance at 1%, 5% and 10% level of significance respectively.*

Source: Own computation using E views 10 software

The short run coefficient of individual variables should be examined to determine the relative contribution of each variable to economic growth in Ethiopia. As per the results that showed in Table 6 the coefficient of labor force has positive and statistical significant effect on economic development of Ethiopia in short run. In short run, a one percent

increment on labor force will result to an on average of 0.47 percent increment in economic growth, holding other things constant. More importantly, the short-run impact of air transport expenditure on economic growth of Ethiopia is found to be very weak compared to the long run. Thus, we can conclude that the hypothesis that states the impact of investment in the air transport on economic growth of Ethiopia is positive but stronger in the long run than in the short run is accepted.

And the coefficient of labor force has positive and significant effect on economic development in short run. In short run, a one percent increment on labor force result on average 0.47 percent increment on economic growth holding other things constant.

Moreover, the coefficient of the agricultural expenditure is positive (=0.152) and statistically significant at 1 percent level significance. This means that in short run by keeping other things constant a one percent increase of expenditure on agriculture will lead economic growth to increase on by an average of about 0.15 percent in Ethiopia. This implies that increases in government expenditure on agricultural equipment, machinery, improved seed …etc., are stimulants of agricultural development therapy affect economic growth positively.

While the coefficient of first lagged values of military expenditure was observed to be positive and significant effect on the economic growth in short run. Holding other things constant a one percent increase of military expenditure will lead to an increase in economic growth by an average 0.29 percent in short run. This implies that in short run the government expenditure on internal and national defense, justice order and security encourage economic activities in short run.

The coefficient of trade openness is also negative and significant at 1 percent level significance in the short run. As one percent increment of trade openness bring on average 0.47 percent decline of economic growth. This may be due to the fact that Ethiopia is net importer of equipment and logistics and hence this directly affects the foreign currency accumulation of the country, which in turn deteriorates the current account balance and hampers economic growth.

4.2.6 Diagnostic testing and model stability

To check the reliability and verifiability of the estimated long-run and short-run models, the multivariate system diagnostic tests of the residuals are undertaken. These tests include serial correlation (Brush and Godfray LM test), Functional form (Ramsey's RESET test), Normality (Jaque-Bera test), Hetroscedasticity (Breusch-Pagan-Godfrey test) and CUMSUM recursive residuals tests are applied to check the overall stability of the long-run and short-run coefficients which are suggested by (Pesaran et al., 2001).

The multivariate system diagnostic test of the residuals (shown in Table 7 to 9) indicates that the model has the desirable property of model estimation. For instance, the Brush - Godfray LM test for serial autocorrelation does not provide any indication of the presence of serial correlation in the residual of real GDP function. That is, the result in Table 4.6 shows that result showed that the null hypothesis of no serial correlation cannot be rejected because the p-value associated with F statistic is greater than the standard significant level (0.47 > 0.05).

Serial Correlation LM Test

Table 7 Breusch-Godfrey Serial Correction LM test result

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.795727	Prob. F(2,14)	0.4706
Obs*R-squared	3.164237	Prob. Chi-Square(2)	0.2055

Source: Own computation using E views 10 software

The Table 7 result showed that the null hypothesis of no serial correlation (Brush - Godfray LM test) is filed to reject because of the reason that the p-value associated with F statistic is greater than the standard significant level (0.47 > 0.05).Therefore, there is no serial correlation.

Heteroskedasticity:

The result of hetroscedasticity test of the residuals in Table 8 below also does not show evidence for autoregressive conditional hetroscedastic errors. The reason is that , as shown in Table 8 the Breusch-Pagan-Godfrey Hetroscedasticity test displays that the null hypothesis of no Heteroskedasticity is accepted at 5% significant level due to its p-value

associated is greater than the standard significance level (0.21 > 0.05).This indeed is not surprising, since hetroscedasticity is not much problem in time series (Green, 1997).

Table 8 Heteroskedasticity test Breusch -pagan Godfrey result

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.510668	Prob. F(14,16)	0.2129
Obs*R-squared	17.64849	Prob. Chi-Square(14)	0.2233
Scaled explained SS	4.907609	Prob. Chi-Square(14)	0.9871

Source: Own computation using E views 10 software

Functional Form Test

The Ramsey's RESET test, which tests whether the model suffers from omitted variable bias or not, provides no indication that the functional form of the VECM is inappropriate in Table 9. The implication is indicating that the model is correctly specified, because the p-value is larger than the conventional significance value (0.116> 0.05).

Table 9 Ramsey RESET test of Functional Form test result

Omitted Variables: Powers of fitted values from 2 to 3

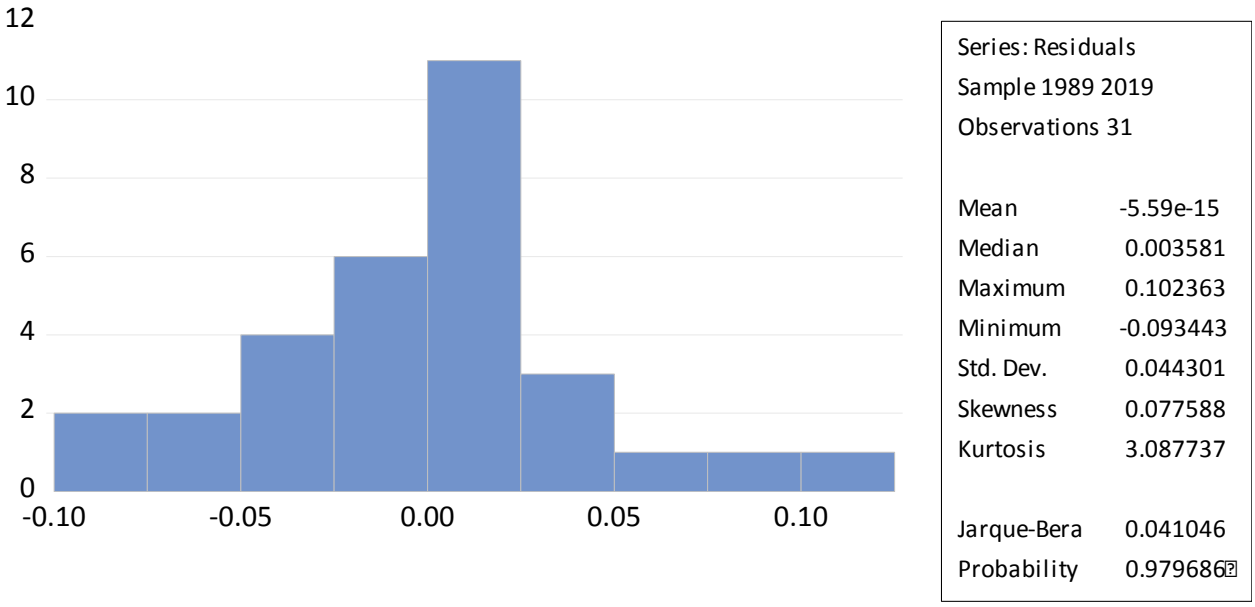
	Value	Df	Probability
F-statistic	2.512949	(2, 14)	0.1168

Source: Own computation using E views 10 software

Normality Test

Similarly, we could not reject the null hypothesis for the Jaque-Berra normality test, which shows that the residuals are normally distributed. That is, the Jarqu-Bera tests of skewness and kurtosis of the residuals revealed normality, for the p-value associated with it is larger than the standard significance level (0.979 > 0.05), implying the absence of outliers in the data.

Figure 9 Jaque- Berra normality test result

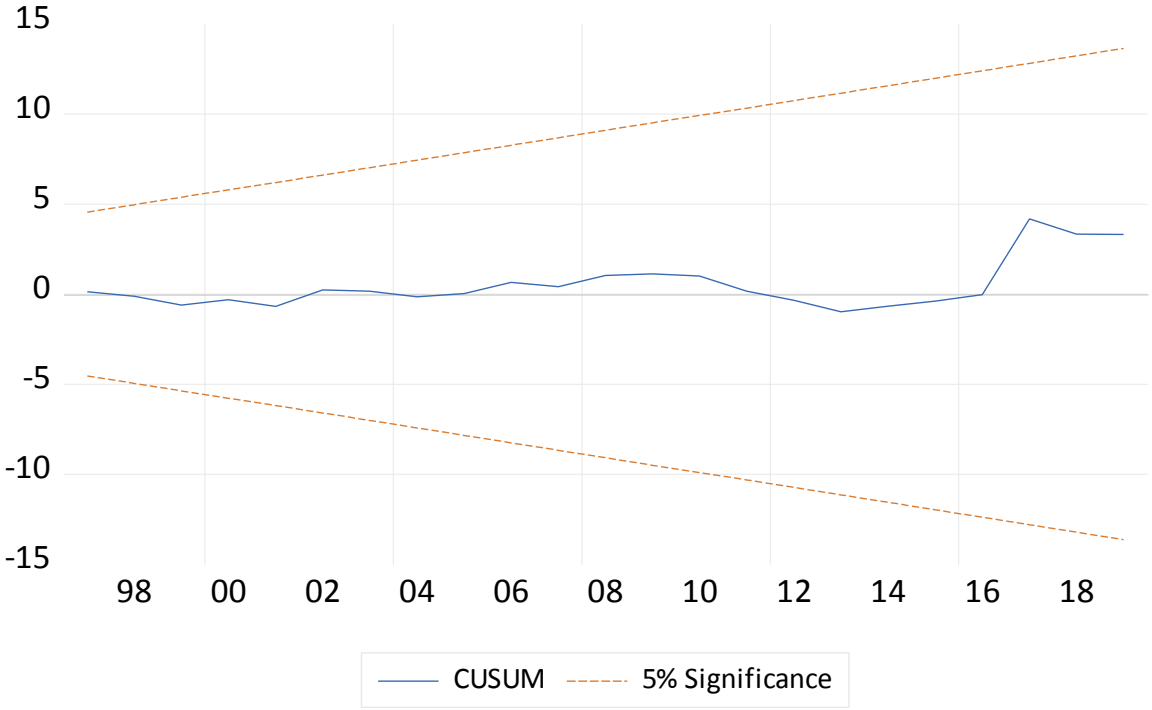


Source: Own computation using E views 10 software

Model Stability

Finally, in order to strength our analysis, the stability of the parameters in real GDP growth model for the long run and short run relationships was examined using one-step recursive residuals graphical plot or the scenario CUSUM test as suggested by (Pesearon and shin, 1997). According to the graph, the null hypothesis of parameter stability cannot be rejected since the CUSUM recursive residual plot bounds within the 95 percent critical boundaries (see Figure 10).. This test statistic show that the parameters are stable or no structural break occurs at the 5 per cent level of significance.

Figure 10 Plot of CUSUM model stability test result



Source: Own computation using E views 10 software

4.2.7 The Pair Wise Granger Causality Results

A granger causality test is made to identify the direction of causality between the dependent variable (real GDP) and the independent variables such as labor force, net capital formation, air transport expenditure, agricultural expenditure, culture and sport expenditure, military expenditure, and trade openness. The result is reported in Table 10 below.

Table 10 The pair wise Granger Causality Results

Null Hypothesis:	Lag 1		Lag 2	
	F-Statistic	Prob.	F-Statistic	Prob.
LnATEX does not Granger Cause *LnRGDP*	2.95291	0.0964*	1.21064	0.3143
LnRGDP does not Granger Cause *LnATEX*	0.15392	0.6977	0.36678	0.6965

LnAGEX does not Granger Cause *LnRGDP*	2.12999	0.1552	2.32099	0.1182
LnRGDP does not Granger Cause LNEXAR	0.01995	0.8887	2.74718	0.0827*
LnCSEX does not Granger Cause *LnAGEX*	3.88440	0.0583*	1.46185	0.2502
LnRGDP does not Granger Cause *LnCSEX*	2.96494	0.0957*	1.68728	0.2047
LnMEX does not Granger Cause *LnRGDP*	0.08898	0.7676	0.02076	0.9795
LnRGDP does not Granger Cause *LnMEX*	4.22808	0.0489**	3.86417	0.0339**
LnK LNGCF does not Granger Cause *LnRGDP*	1.03741	0.3168	0.48514	0.6211
LnRGDP does not Granger Cause *LnK*	1.63733	0.2108	0.74529	0.4845
LnL does not Granger Cause *LnRGDP*	0.49258	0.4884	0.24497	0.7845
LnRGDP does not Granger Cause *LnL*	0.55822	0.461	0.23788	0.79
LnTOP does not Granger Cause *LnRGDP*	2.61546	0.1167	0.96308	0.3949
LnRGDP does not Granger Cause *LnTOP*	0.88665	0.3542	0.33572	0.7179

Based on the result of pair wise granger causality test on table above, we reject the null hypothesis that air transport expenditure does not cause economic growth at 10 percent level significance. However, the null hypothesis that real GDP does not Granger cause air transportation investment (expenditure) cannot be rejected. The implication is that there is a weak unidirectional causal relationship between expenditure on air transportation and economic growth with the direction running from air transportation expenditure to economic growth for Ethiopia. The inference is that the growth of air transport expenditure influences real GDP growth in Ethiopia in the long-run, but the reverse is not necessarily true.

CHAPTER FIVE

SUMMARY CONCLUSION AND RECOMMENDATION

5.1 SUMMARY

The main objective of the study was to examine the relationship between the air transport expenditure proxies operational cost of EAL and economic growth which proxy by real gross domestic product for period year 1986/87 up to 2018/19. In order to scrutinize the relationship between the air transport expenditure and economic growth the researcher has employed the time series data via using Autoregressive Distributed lag model to co integration approach and the error correction model. In addition to this the descriptive analysis method were applied.

Unit root test is accomplished by using Augmented Dickey Fuller test to check stationarity. Co integration analysis to check the existence of meaningful long run relationship among the variables as well as causality test to identify the cause and effect relationship among the variables is conducted. Hence, there is a long run relationship among the variables and there exists granger causality among the variables. Diagnostic tests are also performed on the residuals to ensure that the residuals are well behaved. In the study, real gross domestic product as a dependent variable and labor force, net capital formation air transport expenditure, expenditure on agriculture, culture and sport, military expenditure and trade openness are incorporated as explanatory variables.

In order to achieve the objective of this study, other variables were included in the growth model as advocated by both theoretical literature and empirical literature. The choice of these variables was informed by a general review of literature on air transport sector and economic growth at national and international level, and availability of data. This led to the specification of the economic growth model. After specifying the economic model, specifying the econometrics model to determine the long run and short run relationships among the dependent and explanatory variables by co integration and error correction models were employed, . Diagnostic testing is also applied to ensure that the model is good fit.

5.2 Conclusion

The primary objective of this study is to examine the relationship between the air transport expenditure and economic growth in Ethiopia for period 1986/87 up to 2018/19. The Ethiopian airline enterprise is the one of the wholly owned by the Government of the Federal Democratic Republic of Ethiopia. Keynesian theory of economic growth supports the active role of government in stabilizing economic growth. In this theory increase in government expenditure leads to higher economic growth which is contrary to neoclassical.

The empirical analysis prevails that among the explanatory variables considered in this study air transport expenditure, government expenditure on agricultural, government expenditure on culture &sport, military expenditure, net capital and trade openness are significant at both 1% and 5% while labor force significant at 10% to economic growth in the long run.

The air transport expenditure has positively related with economic growth in long run .This implies air transport, just like any other mode of transport, plays a crucial role in the economy of a country. And also labor force, net capital formation and expenditure on culture and sport, and agriculture are positively related with economic growth while military expenditure and trade openness are negatively related with economic growth in long run.

Whereas in the short government expenditure on agricultural, lagged military expenditure, labor force and trade openness are significant at 1%and 5% level respectively. The other air transport expenditure has weak positive impact of economic growth and expenditure on culture & sport, gross capital formation and labor force are insignificant effect on economic growth in the short run.

In the estimation of the dynamics short run model, the speed of adjustment has a negative sign and its magnitude is not greater than unity (-0.986). It implies that about 99% of the disturbance in the short run will be corrected each year. Furthermore there is a weak unidirectional causal relationship between expenditure on air transportation and economic growth with the direction running from air transportation expenditure to economic growth for Ethiopia but the revise is no true.

5.3 Policy Recommendation

Based on the finding of the study, the following recommendation to be forwarded. The airline enterprise is the safest, fastest and long distance travel means of transport that the government should do more in expanding the operational expenditure transport for well operation of the sector in order to enhance competitiveness of airlines enterprise in world airlines industry. The study found that the economic growth is positively elastic to the expansion of air transport expenditure for the period under consideration .Thus government provides priority for the sector via allocating the more operational budget to improve the economic growth.

As per finding of this study, higher spending on agriculture, culture and sport lead to rapid economic growth; in contrast, spending on national defence in long run negatively affects economic growth by reducing the budget share of the productive sectors such as air transport sector, agriculture, etc..

The net capital formation which proxy by investment has positive impact on economic growth. So the government inspires the private and public investment to improve the economic growth of the country. Regarding to Labor force in the finding of study there is more significant and positive impact on economic growth in short run than long run. Government should due attention on economy activities which create more job for youth and encouraging participation of youth in different economic activities.

On other hands trade openness is negatively related with economic growth .This implies that the poor quality of institution and weak exporting capacity of the country. The government due attention on improvement of financial system of country as well as promoting export through solving problem related with exported item and substitution of import by deliverance of quality and quantity products and increasing domestic products consumption via creating awareness for domestic consumers.

Hence, government should maximize expenditure on air transport sector through efficient management system and exploration of other sources of revenue. Finally, the researcher invites the other researcher for further study on EAL enterprise by incorporating capital expenditure.

REFRENCE

Abaynew Demisew (2019). The effect of leverage on airline profitability. *Empirical study on selected African Airlines.*

Abed, S., Ba-Fail, A., & Jasimuddin, S. (2001), an econometric analysis of international air travel demands in Saudi Arabia. Journal of Air Transport Management

Abraham Alexander (2015).Air Transportation and Economic Growth in Nigeria. *Journal of Economics and Sustainable Devolvement.*

Abrar Suleiman and Semira Seid (1999), "Recent Macroeconomic Reforms and Performance of the Ethiopian Economy: A Survey of the issue," Aspect of Development Issue in Ethiopia, Proceedings of a Workshop on the Twenty Fifth Anniversary of the Institute of Development Research, May 26-28,1998, Addis Ababa University

ACI (2004), the Social and Economic Impact of Airports in Europe

Adefolalu A. "The role of transport in Nigerian and Nigerian National Development" (1977): Ibadan, NISER

Air Transport Action Group – ATAG (2005). The contribution of air transport to sustainable development in Africa. Analysis by Oxford Economic Forecasting for ATAG.

Amanuel Sofany (2016), the determinant of Domestic air transport demand in Ethiopia.

Arkebe Oqubay and Taffere Tesfachew (2019), African Development Bank group economic governance and Knowledge management vice presidency .*How they did it Getting Granular in saving policy issue .the Journey of Ethiopia Airlines*.

Asian Development Bank (2012).infrastructure for supporting inclusive growth and poverty reduction in Asia.

ATAG (2018), The Economic & Social Benefits of Air Transport.

ATAG, (2015), Global Sustainable Aviation Summit. Geneva Switzerland.

Aunurrofik (2018).The effect of air transportation on Regional Economic Development .Evidence from Indonesia.

Banerjee, A., Dolado, J., Galbraith, J., and D. Hendry (2003).*Co-integration, Error Correction, and the Econometric Analysis of Non-stationary Data: Advanced Text in Econometrics*. New York: Oxford university press.

Barro R, (2000) "Public Finance in Models of Economic Growth", Review of Economic Studies

Barro, R.J and X. Sala-I-Martin (2004). Economic Growth. New York: McGraw-Hill.

Batra, R.; Slottje, D. J. 1993. Trade policy and poverty in the United States: theory and evidence,1947–1990, *Review of International Economics* 1(3): 189–208.

Bazezew Berihun (2014) Impact of Government Sectoral Expenditure on Economic Growth in Ethiopia with a Particular Focus on Agriculture, Defense, Education and Health Sectors. Addis Ababa University.

Bieger, T., & Wittmer, A. (2006). Air Transport and Tourism - Perspectives and Challenges for Destinations, Airlines, and Governments. Journal of Air Transport Management.

Bijan Vasigh Ken Fleming and Thomas Tacker (2008).Introduction to Air transport Economics .From Theory to Application.

Bilal Kargi (2014).Labor force participation rate and economic growth in case of Turkey.

Burnside, C. M. Eichenbaum, and J. Fisher (2000) "Assessing the Effects of Fiscal Shocks". Mimeo, Northwestern University.

Button, K. & Taylor, S. (2012). International Air Transportation and Economic Development. Journal of Air Transport Management.

CSA (Central Statistical Agency) of the Federal Democratic Republic of Ethiopia and Measure DHS/ICF Macro. 2006. "Ethiopia Demographic and Health Survey 2005."

CSA (Central Statistical Agency) of the Federal Democratic Republic of Ethiopia and Measure DHS/ICF Macro. 2016. "Ethiopia Demographic and Health Survey 2015."

Dargay, J., and Hanly, M. (2011), the determinants of the demand for international air travel to and from the UK. Paper presented at the 9th World Conference on Transport Research, Edinburgh, Scotland, and May, 2001.

David Romer, D. (2006). Advanced macroeconomics. Published by McGraw-Hill/Irwin

Deme,M.(2015). An Examination of Trade-Led Growth Hypothesis in Nigeria: A Co-integration, Causality, and Impulse Response Analysis. The Journal of Developing Areas.

Dempsey, P. Stephen (2000), Airport Planning & Development Handbook: A Global Survey, New York, McGraw-Hill

Deribe, T. (2016). Analysis of the determinants of Profitability in Airlines Industry. Unity University, Unpublished.

Dornbusch R.and Fischer S (1992) .Macroeconomics; sixth edition.

Dunne, P. (2010) "Military Spending and Economic Growth in Sub Saharan Africa"

Dwyer, L., Forsyth, P. & Dwyer, W. (2010), Tourism Economics and Policy, Bristol, UK; Tonawanda, NY: Channel View Publications.

EEA (1999/2000), Annual Report on the Ethiopian Economy, Befekadu D., and Berhanu N.(eds),Vol. I

EEA (2001), Ethiopian Economic Association News Letter, Vol.1, Issue1 (September

Egger, R. (2015). Grundlagen des e Tourism; Informations- und Kom munikation stechnologien in Tourisms. Aachen: Shaker Verlag .

Elsabeth Melesse(2018) Financial risk management practices; The case of Ethiopian Airline

Enders, W. (1996) "Applied Econometric Time Series" Lowa State University: John Wiley & Sons INC.

Eric Tchouamou Njoya.(2013), "Air Transport and Destination Performance – A case study of three African countries (Ethiopia, Kenya and South Africa)"

Ethiopia Airlines press released 21 Nov 2008.

Ethiopian airlines Fact sheet may (2015).

Ethiopian Civil aviation authority (2007), unpublished.

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

Filani M. O. "Air transport development and traffic trends". Ibadan:Macmillian Press Ltd(1986).

G.S Maddala (1992) Introduction to Econometrics, 4th ed. Unversity at Albany, the state University of New York.

G/Egziabher, S. (2012). Why Ethiopian Airlines Becomes Successful and What are the Lessons for other Public Companies?, Addis Ababa University, Unpublished.

Graham, A. (2000), Demand for leisure air travel and limits to growth. Journal of Air Transport Management.

Granger .C.W.J (1987).''Testing for Causality '', *Journal of Economic Dynamics and control.*

Greene W.(1997) The Oxford Handbook of Bayesian Econometrics analysis at Oxford University.

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

Gutierrez et.al, 2007. Panel Unit root test for cross –sectionally correlate Panel :A Monte Carlo Comparison ,Oxford Bulletin of Economics and Statistics.

Haile Kebret (1999), "Military Expenditures and Economic Performance: Lessons from the Ethiopian Economy," Ethiopian Journal of Economics, Vol. V, No.2, pp.1-26

Haile Kebret (2000), "Land Reform: Revisiting the Public Versus Private Ownership Controversy," Institutions, Resources and Development in Ethiopia, in Alemu, M, and Dejene, A.(eds) Proceedings of the Annual Conference on the Ethiopian Economy, Oct 8-9,Addis Ababa,pp.47-66

Hakan Oktal ,Hatice Hatice Küçükönal, Vildan Korul, Ali Emre Sarılgan and Savas S. Ateş (2014). Social and Economic impact of Air Transportation .General Review ,Anadolu University Eskisehir Turkey.

Hall, R. W. (2003). Handbook of Transportation Science. United State of America: Springer.

Haller, A. P. (2012). Concepts of Economic Growth and Development Challenges of Crisis and of Knowledge. Economy Trans disciplinarily Cognition.

Harris J. (1999). The classical theory of economic growth.

Hayle B.S. Transport and Development, New York: Macmillan Press Limited (1973).

Heppenheimer, T.A. (2012) A Brief History of Flight, New York, John Wiley & Sons (A readable history of aviation with an up-to-date discussion of possible future developments)

Hye,Q.M.,Wizarat,S., and Lau,W.-Y.(2016).The impacr of trade openness on economic growth in China: An empirical analysis .*The Journal of Asian Finance ,Economics and Business.*

IATA annual review 2013, 69th Annual General Meeting, Cape Town, June 2013

ICAO 2002, Economic Contribution of Civil Aviation

Ickes, B. W. (1996). Endogenous growth models. *Department of Economics, Pennsylvania State University. University Park.*

Ieva O.and Liga P. (2017), proceedings of the 2017 International Conference "ECONOMIC SCIENCE FOR RURAL DEVELOPMENT" SPORTS ROLE IN ECONOMICS .Faculty of Economics and Social Development, Latvia University of Agriculture.

IMF(2018). "The Federal Democratic Republic of Ethiopia," IMF Country Report No. 18/18, January.

InterVISTAS Consulting Inc. (2007), Estimating Air Travel Demand Elasticities, Final Report prepared for IATA).

Ishutkina, Marya and R. John Hansman (2009). Analysis of the interaction between air transportation and economic activity: a worldwide perspective. MIT International Center for Air Transportation Report No ICAT-2009.

J,Asian Dev.(2012) .Impact of Agriculture Volatility on economic growth .A case study of Pakistan .

Jahan, S. Mahmud, A. S., & Papageorgiou, C. (2014). What is Keynesian economics? The central tenet of this school of thought is that state intervention can stabilize the economy.

John G.Wensveen (2007); Air transportation a management perspective 6th ed,2007 USA.

Kind, H. J. 2002. Endogenous growth and trade liberalization between small and large countries,*Review of International Economics*

Koch, S.F., Schoeman, N. J., and Tonder, J.J.V. (2005).Economic Growth and the Structure of Taxes in South Africa: 1960-2002.South African Journal of Economics, 73(2), 190-210.

Kockelman K. Chen D.Larson K.and Nichols B (2013) *.the economics of transportation systems: areferences for practioners .University of Texas at Austin*

Lanza, V. (2012). The Classical Approach to Capital Accumulation: Classical Theory of Economic Growth.

Levine R.and Zervos S.(1998): The stock market ,Banks and Economics growth: *Journal of American Economic Review.*

Maingi,J.N.(2015). The Impact of Government Expenditure on Economic Growth in Kenya: 1963-2008. Kenyatta University

Mekdad, Y., Dahmani, A., & Louaj, M. (2014). Public spending on education and economicgrowth in Algeria: Causality test. International Journal of Business and Management.

Melitz, M. J. (2003). The impact of trade on intra-industry reallocations and aggregate industry productivity Econometric Society.

Naol Kebede (2019), Economic implication of military expenditure on economic growth Evidence from Ethiopia.

Nkoro.E and Uko,A.K (2016) Autoregressive Distributed lag (ARDL) Co integration technic :Application and Interpretation Journal of Statistics and Econometrics methods.

Nurudeen and Usman (2010) examine the effect of government expenditure and economic growth in Nigeria from 1970 to 2008.

Olawale O.Akindele(2010); The causal relationship between capital formation and economic growth :The Nigerian Experience.

Oxford Economics Forecasting (2013).The contribution of Air transport to sustainable development in Africa.

Ozcan, I., C. 2013. Air passenger traffic and local employment: Evidence from Turkey. European Journal of Transport and Infrastructure Research.

Pesaran M.H., Shin Y. and R.J. Smith (2001), "Bound Testing Approach to the Analysis of Level Relationships", Journal of Applied econometrics, Vol.16.

Pesaran, M. and Shin, Y. (1999), "An Autoregressive Distributed Lag Modeling Approach to Cointegration Analysis" in S. Strom, Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch centennial Symposium, Cambridge University Press, Cambridge.

R. J. Hansman(2009). The impact of information technologies on air transportation. In AIAA Aerospace Sciences Conference, AIAA 2005-0001, Reno, Nevada.

Rodrich D. (2006). *Goodbye Washington Consensus hello Washington Confusion? A review of the World Bank Economic growth in 1990s*. Learning from a decade of reform Amercian Association.

Romer, P. M. (1994). The origins of endogenous growth. The journal of economic Perspectives.

RYTIS BERESNEVICIUS (2019), Ethiopian Airlines reports profitable FY 2019 amidst difficulties, AEROTIM, HUB, # 5 stay home, 7th October.

S .I .Ladan(2012) An Analysis of Air Transportation in Nigeria. Department of Basic and Applied Science, Hassan Usman Katsina Polytechnic ,Katsina.

Shakouri B, Yazdi SK, Nategian N, Shikhrezaei N (2017) The Relation between International Tourism and Economic Growth. J Tourism Hospital.

Sharma B. (2012). Government expenditure and economic growth in Nepal a minute analysis.

Shiril Tassim and Remail Yosoff (2017).The contribution of passenger movement to economic growth in Malaysia. Open University Malaysia.

Siegfried, J., & Zimbalist, A. (2016).The Economic Impact of Sports Facilities, Teams and Mega-events. Australian Economic Review.

Steiner, J. E. (1967), Aircraft evolution and airline growth. Financial Analysts Journal, 23(2), 85-92

Taye Mengiste (1994), "Market Reform and Manufacturing Public Enterprises," Ethiopian Journal of Economics, Vol.2, No1, pp.111-129

Teshome Mulat (1993), "Trends in Government Finance," Ethiopian Journal of Economics, Vol. II, No1, pp.73-100

Tewodros Ayalew (2016), the effect of the government transport infrastructure expenditure on economic growth in Ethiopia.

Tewolde GebreMariam (2019a), "Welcome Aboard", Selamta, The in Flight Magazine of Ethiopian Airline, January/February issue.

Tewolde GebreMariam (2019b), "Welcome Aboard", Selamta, The in Flight Magazine of Ethiopian Airline, September/ October issue.

The Ethiopian Airlines (2017), Annual report 2016/17 for the year ended June 30, 2017. Browsed from www.ethiopialairlines.com on (April 10, 2020)

Tsai, B MC (2012), Financial Risk Exposures in the Airline Industry-Case of South African Airlines. Unpublished Manuscript, University of Cape town, South Africa.

Tybout, J. R. (2001). Plant- and firm-level evidence on 'new' trade theories. Unpublished.

United Nations Conference on Trade and Development (2013).Sustainable tourism contribution to economic growth and sustainable development.

Verbeek, M. (2004) A Guide to Modern Econometrics (2 nd.) Erasmus: John Wiley & Sons Ltd,

WDI (World Development Indicators) (database). World Bank, Washington, DC. Available at http://data.worldbank. org/data-catalog/world-development-indicators.

Wei W.S.(2006)''Time series analysis: Uni variant and Multi variant ''.Boston : Pearson.

Wells, A.T. (2005), Air Transportation. A Management Perspective. 2nd edition. Wadsworth USA.

Werthner , H. , & Klein , S. (2009). Information technology and tourism – a challenging relationship. Wien, New York: Springer Verilog.

Wondaferahu Mulugeta (2003), Fiscal Policy and Economic Growth in Ethiopia, Unpublished MSc Thesis, Addis Ababa University

World Bank (2017) “World Development Indicators Database”, Washington DC, U.S.A

Yasin M., 2014 .Public spending and Economic Growth: Empirical Investigation of sub Saharan Africa .Southwest Economic Review.

Yergin D. and Stanslaw J.(1998). Keynesian economic theory.

APPENDIX

Unit Root test

LnY

Null Hypothesis: D(LNY) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on AIC, maxlag=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.835701	0.0005
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNY) has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 1 (Automatic - based on AIC, maxlag=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.938112	0.0021
Test critical values:	1% level	-4.296729	
	5% level	-3.568379	
	10% level	-3.218382	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNY) has a unit root

Exogenous: None

Lag Length: 2 (Automatic - based on AIC, maxlag=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.492848	0.8157
Test critical values:	1% level	-2.647120	
	5% level	-1.952910	
	10% level	-1.610011	

*MacKinnon (1996) one-sided p-values.

LnL (Sationary at Level)

Null Hypothesis: LNL has a unit root

Exogenous: Constant

Lag Length: 1 (Automatic - based on AIC, maxlag=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.899085	0.9941
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNL has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on AIC, maxlag=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.779154	0.0029
Test critical values:	1% level	-4.273277	
	5% level	-3.557759	
	10% level	-3.212361	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNL has a unit root

Exogenous: None

Lag Length: 1 (Automatic - based on AIC, maxlag=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		4.893227	1.0000
Test critical values:	1% level	-2.641672	
	5% level	-1.952066	
	10% level	-1.610400	

*MacKinnon (1996) one-sided p-values.

LnK

Null Hypothesis: D(LNK) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on AIC, maxlag=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.238280	0.0002
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNK) has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on AIC, maxlag=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.903578	0.0002
Test critical values:	1% level	-4.284580	
	5% level	-3.562882	
	10% level	-3.215267	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNK) has a unit root

Exogenous: None

Lag Length: 0 (Automatic - based on AIC, maxlag=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.389007	0.0001
Test critical values:	1% level	-2.641672	
	5% level	-1.952066	
	10% level	-1.610400	

*MacKinnon (1996) one-sided p-values.

LnATEX

Null Hypothesis: D(LNATEX) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on AIC, maxlag=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.348439	0.0018
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNATEX) has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on AIC, maxlag=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.541192	0.0054
Test critical values:	1% level	-4.284580	
	5% level	-3.562882	
	10% level	-3.215267	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNATEX) has a unit root

Exogenous: None

Lag Length: 2 (Automatic - based on AIC, maxlag=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.004717	0.2754
Test critical values:	1% level	-2.647120	
	5% level	-1.952910	
	10% level	-1.610011	

*MacKinnon (1996) one-sided p-values.

LnAGEX

Null Hypothesis: D(LNAGEX) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on AIC, maxlag=2)

		t-Statistic	Prob.*

Augmented Dickey-Fuller test statistic		-6.195679	0.0000
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNAGEX) has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on AIC, maxlag=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.391676	0.0000
Test critical values:	1% level	-4.284580	
	5% level	-3.562882	
	10% level	-3.215267	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNAGEX) has a unit root

Exogenous: None

Lag Length: 2 (Automatic - based on AIC, maxlag=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.008088	0.2741
Test critical values:	1% level	-2.647120	
	5% level	-1.952910	
	10% level	-1.610011	

*MacKinnon (1996) one-sided p-values.

LnCSEX

Null Hypothesis: D(LNCSEX) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on AIC, maxlag=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.424962	0.0001
Test critical values:	1% level	-3.661661	
	5% level	-2.960411	
	10% level	-2.619160	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNCSEX) has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on AIC, maxlag=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.769588	0.0003
Test critical values:	1% level	-4.284580	
	5% level	-3.562882	
	10% level	-3.215267	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNCSEX) has a unit root

Exogenous: None

Lag Length: 0 (Automatic - based on AIC, maxlag=2)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.420221	0.0001
Test critical values:	1% level	-2.641672	
	5% level	-1.952066	
	10% level	-1.610400	

*MacKinnon (1996) one-sided p-values.

LnMEX

Null Hypothesis: D(LNMEX) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on AIC, maxlag=2)

		t-Statistic
Augmented Dickey-Fuller test statistic		-3.782651
Test critical values:	1% level	-3.661661
	5% level	-2.960411
	10% level	-2.619160

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNMEX) has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 0 (Automatic - based on AIC, maxlag=2)

		t-Statistic
Augmented Dickey-Fuller test statistic		-3.743657
Test critical values:	1% level	-4.284580
	5% level	-3.562882
	10% level	-3.215267

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LNMEX) has a unit root

Exogenous: None

Lag Length: 0 (Automatic - based on AIC, maxlag=2)

		t-Statistic
Augmented Dickey-Fuller test statistic		-3.671808
Test critical values:	1% level	-2.641672
	5% level	-1.952066
	10% level	-1.610400

*MacKinnon (1996) one-sided p-values.

LnTOP (Sationery at level 5% significance)

Null Hypothesis: LNTOP has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on AIC, maxlag=2)

		t-Statistic
Augmented Dickey-Fuller test statistic		0.665368
Test critical values:	1% level	-3.653730
	5% level	-2.957110
	10% level	-2.617434

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNTOP has a unit root

Exogenous: Constant, Linear Trend

Lag Length: 2 (Automatic - based on AIC, maxlag=2)

		t-Statistic
Augmented Dickey-Fuller test statistic		-3.655891
Test critical values:	1% level	-4.296729
	5% level	-3.568379
	10% level	-3.218382

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LNTOP has a unit root

Exogenous: None

Lag Length: 0 (Automatic - based on AIC, maxlag=2)

		t-Statistic
Augmented Dickey-Fuller test statistic		4.792664
Test critical values:	1% level	-2.639210
	5% level	-1.951687
	10% level	-1.610579

*MacKinnon (1996) one-sided p-values.

ARDL (1, 1,0,0,1, 0,2,2) selected based AIC

Dependent Variable: LNY

Method: ARDL

Date: 04/15/20 Time: 19:23

Sample (adjusted): 3 33

Included observations: 31 after adjustments

Maximum dependent lags: 2 (Automatic selection)

Model selection method: Akaike info criterion (AIC)

Dynamic regressors (2 lags, automatic): LNL LNK LNATEX LNAGEX LNCSEX LNMEX LNTOP

Fixed regressors: C

Number of models evalulated: 4374

Selected Model: ARDL(1, 1, 0, 0, 1, 0, 2, 2)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LNY(-1)	0.013098	0.143635	0.091187	0.9285
LNL	0.4725574	0.075354	6.271165	0.0285
LNL(-1)	-0.361510	0.316953	-1.140580	0.2708
LNK	0.511092	0.084752	6.030463	0.0000
LNATEX	0.278555	0.091893	3.031293	0.0079
LNAGEX	0.152547	0.102452	1.488958	0.1559
LNAGEX(-1)	0.154177	0.124124	1.242115	0.2321
LNCSEX	0.137219	0.057512	2.385931	0.0297
LNMEX	-0.017608	0.067591	-0.260502	0.7978
LNMEX(-1)	0.133221	0.099780	1.335156	0.2005
LNMEX(-2)	-0.290619	0.085769	-3.388403	0.0038
LNTOP	-0.471148	0.141894	-3.320420	0.0043
LNTOP(-1)	-0.405563	0.141177	-2.872718	0.0110
LNTOP(-2)	0.298672	0.121120	2.465913	0.0254
C	4.744805	2.971686	1.596671	0.1299

R-squared	0.996734	Mean dependent var	19.45061
Adjusted R-squared	0.993875	S.D. dependent var	0.775140
S.E. of regression	0.060662	Akaike info criterion	-2.460660
Sum squared resid	0.058878	Schwarz criterion	-1.766795
Log likelihood	53.14023	Hannan-Quinn criter.	-2.234477
F-statistic	348.7393	Durbin-Watson stat	2.378913
Prob(F-statistic)	0.000000		

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

Estimated long run coefficient using the ARDL approach (1, 1,0,0,1, 0,2,2) selected based on AIC

ARDL Long Run Form and Bounds Test

Dependent Variable: D(LNY)

Selected Model: ARDL(1, 1, 0, 0, 1, 0, 2, 2)

Case 2: Restricted Constant and No Trend

Date: 04/15/20 Time: 19:24

Sample: 1 33

Included observations: 31

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.744805	2.971686	1.596671	0.1299

LNY(-1)*	-0.986902	0.143635	-6.870895	0.0000
LNL(-1)	0.738163	0.425721	1.733913	0.1022
LNK**	0.511092	0.084752	6.030463	0.0000
LNATEX**	0.278555	0.091893	3.031293	0.0079
LNAGEX(-1)	0.306724	0.112330	2.730566	0.0148
LNCSEX**	0.137219	0.057512	2.385931	0.0297
LNMEX(-1)	-0.175005	0.058363	-2.998570	0.0085
LNTOP(-1)	-0.578039	0.136870	-4.223260	0.0006
D(LNL)	0.4725574	0.075354	6.271165	0.0285
D(LNAGEX)	0.152547	0.102452	1.488958	0.1559
D(LNMEX)	-0.017608	0.067591	-0.260502	0.7978
D(LNMEX(-1))	0.290619	0.085769	3.388403	0.0038
D(LNTOP)	-0.471148	0.141894	-3.320420	0.0043
D(LNTOP(-1))	-0.298672	0.121120	-2.465913	0.0254

* p-value incompatible with t-Bounds distribution.

** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation

Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNL	0.747959	0.413855	1.807296	0.0896
LNK	0.517875	0.070512	7.344455	0.0000
LNATEX	0.282252	0.074966	3.765092	0.0017
LNAGEX	0.310794	0.103626	2.999180	0.0085
LNCSEX	0.139040	0.054667	2.543389	0.0217
LNMEX	-0.177327	0.059031	-3.003983	0.0084
LNTOP	-0.585710	0.095995	-6.101450	0.0000
C	4.807775	2.913907	1.649941	0.1184

EC = LNY - (0.7480*LNL + 0.5179*LNK + 0.2823*LNATEX + 0.3108*LNAGEX
+ 0.1390*LNCSEX -0.1773*LNMEX -0.5857*LNTOP + 4.8078)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	8.845426	10%	1.92	2.89
K	7	5%	2.17	3.21
		2.5%	2.43	3.51

		1%	2.73	3.9
		Finite Sample:		
Actual Sample Size	31	n=35		
		10%	2.196	3.37
		5%	2.597	3.907
		1%	3.599	5.23
		Finite Sample:		
		n=30		
		10%	2.277	3.498
		5%	2.73	4.163
		1%	3.864	5.694

Error correction Representation for the selected ARDL model (1, 1,0,0,1, 0,2,2)

ARDL Error Correction Regression
Dependent Variable: D(LNY)
Selected Model: ARDL(1, 1, 0, 0, 1, 0, 2, 2)
Case 2: Restricted Constant and No Trend
Date: 04/15/20 Time: 19:25
Sample: 1 33
Included observations: 31

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNL)	0.4725574	0.075354	6.271165	0.0000
D(LNAGEX)	0.152547	0.060384	2.526300	0.0225
D(LNMEX)	-0.017608	0.033493	-0.525706	0.6063
D(LNMEX(-1))	0.290619	0.042869	6.779247	0.0000
D(LNTOP)	-0.471148	0.075435	-6.245752	0.0000
D(LNTOP(-1))	-0.298672	0.057989	-5.150501	0.0001
CointEq(-1)*	-0.986902	0.090313	-10.92764	0.0000

R-squared	0.885324	Mean dependent var	0.084119
Adjusted R-squared	0.856655	S.D. dependent var	0.130822
S.E. of regression	0.049530	Akaike info criterion	-2.976789
Sum squared resid	0.058878	Schwarz criterion	-2.652985
Log likelihood	53.14023	Hannan-Quinn criter.	-2.871237
Durbin-Watson stat	2.378913		

* p-value incompatible with t-Bounds distribution.

Pair wise Granger Causality test at lag one

Pairwise Granger Causality Tests
Date: 04/15/20 Time: 19:33
Sample: 1 33
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
LNL does not Granger Cause LNY	32	0.49258	0.4884
LNY does not Granger Cause LNL		0.55822	0.4610
LNK does not Granger Cause LNY	32	1.03741	0.3168
LNY does not Granger Cause LNK		1.63733	0.2108
LNATEX does not Granger Cause LNY	32	2.95291	0.0964
LNY does not Granger Cause LNATEX		0.15392	0.6977
LNAGEX does not Granger Cause LNY	32	2.12999	0.1552
LNY does not Granger Cause LNAGEX		0.01995	0.8887
LNCSEX does not Granger Cause LNY	32	3.88440	0.0583
LNY does not Granger Cause LNCSEX		2.96494	0.0957
LNMEX does not Granger Cause LNY	32	0.08898	0.7676
LNY does not Granger Cause LNMEX		4.22808	0.0489
LNTOP does not Granger Cause LNY	32	2.61546	0.1167
LNY does not Granger Cause LNTOP		0.88665	0.3542
LNK does not Granger Cause LNL	32	0.49519	0.4872
LNL does not Granger Cause LNK		4.64479	0.0396
LNATEX does not Granger Cause LNL	32	2.02048	0.1659
LNL does not Granger Cause LNATEX		3.77418	0.0618
LNAGEX does not Granger Cause LNL	32	10.4046	0.0031
LNL does not Granger Cause LNAGEX		1.43148	0.2412
LNCSEX does not Granger Cause LNL	32	5.28896	0.0289
LNL does not Granger Cause LNCSEX		6.69653	0.0149
LNMEX does not Granger Cause LNL	32	0.44579	0.5096
LNL does not Granger Cause LNMEX		3.62783	0.0668
LNTOP does not Granger Cause LNL	32	3.17476	0.0853

LNL does not Granger Cause LNTOP		9.11472	0.0052
LNATEX does not Granger Cause LNK	32	7.83979	0.0090
LNK does not Granger Cause LNATEX		0.65648	0.4244
LNAGEX does not Granger Cause LNK	32	4.54100	0.0417
LNK does not Granger Cause LNAGEX		0.21245	0.6483
LNCSEX does not Granger Cause LNK	32	9.32061	0.0048
LNK does not Granger Cause LNCSEX		0.77921	0.3846
LNMEX does not Granger Cause LNK	32	0.30691	0.5838
LNK does not Granger Cause LNMEX		8.17526	0.0078
LNTOP does not Granger Cause LNK	32	5.98079	0.0208
LNK does not Granger Cause LNTOP		4.73725	0.0378
LNAGEX does not Granger Cause LNATEX	32	0.08795	0.7689
LNATEX does not Granger Cause LNAGEX		4.93255	0.0343
LNCSEX does not Granger Cause LNATEX	32	0.42164	0.5212
LNATEX does not Granger Cause LNCSEX		10.2097	0.0034
LNMEX does not Granger Cause LNATEX	32	0.00225	0.9625
LNATEX does not Granger Cause LNMEX		3.56553	0.0690
LNTOP does not Granger Cause LNATEX	32	1.91426	0.1770
LNATEX does not Granger Cause LNTOP		1.38774	0.2484
LNCSEX does not Granger Cause LNAGEX	32	2.24556	0.1448
LNAGEX does not Granger Cause LNCSEX		4.29811	0.0471
LNMEX does not Granger Cause LNAGEX	32	0.35999	0.5532
LNAGEX does not Granger Cause LNMEX		5.46338	0.0265
LNTOP does not Granger Cause LNAGEX	32	3.88800	0.0582
LNAGEX does not Granger Cause LNTOP		1.35849	0.2533
LNMEX does not Granger Cause LNCSEX	32	5.05281	0.0324
LNCSEX does not Granger Cause LNMEX		1.86799	0.1822
LNTOP does not Granger Cause LNCSEX	32	4.61573	0.0402
LNCSEX does not Granger Cause LNTOP		0.22158	0.6414
LNTOP does not Granger Cause LNMEX	32	7.42775	0.0108
LNMEX does not Granger Cause LNTOP		8.60552	0.0065

Pair wise Granger Causality test at lag two

Pairwise Granger Causality Tests

Date: 04/15/20 Time: 19:34

Sample: 1 33

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LNL does not Granger Cause LNY	31	0.24497	0.7845
LNY does not Granger Cause LNL		0.23788	0.7900
LNK does not Granger Cause LNY	31	0.48514	0.6211
LNY does not Granger Cause LNK		0.74529	0.4845
LNATEX does not Granger Cause LNY	31	1.21064	0.3143
LNY does not Granger Cause LNATEX		0.36678	0.6965
LNAGEX does not Granger Cause LNY	31	2.32099	0.1182
LNY does not Granger Cause LNAGEX		2.74718	0.0827
LNCSEX does not Granger Cause LNY	31	1.46185	0.2502
LNY does not Granger Cause LNCSEX		1.68728	0.2047
LNMEX does not Granger Cause LNY	31	0.02076	0.9795
LNY does not Granger Cause LNMEX		3.86417	0.0339
LNTOP does not Granger Cause LNY	31	0.96308	0.3949
LNY does not Granger Cause LNTOP		0.33572	0.7179
LNK does not Granger Cause LNL	31	0.24486	0.7846
LNL does not Granger Cause LNK		2.15668	0.1360
LNATEX does not Granger Cause LNL	31	0.18360	0.8333
LNL does not Granger Cause LNATEX		2.34232	0.1161
LNAGEX does not Granger Cause LNL	31	2.87045	0.0747
LNL does not Granger Cause LNAGEX		2.20606	0.1303
LNCSEX does not Granger Cause LNL	31	0.94788	0.4005
LNL does not Granger Cause LNCSEX		4.31193	0.0241
LNMEX does not Granger Cause LNL	31	1.51075	0.2395
LNL does not Granger Cause LNMEX		7.08705	0.0035
LNTOP does not Granger Cause LNL	31	0.32346	0.7265
LNL does not Granger Cause LNTOP		6.15706	0.0065
LNATEX does not Granger Cause LNK	31	4.29872	0.0244

LNK does not Granger Cause LNATEX		0.19575	0.8234
LNAGEX does not Granger Cause LNK	31	2.79981	0.0792
LNK does not Granger Cause LNAGEX		0.12299	0.8848
LNCSEX does not Granger Cause LNK	31	4.49889	0.0210
LNK does not Granger Cause LNCSEX		0.79455	0.4624
LNMEX does not Granger Cause LNK	31	2.26727	0.1237
LNK does not Granger Cause LNMEX		5.58187	0.0096
LNTOP does not Granger Cause LNK	31	3.34154	0.0511
LNK does not Granger Cause LNTOP		2.87219	0.0746
LNAGEX does not Granger Cause LNATEX	31	0.53154	0.5940
LNATEX does not Granger Cause LNAGEX		2.26023	0.1244
LNCSEX does not Granger Cause LNATEX	31	0.43834	0.6498
LNATEX does not Granger Cause LNCSEX		6.20252	0.0063
LNMEX does not Granger Cause LNATEX	31	0.00627	0.9938
LNATEX does not Granger Cause LNMEX		4.78891	0.0170
LNTOP does not Granger Cause LNATEX	31	1.18146	0.3228
LNATEX does not Granger Cause LNTOP		0.75476	0.4801
LNCSEX does not Granger Cause LNAGEX	31	1.65166	0.2112
LNAGEX does not Granger Cause LNCSEX		2.65839	0.0890
LNMEX does not Granger Cause LNAGEX	31	0.47961	0.6244
LNAGEX does not Granger Cause LNMEX		4.99482	0.0146
LNTOP does not Granger Cause LNAGEX	31	2.74340	0.0830
LNAGEX does not Granger Cause LNTOP		0.56819	0.5734
LNMEX does not Granger Cause LNCSEX	31	2.38122	0.1123
LNCSEX does not Granger Cause LNMEX		3.13903	0.0601
LNTOP does not Granger Cause LNCSEX	31	2.60775	0.0929
LNCSEX does not Granger Cause LNTOP		0.24048	0.7880
LNTOP does not Granger Cause LNMEX	31	10.5114	0.0005
LNMEX does not Granger Cause LNTOP		9.06127	0.0010