QUANTIFYING THE RELATIONSHIP BETWEEN AIR TRANSPORTATION AND ECONOMIC GROWTH IN KENYA

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X50/30485/2019

A Research Paper is Submitted in Partial Fulfillment of the Requirements for the Award of the Degree of Master of Arts in Economics at the University of Nairobi

November 2023

DECLARATION

This research paper is entirely original to me and has never been used to fulfill a requirement for a degree at another institution.

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This research paper has been submitted with my approval for examination as the university supervisor.

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DEDICATION

For my parents, Daniel, and Mercy Kaguku, who have been my inspiration and source of constant support throughout my academic career. Additionally, I dedicate it to my beloved Everlyne Kuria, who showed me so much compassion and understanding throughout the arduous process of carrying out this research.

ACKNOWLEDGEMENT

I want to start by giving thanks to God for helping me through my studies and making it possible to finish this research project.

I am forever grateful to Dr. Sule, my research supervisor, for his guidance and support while I worked on this research. His assistance remains priceless. I also want to express my gratitude to my professors and the entire University of Nairobi team for enhancing my academic experience.

I express my gratitude to my family and friends for their support and encouragement throughout this time. I would also like to thank my classmate Tim Odinga, my brother Naftaly Ng'ang'a and my friend Janice Mutisya for reading and offering positive remarks; I really appreciate it.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ASKs	Available Seat Kilometers
ATAG	Air Transport Action Group
GDP	Gross Domestic Product
FTKs	Freight Tonne Kilometers
IATA	International Air Transportation Association
ICAO	International Civil Aviation Organization
IMF	International Monetary Fund
IOSA	IATA Operations and Safety Audit
JKIA	Jomo Kenyatta International Airport
KAA	Kenya Airports Authority
KCAA	Kenya Civil Aviation Authority
KIPPRA	Kenya Institute for Public Policy Research and Analysis
KNBS	Kenya National Bureau of Statistics
KOF	Swiss Economic Research Institute
KQ	Kenya Airways
MOT	Ministry of Tourism
RASK	Revenue Per Available Seat Kilometer
RPKs	Revenue Passenger Kilometers

ABSTRACT

Air transportation remains a core factor in the world's economic growth. Thus, in the context of Kenya, this study looked at the connection that between air transportation and the economy. To conduct the study, the research explored both the long-run and the short-run relationship between air transportation (both passenger and cargo) and the gross domestic product (GDP) in Kenya. Data for Kenya from 1971 to 2019 were analyzed using the linear autoregressive distributed lag (ARDL) modeling technique. Further investigated was the connection between a few control variables and economic growth, including net migration, diaspora remittances, the globalization index, imports, and exports. In the short run, the study found that there was statistically significant relationship that leads to overall growth of the economy in Kenya. The positive shocks were seen to propel the short run economic growth. The study also discovered that the variables were statistically insignificant over the long term, meaning that the relationship had greater short-term influence than long-term impact.

Keywords: Air Transportation, ARDL, Economic Growth, Kenya

CHAPTER ONE: INTRODUCTION

1.1 Background Information

The aviation industry is crucial in providing people with access to capital, markets, skills, information, and facilitating the movement of people, goods, and opportunities worldwide. However, the relationship existing between air transportation and economic growth is complex, with multiple mechanisms at play due to the unique characteristics involved (Ishutkina and Hansman, 2009). These unique characteristics differ between economies with some countries having a greater proportion of domestic travel compared to international travel and vice versa. Consequently, the purpose of air travel also differs between economies due to different economic activities across countries of the world.

According to research by the International Air Transport Association, the aviation industry worldwide supported over 65 million jobs in 2019 and created $2.7 trillion in economic activity (IATA, 2020). In addition, the International Civil Aviation Organization conducted research which indicated that the aviation industry transported 4 billion people in the year 2020, or just over 50% of the world's population (ICAO, 2021). By the year 2019, airlines served an average of 4.3 billion people annually, translating to 8.3 trillion RPKs, the industry benchmark for calculating the demand for air travel.

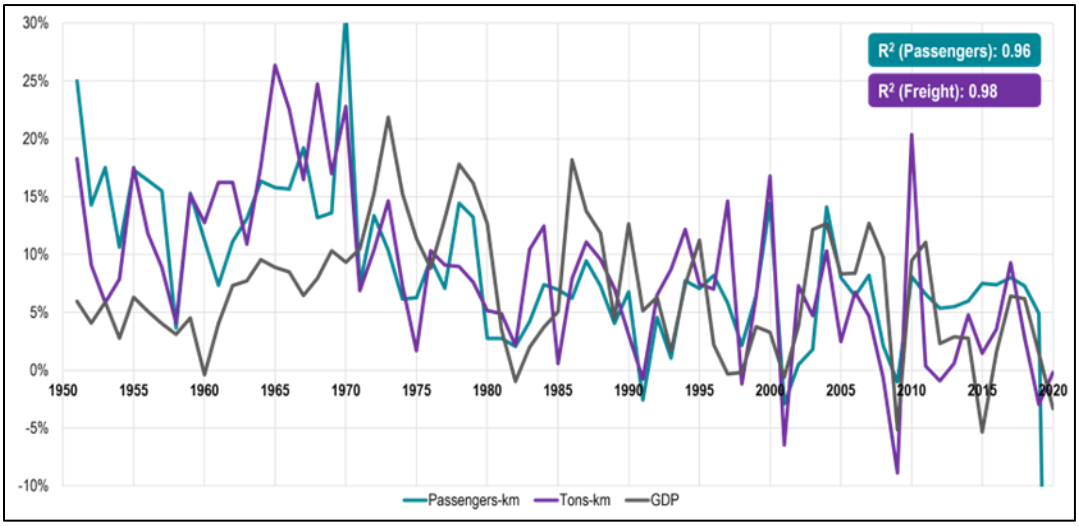
A total of 58 million freight tonnes were flown around the globe in the aviation industry's cargo subsector, reaching a peak of 231 billion in FTKs, the demand metric for air freighters (ATAG, 2019). Therefore, the use of air travel has a significant impact on trade and individual movements, two of the main pillars of globalization, and on economic links between various parts of the world. Additionally, air travel is the sole practical mode of transportation for lengthy distances, and it is the best for delivering expedited freight (very perishable documents) and providing access to remote locations. Through the services it provides, air transportation broadens the geographic reach and greatly shortens the cycle time of economic activity (Ishutkina, 2009).

In 2019, Air Transport Action Group carried out research that found that the aviation industry generated $63 billion to Africa’s GDP and supported 7.7 million jobs. That contribution is

an equivalent of 2.7% of African GDP and 2.2% of all employment across African countries. Further, the research by the ATAG showed that the aviation enabled sectors supported an additional 16.5 million jobs elsewhere in Africa alone. This means for every $1 generated by the aviation industry, $6 of economic activities was supported elsewhere in Africa (ATAG, 2019).

The same research indicated that the aviation sector employed 500,000 people directly in the year 2018. This number broken down, 57% of the total which is an equivalent of 252,000 people were employed directly by airlines or airline handling agents as flight crew, airports ground services and check-in staff, equipment, and engine maintenance and back off support staff. A further 10% of the total worked in airports management, security staff and equipment operators. Another 112, 000 (25% of the total worked on site within the airports in retails, restaurants, and airport hotels while 17,000 (4%) worked in civil aviation manufacturing which includes systems, airframe, components, and engines. Further, 4%, which is an equivalent of 13,000 people, worked within the civil aviation navigation department and related bodies. All these fields contribute significantly to GDP in Africa generating $9 billion directly. In addition, ATAG also found that the aviation industry spending by suppliers is estimated to have contributed to more than 0.5 million jobs and a further $5.5 billion contribution to Africa's GDP. In addition, spending from employees employed directly in the aviation sector and aviation's supply chain contributed a total of $4 billion to GDP and created 330,000 more jobs.

Figure 1. 1: Global Air Transportation Growth (Passenger and Freight) and Economic Growth (1950-2020)



Source: World Bank

1.1.1 Air Transportation Demand in Kenya

Aviation industry in Kenya was started in the year 1929 and was dominated by foreign carriers until the establishment of East African Airways in 1946. Kenya Airways was established in February 1977 following the dissolution of the East Africa Community and continues to serve as the country's national airline today. Air transportation in Kenya, both passengers and cargo, facilitate over $10 billion in export, some $4.4 billion in Foreign Direct Investment (FDI) and approximately $800 thousands in inbound leisure and business tourism (IATA, 2019).

Aviation industry in Kenya contributes 4.6% of the total annual GDP (KNBS, 2022). The passenger journeys made in Kenya in the year 2017 was more than 4.6 million which contributed to a $3.2 billion gross value addition to the GDP from the tourism and the aviation industries and translated to 410,000 jobs. Recent data shows that tourism and aviation combined contributes up to 40% of overall exports from Kenya (IMF, 2020). The aviation industry is therefore crucial to the long-term economic development blueprint, Kenya's Vision 2030, which intends to lift Kenya out of poverty and into the middle-income position by the year 2030 (KIPPRA, 2022). Travel by air, tourism, and foreign travel have all seen

considerable increases in Kenya since 2012—all crucial factors in the country's social and economic development. IATA estimates that in 2017, the country's GDP increased by US$1.7 billion because of the spending of international visitors. This demonstrates that the aviation industry and foreign travelers who fly directly support 5.1% of the Kenya's GDP. The $0.8 billion in expenditures made by international tourists in Kenya in 2014 were profitable for the country's hotels, eateries, transportation companies, and other tourism-related enterprises (IATA, 2017). The demand for air travel increased dramatically from less than 1 million passengers in 1990 to 9.3 million in 2018 (KCAA, 2019).

Kenya's economic expansion has made air transport connectivity even more crucial. Kenya's aviation sector grew significantly in the last few years, with 10.6 million passengers carried in 2018 compared to 5.1 million in 2010 (KAA, 2019). The advent of low-cost airlines, greater investments in airport infrastructure, and aviation industry liberalization have all contributed to this expansion. Kenyan consumers have profited from enhanced air transportation connectivity in several ways, such as improved corporate communication, simpler market access, and a rise in travelers. For example, Kenya Airways has played a significant role in increasing travel to Kenya, with over 4 million passengers flown in 2018 and generating around $1.2 billion in tourism revenue (Kenya Airways, 2019). Additionally, because of their competitive pricing and ability to access smaller domestic airports, low-cost carriers have made air travel more accessible for Kenyans.

Figure 1. 2: Trend in Air Transport Demand

Figure 1. 3: Trend in Air Freighter Tonnage (Million ton-km)

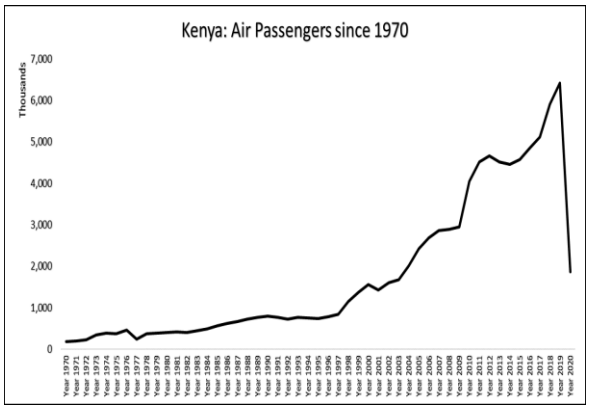


Fig 1.2: Trend in Air Transport Demand
Source: Author's Construction from World Bank Data, 2022

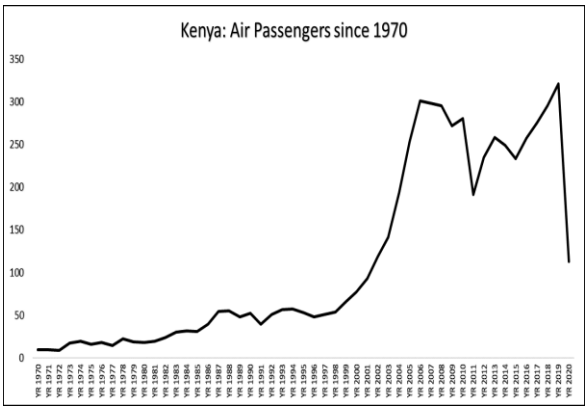


Fig:1.3: Trend in Air Freighter Tonnage (Million ton-km)
Source: Authors own construction from World Bank Data, 2022

Recent studies have shown that air operators, commercial airlines, airport-based enterprises (both restaurants and retail), manufacturing and maintenance of aircrafts, as well as air navigation employ about 15,000 people in Kenya (IATA, 2018). Further, the aviation sector supports an additional 96,000 jobs by acquiring goods and services from Kenya. On top of these, through the wages the sector pays to all its employees, aviation further supports an additional 43,000 jobs which are subsequently spent on consumer goods in Kenya. The most important benefit goes to both passengers and shippers and the spillover impact on their businesses. (IATA, 2018).

According to IATA's projections, the global air transport market will increase at a rate of up to 249% over the next 20 years if current trends continue. If this pattern continues, an additional 11.8 million passengers would enter Kenya by the year 2037. The prediction by IATA also states that 859 000 jobs and almost $11.3 billion in GDP would be created.

1.1.2 Air Transportation Connectivity and Consumer benefits in Kenya

Air transportation connectivity reflects how a country is connected to other regions in the world which is fundamental to the ability of the given country to develop economic linkages. There are several models that have been used to measure air connectivity between countries

and regions in the world. One such model is a simple physical model where one counts connections. In addition, there is the utility-based model which considers all costs that passengers face while connecting two destinations. These costs include but are not limited to transfer and travel time, ticket price and time used to access the airport terminals (Burghouwt & Redondi, 2013; Arvis & Shepherd, 2011). Connectivity can simply be measured by and extent to which hubs are connected to each other through spokes which are facilitated by freedoms of the air. The aim of this connectivity is to bring benefits to consumers – in this case passengers and shippers – countries and businesses through reduced time and cost of traveling, trade facilitation, investment stimulation and as well as productivity efficiency (Bottini & Morphet, 2012; Burghouwt & Wit 2015; Burghouwt, 2016; Burghouwt, 2017). It is the responsibility of Kenya Civil Aviation Authority to facilitate connectivity and access to different regions through air travels by facilitating traffic rights to different airlines, restriction on airport use as well as taxation on passenger and goods flow between two countries (Burghouwt, 2016).

Table 1. 1: Aircrafts Movement in Kenya, 2018 to 2022

Operation Type	Movement Type	Yr-2018	Yr-2019	Yr-2020	Yr-2021	Yr-2022*
Domestic Ops	*Arrivals*	113,803	108,836	61,060	83,879	103,443
	Departures	115,435	110,430	61,988	82,755	102,474
	Total	**229,238**	**219,266**	**123,048**	**166,634**	**205,917**
International Ops	*Arrivals*	47,918	48,260	22,488	26,827	35,195
	Departures	48,183	49,172	22,791	26,683	35,013
	Total	**96,101**	**97,432**	**45,279**	**53,510**	**70,208**
Total Operations	*Arrivals*	161,721	157,096	83,548	110,706	138,638
	Departures	163,618	159,602	84,779	109,438	137,487
	Sub-Total	**325,339**	**316,698**	**168,327**	**220,144**	**276,125**
	Over-flights	58,005	58,736	29,101	33,837	47,296
Grand Total	**Total Movements**	**383,344**	**375,434**	**197,428**	**253,981**	**323,421**

*Subject to future revision

Source: KNBS Economic Survey, 2023

Kenya's post-independence increase in air travel has sped up the construction of airport infrastructure. There are many airports and airstrips that have been built. Currently, the nation has 568 aerodromes scattered over the whole nation, including national parks and game reserves (KNBS, 2022). A parastatal created by a Parliamentary Act in 1991 called Kenya

Airports Authority (KAA) operates about 160 of them as public aerodromes (Irandu, 2018). JKIA serves as a major regional hub for international travel. The Nairobi based hub is strategically a place to connect passengers arriving in the country for trade, United Nations envoys, international students, local tourism which include both the coastal tours and inland game facilities and investment. Recently, the Moi international Airport based at the coastal city of Mombasa has also become a key connecting hub for airlines such as Qatar Airways (QR), Ethiopian Airways (ET), Air Uganda (UR), Amsterdam based Royal Dutch Airlines (KLM) a member of KLM-Air France group as well as onward connections through the national carrier, Kenya Airways (KQ). Other operators within domestic Kenya includes but not limited to Jambojet, Fly540, Fly748, Renegade Air, Safarilink, Skywards Express and other privately owned airlines.

Together with other airlines that operate into Kenya, carriers such as Kenya Airways (KQ) have facilitated promotion of commerce, Kenya's social and economic development, creation of jobs, offering logistics that are vital in boosting tourism and trade which are major drivers to economic growth. Through aviation development policies, reduced bureaucracy at the ports of entry and exit has been paying off due to efficient clearance and transfer time and cost. Overall, air transport connectivity has become a critical factor in promoting economic development and consumer welfare in Kenya. Growth in the aviation sector, together with increasing spending on airport infrastructure and the appearance of low-cost carriers, has boosted market access, strengthened connectivity, and expanded the nation's tourism potential.

1.2 Problem Statement

In Kenya, the transportation sector has a key role in economic growth. The Kenya National Bureau of Statistics Economic Survey of 2022 shows that the road sub-sector dominates the transportation industry in Kenya, which includes aviation. Currently, the transportation sector accounts for approximately 8.3% of the GDP. In its Vision 2030 economic blueprint, Kenya aims at a sustained 10% annual economic growth rate which has so far not been achieved with the period 2010 to 2022, the country only managing an average growth rate of 5.03 percent majorly contributed by the manufacturing and agricultural activities (World Bank,

2022). To achieve this growth, the government has recently focused on some of the sectors of the economy that have potential to fasten economic growth which include but not limited to, the tourism industry, export of both raw and final products, ease of movement between boarders for trade and non-trade activities and reliance on diaspora remittances as an alternative source of income. To achieve growth in tourism sector for instance, the country needs to position itself as a key tourism destination as it is the case of Mauritius, Maldives, Zanzibar, the Vanilla Islands, Switzerland, and other key global tourism destinations which can be promoted through a great network of air transport connectivity.

In addition, there is need to explore and leverage other sub-sectors of the transportation industry, such as aviation, that have the potential to accelerate economic growth. Furthermore, global projections indicate a steady increase in demand for air travel, with the potential to contribute trillions of dollars in incremental GDP and millions of jobs to the global economy. Thus, it is essential to comprehend the precise effects of air travel on Kenya's economy and create a well-informed strategic plan to maximize the aviation sector's potential and raise the GDP contribution of the transportation sector.

We lack thorough empirical data about the precise contribution of the air travel subsector to the Kenyan economy, despite the aviation industry's considerable influence from both internal and external economic forces and its potential to spur economic growth. This has resulted in less attention being paid to the sector, which has influenced low budgetary allocation and continued to harm the aviation industry's long-term growth. To increase government attention to aviation as an enabler to economic growth, it is therefore crucial to understand the specific impact of air transportation on Kenya’s economy, yet this information is not available. This study aims to fill the existing knowledge gap by quantifying the relationship between air travel and the Kenyan economy, providing valuable insights for policymakers and stakeholders to support informed decision-making and maximize the economic benefits of the aviation sector.

1.3 Research Questions

Below research questions will guide this study:

i. What is the connection between air travel and Kenya's economic growth?

ii. What are the growth trends of air transportation and related sectors of the economy in Kenya?

iii. What policy conclusions can be inferred from the research findings of (ii) above?

1.4 Specific Objectives

i. To estimate relationship between Air transportation and economic growth in Kenya.

ii. To determine the connection between the aviation industry and how it affect economic growth in Kenya.

iii. Based on the research's findings, come to certain conclusions, and offer some policy suggestions.

1.5 Justification of the Study

This research will be beneficial since the impact of aviation industry to economic productivity is essential for smart policy making and strategic investment in the aviation industry. Government institutions, aviation regulatory bodies such as Kenya Civil Aviation Authority and airlines will be armed with robust analysis which measures the broader contribution, relationship, and interaction of air transportation with the economy. With this therefore, such agencies are poised to make smarter and well-informed decisions. In addition, this study will give insight on economic footprint of air transportation, both cargo and passengers, and its contribution to among others, GDP, employment, tourism, international trade and global mobility of capital and knowledge and financial impact on welfare. This study will not end there as it will contribute heavily as an essential focus point and guide for other implications of aviation industry such as welfare, foreign direct investment, cultural transfer, and opportunities for international trade.

Finally, this research will greatly expand our knowledge of the connection between economic growth and air travel, which will help other scholars who are interested in this subject.

CHAPTER TWO: LITERATURE REVIEW

2.1 Chapter Overview

To offer the information needed for a complete understanding of the existing relationship between economic growth and air travel, the existing literature that served as the basis for this research is examined under the chapter. A body of research that identifies the gap that this study is seeking to fill will be reviewed and presented in this chapter. The chapter will also draw attention to a few issues with past studies.

2.2 Theoretical Literature Review

This section will explore three theories. They include the input-output theory and the causal relationship theory of economic growth which propose a dependence relationship between economic variables, while the endogenous growth theory aims to explain long-term economic growth through factors that arise from within the economy rather than external factors like technological advancement.

2.2.1 The Endogenous Growth Theory

According to the theory of endogenous growth, exogenous factors like population growth and resource exploitation have less of an impact on economic growth than knowledge generation, innovation, and human capital. In contrast to classical growth theory, endogenous growth theory contends that several factors, such as innovation, human capital, and technical advancement, drive economic growth. The theory also suggests that long-term sustainable economic growth can result from investments in these internal forces. The theory states that long-term growth is fueled by economic activities that lead to the development of new technological knowledge. The theory has changed throughout time in response to empirical evidence. Endogenous growth, according to the theory, is long-term economic growth that is determined by characteristics specific to the economy. The chances and incentives for the advancement of technological knowledge are greatly influenced by internal dynamics. Further, economic growth rate as indicated by the growth rate of production per person is ultimately determined by the rate of growth of total factor productivity, TFP, which is in turn controlled by means of the rate of technological invention. However, the neoclassical growth

hypothesis was developed in 1956 by Solow and Swan on the false premise that a scientific method independent of economic factors could determine the rate of technological advancement. Thus, they suggest that economists might accept the long-term growth rate as exogenous—that is, coming from outside the economic system.

By suggesting avenues via which the rate of technological advancement can be controlled by economic considerations, the endogenous growth theory has posed a challenge to the neoclassical perspective. The hypothesis begins by noting that economic activity-driven inventions of new goods, services, and markets drive technical advancement.

Numerous studies have used endogenous growth theory investigating the link between air transportation and industry-specific economic growth. For example, Redondi et al. (2017) found that air travel promotes knowledge dissemination and innovation, both of which are advantageous for economic growth. Other studies, like those by Graham and Vowles (2006), contend that air travel promotes the dissemination of concepts, information, and technology, which in turn fosters higher productivity and economic expansion, bolstering these claims. Additionally, according to endogenous growth theory, which is a significant driver of economic growth, air travel has a positive effect on capital accumulation by encouraging the expansion of industries that are capital-intensive or dependent on global supply chains. Overall, the research indicates that because of its effects on productivity, human capital, innovation, and knowledge diffusion, air travel is essential for fostering economic growth.

2.2.2 The Causal Relationship Theory of Economic growth

According to the theory of Causal Relationship of economic growth, several variables and growth have a reciprocal relationship. According to this idea, in addition to exogenous factors, the economy's endogenous forces also affect economic growth. The expansion of the economy is significantly influenced by these endogenous variables, which also include investment, technological advancement, human capital, and infrastructure development.

When this theory is applied to the connection that exists between economic growth and the aviation industry, it becomes clear that the latter can both cause and result from the former. The development of the aviation industry comes in handy in promotion of regional growth,

drawing in foreign investment, creating jobs, and easing trade and tourism, all of which can further economically progress. By offering effective transportation networks, bringing together companies and customers from different countries and continents, and promoting economic integration, the aviation sector boosts economic activity. Nonetheless, the growth and advancement of the aviation sector can also be encouraged by economic progress. As economies grow, so does the necessity for air travel and freight services, which drives the growth of airlines, airports, and related infrastructure. Economic growth enables the growth of existing facilities, the construction and upgrade of airports, the acquisition of state-of-the-art machinery, and other aviation-related investments. The aviation industry and economic growth are positively correlated, highlighting the dynamic and active nature of their relationship.

In the past, the theory of Causal Relationship has been used to examine how air travel affects economic expansion. Numerous studies have been done to investigate the connections between air travel and various economic growth drivers, such as trade, tourism, and foreign direct investment. For example, Dogruel and Mokhtarian's (2014) study found a causal relationship between air travel and international trade, with air travel facilitating the transfer of goods and services and promoting international trade. A similar study by Martn and Voltes-Dorta discovered a causal link between air travel and tourism, with air travel simplifying travel and encouraging tourism. Moreover, air transport has also been found to have a causal relationship with foreign direct investment (FDI). According to Seetanah and Jeetah's (2016) study, air travel facilitates investment and the flow of people and goods, which has a positive impact on foreign direct investment (FDI). The causal relationships theory of economic growth provides a useful framework for understanding the complex relationships between air transport and different factors that drive economic growth.

2.2.3 The Input-Output Theory

The relationship between various economic sectors is explained by the input-output theory of economics (Collet & Gardiner, 1984). According to this theory, interdependence—the idea that one sector's output becomes another's input—is the reason why the economy grows. The input-output theory has been used to study the link between different economic sectors and

air travel, besides the effect of air travel on economic growth. All things considered, the input-output theory provides a useful framework for understanding the interdependence of different economic sectors and the potential effects of changes in one sector on other sectors.

According to Mark & John (2009), a set of accounts that detail transactions and dependent links between the aviation and other economic sectors form the basis of input-output analysis. Through interindustry connections, these accounts can be used to assess how demand shifts in the aviation services impact other businesses. The influence of input and output is often measured using three main criteria. The direct impact, which is the way in which corporate operations, or a proposed industry development affects employment or economic output, comes first. The second is the indirect impact caused by the inter-industry purchases of goods and services in reaction to the aviation industry's activity. This comprises the jobs and activities generated in the industry's overall supply chain. The household spending of those who are both directly and indirectly employed by the operations of the industry also has an induced impact (ATAG, 2018).

2.3 Empirical Literature Review

The connection between air transportation and the economy has been the subject of numerous studies. Eric, Artur, and Nicholas conducted a study in Kenya in 2020 on how better air connectivity affects the country's tourism industry and its possible implications on wellbeing. In this work, the Computable General Equilibrium, CGE, model was utilized to calculate the potential welfare effects of consumer choice and air connectivity in Kenya using data range between the year 1995 to 2014. They concluded that there existed a significant correlation between passenger flows and air connectivity, which in turn had a direct bearing on the expansion of Kenya's tourism industry. They further supported this model using the Gravity model. Their analysis typically concluded that future trends would continue along the same path as those examined in the current trend, and that the expansion of air connectivity would continue to have a favorable impact on travel, tourism, and welfare.

Fernandes and Pacheco (2010) studied the nexus between Brazil's airline passenger transportation model and the economic growth by means of the Granger causality test. Fernandes and Pacheco used total RPKs as an indicator of airline demand and GDP as an

estimate of economic growth in their examination of time series data from 1966 to the year 2006. Fernandes and Pacheco discovered that national airline access has a direct Granger causality link between GDP and RPK, and that the antecedence was also reflected in the long run bond between the variables.

Button and Yuan (2012) caried out a study on the economic role of the aviation industry to the Chinese economy using the Input-output model. This comprehensive scholarly work used time series data that spanned the period from 1985 to 2009. Button and Yuan used direct and indirect economic effects of aviation, including employment, output, and tax revenues as variables, and found that the aviation industry has a substantial positive effect on economic growth in China, contributing to employment, output, and tax revenues.

Balsalobre-Lorente et al. (2021) examined the asymmetric effect of air travel on economic growth. The authors used air travel as a substitution for tourism to confirm the tourism led growth hypothesis. The empirical findings from NARDL showed that urbanization, air travel, and social globalization all significantly and favorably affect economic growth. From the results of the asymmetric NARDL long-run statistics, a positive change of 1% in air travel boosts economic growth by 1.31%, whereas a 1% rise in negative air travel boosts GDP by 1.44%.

Zhang and Zhang (2017) employed the Generalized Method of Moments, GMM, estimator to carry out research on the impact of aviation on economic growth with evidence from a global panel of countries. The research focused on aviation activities and economic indicators in 170 countries focusing on country-specific factors. The study used data ranging between 1971-2019 and established a positive and important relationship existed between the aviation industry and economic growth globally, with the aviation sector contributing to employment, trade, and tourism.

Limi (2019) used a fixed effects regression model to conduct research on development of Airport infrastructure development and regional growth of Sub-Saharan Africa economy. The variables used by Limi included regional GDP, Airport infrastructure, employment, and other economic indicators using data from 1990 to 2015. The study by Limi revealed a positive connection between airport infrastructure as well as regional growth in Sub-Saharan

Africa economy, emphasizing the importance of investing in airport development for economic development.

Arvis et al. (2014) used data between the year 2007 and 2014 to carry out a study titled connecting to compete in the global economy. Arvis used the Gravity model using trade and air transport data in a global perspective. Among the key variables used in the model were trade flows, international air connectivity data and economic growth rate. Arvis established that there was a demonstration of a positive correlation between air transport connectivity and trade, indicating that improvements in air connectivity can enhance economic growth through increased trade.

Bel and Fageda (2009) did an analysis using dynamic panel data model on European airports panel data from 1982 to 2002. The aim of the research was to study globalization, intercontinental flights, and location of headquarters impact on economy and found that increased airport traffic has a significant and positive impact on regional economic growth, particularly in terms of employment and productivity. Bel and Fageda used variables such as regional GDP, airport traffic, employment, and other economic indicators to carry out their research.

The effects of energy, air travel, foreign direct investment and information and communications technology, on economic growth in the United States between 1981 and 2017 were examined by Adedoyin et al. (2020). This occurred during the fourth industrial revolution. The study looked at the short-term and long-term connections between economic growth and air travel. The analysis employed canonical cointegrating regression, entirely modified least squares as well as the dynamic ordinary least squares. Econometric methods used in their analysis verified the air transport led growth hypothesis by demonstrating that air travel increases economic growth. Additionally, the study discovered that although air travel is a significant pointer of economic activities, it may not at all times be straightforward that air travel must foster growth in the economy.

While investigating the nexus between air transport and the economic growth in the case of Australia, Khanal, Khanam, Rahman, and Velayutham (2022) employed the non-linear autoregressive distributed lag, NARDL, modeling approach using statistics for Australia

from ranging from 1971 to 2019. To support air transport run growth hypothesis (ATLGH) in the Australian setting, the study looked at whether air travel stimulates economic growth. The results of the study discovered a asymmetric and statistically significant effect of air travel on economic growth, this effect existed in both the short term and in the long term. They came to the study's conclusion that the aviation sector's positive shocks are what drive long-term economic growth. The study's conclusions also show that negative air travel shocks have a more negative influence on economic growth than positive ones.

Blonigen and Cristea (2015) used an OLS approach to carry out a research study on services on air travel and urban economic growth with data from 1969-1991 discovered that a 50% increase in the average city's air traffic growth rate resulted in 7.4% rise in real GDP. They used the modifications in air traffic brought on by the deregulation of airlines in 1978 as the basis for their study. In the study, it was discovered that air connectivity increases GDP, with this effect being more pronounced in the industrial sector than the service sector.

Fleming & Ghobrial (2014) used data between 2004-2014 and conducted study using the Least Square and Fixed Effects models on the factors that affect passenger traffic at Turkish airports at the provincial level of the nation and discovered that GDP, population, tourism, and foreign migration promote air traffic increase. This study concentrated on the sharp increase in air travel that occurred when the Turkish market was deregulated, and air operations were greatly expanded. According to a Fleming and Ghobrial analysis, airports' proximity to major cities, their presence near educational institutions, and the presence of foreign nationals all helped to increase air traffic. These factors were similar in emerging economies and developed economies alike.

Growth of civil aviation was significantly impacted by economic development. Florida et al. (2012), who investigated the effect of the airport network in local economic development in the United States using the OLS Regression model, provided additional support to Fleming & Ghobrial study. The study by Florida et al. focused on two aspects: whether a place has an airport or not, and the function that airports serve in economic development. Overall, the findings indicated that airports had a far more significant impact on regional development than the expansion of technological sectors, almost to the same extent as human capital

impacts.

2.4 Overview of Literature

The assessment of the literature demonstrates that there is rising interest in comprehending how air travel affects economic growth. Investment in the aviation industry is thought to help the economy thrive by acting as a catalyst for the expansion of associated industries and the aviation supply chain. Even though there have been many studies looking at the connection between the aviation sector and the economy, the majority have generally restricted their studies to the welfare implications of the aviation business and have focused on air travel outside of Kenya. Additionally, most of those studies employed tourism as a stand-in for demand for air travel rather than the actual demand from both passenger and freighter operations due to different research limitations. Additionally, most of the studies examined emphasized the gaps in earlier literature that also had insufficient empirical evidence. The quantitative approaches used in other studies likewise shared a common strategy, although they did not share a common approach to data testing.

The empirical literature reviewed presented mixed outcomes. There was only one literature reviewed that focused on Kenya which was limited in scope since it used tourism as a proxy for air transport and mainly focused on welfare implication instead of economic growth. Also, the rest of the research were done at a regional level or other countries outside Kenya. In addition, the studies conducted before were limited in terms of variables used and this study aims to bring more variables into the model. To quantify the complex nature of the relationship existing between the air transportation patterns and economic growth, this research will develop various possible approaches and add more variables to the analysis model in addition to filling the gap found in other methodologies in the literature reviewed.

CHAPTER THREE: RESEARCH METHODOLOGY

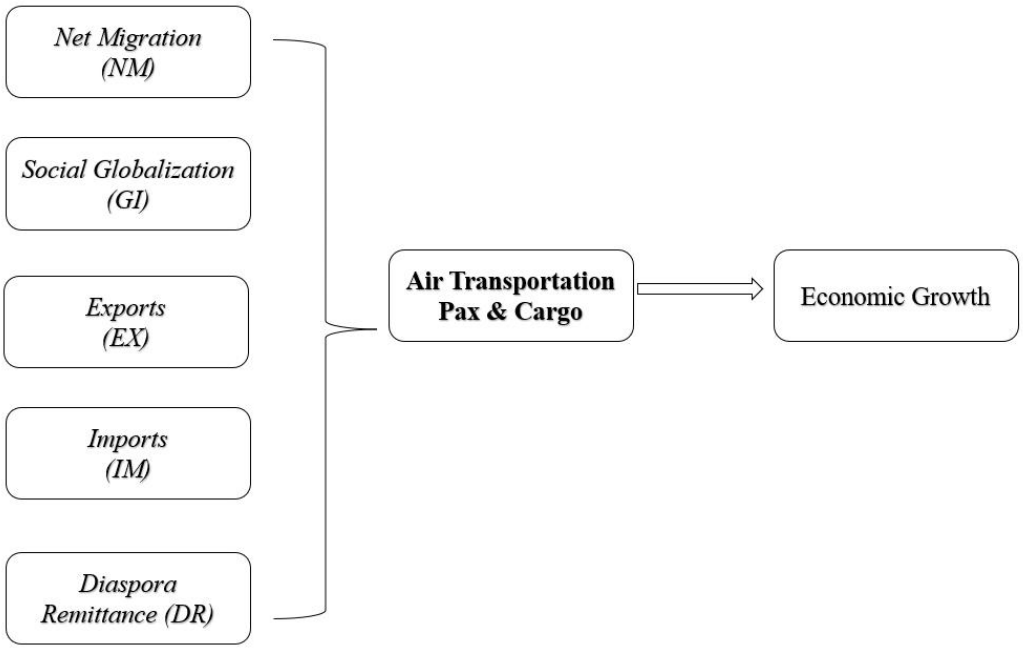
3.1 Overview of the Chapter

This chapter will present the methodology carried out in this study in realizing the research objectives. It highlights conceptual framework of the study followed by the theoretical model and the model specification. Further, the chapter concludes by describing the data variables and estimations as well as describing the diagnostic tests and data sources used in the study.

3.2 Conceptual Framework

Reference to the literature discussed, GDP has been identified to play a major role in air transportation. It is evident that other variables such as tourism demand, foreign direct investment, net migration rate are key drivers of growth of the air transport industry. This study will therefore adopt a conceptual framework shown in Figure 1.3 below. The below conceptual framework illustrates the relationship between GDP and air transportation in addition to other related control variables.

Figure 3. 1: The Conceptual Framework



Source: Author's own construction, 2023

In this conceptual framework, air transportation will form an independent variable. The impact of this variable is also influenced by other variables such as tourism demand and net migration, social globalization, foreign direct investment, diaspora remittances, imports and exports which will form the intervening variables. Economic growth brought about by improved air transportation forms the dependent variable of the framework.

3.3 Theoretical Framework

The study will be premised on the theoretical framework of Solow-Swan neoclassical growth model which depicts growth through capital accumulation, labor, and technology (Solow, 1956; Swan, 1956). This algebraic model is given in the form of.

$$Y_{t=}F(A_tK_tL_t)$$

Where *A* is technological advancement, *Y* is production, *K* is capital, *L* is labor, and *t* is time.

When time (t) enters the function indirectly through $K, L,$ and $A,$ and output changes over time depending on production inputs. Since air transport enables quicker and more efficient movement of products, services, and people, which in turn results in higher economic activity and commerce, technological advancement will proceed in this research through social globalization and capital through financial globalization. The flow of domestic and international capital into various regions or nations is made easier by this greater interconnectedness. Businesses are more inclined to invest in capital-intensive activities that lead to capital accumulation, such as infrastructure development, manufacturing, and technology, when they have better market access.

This equation will be assumed to take a linear form and take logarithms on both sides in the following form to assess the association between air travel and economic growth in Kenya.

$$ln\ (\mathrm{Y}_t)=ln\ (A_tK_t^{\alpha}L_t^{\beta})$$

And can be expanded to take the below form.

$$ln\ (\mathrm{Y}_t)=lnA_t+\alpha lnK_t+\beta lnL_t$$

3.4 Model Specification

The nonlinear autoregressive distribution method, or ARDL, will be used in the study to quantify the relationship between the variables. The equation is expressed in its functional form as.

$$GDP = f\,(ATpax, ATcargo, GI, NM, EX, IM, DR)$$

Where, GDP is Gross Domestic product (economic growth), ATpax is air transport passenger demand, ATcargo is air transport passenger demand, GI is the Social Globalization Index, NM is net migration, EX is export, IM is import and DR is diaspora remittance.

This function of the study will therefore be presented as multiple regression equation of the form.

$$GDP_t = \beta_0 + \beta_1\, lnATpax_t + \beta_2\, lnATcargo_t + \beta_4 GI_t + \beta_5\, NM_t + \beta_6\, EX_t - \beta_7\, IM_t + \beta_8\, DR_t + \varepsilon_t$$

Where β_0 is an intercept or constant, $\beta_1, \beta_2, \beta_3, \beta_4 \ldots, \beta z$ are the coefficients or the parameters of the independent variables.

This equation will be extended to natural logarithms as

$$lnGDP_t = \beta_0 + \beta_1\, lnATpax_t + \beta_2\, lnATcargo_t + \beta_3\, lnDR_t + \beta_4 GI_t$$

$$+ \beta_5\, lnNM_t + \beta_6\, lnEX_t - \beta_7 lnIM_t + \varepsilon_t$$

Since the elasticities of the equation are constant across the whole range of values, it is a sort of multiplicative function. The following parameters $\beta_1, \beta_2, \beta_3, \beta_4 \ldots, \beta_z$, which will be determined by a regression analysis, give these elasticities (Aderamo, 2010).

3.5 Measurement of Variables

Table 3. 1: Definition and Measurement of Variables

Variable	Description	Measure/Estimation	Expected Sign
The Dependent Variable			
GDP (Economic Growth)	This economic growth rate in Kenya for the given period. (World Bank, 2020),	This represents the annual percentage change in GDP from the same time last year to the current year.	
Independent Variables			
Air Transportation	Air passengers carried include both passengers and cargo uplifted in Kenya by commercial air carriers (IATA, World Bank, 2020)	Measures in passenger uplift for Passenger demand and Freighter Tonnage for cargo demand	On economic expansion, this component is projected to have a positive effect.
Social Globalization Index	Social globalization refers to interpersonal, informational, and cultural globalization (KOF Globalization Index, 2021)	Measured as a value between 0 and 100. The higher the value the better the globalization	Positive
Export Growth	The rate of export and import in Kenya of goods (World Bank, 2020).	The percentage increase in the value of the amount of goods and services exported by a country over a specific period	Export expected to display a + impact on economic growth

Variable	Description	Measure/Estimation	Expected Sign
Import Growth	The rate of export and import in Kenya of goods (World Bank, 2020).	The percentage increase in the value of the amount of goods and services imported by a country over a specific period, usually measured annually. It indicates the rate at which the value of imports is growing over time.	import expected to display a - impact on economic growth
Net Migration	This is the difference between Kenyans in other countries and foreigners in Kenya. This will include both short term and long term. (World Bank, 2020)	This will be a year-on-year growth in net migration and will be measured in percentage	Positive or negative based on sign of Net migration
Diaspora Remittances	This is the amount received in Kenya from Kenyans in diaspora from their earnings and compensations. (World Bank, 2020)	This will be a year-on-year growth in diaspora remittances and will be measured in percentage	Positive or negative based on impact. For a period where remittances are high, it could mean there was a higher population leaving for jobs abroad.

Source: Author's construction from World Bank Data, 2022

3.6 Data Sources

This study will use time series secondary data from 1971 to 2019. This data will be obtained from various sources due to the complexity of getting data from a single source. Data on economic growth will all be sourced from the World Development Indicator's open data repository. The World Bank and the International Air Transportation Association (IATA) will both provide data pertaining to the aviation sector while social globalization and financial development will be obtained from KOF data repository.

3.7 Diagnostic Testing

3.7.1 Unit Root Test

Unit root tests will be used in the study to identify variable nonstationary. When variables are discovered to be non-stationary, there is a chance that the estimates will change over time, which could produce erroneous results. In this inquiry, the Augmented Dickey Fuller Test, ADF, will be applied. Presence of any bias will be removed via successful differencing if test variables are discovered to be non-stationary. According to the Ho, the variable being studied is nonstationary (Gujarati, 2004).

3.7.2 Bounds Test

This test, created in 2001 by Pesaran, Shin, and Smith, assesses whether long-term correlations exist between various variables. This test will assist in establishing whether there is a relationship between the time series over the long run since cointegration occurs when two or more non-stationary time series exhibit long-run equilibrium. This diagnostic test will assist in the management of both long-term equilibrium and transitory disequilibrium. An ARDL model can be estimated without an error correction term (EC) if this result shows that there does not exist a long-term relationship between the variables.

3.7.3 Breusch-Pagan.

I will use this to test the presence of heteroskedasticity. Whenever the error term has no constant variance, then the standard errors are biased and will affect hypothesis testing.

3.7.4 The Durbin Watson and Breusch-Godfrey Test

In my analysis, I will carry out Durbin Watson test and the Breusch- Godfrey tests as part of my post-estimation diagnostic tests to estimate if there exists any serial correlation across different time periods in the error term. This is because autocorrelation, if exists, brings about a biased standard error which would adversely affect hypothesis testing.

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 Chapter Overview

This chapter covers the main conclusions of this study, together with the descriptive statistics, the results of co-integration test, test for stationarity, and ARDL model that was produced to achieve the objectives of the research.

4.2 Descriptive Statistics

The model's descriptive statistics derived from the research's selected variables are shown in this section. The results of the two primary tests—kurtosis and skewness—are examined at the raw data level to ascertain whether the data is normal. While skewness gauges a distribution's degree of asymmetry around its mean, kurtosis results indicate how acute a distribution is in comparison to a typical bell curve. The skewness and kurtosis of a normal distribution are respectively between -0.5 and 0.5 and -3 and 3. A symmetric distribution of the data can also be ascertained by comparing the median and mean; if these two variables are about identical, then the data is concluded to be symmetric. Below are the descriptive statistics analyzed in Table 4.1.

Table 4. 1: Descriptive Statistics

	Variables							
Statistics	**GDP**	**AT**	**AC**	**DR**	**IM**	**EX**	**NM**	**GI**
N	49	49	49	49	49	49	49	49
Mean	4.633	8.833	9.415	32.042	4.955	3.087	0.179	44.832
Median	4.214	6.668	6.963	10.471	4.681	2.372	0.015	44.821
SD	3.909	15.608	21.924	100.012	13.100	8.038	1.812	7.343
Min	-0.799	-47.220	-31.726	-90.535	-23.814	-11.618	-3.969	34.071
Max	22.174	57.196	100.000	478.705	33.815	31.521	9.182	55.893
Skew.	2.399	0.294	1.427	3.654	-0.299	0.919	2.423	0.169
Kurt.	11.173	7.451	7.453	16.520	2.668	5.156	14.660	1.545

***GDP** is GDP growth, **AT** is growth of air passenger, **AC** is growth of air cargo, **DR** is growth in diaspora remittance, **IM** is imports growth, **EX** is export growth, **NM** is growth in Net migration, **GI** is Globalization Index*

Table 4.1: Source: Author's Computation

A comparison of the median and the mean shows that the data is symmetric apart from Diaspora remittance which had a huge variance with a mean of 32.042 and a median of 10.471. The skewness

of air passenger growth, import growth and globalization index was symmetrical, while skewness for GDP, Air Cargo, diaspora remittances exports and net migration ranges between 0.5 and 3.6 which implies that the data are generally skewed to the right. Import growth was also analyzed and found to be skewed to the left given its skewed value of -0.299. Kurtosis of all variables, except imports and globalization index ranged outside -3 and 3, implying there was no evidence of normal distribution.

4.3 Correlation Analysis

Bias resulting from multicollinearity occurs when there is one or more pairs of independent variables exhibiting perfect correlations with one another. Table 4.2, below, shows the exploration of correlation matrices. The model variables exhibit a combination of positive and negative correlations. Apart from the GDP growth and air passenger growth coefficients, which both showed moderately positive correlations at 0.5799, the correlation study did not reveal any strong positive correlations. Murkras (1993) asserts that multicollinearity inflates parameter estimate variance, resulting in the production of erroneous estimates and coefficient signs and, thus, inaccurate findings and conclusions.

Table 4. 2: Correlation Analysis

Correlation Matrix								
	logGDP	**logPax**	**logCargo**	**logDR**	**logIM**	**logEX**	**logNM**	**KOFGI**
logGDP	1							
logPax	0.092	1.000						
logCargo	-0.103	0.580	1.000					
logDR	0.006	0.043	0.066	1.000				
logIM	0.121	0.039	0.077	0.061	1.000			
logEX	-0.021	0.185	0.220	-0.037	0.440	1.000		
logNM	0.107	-0.215	-0.029	-0.114	0.154	-0.065	1.000	
KOFGI	-0.217	-0.058	-0.135	0.016	0.160	0.011	-0.096	1.000

Table 4.2: Source: Author's computation

4.4 Lag Selection Criteria

To proceed to unit root test, lag selection was modeled and analyzed and the Akaike Information Criteria, AIC, was preferred for all variables since it had the lowest values at the 4 lags.

Table 4. 3: Lag Selection Criteria

Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-509.356				1.33726	22.9936	23.1133	23.3148
1	-359.874	298.96	64	0	0.03128	19.1944	20.272	22.0851*
2	-287.918	143.91	64	0	0.02881	18.8408	20.8763	24.301
3	-211.573	152.69	64	0	0.03772	18.2921	21.2855	26.3217
4	-10.7663	401.61*	64	0	.00071*	**12.2118***	16.1631*	22.8109
	Sample: **1975 - 2019**				Number of obs	=	**45**	

Table 4.3: Source: Author's computation

4.5 Stationarity Test

Prior to doing the unit root tests, an ideal lag duration was chosen to make sure the residuals are not serially associated. To prevent spurious regression, the best lag selection was identified using the Akaike Information Criterion (AIC). The series' stationarity was then assessed using the Augmented Dickey Fuller (ADF) test. Test results for the ADF are displayed in Table 4.4.

Table 4. 4: Stationarity Test

At Level			
Variables	***ADF Test Statictics (ADF)***	***p-Values***	***Remark***
loggdp	-4.189	0.005	Stationary
logpax	-8.226	0.000	Stationary
logcargo	-7.447	0.000	Stationary
logrem	-6.654	0.000	Stationary
logimp	-7.662	0.000	Stationary
logexp	-2.473	0.342	Non-Stationary
logmig	-2.865	0.174	Non-Stationary
KOFGI	-1.648	0.773	Non-Stationary
At First Difference			
d.loggdp	-5.507	0.000	Stationary
d.logpax	-5.850	0.000	Stationary
d.logcargo	-5.208	0.000	Stationary
d.logrem	-5.521	0.000	Stationary
d.logimp	-6.830	0.000	Stationary
d.logexp	-6.548	0.000	Stationary
d.logmig	-4.644	0.001	Stationary
d.KOFGI	-5.311	0.000	Stationary

Table 4.4: Source: Author's computation

The globalization index, exports, and net migration are not stationary at their level. However, they become stationary once the first difference is taken, suggesting that all variables are therefore integrated of order one, or I (1).

4.6 ARDL Regressions

Results of both the short run and long run relationship between the GDP, demand for air passengers and cargo, diaspora remittances, export and import, net migration and social globalization are analyzed to indicate the state of their relationship in tables 4.5 and 4.6.

Table 4. 5: Short Run Estimated coefficients using ARDL.

Short Run Estimation							
Variable		***Coefficient***	***Std. Err.***	***t***	***P>|t|***	***[95% Conf. Interval]***	
logGDP							
	LD.	0.220	0.151	1.460	0.157	-0.091	0.531
logPax							
	D1.	0.673	0.277	2.430	0.023	0.101	1.244
	LD.	0.414	0.206	2.010	0.056	-0.011	0.840
	L2D.	0.238	0.133	1.790	0.087	-0.037	0.512
logCargo							
	D1.	-0.767	0.178	-4.320	0.000	-1.134	-0.401
logDR							
	D1.	-0.043	0.129	-0.330	0.743	-0.310	0.224
	LD.	0.201	0.096	2.090	0.048	0.002	0.400
logExp							
	D1.	0.359	0.133	2.710	0.012	0.085	0.633
logMig							
	D1.	1.030	0.267	3.850	0.001	0.478	1.582
	LD.	0.795	0.189	4.210	0.000	0.405	1.185
KOFGI							
	D1.	0.127	0.127	1.000	0.327	-0.136	0.390
	LD.	0.128	0.133	0.960	0.344	-0.146	0.403
	L2D.	0.187	0.109	1.720	0.098	-0.037	0.412
_cons		0.957	1.488	0.640	0.526	-2.113	4.028

Table 4.5: Source: Author's computation

Table 4. 6: Long Run estimated coefficients using ARDL.

Long Run Estimation						
Variable	***Coefficient***	***Std. Err.***	***t***	***P>|t|***	***[95% Conf. Interval]***	
logPax	-2.087	1.135	-1.840	0.078	-4.429	0.255
logCargo	2.109	1.057	2.000	0.057	-0.072	4.290
logDR	0.226	0.328	0.690	0.497	-0.451	0.904
logImp	-0.122	0.271	-0.450	0.656	-0.681	0.437
logExp	-0.281	0.434	-0.650	0.524	-1.176	0.615
logNM	-1.422	0.750	-1.900	0.070	-2.970	0.126
KOFGI	0.038	0.033	1.160	0.259	-0.030	0.105

Number of Obs = ***46*** *R-Squared =* ***0.7697*** *Root MSE =* ***0.5236*** *Log likelihood =* ***-20.544234***

Table 4.6: Source: Author's computation

The findings of the short- and long-term analysis revealed a mixed relationship between air transportation's positive and negative effects on economic growth. The short-term results shown in Table 4.5 indicate that, when all other factors remain unchanged, a 1% increase in AT Pax accelerates economic growth by 0.673%. This positive shocks in air transportation, AT, propels the short-term economic growth in Kenya. Though a significant variable, the cargo variable was found to have a negative relationship with economic growth in the short run with a coefficient of -0.767. This was contrary to the expected relationship in impact estimation. The lagged difference of AT Cargo was found to be both significant and positively related to GDP where a 1% increase in AT Cargo demand resulted in a 0.201% increase in GDP. In terms of the control variables and their relationship with economic growth, the analysis found that exports and net migration were positively related to economic growth where a 1% increase in exports resulted in 0.359% growth of the economy whereas 1% increase in net migration resulted to a 1.02% increase in GDP. Although the globalization index was found to have a strong positive relationship with economic growth, it was found to be statistically insignificant at the 5% level.

In Table 4.6, the long run dynamics of the model are displayed. The results from the analysis indicated that the magnitude of the significant were altered and the relationship did not remain the same compared to the short run. The interesting finding from the analysis was that AT Cargo, which had a negative relationship in the short run, was found to have a positive relationship where a 1% increase in AT cargo demand resulted in a 2.11% increase in economic growth. The coefficient

estimates of AT pax of -2.086778 suggests that a one-unit increase in logpax is associated with a decrease of approximately 2.086778 units in GDP. However, it approaches significance, with a p-value of 0.057, so there may still be a potential relationship worth considering which was also the same case with AT cargo with a coefficient of 0.078. The coefficients of diaspora remittances, import, export, net migration, and globalization index were -0.1222542, -0.2805087, -1.421919, -0.2264205, and 0.0376212, respectively which represented the estimated change in the dependent variable associated with a unit increase in each respective independent variable. None of these coefficients are therefore statistically significant at the conventional 5% significance level, except for net migration at a significance level of 0.032 (assuming a two-tailed test).

The error correction term is negative and statistically significant at the 5% critical level, indicating that the variables adjust to the equilibrium at a rate of −0.49 per year.

Table 4. 7: Adjustment Speed between LR & SR

SR to LR Adjustment Speed						
D.loggdp	***Coef.***	***Std. Err***	***t***	***P>|t|***	***[95% Conf. Interval]***	
loggdp						
L1.	-0.4864262	0.1797	-2.71	0.012	-0.8573088	-0.1155436

Table 4.7: Source: Author's computation

4.7 The Bound Test

Bounds test was used for nonlinear co-integration to investigate the relationship existing between the dependent and the independent variables to determine whether long-term relationships existed between the variables. Table 4.5 illustrates that the F-statistics estimates were determined to be significantly higher than the upper critical bound. The results demonstrated the factors' long-term relationship.

Table 4. 8: Bounds co-integration test results.

Series	**F-*Statistics***	**LCB** ***I (0)***	**UCB** ***I (1)***	***Conclusion***
lnGDP = f ($lnAT_p$, $lnAT_c$, lnDR, lnIM, lnEX, lnNM, GI)	**4.628** ***	2.03 2.23 2.60 2.96	3.13 3.50 3.84 4.26	Cointegrated

Note: At 1%, 2.5%, 5%, 10% level of significance in descending order. The bold values represents the computed F-statistic.

Table 4.8: Source: Author's computation

Since the results of the computed F-statistic for the model is greater than the critical F-value for I (0) regressors at all significance levels, the null hypothesis stating that there is no co-integration is rejected and suggests that co-integration does exist.

4.8 Diagnostic Tests

Tests were conducted on the models to determine serial correlation, heteroscedasticity, and stability. The model's cumulative sum of squares of recursive residuals (CUSUMQ) and cumulative sum of recursive residuals (CUSUM) are plotted in Figures 4.1 and 4.2, respectively, and the results of the heteroscedasticity and serial correlation tests are as shown in Table 4.6.

Table 4. 9: Diagnostic tests.

Test	Statisctics	Conclusion
Serial Correlation	F = 2.096 (-0.1612)	No significant evidence of serial correlation in the model
Heteroscedasticity	$\chi 2$ = 0.109 (0.7413)	No significant evidence of ARCH effects in the model

Figures in parenthesis indicate the p-values.

Table 4.9: Source: Author's own computation

In the model, the null hypothesis that there is no presence of serial correlation between the variables is not rejected. We are unable to reject the null hypothesis because the probability value (0.1612) is higher than the significance level (typically set at 0.05 or 0.01). This implies that the model does not contain any significant evidence of serial correlation. We are unable to reject the null hypothesis since the probability value (0.7413) is higher than the significance level. This suggests that the model does not contain any significant evidence of ARCH effects, which rules out any significant heteroskedasticity.

Figure 4. 1: Plot of recursive CUSUM

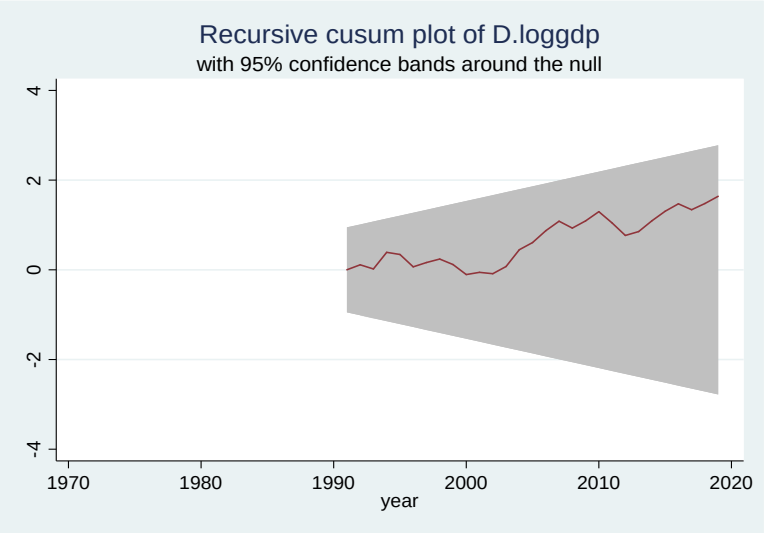


Figure 4. 2: Plot of CUSUMQ

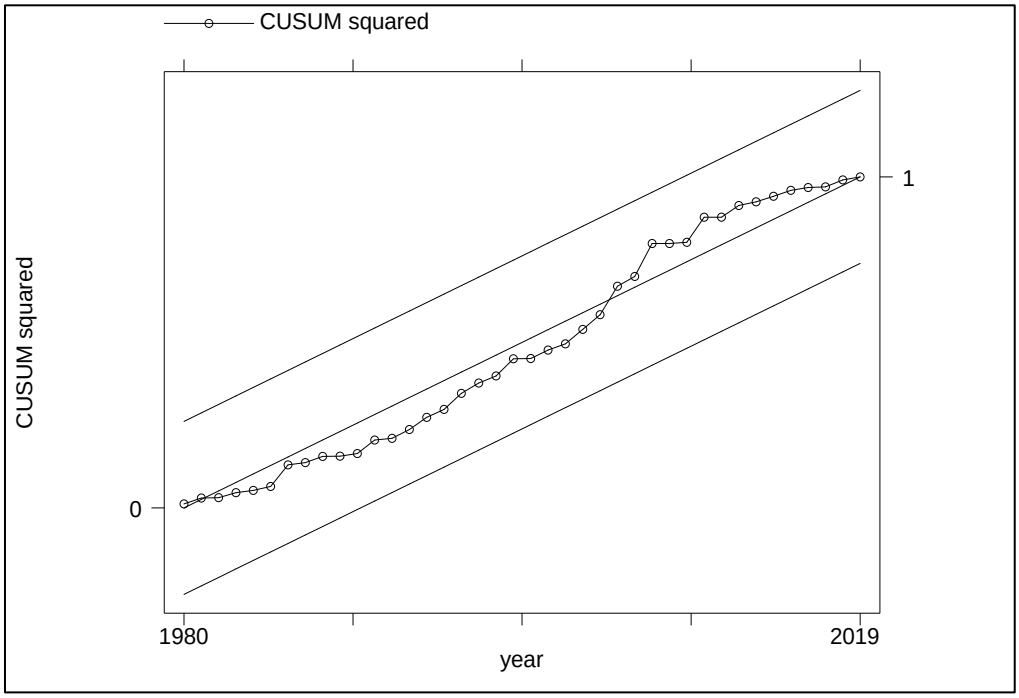


Figure 4. 2: Plot of CUSUMQ

Source: Author's computation

The findings from the cumulative sum of recursive residuals (CUSUM) and those of the cumulative sum of squares of recursive residuals, CUSUMQ, plots were also used to test models for parameters and variance stability. Figures 4.1 and 4.2 validate the model's stability and fall within the 5% significance level.

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

5.1 Introduction

This chapter outlines a summary of and conclusion of the study. It will also highlight various policy recommendations from the study findings and suggest various areas of research drawn from the main limitations of this research.

5.2 Summary and Conclusions

This study examined the relationship that exists between air travel and economic growth in Kenya from 1971 to 2019 using ARDL model while controlling for net migration, exports, imports, globalization, and remittances from the diaspora. The findings of the co-integration study demonstrated the long-term relationship between the variables. Results from the study demonstrated that there are both positive and negative relationships between air transportation and economic growth. The short-term data showed that a 1% increase in air travelers (AT Pax) resulted in a 0.673% increase in economic growth, however freight demand (AT freight) had a negative correlation (coefficient of -0.767) with economic growth. Nonetheless, it was discovered that the lagged difference of AT Cargo and GDP were positively correlated, with a 1% rise in AT Cargo demand translating into a 0.201% increase in GDP.

It was discovered that several control variables showed favorable correlations with economic growth, including exports, net migration, and the globalization index. At the 5% level, the globalization index was not statistically significant. When compared to the short-run, the long-run dynamics of the ARDL model revealed different connections, with AT Cargo showing a positive link with economic growth.

The analysis leads to the conclusion that air transportation contributes significantly to growth of Kenya's economy. Although there are both negative and positive effects of increased air passenger traffic on the complex relationship between cargo demand and economic growth, the short-term benefits of this relationship seem to be positive.

5.3 Policy Recommendations

The research findings indicate a positive correlation between the demand for air travel and economic growth. It is recommended that policymakers prioritize the enhancement of air passenger services, which encompasses augmenting airport infrastructure, enhancing airline connectivity, and guaranteeing optimal operations. Increased passenger flow will be made possible by this, resulting in short-term economic gain.

Further, policies should be developed to address the issues the cargo sector faces, given the inverse relationship between short-term economic development and cargo demand. Policies that facilitate economic growth include expediting customs processes, cutting expenses associated with logistics, and providing incentives for air freight operations.

Finally, given the strong relationship between exports and net migration and economic growth, policymakers ought to endorse policies aimed at promoting exports and luring skilled migrants. This can be accomplished by implementing trade facilitation measures, funding export-oriented businesses, and enacting immigration laws that draw in skilled workers.

5.4 Areas of Further Research

The use of the number of passengers transported as a gauge for the air transportation sector is one of its weaknesses. Future studies, however, might gauge this using different metrics, like the GDP percentage attributable to air travel revenue. More thorough understanding of the causal relationship between air travel and Kenya's economic growth would be possible with the application of sophisticated econometric techniques in a more rigorous causal study. Additionally, monthly or quarterly data may be used to conduct research on the relationship between economic growth and air transportation over different time periods.

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APPENDIX

Raw data used in the study.

Year	GDP	AT Pax	AT Cargo	DR	IMP	EXP	NM	KOGI
1971	22.174	9.621	-2.128	0.000	16.194	4.577	2.804	34
1972	17.082	15.319	-7.609	90.909	-16.007	-10.707	-0.024	34
1973	5.897	57.196	100.000	-9.524	-1.544	8.647	0.075	35
1974	4.066	12.324	11.765	47.368	19.879	15.157	0.209	36
1975	0.882	-5.564	-17.368	-28.571	-23.814	-11.618	0.134	36
1976	2.154	24.371	14.013	-25.000	-2.651	1.900	0.274	37
1977	9.454	-47.220	-20.670	86.667	18.305	2.789	-0.368	37
1978	6.912	53.097	55.634	42.857	27.450	1.679	0.056	36
1979	7.615	3.881	-16.290	-27.500	-19.031	-4.575	-0.073	37
1980	5.592	4.001	-2.703	44.828	9.986	5.430	-0.291	38
1981	3.774	4.127	6.111	183.333	-21.036	-4.187	0.322	38
1982	1.506	-4.257	22.513	-13.445	-16.127	3.180	-0.178	37
1983	1.309	11.296	29.487	-14.563	-18.396	-2.285	-0.449	38
1984	1.755	10.034	3.960	-2.273	17.867	0.875	0.391	38
1985	4.301	16.590	-3.492	16.279	-7.121	6.718	0.065	39
1986	7.178	9.415	29.276	-21.000	16.844	9.772	0.503	39
1987	5.937	7.280	38.168	26.582	13.287	0.260	-0.086	38
1988	6.203	9.927	1.657	16.000	9.027	4.607	-0.344	39
1989	4.690	5.493	-13.587	16.379	9.767	9.408	-0.218	40
1990	4.192	4.458	9.434	56.296	3.378	22.540	-0.546	40
1991	1.438	-4.343	-24.904	-10.900	-4.483	-1.242	4.300	41
1992	-0.799	-5.066	30.102	-7.447	-2.342	-0.780	-0.283	40
1993	0.353	6.668	10.000	2.874	33.815	31.521	0.417	45
1994	2.633	-2.079	1.961	16.201	16.822	-1.156	-0.339	45
1995	4.406	-1.739	-7.692	-36.263	17.492	-7.661	0.871	44
1996	4.147	5.159	-9.470	0.051	1.821	4.559	0.050	45
1997	0.475	7.334	6.276	478.705	10.553	-10.646	0.015	46
1998	3.290	36.221	6.102	4.993	4.681	-4.884	-0.130	45
1999	2.305	19.273	21.707	9.953	-1.479	9.280	-0.811	47
2000	0.600	14.520	17.447	-8.028	1.918	1.135	-1.408	47
2001	3.780	-8.796	20.361	-90.535	19.470	3.607	9.182	48
2002	0.547	12.809	27.660	12.234	-11.286	7.115	-0.811	48
2003	2.932	4.895	19.561	15.228	-0.062	7.212	1.319	49
2004	5.104	19.504	36.682	470.749	12.296	12.595	0.304	48
2005	5.907	20.888	30.861	13.086	14.943	9.380	-0.826	50
2006	6.472	10.756	18.982	34.229	25.317	3.540	1.868	51
2007	6.851	6.417	-1.041	13.103	4.406	6.158	-1.729	52
2008	0.232	0.808	-0.973	3.427	12.744	2.372	-3.575	52

Year	GDP	AT Pax	AT Cargo	DR	IMP	EXP	NM	KOGI
2009	3.307	2.374	-8.002	-5.373	8.348	-5.219	-0.760	53
2010	8.058	36.985	3.104	8.599	10.324	14.352	-3.969	54
2011	5.121	11.613	-31.726	36.222	13.757	8.367	1.126	55
2012	4.569	3.211	22.708	29.639	0.430	2.260	-0.042	55
2013	3.798	-2.943	10.024	7.701	2.017	-0.460	0.342	55
2014	5.020	-1.505	-3.687	10.471	11.384	1.850	0.257	56
2015	4.968	2.719	-6.220	8.913	-4.635	-2.185	0.325	55
2016	4.214	6.096	10.498	11.175	-7.410	-6.569	-0.690	55
2017	3.838	5.395	6.963	12.474	12.422	-1.018	1.311	55
2018	5.648	15.574	7.091	38.633	1.434	6.772	0.680	55
2019	5.114	8.673	8.780	4.331	1.844	-3.158	-0.463	55