The Impact of Using Derivatives as a Hedging Instrument in Supporting Global Development Trends: An Analysis of the African Aviation Sector

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ABSTRACT

With less than a decade before the impending deadline for the realisation of the United Nations 2030 Sustainable Agenda for Development and with the Covid-19 pandemic having significantly slowed down progress on the Sustainable Development Goals (SDGs), aggressive collaborative efforts from all sectors of the global economy are required now more than ever, not only for the achievement of the targeted goals but also to aid in an inclusive global economic recovery. With the global airline industry having been identified as one of the key pillars for propelling this agenda forward as it is believed to contribute to at least 15 of the 17 SDGs, exploring ways in which this industry can remain profitable and sustainable, so it continues to contribute towards the unified goal has become an important focus area for those at the forefront of the agenda. One of the identified major threats to the longevity and prosperity of the airline industry is said to be the inherent exposure to the volatility in commodity markets, as fuel expenditure generally makes up the single largest cost component of an airline's operating expense. This dissertation, therefore, investigates the relationship between fuel hedging and the firm value of commercial airlines in order to establish the effectiveness of fuel hedging as a potential lever that can be used to effect the desired change towards the realisation of the SDGs.

The study draws on evidence from African, European and North American airlines and makes use of a panel least square estimation technique to estimate the behaviour of the parameters in the selected statistical sample over a 10-year period from 2009 to 2019. Using Tobin's Q as a proxy for firm value, the study computes a series of regressions, incorporating different control variables such as airline size, percentage of jet fuel cost to total operating costs, jet fuel cost per passenger, and profit per passenger - which are all deemed to have significant explanatory power to allow for the isolation of the effect of fuel price hedging. The study further makes use of two hedging variables (percentage hedged and fair value of hedging derivatives to assets) in separate regression equations to ascertain their individual relationships with the dependent variable - Tobin's Q.

The analysis of the results in this dissertation reveals a positive correlation between the airlines' hedging activity and airline firm value thereby suggesting that mitigating the risks associated to fuel price volatility could yield positive outcomes for firm value. These findings can prove to be useful for those at the forefront of the 2030 global development agenda, as well as the airline companies themselves in driving the SDG goals.

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GLOSSARY OF TERMS

AIG	American International Group
ATAG	Air Transport Action Group
CAPM	The Capital Asset Pricing Model
CO_2	Carbon Dioxide
GDP	Gross Domestic Product
HLPF	High-level Political Forum on Sustainable Development
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IPCC	Intergovernmental Panel on Climate Change
LDCs	Least Developed Countries
LLDCs	Landlocked Developing Countries
M&M	Modigliani and Miller Theorem
OLS	Ordinary Least Square
OTC	Over-the-Counter
Q_RATIO	Tobin’s Q
R&D	Research and development
RPKs	revenue passenger kilometres
SDGs	Sustainable Development Goals
SIDS	Small Island Developing States
UN	United Nations
UNWTO	United Nations World Tourism Organization
USD	U.S. Dollar
VECM	Vector Error Correction Model
VNRs	Voluntary National Reviews

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CHAPTER 1: INTRODUCTION

1.1 Background of the Study

Over the past few years, the leading global discourse amongst development partners has been largely dominated by the UN Agenda 2030 on Sustainable Development and the Paris Agreement. The adaptation of the United Nations 17 Sustainable Development Goals (SDGs) in 2015, fostered a new way of thinking pertaining to global development and set in motion a plethora of ambitious targets for the global scene that were aimed at setting priorities and stimulating action over the next decade in areas of critical importance for humanity and the world at large (United Nations, 2020). The key values that the SDGs have been built on are vital now more than ever as they will be instrumental in the post-COVID-19 recovery as most governments shift focus to promoting economic growth that encompasses inclusion, equity and sustainability in propelling the much-needed transformation for a healthier, more resilient and more sustainable world (United Nations, 2020). Achieving the SGDs and their targets will, however, require aggressive collaborative efforts from all sectors of the global economy (Colglazier, 2015).

In today's modern integrated world, tourism is widely perceived as one of the most sizeable and fastest growing economic sectors worldwide. In emerging economies, tourism is specifically recognised as a tool to stimulate economic development and alleviate poverty through the drawing in of foreign currency investments, as well as increased economic participation fostered by the establishment of new local markets (Meyer & Meyer, 2015). The aviation sector, being the backbone of tourism and business, has unsurprisingly been identified as one of the strategic sectors that is expected to be a key pillar in supporting the attainment of the SDGs (ATAG, 2019). The sector is said to support at least 15 of the 17 SDGs across various channels through its pivotal role in generating economic growth, creating jobs, facilitating international trade and tourism, as well as being instrumental in humanitarian aid drives for states and regions impacted by natural disasters, conflicts and pandemics (Forbes, 2020).

On a global scale, the airline industry, a major sub-sector of tourism, has demonstrated significant expansion through innovation over the years and has proven to be a versatile and indispensable mode of transport. Historical data shows that the industry has doubled in size every fifteen years, making it one of the fastest growing industries in the world (Addepalli, Pagalday, Salonitis, & Roy, 2018).

The most recently published data by Stata (2020) shows that in 2019 alone, the global airline industry carried approximately 4.3 billion passengers, generating a combined revenue of USD 838 billion. In the same period, it is reported that 58 million tons of freight were transported.

It is further estimated that on a daily basis, an excess of 100,000 flights transporting almost 12 million passengers and USD 18 billion worth of goods were operated. According to Gittens, de Juniac, Fanning, Hocquard, and Liu (2019), one can still expect to see great expansion as there is generally a positive outlook for the industry, with air passenger traffic and air freight expected to more than double over the next two decades.

Although a nexus between a thriving airline industry and its potential to meaningfully contribute to the economy has been determined by various studies, such as those of Perovic (2013), and Baker, Merkert, and Kamruzzaman (2015), there are, however, still concerns surrounding the actual profitability and stability of the industry, especially in the context of developing nations (Sinha, 2019). The world is currently witnessing the global economic centre of gravity shift eastward and south as the powerhouses of Asia build global strength and emerging economies in Latin America and Africa continuing to gain from trade and development. Consistent with these changes, the Asia-Pacific has, over the years, managed to surpass both North America and Europe to claim the title of the largest aviation market in the world (Verjee, 2019). With that said, one would naturally expect the global aviation space to closely mirror the broader economic trends. However, this has unfortunately proven to not be the narrative for most of the airlines in both developed and emerging economies (Verjee, 2019). In fact, history is replete with empirical evidence of failed airlines, many of which were said to be profitable at some stage of their operation. According to industry executive Robert Martin, the global sector has witnessed the demise of at least 301 airline company failures worldwide in the past two decades alone (Martin, 2019). The list includes some well-known names in the international airline arena including Pan Am, Trans World Airlines (TWA), Swissair, and most recently in the UK, Monarch and Flybmi (Verjee, 2019). The African region has been no exception to this demise, as over the years it has also seen the failure of most of its big national carriers such as Air Nigeria, Zambian Airways, Air Burundi, Uganda Airlines, Air Gabon and most recently, South African Airways (Amankwah-Amoah, 2020). The industry has also witnessed the liquidations of numerous low-cost carriers such as Catovair, Kalahari Express Airlines, Air Shabelle, Air Somalia and Airlink Zimbabwe, just to name a few.

South Africa, which has one of the highest domestic air traffic rates on the continent, has recently witnessed the failure of a number of its own domestic low-cost carriers, with big names such as Skywise, 1time Airline, Fly Blue Crane, Velvet Sky and Nationwide all dominating headlines citing failure due to liquidity challenges (Verjee, 2019).

The global airline industry is largely characterised by a vast number of airlines that are making excessive losses, with a few successful industry players realising very thin profit margins of between two to six percent per annum (Agrawal, 2020). The difficulty to thrive in this cut-throat environment is what has led to economists, such as Adam Pilarski, to describe it as a sector that "seems to violate the most basic principles of economics and business" (Verjee, 2019). The unsatisfactory financial performance within the industry is believed to be embedded in specific challenges linked to changes in the general macro-economic conditions, as well as firm-specific factors, such as variations in revenues, operating expenditure and financing costs (Loudon, 2004). In other words, the challenges facing airlines, when narrowed down, are attributable to the high susceptibility of these entities to harsh business environments resulting from their significant vulnerability to exogenous risks that are triggered by various uncontrollable external factors (Lee & Shawn, 2007). According to Loudon (2004), the major factors that have been said to pose a major threat to the stability of an airline's cash flow and profitability include the wide range of financial risks that are inherent within the aviation industry as a collective. These are mainly foreign exchange risk, commodity price risk and interest rate risk (Morrell & Swan, 2006). Foreign exchange risk is an exposure created by ticket sales in foreign locations, the need to purchase dollar-denominated jet fuel for operations, and in some instances, the making of foreign currency payments of aircraft leases and the procurement of spare aircraft parts. Interest rate risk, on the other hand, is inherent in the nature of the airlines' capital structure which typically consists of sizeable debt as the industry is highly capital intensive. Lastly, commodity price risk (fuel price risk) arises due to the exposure that airlines have to volatility in the fuel spot market (Loudon, 2004). From these three fore mentioned risk exposures, fuel price risk is usually a major cause for concern for most commercial airlines, given the fuel-intensive nature of the airline industry, as it can have a considerable effect on bottom-line profits, as well as making the task of budgeting for future fuel exposures a rather challenging one (Cobbs & Wolf, 2004). Furthermore, fuel expenditure is generally cited as the highest operating cost for most airlines, in some instances, even making up more than 40 percent of the total operating expenses, surpassing both labour and financing costs (Lee & Shawn, 2007).

According to the International Air Transport Association (IATA), the quantum of the fuel expenditure for the global airline industry was estimated at USD 188 billion in 2019. This accounted for approximately 23.5% of operating costs at a mean Brent price of USD 65 per barrel (IATA, 2020).

Failure to manage fuel spending can lead to excessive expenditure, which can in turn translate to lower profit margins or even worse, financial losses (Ndung'u, 2016). According to Lee and Shawn (2007), it is, therefore, advisable for this risk to be quantified and effectively managed as it can have a significant adverse impact on the business. This can be done through the use of hedging tools such as forward contracts, options and swaps to secure the price of the underlying asset, which in this case is the oil commodity, thereby stabilising the volatility of input prices (Merkert & Swidan, 2019).

1.2 Definition of Research Problem and Statement of Research Question

The airline industry suffers from various structural issues that need to be addressed in order to ensure its profitability and expansion. The anticipated growth in the industry is heavily reliant on factors such as sustainable world economic and trade growth, declining airline operational costs and ticket fares (Baker, Merkert, & Kamruzzaman, 2015). As previously noted, a huge determining factor on the industry's future growth prospects thus becomes the costs associated with jet fuel prices (Loudon, 2004). Gittens et al. (2019) argue that all airlines within the airline industry must undertake risk mitigating action to assist in managing unnecessary exposure to volatile jet fuel prices in order to encourage the projected growth in a sustainable manner.

Various literature in corporate finance has fostered an improved understanding of why non-financial firms may hedge. This includes studies such as those of Smith and Stulz (1985), Judge (2006), and Breeden and Viswanathan (2015). However, very little research has focused on whether hedging actually achieves reasonable economic objectives. This paper aimed to test the validity of the claims by several notable researchers, including Rao (1999), Carter, Rodgers, and Simkins (2004), and Merkert and Swidan (2019), who suggest that jet fuel hedging adds to firm value and that it is one of the key tools for growing airline profitability and financial sustainability through its ability to contain the variable costs associated with jet fuel price volatility. This research paper was inspired by the recent collapse of yet another big national carrier in the African region, namely South African Airways (SAA).

The study brings to the fore the significance of financial derivatives in the aviation sector by investigating the impact they have on airline value and profitability. It draws on comparisons and extracts valuable lessons from twenty-three African, European and North American airlines to determine the relationship between fuel price hedging and airline value.

This dissertation sought to answer the following research questions:

1. Does a relationship exist between fuel price hedging and firm value of airlines?
2. What is the impact of derivatives hedging on the financial performance of airlines?
3. What is the impact of derivatives hedging on firm value of airlines?

1.3 Statement of Research Objectives and Hypothesis

1.3.1 Objective

The aim of this research paper is to evaluate whether mitigating the largest risk component of an airline through the hedging of jet fuel prices results in the financial performance and firm value of airlines in the short run, therefore, enhancing the airlines' commercial success in the long run and yielding additional value for the entities.

The objective of this research was, therefore:

I. To ascertain whether a statistically significant relationship exists between an airline's fuel hedging activity and its firm value.

1.3.2 Hypothesis

The main hypothesis of this study is rooted on the dispute of the Modigliani-Miller (M&M) theorem which is founded on the assumptions of perfect efficient markets with no taxes, no transaction costs for trading securities, as well as no bankruptcy costs (Modigliani & Miller, 1958). It is, however, important to note that in the real world, the assumption of perfect capital markets does not necessarily hold, and therefore, an airline is able to embark on financial risk management strategies that involve the use of derivatives to hedge these market imperfections, and thereby, minimise the losses linked with market exposures to derive some form of added firm value (Morrell & Swan, 2006). In accordance with this logic, the hypothesis of this study is that the factors, that influence derivative hedging and the nature of firms that use financial instruments to hedge, are all consistent with the risk management theories.

This study considered a hypothesis concerning the use of derivatives in the airline industry and the effect of their usage on the firm's value.

The null hypothesis and its corresponding alternative hypothesis are presented as follows:

H_0: There is no relationship between jet fuel price hedging and airline firm value.

H_1: There is a relationship between jet fuel price hedging and airline firm value.

1.4 Justification of the Study

In early 2017, the International Civil Aviation Organization (ICAO) released a paper that clearly demonstrates how the airline industry is supporting 15 of the 17 SDGs. Since then, these findings have been gradually piquing the interest of the international community. In December 2017, the UN General Assembly's Economic and Financial Committee approved a resolution focused on "Strengthening the links between all modes of transport to aid in the achievement of the Sustainable Development Goals" (United Nations, 2017). The resolution also strongly recognises the need for a sustainable aviation sector in advancing the SDGs. Air transport is firmly represented in the 2017 Global Mobility Report and efforts are now ongoing to finalise the Global Roadmap for Action, which lays out a pathway for planners, public decision-makers and the private sector to further the world's progress toward sustainable mobility (ICAO, 2018).

The UN recognises that economic development worldwide has received a substantial boost from air transport. In 2019, the industry represented 3.6% of the global gross domestic product (GDP) which amounted to USD 2.7 trillion and created approximately 65.5 million direct jobs worldwide (Forbes, 2020). Air transport has also proven to be an enabler for sustainable development as it serves as the main mode of transportation to deliver humanitarian relief, particularly to Least Developed Countries (LDCs), Landlocked Developing Countries (LLDCs) and Small Island Developing States (SIDS). In many instances, air operators have been active participants in the evacuation of individuals impacted by natural disasters or those that need to be airlifted due to conflict. Furthermore, airports have become staging points for first responders, relief supplies, cargo deliveries and refugee transfers (ICAO, 2018).

The worldwide economic, social and environmental benefits brought about by the airline industry can be classified into the following distinct groups:

I. Air Transport as a Major Contributor to Global Economic Prosperity

Aviation's broader global economic impact is estimated at USD 2.7 trillion, making up 3.6% of the world's gross domestic product (GDP).

As the sole provider of rapid worldwide transportation, aviation plays a pivotal role in global business and tourism. Thus, it continues to be a main facilitator of economic growth, especially in emerging economies. Airlines globally are approximated to carry over 4 billion passengers on an annual basis, with a combined revenue passenger per kilometre totalling around USD 8 trillion (ATAG, 2020). The sector is also at the forefront of facilitating world trade, assisting in growing countries' global economies by enabling integration with international markets. Annually, nearly 62 tons of freight is transported by air, to the aggregate estimated value of USD 6 trillion, representing 35% of all international trade (ATAG, 2020).

The connectivity that is facilitated by air transport is the engine that drives tourism development, deriving considerable economic value for all parties in the tourism value chain. Estimations show that an average of 1.4 billion tourists travel across borders on an annual basis, almost 60% of whom use air transport to reach their destinations. Connectivity is believed to have a tremendous impact on improving productivity. As sited in ATAG (2020) "it encourages investment and innovation, improving business operations and efficiency, and also allows companies to import high-quality labour.

II. Air Transport as a Major Global Employer

SDG 8 calls on governments of all nations to create a conducive environment for inclusive and sustainable economic growth and job creation. Through policy collaborations between the aviation and tourism sectors, air transport directly contributes to SDG Target 8.9 which talks to the development and execution of policies to aid tourism in order to create more employment and also promote the local informal sector by 2030 (Gittens et al., 2019).

The airline industry supports approximately 65.5 million jobs globally. With 10.2 million of those jobs being direct sectorial positions, 3.5 million being in the air navigation services space in airports and 1.2 million being in the civil aerospace sector which manufactures aircraft systems, frames and engines (ATAG, 2018). Furthermore, statistics from ATAG (2018) report that "a further 5.6 million people are employed in other on-airport positions. There are approximately 10.8 million indirect jobs created through the procurement of goods and services from institutions within the aviation supply chain. The industry employees also support 7.8 million induced jobs through the spending of wages while aviation-enabled tourism further generates around 36.7 million jobs globally" (ATAG, 2018).

III. Air Transport Investments in Vital Infrastructure

SDG 9 promotes industry innovation and the building of infrastructure to foster inclusive and sustainable industrialisation (Gittens et al., 2019). Aviation is one of the leading industries in innovation. The air transport industry continuously develops and funds most of its own infrastructure spending, including airport terminals, air traffic control towers and runways, unlike other industries that are reliant on infrastructure to be funded through the national fiscus or subsidies. In 2018, airports invested an estimated USD 64 billion towards the construction of new infrastructure, creating more job opportunities for locals. Furthermore, the expenditure on research and development (R&D) in the aviation space is much higher and more beneficial to the economy than in most industries (ATAG, 2018).

IV. Air Transport as a Provider of Significant Social Benefits

SDG 11 is concerned with building inclusive, safe, resilient and sustainable cities and communities. Aviation's role is pivotal in tackling income inequalities and overcoming the social exclusion facing disadvantaged groups as the aviation-induced infrastructure plays a big role in metropolitan and countryside areas and aids the connectivity of people through integrated transport links. The increase in cross-border travel signifies closer relationships and ties between developed and emerging economies at both individual and state level. Also, the seamless transportation of products and human capital across borders further enables the advancement of social and economic networks that will have a durable impact. It contributes to the enhancement of the standard of living and poverty alleviation by availing fast and reliable transport services that grant people access to what they need for better living standards; this includes basic human rights such as access to food, healthcare, education and safe communities (Gittens et al., 2019). Also, air transport has demonstrated to be a vital lifeline for isolated and underdeveloped communities in land-locked countries and those that are in shortage of dependable road or rail networks as they heavily rely on the rest of the world for essential supplies (ATAG, 2018)**.**

V. Air Transport is Working to Mitigate its Environmental Impact

Another critical focus of the 2030 Agenda is protecting and preserving our environment for future generations to come. SDG 13 calls for immediate steps to be taken to combat climate change and its harmful effects.

As per the recent figures made available by the Intergovernmental Panel on Climate Change (IPCC), airline operations on average emit 860 million tons of carbon dioxide (CO_2) per annum; this equates to approximately 2% of the total global carbon emissions by humans (Gittens et al., 2019). In 2008, industry players unanimously reached a consensus to accept the "world's first set of sector-specific climate change targets" (ATAG, 2018). Since then, it has already commenced delivery on the first goal which is aimed at improving fleet fuel efficiency by 1.5% per year. Various industry partners are making collaborative efforts to alleviate carbon emissions into the atmosphere through the use of a four-part strategy of innovative technology, efficient operations, improved infrastructure and market-based measures to fill the remaining emissions gap. From 2019 going forward, the plan is to cap total carbon emissions while continuing to meet the needs of passengers and economies. The long-term goal is to at least halve the net carbon footprint from what it was in 2005 (ATAG, 2018).

The growing interest in the linkages between the airline industry and the SGDs has been accompanied by the leaders at the forefront of the sustainable development agenda seeking creative ways to support the aviation sector, as well as various other sectors that are believed to have the potential to propel this agenda forward (Gittens et al., 2019).

In conclusion, with the benefits brought about by the airline industry to economic development, the long-term growth and profitability of these entities, therefore, becomes of paramount importance in achieving the desired objectives. One of the proposed ways of achieving this is the hedging of the jet fuel price risk through commodity derivatives (Baker et al., 2015). In general, there has been growing interest in the reasons behind why non-financial firms may be interested in hedging their exposure. This is evident in the growing literature centred around this topic as seen in recent years (this is discussed further in the subsequent chapter). With that said, very few studies have focused on the impact of hedging on firm value and financial performance, especially within the context of the airline industry. This study, therefore, aims to bridge this literature gap and inform the decision of hedging, based on whether there is a hedging premium realised through firm value by the firms that undertake hedging activity. The findings of this study will in turn provide insight to sustainable development agenda leaders on the possible available levers at their disposal for accelerating the progress towards the unified goal.

1.5 Limitations of the Study

This thesis is confined to examining the relationship between the fuel price hedging activity of airlines and firm value of the airlines across three continents – Africa, Europe and North America. A further limitation of the study was the unavailability of sufficient data. The data obtained covered 253 observations in total, of which only 33 observations are from African airlines due to the challenges of sourcing relevant data. The study period is from the financial year-end 2009 to the financial year-end 2019 as there were consistent data gaps in reporting for most airlines before this period.

1.6 Organisation of the Research

This dissertation comprises five chapters that are organised as follows:

Chapter 1 unpacked the background and introduction to this study, followed by the problem statement, research objectives and hypothesis, and the justification of the study. This was done by presenting a critical synthesis of the relevant research done on the various ways that a thriving aviation industry defined by firm value can contribute toward the SGDs and through the presentation of literature that has been conducted on the value that using hedging derivatives adds to airlines.

Chapter 2 provides relevant previous literature, existing theories, and the various research viewpoints as they relate to the impact of fuel hedging on firm value.

Chapter 3 presents the research methodology that was used as a blueprint for data gathering and analysis. It discusses further the estimation technique applicable to this study.

Chapter 4 presents the panel data analysis and regression output supported by the existing literature, as well as discussion of the study’s findings.

Chapter 5 outlines a summary of the conclusion, provides recommendations to interested parties, and identifies areas for future research.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter is segmented into five sections. Section 2.2 unpacks the corporate risk management theories and framework that form the basis for building the regression model in this study. Section 2.3 then proceeds with a detailed analysis and discussion on the current body of knowledge on record that has been compiled by various sources on similar subject matter as the one under investigation in this study. Both the theoretical and empirical literature were used as evidence to construct expectations of outcomes that one might anticipate when testing the relationship between hedging and firm value in the airline industry. Section 2.4 explores literature on the financial impact on airlines that is attributable to fuel market volatility and its effect on company returns and lastly, Section 2.5 discusses the different types of derivative markets, as well as the instruments available to airlines for risk management purposes.

2.2 Theoretical Literature

2.2.1 Early Theories on the Determinants of Firm Value

The Modigliani and Miller (M&M) theorem initially pioneered by Franco Modigliani and Merton Miller in 1958, states that "if certain assumptions such as those underpinning the Capital Asset Pricing Model (CAPM) hold, then a firm should be indifferent between issuing equity, raising debt and making use of its own cash when it comes to choosing a suitable method to finance its investment as this will not have any effect on the value of the firm or its share price since this value is only determined by its earning power and the risk of its underlying assets" (Modigliani & Miller, 1958). In other words, this theory suggests that the value of an entity is solely dependent on the present value of its future earnings, as well as the underlying assets. For this theory to hold, certain conditions need to be satisfied; these include the assumptions of perfect markets, no transaction costs, no taxes and bankruptcy costs (Modigliani & Miller,1958). It can, therefore, be deduced that according to this theory, the use of derivative hedging as a risk management strategy has no effect on firm value as underpinned by the assumption laid out in the M&M theorem. In the real world, however, these neoclassical investment models rooted in the premise that firms face frictionless capital markets are considered unreasonable and, therefore, generally do not hold. Due to this, several corporate risk management theorists have since emerged with new literature that challenges the assumptions of frictionless capital markets (Volpe, 2016).

Various studies, such as those conducted by Hubbard (1997) and Stapleton and Subrahmanyam (1977), have confirmed that markets do exhibit some level of inefficiencies arising from information asymmetry and realistically, most governments do collect taxes as one of their major sources of domestic revenue. The debunking of the M&M theory as unrealistic has further led to the emergence of numerous theories seeking to establish other variables that may have an impact on firm value in order to accurately explain this phenomenon.

These new theories discredited the initial claims by Modigliani and Miller (1958), providing justification for corporates to hedge their risk exposure. According to the proponents of these theories, in the presence of market imperfections, hedging can positively affect firm value by mitigating the risks associated with market frictions such as taxes, financial distress costs (Myers, 1977), agency costs (Leland, 1998), and underinvestment costs (Gay & Nam, 1998). From a risk management perspective, these studies considered the potential effect that hedging has on firm value, as well as the motives behind firms hedging.

2.2.2 Recent Theories on Derivatives Hedging and Firm Value

The emergence of theories centred around the correlation between derivatives hedging and firm value have been predominantly influenced by factors such as information asymmetry, opportunistic behaviour in the face of incomplete contracts, the principal-agent problem, as well as conflicts between the different claimholders and stakeholders of the firms (Kovacevic & Olstad, 2011). Nevertheless, it is worth noting that, despite the significant work that has gone into the literature, there is no single widely accepted theoretical construct that explains the precise relationship between derivatives hedging and firm value. Instead, this relationship is best explained by four theories that attempt to provide motivations behind a firm’s decision to hedge. The most prominent literature behind these theories includes studies by Stulz (1984), Smith and Stulz (1985), Froot, Scharfstein, and Stein (1993), Carter et al. (2006), and Nance, Smith, and Smithson (1993). It is, therefore, imperative to present the core relevant theories that have been proposed to date before unpacking the empirical evidence that supports or discredits them. Below are the commonly cited corporate risk management theories that have emerged, providing insight into the reasons behind the hedging decisions of most firms.

2.2.2.1 Financial distress costs

The first justification for firms hedging is to decrease the likelihood of having to sustain financial distress costs. This may occur when a company is unable to meet its obligations to its creditors or when doing so is done with extreme difficulty. This type of situation could force the company into bankruptcy or even liquidation, which could potentially result in the firm encountering costs such as legal and advisory fees (Kahl, 2002). This theory, therefore, argues that risk management through hedging can minimise the probability of financial distress by decreasing the volatility of earnings, thereby, adding to the creation of firm value (Mohammad, 2014). This theory is supported by Smith and Stulz (1985) who formulated a theoretical model that amended the market imperfections in the M&M theorem and proposed a framework to illustrate how hedging increases firm value. They found that hedging will stabilise earnings and reduce cash flow volatility, thus decreasing the probability of bankruptcy, and in turn reducing financial distress costs and increasing firm value. The theory was further hypothesised by Froot, Scharfstein, and Stein (1993) who also reached the same conclusion. In their study, they demonstrated that the reduction of internal cash flow volatility improves internal cash flows and reduces the risk of rejecting high cash flow investment opportunities (Froot et al., 1993). More evidence abounds to show firm value is increased when hedging is used to lower cash flow volatility to make outflows more predictable. Carter et al. (2006) and Allayannis and Weston (2001) back this theory with their findings which suggest firms that engage in hedge activity have statistically significant hedging premiums. Further empirical evidence from research studies supports the assertion that hedging can increase firm value by reducing taxes as well as the costs of financial distress arising from solvency (Gruber & Warner, 1977; Diamond, 1984).

2.2.2.2 Underinvestment problem

The second justification for hedging is to attempt to avoid the underinvestment problem. Myers (1977) and Majluf (1984) define the underinvestment problem as one that occurs due to the pecking order theory, whereby firm managers tend to believe that they are acting in the best interest of the shareholders when forgoing positive NPV projects as the benefits of these tend to accrue to the bondholders. Froot et al. (1993) and Carter et al. (2006) found that derivatives hedging as a risk management strategy could significantly reduce the underinvestment problem which would in turn lead the firm to generate higher cash flows which would then ultimately result in a positive impact on firm value (Mohammad, 2014).

Froot et al. (1993) showed that derivatives hedging is linked to the association between the firm's cash flow and its investment opportunities. They, therefore, constructed a model where inefficiencies in the financial market make the cost of capital proportional to its cash flow. This helps the firm to protect its cash flow from fluctuations, as in the event of a negative shock, the firm could either borrow at a higher rate to keep its investment or alternatively reduce its investment, causing an underinvestment problem (Froot et al., 1993).

2.2.2.3 Tax incentive

The third justification for hedging is to take advantage of tax incentives. Smith and Stulz (1985) argue that a firm's tax structure can serve as a motivation to hedge. They highlight that consistent with Jenson's inequality, they assert that "firms engaging in hedging could reduce their expected tax liability which would ultimately reduce their profit volatility, thus increasing firm or shareholder value through stabilised earnings".

Smith and Stultz (1985) also show that given the taxation structure, firms may add value by reducing the volatility of their cash flow. They provide evidence to show that in a progressive taxation system environment, hedging reduces the expected payment of taxes, increases the firm's after-tax income, thereby creating a positive effect on firm value.

2.2.2.4 Managerial risk aversion

Lastly, the final theory that justifies hedging is linked to a lack of management risk appetite, especially if the personal wealth of risk managers is directly tied to company performance, that is, if they hold company stock. Under this theory, managers are believed to be inclined to undertake the decision to hedge if it safeguards their own personal interests in the business (Nadeem, Mohammad, & Mroso, 2014).

Managerial risk aversion is one of the incentives for corporate hedging. Firm managers are likely to be more risk averse and unwilling to take risk as they have more to lose if the firm fails; this creates an incentive for managers to reduce risk exposure through hedging (Smith & Stulz, 1985). Stulz (1984) emphasises the connection between hedging practices and the firm managers' risk appetite. He notes that risk-averse managers, whose incomes are linked to the firm's financial performance, have the incentive to protect their earnings through hedging operations since these would reduce the firm's cash flow volatility.

However, Stulz (1984) concludes that in this scenario, hedging would not add value to the firm, since it would only benefit the managers and not the shareholders. Various other studies such as those of Sanders (2001), Smithson and Simkins (2005), Baker et al. (2010), and Martin et al. (2013) confirm this theory and conclude that companies usually make use of selective hedging by adjusting their hedging strategies based on their views on the market. This is done as various elements of managerial compensation, such as stock options or stock ownership, are usually tied to profitability.

In conclusion, firms engage in hedging in the hope of making cash flows more predictable by reducing risk and potentially increasing firm value. Therefore, this thesis built on the existing body of literature by including some African Airlines in the sample to examine the impact of derivatives hedging on firm value, as well as extracting the impact of a financially sustainable aviation sector on the realisation of the 17 SDGs.

2.3 Empirical Literature: Hedging vs Firm Value

As previously discussed, corporate risk management theories focus on hedging as a strategy to reduce tax liabilities, bankruptcy and financial distress costs by smoothing out market volatilities (Myers, 1977; Leland, 1998; Gay & Nam, 1998).

Although there have been various studies that have attempted to test these theories by determining the relationship between hedging and firm value in an effort to gain more insight into strategic and financial decision-making, the empirical evidence remains inconclusive as there is a clear lack of consensus between researchers when it comes to the subject. On the one hand, there is a plethora of literature that seems to be consistent with the assumptions in the shareholder value maximizing theory, which advocates that hedging using derivatives can have a significantly positive impact on firm value. However, on the other hand, there also exists some evidence indicating that the theory may not necessarily always hold as the results of some studies find no linkage between hedging and firm value.

The supporting view: Hedging adds value

Building on Leland (1998), a study conducted by Merkert and Swidan (2019) made use of empirical evidence from the international airline industry to determine whether the current theoretical frameworks can in fact explain the financial impact of hedging.

The study found that there is a positive correlation between hedging benefits and the corporate risk management theories. Various other studies have also surfaced arguing that hedging increases firm value; these include Allayannis and Weston (2001) who examined the relation between foreign currency hedging and firm value measured by Tobin's Q and established that a significant and positive correlation exists between the use of currency derivatives and firm value.

Hagelin (2003), by obtaining 462 firm year observations of Swedish companies, shows that hedging activities increase firm value. Also using a sample of Swedish companies, Pramborg (2004) collaborated the findings of a positive impact of hedging on firm value in the case of firms that use it to hedge their transaction exposure. He proceeded to conclude that the quarterly income volatility of the firms used in his sample would have declined by 23% based on his assumed hedging policy. Other researchers, such as Carter et al. (2006), Korkeamäki (2016), and Rao (1999), take a slightly different approach and estimate how better off an airline would be if it had bought different heating oil futures at different periods of time. They all concluded that these financial instruments best served the airlines in periods of high fuel price volatility.

A study conducted by Ndung'u (2016) on the impact of various financial hedging instruments on company profitability found that all the different types of hedging instruments used by Kenyan Airways exhibited a significant and positive correlation on profitability. Carter et al. (2006) establish the existence of a hedging premium (i.e., the marginal benefit attributed to hedging), of about 10% in their regression analysis of jet fuel hedging on firm value, although this is contrary to the findings of a hedging premium of 5% documented by Allayannis and Weston (2001), but nonetheless still supportive of the premise that hedging does add value to firms. They further analysed how the positive relation between hedging and firm value is connected to capital investment and found that most of the hedging premium is attributable to the interaction of hedging with investment. This result is consistent with the assertion that the principal benefit of jet fuel hedging by airlines stems from a reduction in underinvestment costs since jet fuel prices are negatively correlated to investments. This is similar to the findings of Carter, Rogers, and Simkins (2006) who examined the impact of hedging jet fuel prices using commodity derivatives in the US airline industry.

The opposing view: Hedging does not add value

Prior researchers on hedging and firm value have failed to provide a consistent result on the value of hedging to firms. Allayannis and Weston (2001) sampled non-financial firms and found value premium whereas Jin and Jorion (2006), in their analysis of the behaviour of American companies in the oil and gas sector from 1998 to 2001, found no relationship between hedging and firm value in the industry. It can be argued that hedging results behave differently in foreign currency hedging which explains the findings of Allayannis and Weston (2001) and also the fact that their study was limited to large firms with assets above USD 500 million, therefore, they were unable to ascertain whether hedging also adds value to the smaller firms.

Nelson, Moffitt, and Affleck-Graves (2005) applied a similar regression model used by Allayannis and Weston (2001) to answer the question of hedging value added to smaller firms. They did not find any evidence of firm value increasing with small firms, and as such, they came to the same conclusion as Jin and Jorion (2006).

Guay and Kothari (2003) argue that hedge gains are relatively very small compared to the amounts attributable to firm size, cash flow and earnings and, therefore, found no conclusive evidence on the impact of financial hedging on firm value. This was further supported by Kothari (2003), Morrell and Swan (2006), Weiss and Maher (2009), and Bertrand, Brusset, and Fortin (2015), who found little or no value-added effect from hedging activity. Tufano (1996) also found little supporting evidence for hedging being a value adding activity in the gold mining industry. This is supported by Merkert and Swidan (2019), who evaluated the impact of hedging on airline financial performance by using data from 100 international airlines over a period of six years. They found that even though fuel price hedging is effective in mitigating financial risks by decreasing EBIT margin volatility, there was ultimately no significant effect on profitability.

Lookman (2004), in his analysis of a sample of oil and gas producers, observed a mixed result. He argued that hedging is a proxy for management quality or agency costs, and when these variables are controlled for, the hedging effect becomes insignificant. In a similar study, Clark and Mefteh (2010) explored currency hedging for non-financial firms in France and concluded that currency hedging is not a significant factor in firm value. They went on to add further that there is no evidence of the direct impact of currency hedging on firm value, especially for emerging markets.

Relevant literature for this study

While there is a possibility that the existing literature examined in this study may not be completely exhaustive, it encompasses a great majority of notable prior research covered on the topic of the value of hedging in general, as well as within the context of the airline industry. The literature review takes a non-biased, holistic approach by demonstrating the ambiguity and inconsistency of the observed findings.

The research work in the academic literature appropriate to this dissertation is that of Carter, Rogers, and Simkins (2006). They studied fuel price dynamics in the airline industry for the period between 1992 and 2003. Their results may not show the actual effect on firm value because of the inclusion of the data set related to the US terrorist attack of 11 September 2001. The consequence of this event had a grave adverse impact on the airline industry. Airlines recorded a significant drop in revenue and market value during the period, and this may have contributed to a downward bias in the results presented by Carter et al. (2006). Data during this period may perhaps possess outliers, therefore, a more applicable and exact data set can reveal the true effect of hedging on firm value.

2.4 Effect of Hedging on the Financial Performance of Airlines

In addition to investigating the effect of hedging on firm value in the airline industry, this thesis also considered the financial performance of airlines on firm value as a result of jet fuel price dynamics on airlines' returns. Financial performance can be measured with several profitability measures. However, this thesis focussed on financial performance measures that have a direct link with jet fuel price dynamics.

Jet fuel prices and the financial performance of airlines affects the firm value of airlines in different ways and for numerous reasons, most of which are outside the scope of this thesis. However, the airline industry has historically exhibited some characteristics that are indicative of how fuel price dynamics can affect the financial performance of airlines. See Table 2.1 below.

Table 2.1: Features that indicate how fuel prices affect the financial performance of airlines

	FINANCIAL PERFORMANCE MEASURE	VARIABLE	STUDIES IN THE LITERATURE
1.	High percentage of jet fuel cost to operating expenditure	• Percentage of fuel cost to operating cost • Fuel cost per passenger • Operating profit per passenger	Cigolini and Rossi (2010) Marshall et al. (2015) Lee (2019) Pineda et al. (2018) Merkert and Swidan (2019)
2.	The size of the organisation (low-cost carriers and full-service carriers)	• Firm size	Yang and Baasandorj (2017) Gaudenzi, and Bucciol. (2016) Hendricks and Singhal (2003) Lu et al. (2012)

Source: Researcher's own compilation from research literature

The first characteristic is the cost of jet fuel as a percentage of total operating expenditure (Cigolini & Rossi, 2010). This is an extremely critical metric in view of the fact that jet fuel consumption in the airline industry accounts for a significant percentage of operating cost. The second characteristic is the size of the airline and the marginal cost of operation (Hendricks, Singhal, & Zhang, 2009). The size of an organization may determine its response to jet fuel hedging strategies. This metric is particularly useful in the airline industry because the low-cost carriers are perceived to be more efficient than the regular and full-service carriers (Lu et al., 2012).

Recent trends in the airline industry

Recent developments in the airline industry have made it more challenging to justify fuel hedging as an effective strategy for ensuring better company performance. Following the recent collapse in oil prices, many airlines with jet fuel hedging contracts continued to pay well above market spot prices, Cathay Pacific being one such airline which reported a fuel-hedging loss of HK$ 6.45 billion in 2017 while their unhedged competitors enjoyed a much lower fuel cost base (Park & Whitley, 2018).

Therefore, the reason behind airlines having no open hedging positions, could be either intentional as the airline is of the view that prices will continue to drop, allowing them to continue gaining a competitive advantage as they benefit from the low prices in the oil spot markets, or it can also be driven by liquidity constraints on the airline's balance sheet (Morrell & Swan, 2006).

A classic example was witnessed in 2014, whereby a market downturn saw Delta Airlines reporting large fuel price hedging losses (Delta Airlines, 2015), while in the same period, American Airlines reported USD 600 million in savings from buying fuel directly in the spot market (American Airlines, 2015). Consequently, many airlines began to opt to abandon their fuel hedging programmes. This includes American Airlines which subsequently reported a 37.8% increase in fuel expense in 2018 (Merkert & Swidan, 2019).

2.5 Aviation fuel price hedging in practice

In theory, commodity price risk can be hedged using derivatives. There are two types of derivative markets; those that are traded via a specialised derivative exchange known as exchange traded derivatives and those that are traded bilaterally between parties without going through an exchange, known as over-the-counter (OTC) derivatives. In practice, however, refined oil products such as jet fuel can only be hedged using OTC instruments (Basu & Gavin, 2010). This is disadvantageous to both the buyer and the seller of the contract as OTC derivatives leave both parties fully exposed to counterparty risk, that is, the probability that either party might not be willing or able to fulfil their obligation at maturity. Also, OTC contracts on jet fuel tend to be less liquid than exchange traded contracts as they are tailored to the airline's specific risk exposure, thus making them more expensive to use for hedging. This is the reason behind the industry's common preference for the use of other proxies that are highly correlated with jet fuel such as Brent, Nymex and Gasoil as the underlying asset for the hedge (Adam-Müller & Nolte, 2011; Haushalter, 2000). This practice is often referred to as cross hedging and should be used with caution as it may give rise to basis risk, which comes about when there is a disparity between the price of the asset to be hedged and the price of the asset serving as the hedge. Basis risk occurs because the changes in the price of the underlying asset and the changes in the futures price do not always move in tandem, which then causes hedge slippage (Morrell & Swan, 2006; Adam-Müller & Nolte, 2011; Haushalter, 2000).

According to Cobbs (2004), Morrell and Swan (2006), and Berghöfer and Lucey (2014), airlines are able to hedge crude oil products, such as Nymex, on the exchange rather than in OTC markets and this option eliminates the counterparty risk through a process known as clearing. Clearing involves the exchange acting as an intermediary between the parties by collecting an initial margin from each side to act as a guarantee. These markets are relatively more liquid than OTC markets and enable the airlines to sell the contract before the date of maturity. When it comes to good liquidity in the long-run, only crude oil instruments make the cut. Jet fuel instruments are said to only have short-term liquidity, hence there are no exchange-traded futures available on jet fuel Cobbs (2004).

In the words of Ndung'u (2016, pg 20), "airlines generally hedge between one and two thirds of their forecasted fuel expenditure, with most seeking to manage the short-term price volatility by hedging six to twelve months ahead." To achieve this purpose, these firms have various financial instruments available at their disposal.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter presents the research methods and techniques that have been applied in evaluating the relationship between fuel price hedging, financial performance and firm value of airlines. It outlines the estimation techniques employed, the data that was used, the sources of the data, the time period covered, the sample methods and size, as well as the unit of analysis. The chapter also discusses and provides an analysis of the variables in the specified regression model.

3.2 Research Design

This study employed a deductive quantitative research method to analyse the interlinkages between fuel price hedging, financial performance and firm value of airlines. Deductive Quantitative Analysis of the research question was performed for this study since this thesis entailed analysing numerical data in the form of hedging percentages and financial performance measures of airlines which was expected to produce quantitative output in the form of changes in firm value. As outlined by Sreejesh, Mohapatra, and Anusree (2014), the research approach for this thesis required the collection, measurement and analysis of data to answer the research questions using selected statistical, computational or mathematical techniques.

3.2.1 Sampling

The study obtained data from operational airlines with readily available data and information across African, European and American airlines as follows:

Table 3.1: Geographical spread of selected airlines

LOCATION	NUMBER OF AIRLINES	PERCENTAGE
Africa	3	13%
Europe	10	43.5%
North America	10	43.5%

Source: IATA, result from research data

As shown in Table 3.1 above, there was an underrepresentation of African airlines in the study. This was due to the lack of data availability pertaining to the airlines operating from this region.

A comprehensive list of airlines across the three continents was examined and multiple selection methods were used in creating the sample for this thesis.

As a starting point, the International Air Transport Association (IATA) membership list was used as a filtering mechanism, together with online search engines for identifying the airlines that are in continuous operation with audited financial statements during the period covered by the study. The study selected a combination of hedging and non-hedging airlines which were further categorised according to their ownership structure in order to reflect a balanced sample between publicly traded, privately-held and government-owned airlines.

The sampling method used to select the representative sample of airlines was purposive sampling, in order to obtain a sample that was large enough and as representative as possible. According to Teddlie and Yu (2007) purposive sampling is advantageous where the goals of sampling are to achieve a sample that is as representative as possible of the population and to achieve comparability across a dimension of interest.

The study selected a representative sample of airlines based on whether they are hedging, or non-hedging airlines which were analysed as follows:

Table 3.2: Hedging and non-hedging airlines

DESCRIPTION	NUMBER OF AIRLINES	PERCENTAGE
Hedging Airlines	15	65%
Non-hedging Airlines	8	34%

Source: Bloomberg

Following the initial filtering, the airlines' specific financial data was sifted from Bloomberg and the annual reports of each airline were downloaded from their respective websites. Only airlines with sufficient data covered in the sample period were included.

In summary, the sample selection process yielded a total of twenty-three (23) airlines that cut across three continents with specific characteristics such as ownership profile, status of hedging activity and the business model of each airline. The sample is representative of the population studied in order to address the research problem stated above.

3.2.2 Data Collation, Sources and Period

The data employed in this study is a panel data of 253 observations (since it has both cross sectional and time-series dimensions) that span over 23 cross sectional units, over a period of 10 years. This dissertation selected a panel data structure as the preferred data model because it discloses dynamics in cross sectional data and also resolves the problem of heterogeneity bias as revealed by Baltagi (1995). Panel data recently became popular and widely acceptable amongst researchers because of its increased availability and greater capacity of statistical software for modelling complex research problems beyond a single cross-section or time-series (Hsiao, 2007, p. 2). The compelling case for panel data modelling is premised on the fact that according to Hsiao (2007), it has been observed to present adequate inference of model parameters due to higher degrees of freedom in the statistical models. It also allows for improved capacity to accurately capture complex human behaviour in data format and lastly, the panel data model allows for control of omitted variables. It is often argued in the literature "that the real reason for the presence or lack of certain effects is due to ignoring the effects of certain variables which are correlated with the explanatory variables. Panel data contains information on both the inter-temporal dynamics and the individuality of the entities allowing one to control the effects of missing or unobserved variables" (Hsiao, 2007, p. 5). These advantages are particularly relevant to the airline industry when considering the peculiarity of each airline in its respective market, as well as the inconsistency in data availability due to corporate actions or regulatory induced factors.

The data required for the regression analysis was obtained from the Bloomberg database, combined with the annual reports of the selected airline companies for the period commencing 2009 to 2019. As observed by Ntim (2013), the data sourcing method applied for this thesis eliminated the bias of subjectivity that would otherwise have been created.

The information sourced directly from the annual reports was expected to be reliable and valid as annual reports issued by the airlines are audited and prepared according to the corresponding acceptable accounting reporting guidelines in the different jurisdictions. The data source was also a sound and common basis for comparing the derivative hedging activities and performance of the selected airlines despite the different jurisdictions.

3.2.3 The Empirical Model Specification

The model specification for this thesis was derived from the prior work of Carter, Rogers, and Simkin (2006), Guay and Kothari (2003), Nelson et al. (2005), and Pramborg (2004) and in recent times, Kovacevic and Olstad (2011) where they focused on the use of firm size and derivatives usage as explanatory variables to establish the nexus with firm value. This dissertation attempts to expand on their research findings by including African airlines and using the result to make a qualitative deduction on the attainment of sustainable development goals.

The fixed effects regression and random effects regression models are generally suitable for a panel data structure. However, the presence of unobservable variables which are constant over time but differ amongst airlines must be controlled, therefore, the fixed effects regression is preferred and frequently recommended to researchers (Clarke, Crawford, Steele, & Vignoles, 2010). This recommendation is validated by the Redundant Fixed Effects Test result.

The generic panel data regression model for this dissertation is described as follows:

$$FIRM_{VALUE\ i,t} = \alpha + \beta_1\ FUEL_{HEDGE\ i,t} + \beta_2\ FINANCIAL_{PERFORMANCE\ i,t} + \sum \beta_i Control_{Variablei,t} + \varepsilon_{i,t} \quad \text{..............1}$$

Where,

$FIRM_{VALUE\ i,t}$ is the dependent variable where i=entity and t=time and measured by Tobin's Q_Ratio. This variable is defined in Section 3.2.4.1(i) below. The definition of the independent variables is presented in Table 3.3 below. $\varepsilon_{i,t}$ represents time invariant fixed effects.

The selected proxy measurements for the dependent and explanatory variables are analysed as follows:

Table 3.3: Summary of regression variables

VARIABLE	PROXY MEASUREMENT	DEFINITION
Firm Value	Tobin's Q_Ratio	See 3.2.4.1 (i)
Fuel Hedging	Percentage Hedged for the Following Year's Jet Fuel Requirements	See 3.2.4.2 (ii)
	Fair Value of Derivative Assets to Total Assets	See 3.2.4.2 (ii)
Financial Performance	Operating Profit Per Passenger	See 3.2.4.3 (iii)
3 Control Variables	Percentage of Fuel Cost to Operating Cost	See 3.2.4.3 (vi)
	Fuel Cost per passenger	See 3.2.4.3 (v)
	Firm Size	See 3.2.4.1 (iv)

Source: Researcher's own compilation from research

To test the hypothesis that jet fuel hedging and financial performance of airlines impact on firm value of the airline, the study used a three-stage fixed-effects regression model.

It starts by isolating the effect of hedging in accordance with the extent of hedging activity by the airlines through the use of two separate proxies for measuring the jet fuel hedged which is then followed by the introduction of a dummy variable.

The first regression model is based on the percentage of jet fuel cost to total operating expenditure presented by Cigolini and Rossi (2009), and Marshall et al. (2015) with the risk exposure formula presented by Jorion (1990), which makes use of the Q_Ratio (proxy for firm value) as the dependent variable and with the hedged percentage of the next year's expected fuel requirement being the independent variable. The second regression model is based on the concept of fair value hedge which is designed to protect the fair value of a company's balance sheet from risks that can affect profit. In this model, the Q_Ratio is kept as the dependent variable and the independent variable used is the ratio of Fair Value of Derivative Assets to Total Assets. The third and final regression model still presents the Q_Ratio as the dependent variable but then includes a dummy variable as the independent variable. The dummy variable isolates hedging airlines from non-hedging airlines by assigning a value of one or zero respectively. The models are also controlled for four other variables that impact financial performance and firm value. The control variables are introduced in the model to isolate the effect of fuel price hedging.

The study computed a series of regressions making use of different control variables that are deemed to have the most explanatory power. These include airline size, jet fuel costs as a percentage of total operating costs, jet fuel cost per passenger, and lastly, profit per passenger.

The three least square regression models are specified as follows:

$$Q\_RATIO_{i,t} = \alpha_0 + \alpha_1 PCT\_HEDGE_{i,t} + \alpha_2 OP\_PROFIT\_PER\_PAX_{i,t} + \alpha_3 FIRM\_SIZE_{i,t} + \alpha_4 FUEL\_COST\_PER\_PAX_{i,t} + \alpha_5 PCT\_FUEL\_COST\_TO\_OPCOST_{i,t} + \varepsilon_{i,t} \quad \ldots\ldots\ldots (1)$$

$$Q\_RATIO_{i,t} = \alpha_0 + \alpha_1 FAIRVAL\_DERIV\_TO\_ASSETS_{i,t} + \alpha_2 OP\_PROFIT\_PER\_PAX_{i,t} + \alpha_3 FIRM\_SIZE_{i,t} + \alpha_4 FUEL\_COST\_PER\_PAX_{i,t} + \alpha_5 PCT\_FUEL\_COST\_TO\_OPCOST_{i,t} + \varepsilon_{i,t} \quad \ldots\ldots\ldots (2)$$

$$Q\_RATIO_{i,t} = \alpha_0 + \alpha_1 DUMMY_{i,t} + \alpha_2 OP\_PROFIT\_PER\_PAX_{i,t} + \alpha_3 FIRM\_SIZE_{i,t} + \alpha_4 FUEL\_COST\_PER\_PAX_{i,t} + \alpha_5 PCT\_FUEL\_COST\_TO\_OPCOST_{i,t} + \varepsilon_{i,t} \quad \ldots\ldots\ldots (3)$$

3.2.4 Description of the Variables

The task of examining the impact of making use of derivatives on firms' value is generally said to be a complex one as it generally requires the use of several proxies where the required data is not easily accessible. This complexity is inherent in the nature of the sophistication of these financial instruments, which generally yield a different impact across various industries (Kovacevic & Olstad, 2011).

This section, therefore, relied heavily and built on the empirical evidence and literature in identifying the variables to be used in the model. It was imperative that proxies were carefully selected since inappropriate proxies may have caused a spurious rejection or acceptance of the hypotheses being tested. Ideally, proxies would be formulated from a theoretical framework that justifies their use under reasonable assumptions with empirical backing (Dybvig & Warachka, 2012). Following this ideal, this study made use of the following variables in testing the hypotheses:

3.2.4.1 Dependent Variable

i. Tobin's Q (Q_Ratio)

The estimation of the Q_Ratio is used as an indirect measure for firm value.

The Q_Ratio has been used extensively in several prior studies investigating the impact that hedging has on creating additional shareholder value. Existing literature that has made use of this ratio include the studies of Kvello and Stenvik (2009), Kovacevic and Olstad (2011), Treanor, Rogers, Carter, and Simkins (2014), and Berghöfer and Lucey (2014). The Q_Ratio is a relatively easy to compute approximation of the original measure known as Tobin's Q.

Tobin's Q is a quotient made popular by Nobel Prize winning Neo-Keynesian economist, James Tobin, who hypothesised that the aggregated market value of all the companies on the stock market should approximate their replacement costs. Although this ratio is often attributed to Tobin's findings, its initial discovery was by an economist by the name of Nicholas Kaldor in 1966, hence earlier studies may refer to it as "Kaldor's V" (Tahir & Razali, 2011). At its elementary level, the Q_Ratio expresses the relationship between market valuation and intrinsic value, giving an indication of whether a given company or industry is overvalued or undervalued. A low Q_Ratio measure (between 0 and 1) indicates that the cost to substitute a firm's assets is greater than the value of its stock, implying that the company stock is undervalued. Conversely, a high Q_Ratio (greater than 1) suggests that the firm's stock is higher than the replacement costs of its assets, thus implying that the stock is overvalue (Dybvig & Warachka, 2012). The main drawback of this method is that the exact replacement cost may not always be available for all assets. Furthermore, the valuation of investments made and amortised on advertisements, research and development and such intangible assets can be an overly complex task. For this reason, most studies opt for the estimated Q_Ratio as a suitable measure instead which is much easier to obtain and calculate, while it has shown to deliver results that are consistent with Tobin's Q (Chang & Pruitt, 1994). Fortunately, this study was able obtain the original Tobin's Q values for all the airlines in the sample from the Bloomberg database.

For the purpose of this study, Tobin's Q will be referred to as the Q_Ratio in line with the other studies mentioned above. Bloomberg's data on Q_Ratio is derived from the following:

Q_Ratio = (Market Cap + Total Liabilities + Preferred Equity + Minority Interest) / Total Assets

The main hypothesis in this study was to examine the correlation of jet fuel hedging to the Q_Ratio of airlines.

3.2.4.2 Independent/Explanatory Variable

ii. The Hedging Variables

As previously stated, the data on the airlines' hedging activities was obtained from Bloomberg, as well as the airlines' respective annual reports. To isolate the effect of hedging in accordance with the extent of hedging activity by the respective airlines, the study introduced three hedging variables: the percentage hedged for the following year's jet fuel requirements, the Fair Value of Derivative Assets to Total Assets and a dummy variable assigning values of one or zero for airlines that hedge and airlines that do not hedge respectively.

The overarching goal was to test the hypothesis that jet fuel hedging variables impact on firm value of the airlines. The null and corresponding alternative hypotheses are represented as:

H_0: The percentage hedged for the following year's jet fuel requirements has no relationship with the firm value of airlines.

H_1: The percentage hedged for the following year’s jet fuel requirements has a relationship with the firm value of airlines.

H_0: The Fair Value of Derivative Assets to Total Assets has no relationship with the firm value of airlines.

H_1: The Fair Value of Derivative Assets to Total Assets has a relationship with the firm value of airlines.

H_0: There is no relationship between airlines that hedge and firm value of airlines.

H_1: There is a relationship between airlines that hedge and firm value of airlines.

3.2.4.3 Other Control Variables

As observed in the literature, hedging jet fuel exposure is undoubtedly a source of value in the airline industry. However, there are several other variables that could also contribute to firm value, and one would need to control for these variables to isolate their impact. The relevant variables are stipulated below:

iii. Operating profit per passenger (OP_PROFIT_PER_PAX)

This study utilised the Operating Profit per passenger carried (OP_PROFIT_PER_PAX) as a proxy for measuring the financial performance of airlines in the sample. This ratio is represented by the following equation:

OP_PROFIT_PER_PAX = Operating Profit / Number of Passengers Carried

where; Operating profit = operating Income – Operating Expenses

The measure described above relates to the internal finance and cash flows of airlines. It becomes a significant factor when determining the ability of the airline to withstand unfavourable jet fuel price movements that could potentially lower the internal cash flow generation capacity of the firm. This can further impact the airline’s ability to stay out of financial distress, as well as hamper any future plans to undertake valuable future investments (Smith & Stulz, 1985; Froot et al., 1993; Carter et al., 2006; Allayannis & Weston, 2001). Gay and Nam (1998) in their analysis of the underinvestment problem found that companies with low profit margins realise more gains from derivative hedging practices, more especially as jet fuel prices make up a substantial part of airline operating cost. Therefore, it is expected that airlines with lower levels of profit are prone to the use of derivatives to hedge their risk exposure, and vice versa.

Therefore, this study attempted to establish a nexus between airline financial performance and firm value. The null and corresponding alternative hypothesis are represented as:

H_0: There is no relationship between operating profit per passenger carried and firm value of airlines.

H_1: There is a relationship between operating profit per passenger carried and firm value of airlines.

iv. Firm Size (FIRM_SIZE)

The observed data for the firm size of the airlines was obtained from the Bloomberg database. The size of the airline as measured by Bloomberg is the total current market value of all a company's outstanding shares stated, that is, the market capitalisation of the firm.

This is a particularly important variable that has been used across most studies in the literature such as those of Guay and Kothari (2003), Lu et al. (2012), and Yang and Baasandorj (2017) when testing the relationship between hedging and firm value as it relates to the financial distress framework of hedging. In accordance with the works of Gay and Nam (1998), smaller size airlines will face relatively higher distressed costs than their larger counterparts, thus the smaller size airlines stand to benefit more from undertaking hedging activities. In this case, the expected observation is an inverse relationship between airline size and the likelihood to hedge.

Therefore, this study attempted to establish an interrelationship between airline size and firm value. The null and corresponding alternative hypothesis are represented as:

H_0: There is no relationship between airline size and firm value of airlines.

H_1: There is a relationship between airline size and firm value of airlines.

v. Fuel cost per passenger carried (FUEL_COST_PER_PAX)

This data was obtained from Bloomberg and calculated as follows:

FUEL_COST_PER_PAX = Total Fuel Cost per Year / Number of Passengers Carried

An alternative variable would have been the use of fuel cost per passenger per kilometre carried. However, sourcing data for fuel cost per passenger per kilometre carried for all the sampled airlines was not attainable.

This study attempted to establish a correlation between jet fuel unit cost and firm value. The null and corresponding alternative hypothesis are represented as:

H_0: There is no relationship between fuel cost per passenger and firm value of airlines.

H_1: There is a relationship between fuel cost per passenger and firm value of airlines.

vi. Fuel cost as a percentage of total operating cost (PCT_FUEL_COST_TO_OPCOST)

This variable, like the profit variable, demonstrates the significance of jet fuel costs to cash flows and earnings. According to the literature, hedging is expected to yield more benefits for firms with higher fuel price risk exposures. Therefore, consistent with Gay and Nam (1998), the expectation is that the category of hedging airlines demonstrates relatively higher fuel cost ratios.

The values for this variable were manually computed for each airline based on data obtained from the annual report and Bloomberg as follows:

PCT_FUEL_COST_TO_OPCOST = Total Fuel Cost per Year / Operating Costs

This study attempted to establish a relationship between the ratio of fuel cost to operating cost and firm value. The null and corresponding alternative hypothesis are represented as:

H_0: There is no relationship between ratio of the fuel cost to operating cost and firm value of airlines.

H_1: There is a relationship between the ratio of fuel cost to operating cost and firm value of airlines.

Table 3.4 below presents a summary of the regression variables and the expected coefficient signs.

Table 3.4: Summary of expected coefficient signs

VARIABLE	PROXY MEASUREMENT	EXPECTED SIGN
Firm Value	Tobin Q_Ratio	
Fuel Hedging	Percentage Hedged for the Following Year's Jet Fuel Requirements	+
	Fair Value of Derivative Assets to Total Assets	+
	Hedgers vs Non-Hedgers	+
Financial Performance	Operating Profit Per Passenger	-
Control Variables	Percentage of Fuel Cost to Operating Cost	+
	Fuel Cost per passenger	+
	Firm Size	-

Source: Researcher's own compilation from research data

3.3 Estimation Technique

As part of quantitatively examining the research questions, the study made use of some of the concepts and relationships formulated from theory and empirical evidence and developed a set of hypotheses that were then tested using quantitative statistical methods. Following the research work of Carter, Rogers, and Simkins (2006) and Morrell and Swan (2006) in examining the relationship between the identified variables, this thesis made use of descriptive statistics and a multivariate regression model.

The study commenced by dividing the airlines into two groups, the hedgers and the non-hedgers. The hedgers are those airlines that reported some form of fuel hedging activity over the study period, while the non-hedgers did not report any fuel hedging activity over the same period (see Appendix I for a list of the grouped airlines). The characteristics of the two groups were then compared using descriptive statistics to determine whether there were any variances between the two groups which could be material in influencing the hedging. If consistent with the risk management theories, the expectation from the results of these tests was that the tested relationship demonstrates hedging to be a value-adding activity.

Panel Regression Analysis

A multivariate regression analysis was conducted to provide answers to the main research question of the relationship between airline hedging and firm value. In this model, the effects of hedging on firm value are isolated from the model while including other factors that could be responsible for affecting firm value. For this purpose, two derivative hedging variables were utilised alternately, before the inclusion of a dummy variable for isolating hedgers from non-hedgers, thus leading to the estimation of three different regression models. This test was deemed to be more informative as it measured the extent of hedging and isolated its influence on firm value.

The effect of other variables on the test was excluded from the model with the intention of drawing an acceptable inference that hedging has a positive effect on firm value. This implied that the test was able to control other variables that could impact firm value. Further to this, tests for multicollinearity, normality in residuals, auto correlation, heteroscedasticity, unit root, cointegration and vector error correction model were also conducted.

An analysis of whether these variables do indeed correspond with the expectations presented by theories in the literature is further discussed in the subsequent chapter.

CHAPTER 4: RESEARCH FINDINGS

4.1 Introduction

This chapter presents the results of the hypotheses put forward in this dissertation (as outlined in Chapter 3). The research findings start with a discussion of the descriptive statistics of the variables used in the regression model, proceeding with a discussion of the results of diagnostic tests on the assumptions behind the least square regression model, and then lastly followed by a discussion of the regression outputs.

4.2 Descriptive Statistics

Descriptive statistics are necessary for obtaining a quantitative synopsis of the raw data used in the sample. The summary statistics allows for a more simplistic and meaningful visual presentation for easier interpretation of the panel data set used in testing the hypotheses. It is, however, important to note that although descriptive statistics may provide valuable information on the data set, they may not be used to make robust conclusions on the data analysis (CFI, 2021). This dissertation begins its empirical investigation by presenting a summary of descriptive statistics of the firm value (Q_Ratio) and independent variables outlined in Table 4.1 below. The table presents mean, median, standard deviation, maximum, and minimum values of the variables for all the airlines included in the sample (see Appendix I for list of airlines).

Table 4.1: Summary of Descriptive Statistics

Variables	Obs	Mean	Median	Max	Min	Std. Dev.
Q_RATIO	253	0.10406	0.08160	0.58247	-0.10425	0.12265
PCT_HEDGE	253	1.89788	1.38629	4.55388	0.00000	1.94662
FIRM_SIZE	253	3.36025	3.42666	4.61457	1.43909	0.72717
PCT_FUEL_COST_TO_OPCOST	253	1.27305	1.44770	2.01050	-0.77635	0.60216
FUEL_COST_PER_PAX	253	0.05720	0.04761	0.33247	0.00890	0.04145
OP_PROFIT_PER_PAX	253	0.00959	0.00991	0.08975	-0.08770	0.01449
FAIRVAL_DERIV_TO_ASSETS	253	0.00041	0.00000	0.12318	-0.11013	0.02391
DUMMY	253	0.51383	1.00000	1.00000	0.00000	0.50080

Source: Result from research data

NOTE: Q_RATIO=Firm Value; PCT_HEDGE= Percentage Hedged for the Following Year's Jet Fuel Requirements; FIRM_SIZE= Company Size; PCT_FUEL_COST_TO_OPCOST= Fuel Cost as % of Total Operating Cost; FUEL_COST_PER_PAX= Fuel Cost per Passenger Carried; OP_PROFIT_PER_PAX = Profit per Passenger Carried; FAIRVAL_DERIV_TO_ASSETS = Fair Value of Derivative Assets to Total Assets; DUMMY=Hedgers vs Non-Hedgers.

All variables have positive means ranging from 0.00041 to 3.36025 over the examined period. This simply implies that the dataset had more positively valued observations than negative as expected. The mean value of Q_RATIO is 0.10406, and the median and standard deviation values are 0.08160 and 0.12265 respectively. These values indicate minimal skewedness as validated by the histogram in appendix II and further imply the presence of no outliers in the data. However, the maximum and the minimum values of the firm value are 0.58247 and -0.10425, respectively. This implies that the Q_RATIO series appear well distributed.

The mean value of PCT_HEDGE (Percentage Hedged for the Following Year's Jet Fuel Requirements) is 1.89788 and the standard deviation is 1.94662 with a median value of 1.38629; this also shows negligible skewedness. The minimum value of 0.0000 represents the fact that that some airlines in the sample do not hedge their risk exposure. The mean value of FAIRVAL_DERIV_TO_ASSETS is 0.00041, and the median is 0.00000 which are also indicative of minimal skewedness. The mean value of FIRM_SIZE is 3.36025 and the standard deviation is 0.72717. This is indicative of a wide variance implying that the sample includes a combination of large-size, medium-size and small-size airlines. The mean value of PCT_FUEL_COST_TO_OPCOST indicates that fuel prices constitute an average of 27% of the operating cost of airlines. While the mean value of FUEL_COST_PER_PAX of 0.05720 and the mean value of OP_PROFIT_PER_PAX of 0.00959 is indicative of thin operating margins amongst the airlines during the period.

Table 4.2 below presents the constructed firm value for all airlines for each year. The last column of the table reports the composite Q_RATIO for all years.

Table 4.2: Composite Q_RATIO

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Comp Q_RATIO
Allegian Air	2.2895	2.2730	1.9427	2.2764	2.6981	2.8824	2.8184	2.3725	1.8866	1.3728	1.6490	**2.2238**
Spirit Airlines	1.6234	1.7721	1.8912	1.7636	3.1394	3.8236	1.6424	1.8302	1.3126	1.3922	1.0707	**1.9329**
Volara	1.9333	1.9333	1.2385	2.6757	2.7253	1.9013	2.4831	1.9263	1.2446	1.0571	1.2241	**1.8493**
Ryanair	1.2881	1.3430	1.2384	1.3565	1.5968	1.8214	1.9269	2.3085	2.1065	2.1544	1.6042	**1.7041**
American Airlines	2.2467	2.1300	2.0150	1.9933	1.3792	1.8186	1.4322	1.3881	1.4835	1.2469	1.2067	**1.6673**
South West Airlines	1.2128	1.2241	0.9854	1.0262	1.3030	2.0800	1.9632	1.9542	2.0564	1.6033	1.7023	**1.5555**
Delta Airlines	1.1981	1.2228	1.1893	1.2747	1.2248	1.5885	1.5388	1.4615	1.5044	1.3359	1.3445	**1.3530**
EasyJet	1.0827	1.0224	0.9501	1.1175	1.6928	1.7758	1.9954	1.2336	1.3399	1.2837	1.1936	**1.3352**
United Airlines	1.2663	1.1536	1.1176	1.2123	1.2912	1.6191	1.2919	1.3555	1.2505	1.2562	1.2015	**1.2742**
Hawaiian Airways	1.1791	1.1037	1.0480	1.0372	1.0499	1.4074	1.5786	1.8733	1.3753	1.1045	1.0652	**1.2566**
Air Canada	0.8963	1.2360	1.3645	1.4393	1.3768	1.4322	1.2190	1.1665	1.2050	1.1714	1.3025	**1.2554**
Norwegian Air	1.4645	1.3423	0.9979	1.2214	1.2620	1.3349	1.2722	1.1648	1.0967	1.1106	1.0243	**1.2083**
Westjet Airlines	1.1147	1.2094	1.0737	1.3063	1.4808	1.5342	1.1065	1.1038	1.1146	0.9628	1.1496	**1.1960**
Intercontinental Consolidated airlines	0.9257	1.0886	0.8930	1.0805	1.2850	1.3926	1.4087	1.2041	1.3075	1.2471	1.2194	**1.1866**
Aeroflot (Russian Air)	1.2415	1.3450	1.0278	0.9622	1.1338	1.1357	1.2691	1.3979	1.1634	1.1767	1.1197	**1.1793**
AeroMexico	1.0956	1.2487	1.4694	1.0610	1.0084	1.0104	1.3435	1.1886	1.0977	1.0624	1.0577	**1.1494**
JetBlue Airlines	1.0065	1.0446	0.9587	0.9603	1.0531	1.3043	1.4724	1.3800	1.2494	1.0209	1.0403	**1.1355**
Comair	1.1524	1.1493	1.1752	0.9257	1.0763	1.2793	1.1804	1.0222	1.1477	1.0645	0.9085	**1.0983**
Kenya Airways	0.8924	1.1061	0.8958	0.7866	0.8796	0.9362	1.1004	1.2727	1.3691	1.3979	1.1527	**1.0718**
Luftansa	0.9730	0.9743	0.8667	1.0620	1.0371	1.0798	1.0307	0.9623	1.1529	0.9973	0.9461	**1.0075**
Turkish Airlines	1.1800	1.1552	0.8808	1.1123	1.0758	1.1297	0.9183	0.8312	1.0216	0.9170	0.8581	**1.0073**
Air France	0.8731	0.8975	0.8226	0.8973	1.0013	1.1327	1.0807	1.0117	1.1139	1.0768	1.0641	**0.9974**
Air Mauritius	0.9534	0.8492	0.8377	0.8718	0.8960	0.8953	0.9977	0.8755	0.8713	0.8734	0.9391	**0.8964**

Source: Result from research data

NOTE: Numbers in red are non-hedging airlines and numbers in black are for hedging airlines.

According to Tobin and Brainard (1968), the Q_RATIO value is interpreted as follows: firms with a Q_RATIO greater than 1 are able to generate more value while those with a Q_RATIO lower than 1 are less able to generate value. By comparing the values of the Q_RATIO across hedging and non-hedging airlines, the non-hedging airlines recorded only three entries in the bottom 10 performers and appear to exhibit a relatively higher firm value compared to hedging airlines. These observations confirm the findings of several other studies, including Jin and Jorion (2006), and Guay and Kothari (2003). A plausible explanation for this observation in the airline industry could be that the low-cost carriers operate more efficiently than the full-service carriers (Lu et al., 2012).

Although this is inconclusive as other determining factors on the relationship between firm value and hedging will have to be considered.

4.3 Multicollinearity Results

An important assumption required for the Ordinary Least Square (OLS) regression model to create the best possible estimate is the absence of multicollinearity. Multicollinearity tests are useful for determining whether there is a state of exceedingly high intercorrelations or inter-associations between the independent variables applied in the models. A high presence of multicollinearity is indicative of a form of disruption in the data which may cause distortions when fitting the model and interpreting the results. This distortion occurs when the predictor variables have a high correlation with each other and, therefore, does not allow for isolating the effects of one predictor variable on the predicted variable. As indicated in the literature, multicollinearity problems increase the standard error coefficients estimates thus leading to confidence intervals that are very wide and increasing the tendency to inaccurately reject test statistics that are statistically significant. This results in inaccurate estimates of regression coefficients with incorrect signs and leads to a loss in predictive ability and causes challenges with the interpretation since there are plenty common variation in the variables (Vasu & Elmore, 1975; Belsley ,1976; Stewart, 1987; Dohoo et al., 1996; Tu et al., 2005).

This study made use of a correlation matrix to test against the presence of multicollinearity bias between the variables and presented the results as shown in Table 4.3. No multicollinearity was observed among the independent or control variables, with all correlation coefficients being well below the multicollinearity threshold of 0.7 as recommended by Kennedy (2008). The independent variables show exceptionally low correlation scores, with the highest correlation score being 0.41043, significant at 1%, which shows a positive correlation between FUEL_COST_PER_PAX and FIRM_SIZE, indicating that a smaller airline will have lower fuel cost per passenger.

FUEL_COST_PER_PAX and PCT_FUEL_COST_TO_OPCOST were negatively correlated at a 1% significance level, with a correlation score of -0.32859, an indication that the lower the fuel cost per passenger the higher PCT_FUEL_COST_TO_OPCOST.

Table 4.3: Correlation Matrix

	A	B	C	D	E	F	G
A	1						
B	-0.08452	1					
	(0.18020)						
C	0.34626***	0.09872	1				
	(0.00000)	(0.11730)					
D	-0.23031***	-0.08093	-0.25728***	1			
	(0.00020)	(0.19950)	(0.00000)				
E	0.17559***	-0.05284	0.41043***	-0.32859***	1		
	(0.00510)	(0.40260)	(0.00000)	(0.00000)			
F	0.16403***	0.27757***	0.24725***	0.16215***	-0.07418	1	
	(0.00900)	(0.00000)	(0.00010)	(0.00980)	(0.23970)		
G	-0.11739*	-0.00763	-0.00052	-0.15041*	0.09753	0.07761	1
	(0.06230)	(0.90390)	(0.99350)	(0.01670)	(0.12180)	(0.21860)	

Source: Result from research data

NOTE: A=Q_RATIO=Firm Value; B=PCT_HEDGE= Percentage Hedged for the Following Year's Jet Fuel Requirements; C=FIRM_SIZE= Company Size; D=PCT_FUEL_COST_TO_OPCOST= Fuel Cost as % of Total Operating Cost; E=FUEL_COST_PER_PAX= Fuel Cost per Passenger Carried; F=OP_PROFIT_PER_PAX = Profit per Passenger Carried; G=FAIRVAL_DERIV_TO_ASSETS = Fair Value of Derivative Assets to Total Assets. Values in parentheses are the p-values; ***, ** and * denotes significance at 1%, 5% and 10% respectively.

4.4 Normality in Residuals

One of the assumptions of least squares regression is that the error terms should be normally distributed in order to achieve a best linear unbiased estimate. However, normality tests are conducted to ascertain if the data set used is well-modelled by a normal distribution, as well as to determine the likelihood for the underlying variables in the data set to follow a normal distribution. It is important to test whether the variables are normally distributed as this allows for the use of parametric statistics on the back of this assumption. If the variables in the regression model fail the formal normality test, it is imperative to construct a histogram to investigate for the presence of any outliers that could be responsible for the non-nomality (Ghasemi, Ghasemi, Zahediasl, Azizi, & Scand, 2010).

This study employed two tests on all three models to determine if the residuals in the regression models follow a normal distribution. The first test conducted was the Jarque-Bera test which was done at the 5% significance level. The results are displayed on Table 4.4 below. The second test conducted was the histogram evaluation test which provides a graphical display of the distribution of the residuals on all the variables (see Appendix II).

Table 4.4: Jarque-Bera Test

	Q_RATIO	PCT_HEDGE	FIRM_SIZE	PCT_FUEL_COST_TO_OPCOST	FUEL_COST_PER_PAX	OP_PROFIT_PER_PAX	FAIRVAL_DERIV_TO_ASSETS	DUMMY
Jarque-Bera	60,25044	37,41100	14,75964	716,56800	2488,41100	1638,11800	997,91220	42,16677
Probability	0,00000	0,00000	0,00062	0,00000	0,00000	0,00000	0,00000	0,00000

Source: Result from research data

The Jarque-Bera test assumes a null hypothesis where the data is normally distributed and is based on the p-value obtained. The test will reject the null hypothesis if the probability value is less than the significance level of 0.05 (P<0.05). Table 4.4 above shows that the probabilities for all the variables is less than 0.05, therefore, the study rejected the null hypothesis and concluded that the residuals in our data were not normally distributed.

This result seems to be consistent with other studies such as those of Kovacevic and Olsad (2011), who stated that passing the Jarque-Bera test is quite challenging and attribute it to the original data not following a normal distribution. Therefore, this study opted to plot the residuals on a histogram to determine whether a bell-shape distribution can be identified. The results of the histogram are depicted in Appendix II. All three regression models depict a bell-shaped curve tendency even though they are slightly skewed from the mean. This could be explained by the fact that the data used a combination of hedging and non-hedging airlines that vary in size and fuel exposure. Research conducted by Barnes (1987) found that non-normality is often exaggerated and suggests that if there is even the slightest resemblance of a bell-shaped curve, the regression analysis should provide reliable results. Since the results presented in the histograms of this study tended towards a bell curve, it can be concluded that the estimation results are valid.

4.5 Stationarity, and VECM

Economic and financial time series often have trend effects or non-stationarity and using this data in statistical analysis tends to produce unreliable and spurious results that lead to poor predictions and interpretations, therefore, testing the panel data for stationarity is usually the first step of time series analysis. Most estimation techniques require the variables in the regression model to be stationary otherwise the statistical inferences (i.e. t-test) will not be appropriate and the hypothesis test on the regression pararmeters will not be valid (Hadri, 2000).

For the purpose of identifying the stationarity or otherwise of the variables used in the study, four panel unit root tests were employed: (1) Levin, Lin, and Chu (LLC), (2) Im, Pesaran, and Shin (IPS), and (3) Augmented Dickey Fuller - Fisher (ADF-Fisher). The results of the tests for all the variables in the model are shown in Table 4.5 below.

Table 4.5: Summary Results of Panel Unit Root Tests

	Levin, Lin & Chu t*		Im, Pesaran and Shin W-stat		ADF - Fisher Chi-square	
	Level	First Difference	Level	First Difference	Level	First Difference
Q_RATIO	-3.02150	-6.45924	-0.99586	-3.32285	49.64290	87.94200
	(0.00130)	(0.00000)	(0.15970)	(0.00040)	(0.33020)	(0.00020)
PCT_HEDGE	5.82087	6.65358	-0.78526	-2.75204	32.54090	55.57350
	(1.00000)	(1.00000)	(0.21620)	(0.00300)	(0.25310)	(0.00140)
FAIRVAL_DERIV_TO_ASSETS	-5.81518	-12.05990	-3.01009	-5.86232	69.69550	115.41900
	(0.00000)	(0.00000)	(0.00130)	(0.00000)	(0.00250)	(0.00000)
DUMMY	-2.16461	-7.54337	-0.45642	-2.59286	17.12100	15.07040
	(0.01520)	(0.00000)	(0.32400)	(0.00480)	(0.24980)	(0.00460)
FIRM_SIZE	-3.84217	-10.07710	-1.35767	-4.72325	57.49710	110.91500
	(0.00010)	(0.00000)	(0.08730)	(0.00000)	(0.11910)	(0.00000)
PCT_FUEL_COST_TO_OPCOST	-6.08449	-9.25517	-2.21557	-3.29756	67.79560	89.11990
	(0.00000)	(0.00000)	(0.01340)	(0.00050)	(0.01990)	(0.00010)
FUEL_COST_PER_PAX	-21.32710	-15.24400	-5.08177	-5.40988	69.61350	115.35200
	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.01390)	(0.00000)
OP_PROFIT_PER_PAX	-3.64366	-4.51756	-2.00299	-3.68947	64.30110	97.02640
	(0.00010)	(0.00000)	(0.02260)	(0.00010)	(0.03850)	(0.00000)

Source: Result from research data

NOTE: Q_RATIO=Firm Value; PCT_HEDGE= Percentage Hedged for the Following Year's Jet Fuel Requirements; FIRM_SIZE= Company Size; PCT_FUEL_COST_TO_OPCOST= Fuel Cost as % of Total Operating Cost; FUEL_COST_PER_PAX= Fuel Cost per Passenger Carried; OP_PROFIT_PER_PAX = Profit per Passenger Carried; FAIRVAL_DERIV_TO_ASSETS = Fair Value of Derivative Assets to Total Assets; DUMMY=Hedgers vs Non-Hedgers. Values in parentheses is the p-values.

As per the results tabled above, all the variables become stationary at first difference. The results of the panel unit root tests reported in Table 4.5 show that the data is conclusively and consistently stationary in first difference.

The VECM test result is shown in Table 4.6 below.

Table 4.6: Summary Result of VECM Estimation

	Model 1		Model 2		Model 3	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
C(1)	-0.040279	0.0034	0.001083	0.6019	-0.0491	0.0019

Source: Results from research data

The VECM is specifically used to analyse the long and short run association of the variables (Andrei & Andrei, 2015). The VECM estimation results for Models 1 and 3 show that the error coefficients (C(1)) are negative and significant which implies a long run equilibrium relationship amongst the variables in each model. However, the error coefficient in Model 2 is positive and insignificant, implying the model will converge to the short run equilibrium relationship.

4.6 Result of the Regression Model

For panel data structures, the fixed effects regression and random effects regression models are usually the most appropriate regression techniques. The fixed effects model is often recommended in situations when unobservable variables are to be controlled and the variables are time invariant (Clarke, Crawford, Steele, & Vignoles, 2010).

Further to determining the presence of significant fixed effects and thus deciding whether the selection of fixed effect model was accurate, the 'Redundant Fixed Effects Test' on Eviews 12 was carried out. The result of the test is shown below in Table 4.7:

Table 4.7: Redundant Fixed Effects Test

Effects Test	Statistic	d.f.	Prob.
Cross-section F	11.354379	(22,225)	0.0000

Source: Results from research data

The results in the table show a high f statistic value (11.3544) and a low probability (0.0000) showing significant fixed effects as ($P<0.05$). Therefore, the selection of the fixed effects model for this thesis was appropriate.

4.6.1 Estimation Result

The regressions analysis for 23 airlines selected from Europe, North America and Africa was performed using a balanced panel data structure of 253 observations.

The ordinary least square estimation was used to estimate each of the three models using the Q_RATIO as the dependent variable as follows: the first model included the PCT_HEDGE, Percentage Hedged for the Following Year's Jet Fuel Requirements, as the independent hedging variable (Model 1); the second model included FAIRVAL_DERIV_TO_ASSETS, Fair Value of Derivative Assets to Total Assets, as independent hedging variable (Model 2), and the last model included a hedging dummy to isolate airlines that hedge from those that do not hedge (Model 3). The panel least square result is shown in Table 4.8.

Table 4.8: Least Square Estimates

	Model 1		**Model 2**		**Model 3**	
Dependent Variable: Q_RATIO	**Coefficient**	**t-Statistic**	**Coefficient**	**t-Statistic**	**Coefficient**	**t-Statistic**
PCT_HEDGE	0.007673*	1.673690				
FAIRVAL_DERIV_TO_ASSETS			-0.69687***	-3.042546		
DUMMY					0.037139**	2.178361
FIRM_SIZE	0.131473***	6.411525	0.121089***	5.917095	0.130045***	6.369539
PCT_FUEL_COST_TO_OPCOST	0.052354	0.883448	0.027352	0.464596	0.049126	0.832816
FUEL_COST_PER_PAX	0.461163**	2.484875	0.409145**	2.241201	0.464957**	2.517961
OP_PROFIT_PER_PAX	-0.251609	-0.581756	-0.064025	-0.149762	-0.237514	-0.552566
C	-0.442901***	-3.994597	-0.360152***	-3.260652	-0.438866***	-3.991312
R-squared	0.666242		0.675440		0.669066	
Adjusted R-squared	0.626191		0.636493		0.629354	
F-statistic	16.63485		17.34244		16.84792	
Prob(F-statistic)	0.000000		0.000000		0.000000	
Countries	23		23		23	
Observations	253		253		253	

Source: Result from research data

NOTE: Q_RATIO=Firm Value; PCT_HEDGE= Percentage Hedged for the Following Year's Jet Fuel Requirements; FIRM_SIZE= Company Size; PCT_FUEL_COST_TO_OPCOST= Fuel Cost as % of Total Operating Cost; FUEL_COST_PER_PAX= Fuel Cost per Passenger Carried; OP_PROFIT_PER_PAX = Profit per Passenger Carried; FAIRVAL_DERIV_TO_ASSETS =

Fair Value of Derivative Assets to Total Assets; DUMMY=Hedgers vs Non-Hedgers; C=Constant. Values in parentheses are the p-values. ***, ** and * denotes significance at 1%, 5% and 10% respectively.

The regression analyses yield several interesting results. The hedging variables in model 1(PCT_HEDGE) and Model 3 (DUMMY) are positive and statistically significant at 10% and 5% respectively while the hedging variable in Model 2 (FAIRVAL_DERIV_TO_ASSETS) has a negative correlation with firm value (Q_RATIO) and is statistically significant at the 1% level. This shows that on an overall basis, jet fuel hedging is positively correlated with airline firm value. Furthermore, the explanatory powers of the models given by the adjusted R-squared are consistent at 66.62%, 67.54% and 66.91% for Models 1, 2 and 3 respectively. This is indicative of a good fit for the models; however, this is not critical to the findings of the study. The focus of the models was to establish the existence and significance of the relationship between firm value, financial performance and hedging activities within the airline industry.

4.6.1.1 Model 1 Estimation Result

An analysis of the regression result for Model 1 shows that the hedging percentage variable (PCT_HEDGE) has a positive coefficient of 0.007673 with a p-value of 0.0956 which makes it statistically significant at the 10% significance level. This means that in the sample, airlines that hedge against jet fuel price risk do realise firm value-add measured by Tobin’s Q. The coefficient translates to a stock premium of 0.007673, meaning that in the long run, ceteris paribus, a 1% increase in the hedged percentage of next year’s expected fuel requirement (PCT_HEDGE) will result in a 0.0077 % increase in the firm value (Q_RATIO) of airlines. This result is consistent with the assertion that the principal benefit of jet fuel hedging by airlines comes from reduction of underinvestment costs since jet fuel price is correlated to investments. In other words, jet fuel hedging reduces airline expenditure on fuel which then improves cash flow and allows the airlines to make further investment decisions that enhance firm value. This is also similar to the findings of Carter, Rogers, and Simkins (2006), Pramborg (2004), Korkeamäki (2016), Rao (1999) and Ndung’u (2016), who also found a positive and significant impact of jet fuel hedging on firm value.

The financial performance variable, operating profit per passenger (OP_PROFIT_PER_PAX), exhibits an expected result of a negative relationship with firm value (Q_RATIO) by recording a negative coefficient of 0.251609 and a p-value of 0.5613. This means that the impact of operating profit per passenger on firm value is negative and not significant, so, ceteris paribus, an increase of 1% in operating profit per passenger (OP_PROFIT_PER_PAX) leads to a 0.25% decrease in firm value as a result of not hedging against adverse risk.

Though this result is not statistically significant, it indicates that firms with more operating profit are less likely to suffer distress costs. Therefore, this gives them less reason to hedge and, consequently, they are susceptible to commodity market volatility and do not realise added gains to firm value in the long run. This is supported in the literature by Merkert and Swidan (2019) who evaluated the impact of hedging on airline financial performance and found that even though fuel price hedging is effective in mitigating financial risks (i.e. decreases volatility of EBIT margin), there is no significant effect on profitability.

Table 4.9: Regression Result for Model 1

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PCT_HEDGE	0.007673	0.004585	1.67369	0.0956
FIRM_SIZE	0.131473	0.020506	6.411525	0.0000
PCT_FUEL_COST_TO_OPCOST	0.052354	0.059261	0.883448	0.3779
FUEL_COST_PER_PAX	0.461163	0.185588	2.484875	0.0137
OP_PROFIT_PER_PAX	-0.251609	0.432499	-0.581756	0.5613
C	-0.442901	0.110875	-3.994597	0.0001

Source: Researcher's own compilation from research data

Furthermore, the regression result for the other control variables shows that firm size (FIRM_SIZE) and fuel cost per passenger (FUEL_COST_PER_PAX) both have strong, significant and positive correlations with firm value while Fuel Cost as a percentage of Total Operating Cost (PCT_FUEL_COST_TO_OPCOST) is positive and insignificant. The firm size (FIRM_SIZE) of airlines appears to be a strong and significant determinant of firm value based on the regression result which showed a positive coefficient of 0,131473 and a p-value of 0.0000 which makes it statistically significant at the 1% significance level. This is statistically interpreted to mean that in the long run, ceteris paribus, a 1% increase in the firm size (FIRM_SIZE) of airlines will result in a 0.1315 % increase in the firm value (Q_RATIO).

This regression result for firm size is inconsistent with the corporate risk management theory that relates to the financial distress framework of hedging. The theory assumes that smaller airlines tend to be more susceptible to higher distressed costs than larger, more well-established airlines and, therefore, tend to derive more gain from undertaking hedging activities. The effect of firm size on firm value has continued to be inconclusive as previous research shows contradicting results on size and firm value relationship.

Researchers, such as Bodnar et al. (1998), Nance et al. (1993), Mian (1996), and Hagelin (2003), show a positive relationship between size, hedging and firm value. A potential clarification might be that the big firms are usually the traditional carriers with a well-established business, route network and brand name and hence maintain a robust risk management programme which makes them highly attractive to investors. However, Mohammad (2014) finds that the approximation of firm size, calculated as a natural logarithm of total assets, has a highly negative value that is strongly significant, indicating that the bigger airlines do not necessarily possess an advantage to the firm value. His finding is consistent with that of Allayannis and Weston (2001), and Lang and Stulz (1994), who suggested that bigger size can also imply cost inefficiency and higher hedging costs that reduce profitability and firm value. Based on observations from the airline industry, the low-cost carriers tend to operate more efficiently relative to the full-service carriers (Lu et al., 2012). Accordingly, their marginal cost of operation is expected to increase firm value (Hendricks et al., 2009).

In the same vein, the fuel cost per passenger (FUEL_COST_PER_PAX) of airlines is also a strong and significant determinant of firm value based on the regression result which shows a positive coefficient of 0.461163 and p-value of 0.0137 at the 5% significance level. This is statistically interpreted to mean that in the long run, ceteris paribus, a 1% increase in the fuel cost per passenger (FUEL_COST_PER_PAX) of airlines will result in a 0.4612% increase in the firm value (Q_RATIO). The fuel cost per passenger variable is consistent with the corporate risk management theory discussed in Section 2.2.2 of the literature review, as firms with higher fuel exposures are generally the ones that benefit from hedging as this activity ensures consistent cash flow by managing the fuel cost component of operating costs. For the same reason, fuel cost to operating cost is expected to have a positive relationship with firm value which in the regression result holds true.

Lastly, a surprising regression result was that of Fuel Cost as a Percentage of Total Operating Cost (PCT_FUEL_COST_TO_OPCOST) which did not express any level of significance. Intuitively, if jet fuel cost comprises a significant percentage of operating expenses, and jet fuel prices are volatile then airlines are expected to hedge against fuel price risk and since hedging has a significant relationship with firm value, PCT_FUEL_COST_TO_OPCOST is expected to be significant. Nevertheless, an explanation for not finding any significance is perhaps that bigger airlines typically have lower jet fuel costs as a percentage of operating expenses.

4.6.1.2 Model 2 Estimation Result

An analysis of the regression result for Model 2 shows that the hedging variable, Fair Value of Derivative Assets to Total Assets (FAIRVAL_DERIV_TO_ASSETS) has a significant and negative effect on firm value. The regression output has a negative coefficient of 0.69687 and a p-value of 0.0026 which makes it statistically significant at the 1% significance level. This result tells us that in the short run, ceteris paribus, a 1% increase in the fair value of hedging derivatives to assets (FAIRVAL_DERIV_TO_ASSETS) will result in a 0.69% decline in firm value (Q_RATIO).

Table 4.10: Regression Result for Model 2

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FAIRVAL_DERIV_TO_ASSETS	-0.69687	0.229042	-3.042546	0.0026
FIRM_SIZE	0.121089	0.020464	5.917095	0,0000
PCT_FUEL_COST_TO_OPCOST	0.027352	0.058873	0.464596	0.6427
FUEL_COST_PER_PAX	0.409145	0.182556	2.241201	0,0260
OP_PROFIT_PER_PAX	-0.064025	0.427514	-0.149762	0.8811
C	-0.360152	0.110454	-3.260652	0.0013

Source: Researcher's own compilation from research data

This result is, of course, at variance with the result in Model 1, contradictory to expectation and in conflict with the corporate risk management theory of Section 2.2.2 in the literature review. The reason for the negative relationship between firm value and hedging in this case could be explained by the findings of Weiying and Jian (2010). They identified the method of accounting for recognising derivative hedging cost in the income statement as the key reason for the negative relationship. They explain further that jet fuel, which constitutes a significant part of airline cost, does not qualify for hedge accounting and is thus highly affected by the volume of hedging activities. Therefore, the higher the ratio of hedging derivatives assets to total assets, the higher the cost of hedging which implies net income reduction and lower profit margins. In other words, high hedging intensity often implies higher premiums which also means ongoing marked-to-market losses and settlement losses at maturity which collectively reduces EBIT, EPS and eventually firm value.

The other independent variables in Model 2 (OP_PROFIT_PER_PAX, FIRM_SIZE, FUEL_COST_PER_PAX and PCT_FUEL_COST_TO_OPCOST) exhibited similar regression output discussed in Model 1 above as it relates to the existence, significance and direction of the independent variables with firm value.

4.6.1.3 Model 3 Estimation Result

In Model 3, a dummy variable was used in the regression model if an airline hedged. An analysis of the regression result for Model 3 shows that the dummy variable, which isolates hedgers from non-hedgers, (DUMMY) has a significant and positive effect on firm value. The regression output has a positive coefficient of 0.037139 and a p-value of 0.0304 which makes it statistically significant at the 5% significance level. This result tells us that in the long run, ceteris paribus, a 1% increase in the derivatives hedging will result in a 0.037% increase in firm value(Q_RATIO).

Table 4.11: Regression Result for Model 3

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DUMMY	0.037139	0.017049	2.178361	0.0304
FIRM_SIZE	0.130045	0.020417	6.369539	0,0000
PCT_FUEL_COST_TO_OPCOST	0.049126	0.058988	0.832816	0.4058
FUEL_COST_PER_PAX	0.464957	0.184656	2.517961	0.0125
OP_PROFIT_PER_PAX	-0.237514	0.429838	-0.552566	0.5811
C	-0.438866	0.109955	-3.991312	0.0001

Source: Researcher's own compilation from research data

In other words, Model 3 suggests that hedging adds value to a hedging firm, and this collaborates the findings in Model 1 that hedging does indeed positively impact firm value.

Just like in Model 2, the other independent variables in Model 3 (OP_PROFIT_PER_PAX, FIRM_SIZE, FUEL_COST_PER_PAX and PCT_FUEL_COST_TO_OPCOST) exhibited similar regression output as discussed in Model 1 above as it relates to the existence, significance and direction of the independent variables with firm value.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

Over the years, the airline industry has proven to provide one the most indispensable modes of transport globally, creating connectivity between nations for business, tourism and even the provision of humanitarian support in times of crisis for devastated economies. On a global scale, the industry demonstrates enormous potential for further expansion and growth, with new low-cost carriers continuously entering the market, keeping the older carriers on their toes and making travel more competitive and accessible. With that said, there are still major concerns around the financial performance of airlines as they operate in a highly uncertain environment, mainly due to the high overheads that are inherent within the nature of their business. The major threat to the industry is its cash flows' high susceptibility to the exposure of volatile fuel markets as jet fuel prices tend to be the major cost item on the airlines' income statements, in some instances even making up to 40% of total operating costs. The industry having been thrust into the spotlight owing to the connection drawn between its success and its ability to meaningfully contribute to most of the SDGs, has generated further interest, especially from sustainable development leaders and enthusiasts looking at ways that could potentially aid this industry to remain profitable and for the airlines to grow their value. This study, therefore, tested the validity of the assertions made by Rao (1999), Carter, Rodgers, and Simkins (2004) and Merkert and Swidan (2019) that jet fuel hedging can significantly reduce the commodity risk exposure faced by airlines, thereby improving the financial performance and adding to the overall value of the firm. With that knowledge, this study, therefore, hoped to bridge this literature gap and inform the decision of hedging within the airline industry and provide insight to the sustainable development agenda leaders on the possible available levers at their disposal for accelerating progress towards the unified goal.

This study focused on the nexus between jet fuel hedging and airline firm value. The dissertation's main objective was to add to the currently existing literature on the subject matter by employing suitable econometric models that display a significant relationship between the jet fuel hedging practices of airlines and their firm value. The study further aimed to initiate a dialogue on the catalytic role of jet fuel hedging in the attainment of the 2030 Sustainable Development Agenda, as well as to draw well-founded conclusions that could be the basis for informing the risk management policies within the aviation sector.

5.2 Summary and conclusion

This study introduced the four main corporate risk management theories that are used as justifications for a firm's decision to hedge. These are: financial distress costs, tax incentive, the underinvestment problem, and managerial risk aversion. These theories were then applied to formulate the variables to be used in the regression analysis to investigate the relationship between hedging and firm value. To test this relationship, the study computed a series of regressions, making use of different control variables that are deemed to have significant explanatory power. The chosen variables were then used in the model to isolate the effect of fuel price hedging. These included: airline size, percentage of jet fuel cost to total operating costs, jet fuel cost per passenger, and lastly, profit per passenger. Two hedging variables (percentage hedged and fair value of hedging derivatives to assets) were used in separate regression equations to ascertain their individual relationships with the dependent variable - firm value, measured by Tobin's Q.

The study firstly presented the descriptive statistics on the dependent and independent variables to provide a quantitative summary of the data employed in the sample. An important finding presented here was that all the variables displayed a small variance between their mean value and standard deviation, implying that the series was well distributed. This dissertation then proceeded to present and discuss the diagnostic tests on the assumptions behind the least square regression model. The results from the diagnostic tests showed that the data used in the study could be relied on to produce accurate results.

The results from the first and third regressions showed that in the long-run, ceteris paribus, a positive relationship does exist between jet fuel hedging and airline firm value, even though this is not the case in Model 2 as it showed a short-run relationship between the two variables. It was, therefore, concluded that the study rejects the null hypothesis that there is no significant relationship between hedging and firm value in favour of the alternative hypothesis that there is a significant relationship between the two variables.

5.3 Policy recommendations

The intended beneficiaries expected to derive value from this research include those that are at the forefront of the 2030 global development agenda, as well as the airline companies themselves. The regression results presented in Chapter 4 signalled a positive correlation between the airlines' hedging activity and airline firm value.

As part of the movement towards the attainment of the SDGs, it is highly recommended that nations begin to implement direct efforts targeted at strengthening policies and government institutions for the mobility of synergetic partnerships with the relevant stakeholders (from both the public and the private sectors) for a chance for the successful implementation of the SDGs. Furthermore, the drivers of the sustainable development agenda should explore all avenues that could potentially propel this course forward. One such avenue is involving partnerships with aviation stakeholders to map out the areas where they can make a meaningful contribution to ensure the attainment of the global development agenda. As highlighted in this study, a starting point would be to ensure that airlines remain sustainable and profitable by managing and mitigating unnecessary market risk exposures to the highly volatile oil markets. This is especially imperative for the airlines operating from the African continent as the region is lagging behind the rest of the world when it comes to progress on the SGDs.

5.4 Avenues for future research

As discussed in Chapter 1, this study aimed to introduce African airlines in the model when testing for the nexus between airline fuel hedging and airline firm value in the hopes of understanding the dynamics of the airline industry within this region, particularly pertaining to the sensitivity it displays to risk management activity. However, a major constraint that this study was confronted with was the unavailability and inaccessibility of comprehensive airline financial data on the African continent. The study consequently relied heavily on the European and North American airlines to draw general inferences on the behaviour of airline firm value in reaction to hedging activity. The gaps within this study provide an opportunity for future researchers to cover a wider scope and to zone in on the relationship that has been hypothesised in this study, with more focus and emphasis on the African context. Secondly, this study made use of a combination of both low-cost and full-service carriers. Literature suggests these two groups of airlines have different operation models, therefore, the valuations of the airlines may be required to cater to these nuances for more accuracy. Another opportunity for future researchers would be to segment the airlines into the two groups and valuate company performance separately for each of the classes. And lastly, this study initiated an important and highly relevant dialogue of hedging activity and firm value acting as catalysts in the attainment of the SGDs. This further provides an opportunity for future researchers to probe into the magnitude of the impact that firm value has on the SDGs.

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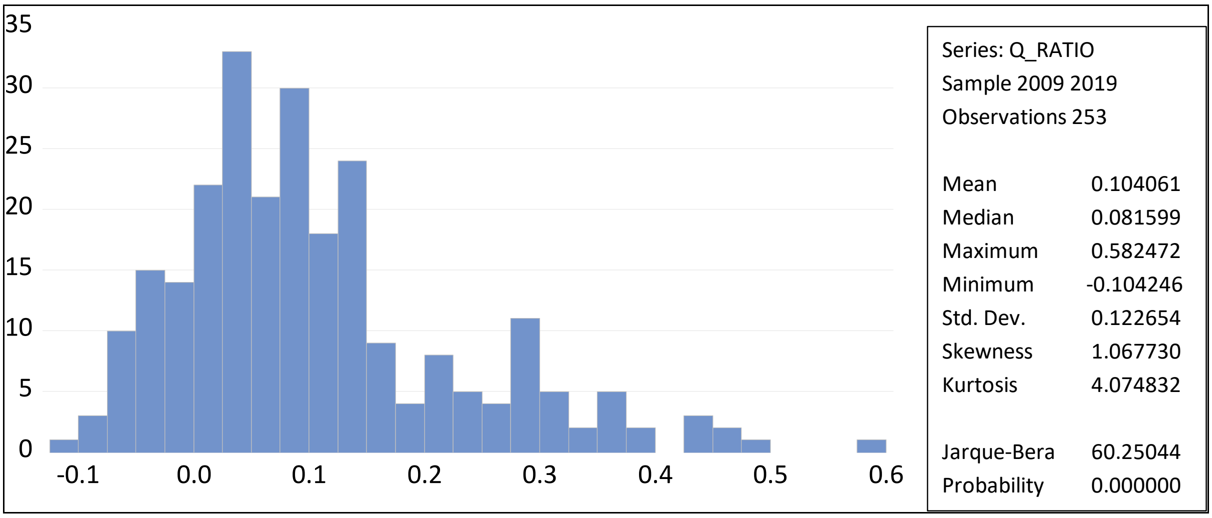
APPENDIX I: LIST OF AIRLINES USED IN THE STUDY

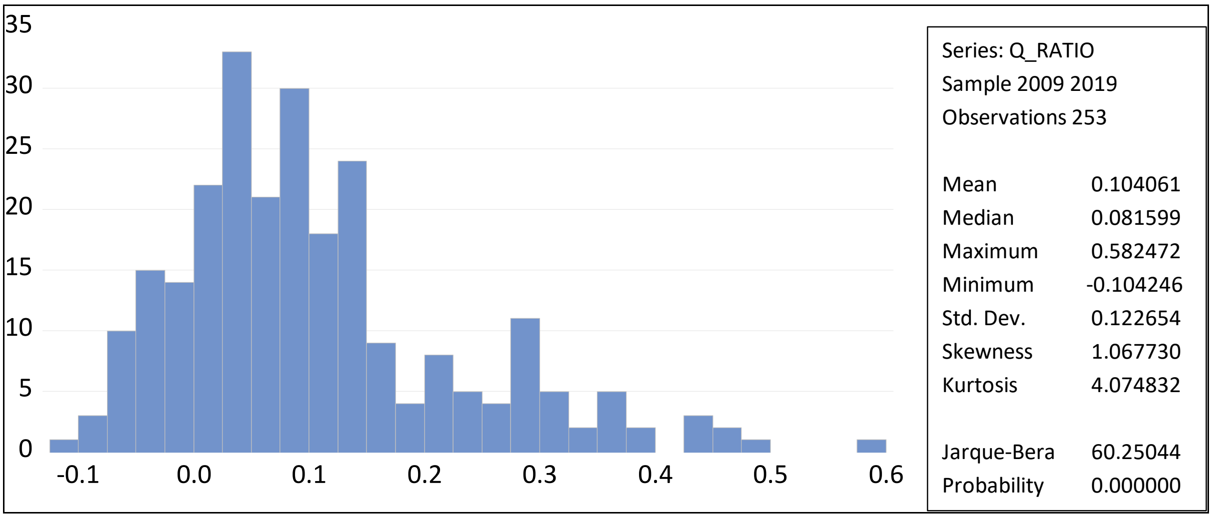
Hedgers	Non-Hedgers
Air France	Aeroflot (Russian Air)
EasyJet	Allegian Air
Intercontinental Consilidated Airlines	Amercan Airlines
Luftansa	Delta Airlines
Norwegian Air	Spirit Airlines
Ryanair	Westjet Airlines
Turkish Airlines	Air Mauritius
AeroMexico	Comair
Air Canada	
Hawaiian Airways	
JetBlue Airlines	
South West Airlines	
United Airlines	
Volara	
Kenya Airways	

APPENDIX II: RESIDUAL HISTOGRAMS OF THE REGRESSION MODELS

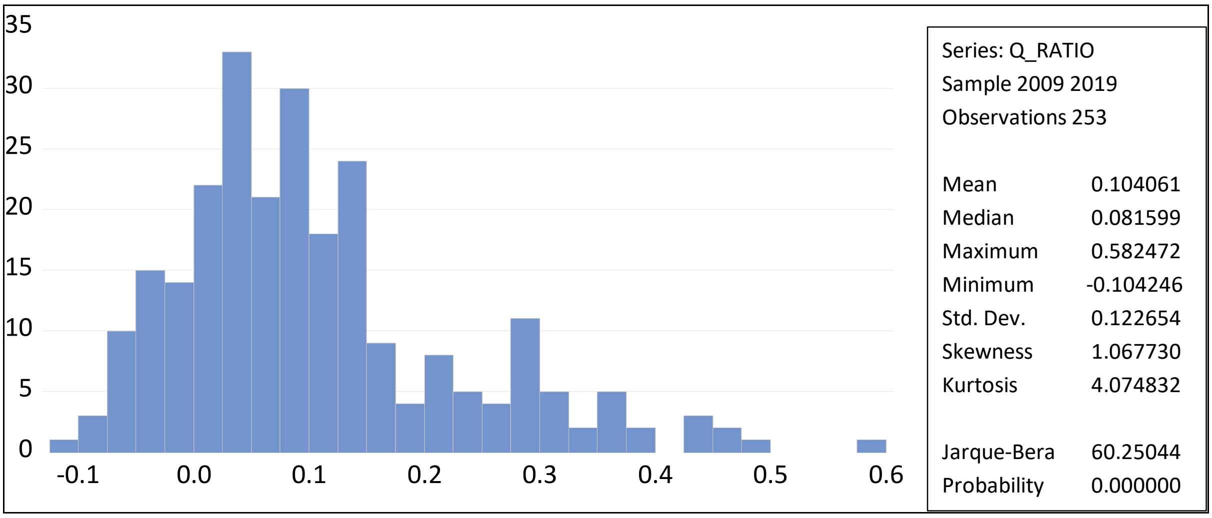
Q_RATIO = PCT_HEDGE FIRM_SIZE PCT_FUEL_COST_TO_OPCOST FUEL_COST_PER_PAX OP_PROFIT_PER_PAX



Q_RATIO = FAIRVAL_DERIV_TO_ASSETS FIRM_SIZE PCT_FUEL_COST_TO_OPCOST FUEL_COST_PER_PAX OP_PROFIT_PER_PAX



Q_RATIO = DUMMY FIRM_SIZE PCT_FUEL_COST_TO_OPCOST FUEL_COST_PER_PAX OP_PROFIT_PER_PAX



Source: Result from research data