SELINUS UNIVERSITY
OF SCIENCES AND LITERATURE

"The Hedge Envelope"

Jet Fuel Key Risk Indicators and Management.

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ABSTRACT

Two things cannot be denied or overlooked in the corporate world. The first is that no organization can eliminate risks, and the second is that nobody can predict the future with certainty.

As a result, organizations develop procedures wherein judgments are made to accept a known or evaluated risk, and steps are taken to mitigate its consequences or likelihood of occurrence.

For any business or service to achieve its goals, they have to adopt this approach, and more likely so in the airline industry.

Airlines must contend with many external factors that can negatively impact their profitability, and the availability of severe external elements is overwhelming.

In addition to rising competition, poor profit margins, interest rate variations, currency fluctuations, jet fuel prices that constitute almost 30% of operation costs, and high volatility swinging from 30$/barel to 120$/barel in the lapse of a few months all pose a substantial threat to the profitability of any airline.

Therefore, it is not unexpected that so many books, academic studies, and theses on hedging approaches and financial derivatives were written, as well as a vast body of professional literature on financial risk management and, in particular, jet-fuel risk exposure in the airline industry.

It is logical that the question regarding the necessity of additional research comes to mind and who it serves.

Literature review and more than three decades of personal practical experience of the researcher in that field indicate that the majority of the published material regarding jet fuel risk mitigation in the aviation industry includes a lot of theoretical analysis with a clear bias toward a mathematical approach, formulas not always well understood by managers, having the risk management team drown in a sea of data, they cannot efficiently analyze.

Typically, airlines are left with a list of risks and limited means of monitoring the chosen mitigation approach, which significantly hinders their ability to respond.

Based on the researcher's experience, not only does the current approach lacks real-world applications, but it also lacks a well-defined methodology describing the processes and procedures for building a risk management program and has a poor application of key indicators capable of giving quick and accurate risk measurements.

This thesis takes a pragmatic approach to some essential jet fuel risk management elements. The designed program simulates an envelope and serves as a wrapper for some crucial parts of aviation fuel risk management. It presents a set of quantitative, detailed, and proactive risk metrics that, if effectively applied, will contribute to adopting practical steps for managing and minimizing risk damages resulting from jet-fuel price volatility.

The envelope addresses two frequently overlooked parts of a risk management program:

- What are the most important characteristics of a jet fuel risk management policy and principles required to support the decision-making process for all key stakeholders, and
- What are the most important components of a program for key risk indicators?

This thesis proposes a comprehensive policy for solid risk management and effective internal governance, which helps the airline anticipate, quantify, manage, and report critical components of a jet fuel market risk exposure program and develops organizational accountability for all stakeholders.

The "Hedge Envelope," as presented in this thesis, refers to the internal corporate governance stage's principles and metrics indicators needed to analyze performance and develop an early warning system.

This is not another academic paper on financial derivatives. Instead, it provides a comprehensive yet pragmatic guide to the hedge envelope as defined herewith while minimizing complicated models as much as possible.

I chose to write this thesis because there is a real need for a clear, practical guide that shows how to set up rules and procedures for an airline's jet fuel risk management program, how to use risk measurements and indicators, and how to work as a guide for those who want to deal with real-world applications.

It presents an opportunity to develop industry best practices and shares information, ideas, and concepts with other people dealing with jet fuel risks offering the ability to directly compare risk exposures with peers, better understand mitigation programs, and assist in developing a standard language, terminology, and a framework for treating jet fuel risks commonly shared by airlines.

The thesis is yet another attempt to add an extra layer of directives to serve the goal of managing, controlling, and anticipating upcoming events that could negatively impact the airline's performance.

ACKNOWLEDGMENT

I want to thank Selinus University Business School for letting me use my many years of professional experience, this, along with a thorough review of the literature, allowed me to write a practical dissertation using the university's one-of-a-kind platform for a Doctor of Philosophy by Research (Ph.D.) in Financial Risk Management, covering specific aspects of Jet-Fuel Risk Management often overlooked.

My deepest thanks go to my supervisor, Professor Salvatore Fava, for all the academic help and advice he gave me during my doctoral studies.

I want to thank Dr. Adriana Nifosi, the Chief Academic Secretary, Dr. Sabrina Mazza, and Mrs. Elvira Di Mauro for their unwavering support and helping with the administrative issues during my studies and journey to complete my research.

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DEDICATION

I dedicate this thesis to my loving family, who supported me constantly during my research.

To my dear wife Sarah for her love, understanding, and supporting me in going after a dream I had put off for too long, never complained about the long hours I spent researching and writing.

To my dear daughters Roni and Leead and my sons-in-law Elad and Adan, who encouraged and shared the belief that age is not a barrier to achieving a goal, no matter how demanding it is.

To my dear grandchildren, Or, Guy, Jonathan, Alon, and Ella: I hope that when you read this dissertation one day, you will realize that anything is possible for those who believe that you only get old when you stop learning and that perseverance, hard work, determination, dedication, and family support will always help you achieve your goals.

DECLARATION

I hereby declare that the work presented in this thesis has not been submitted for any other degree or professional qualification and is the result of my independent work.

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CHAPTER 1: INTRODUCTION

1.1 Overview:

"*You cannot improve what you do not measure*." This quote, often attributed to Peter Druker, is probably valid in all business activities and even more so in risk management. However, what if there are no defined procedures to manage the hedge policy or a clear definition of the firm's risk appetite? What if there is insufficient knowledge regarding what or how to measure the efficiency of the policy? What if, after performing the measurements, there is not enough knowledge regarding how to report and present the findings so that they are understood by managers who are not versed enough in the complex subjects presented but still bear the ultimate responsibility for managing the firm?

This thesis, like an envelope that surrounds something, will act as a guide on how to build a procedure and process for jet fuel hedging in airlines and present a collection of quantifiable, specific, and proactive risk metrics that, if successfully implemented, will help take efficient steps in controlling and mitigating risks emerging from jet fuel in the airline industry.

Risk is an inherent part of business, and most likely, there are no organizations that do not face it daily. There are many risks, such as operational, strategic, financial, security, safety, regulatory, cyber, etc. If not correctly assessed, evaluated, implemented, managed, and controlled, risk could have a disastrous effect on the organization.

The fact that risk exists is not new knowledge. Organizations are preparing and implementing risk management programs worldwide and in nearly every industry. Even more, the corporate sector has developed an elaborate program to examine risk, not from a silo perspective but from a sophisticated enterprise-wide

perspective. However, the tools for transforming risk analysis into a set of valuable and applicable metrics that allow us to assess and demonstrate how dangerous action is and warn of the probability of adverse outcomes, are insufficient.

Most research into risk metrics has referred to the banking and financial sectors, and insufficient attention has been devoted to the airline industry, which is well known for its poor financial results and market parameters volatility.

Often, businesses do not gather the metrics they require; as a result, the risk management function is swamped with massive amounts of data it can't evaluate correctly.

While companies cannot eliminate risks, they can strive to manage them effectively by establishing processes and frameworks to minimize threats and their negative economic impact. The essential components of such a process include risk identification, risk assessment, risk evaluation, risk treatment, risk monitoring, and review (see Figure 1-1).

FIGURE 1-1 ESSENTIAL COMPONENTS OF RISK MANAGEMENT

There is a massive wealth of professional literature regarding financial risk management, including books, research papers, and scholarly articles covering the risk components of identifying, assessing, evaluating, and responding. Minimal research deals with the elements of building procedures and processes for jet fuel hedging in airlines and with providing a set of quantifiable, specific, and proactive risk metrics measuring and reporting indicators capable of identifying the effectiveness of a risk mitigation strategy, whether it is on track, and what action to take to rectify deviations.

The lack of sufficient practical review and research in the above areas is especially felt in the airline's financial risk management and reporting.

A risk management program that does not include systematic and well-defined procedures, processes, responsibilities of the various stakeholders, and indicators that assess and quantify the effectiveness of the risk mitigation strategy will ultimately fail to demonstrate the degree to which the organization regularly meets the goals of the program.

This thesis's focus will be to address this gap and suggest and present a practical approach applied by the author, who has more than thirty-five years of career in airline financial management and risk mitigation.

This is not another academic paper regarding financial derivatives or sophisticated mathematical models for optimizing hedge ratios. It is a pragmatic guide regarding the essential elements of a comprehensive policy for sound risk management and a set of critical risk indicators metrics selected and presented to evaluate and measure the efficiency of an airline jet-fuel risk management program.

This chapter will introduce the thesis by discussing the background and context, then defining the research problem, aims, objectives, questions, significance, and limitations.

1.2 Background

Before reviewing the subject of risk indicators and associated metrics, one should briefly define risk and develop risk management theories and practices.

The most direct way to define risk is by using ISO's definition of risk as an "effect of uncertainty on objectives."[1] In other words, risk refers to the unknown nature of future developments involving, for example, market prices or market rates.

In the business world, this can bring either losses or rewards that are quantified using the expectancy risk formula:

Risk ($) impact = Probability (%) x Financial outcome ($)

Namely, the financial outcome of a risk event depends on the likelihood of its occurrence multiplied by the cost of the damages inflicted on the business when such an event happens.

If an event (or events) with a high probability of occurrence and significant financial negative implications arises, that may endanger the company's performance and goal achievements according to its strategy.

The threat that may result in endangering a company's performance due to a sudden change in exogenous factors has led managers to deal with some level of risk management a long time ago. It is not a modern concept, and risk management strategies have existed for several years (Doherty, 2000).

Organizations have been compelled to reevaluate their risk management strategies following the 2008 financial crisis. As a result, board members

[1] **"ISO 31000" , 2020**

recognized that they are responsible for risk assessment and threshold setting and reviewing and assessing actions related to risk procedure fulfillment.

The New York Stock Exchange enacted governance guidelines in 2004, empowering audit committees of NYSE-listed companies to oversee management's risk management systems.

In 2008, Standard & Poor's included a detailed examination of an issuer's enterprise risk management (ERM) systems in their credit rating examination in seventeen new industries.

The Securities and Exchange Commission (SEC) extended proxy disclosure rules in 2009 to provide investors with additional information on the board's risk oversight role.

The Federal Financial Reform law enacted in 2010 now requires risk committees on the boards of directors of financial institutions and other companies regulated by the Federal Reserve.

Numerous organizations embrace enterprise risk management (ERM). The executive management teams leading these efforts are turning to frameworks such as COSO's 2004[2]Enterprise Risk Management – Integrated Framework (COSO[3] ERM Framework) to reinforce their enterprise-wide risk management processes.

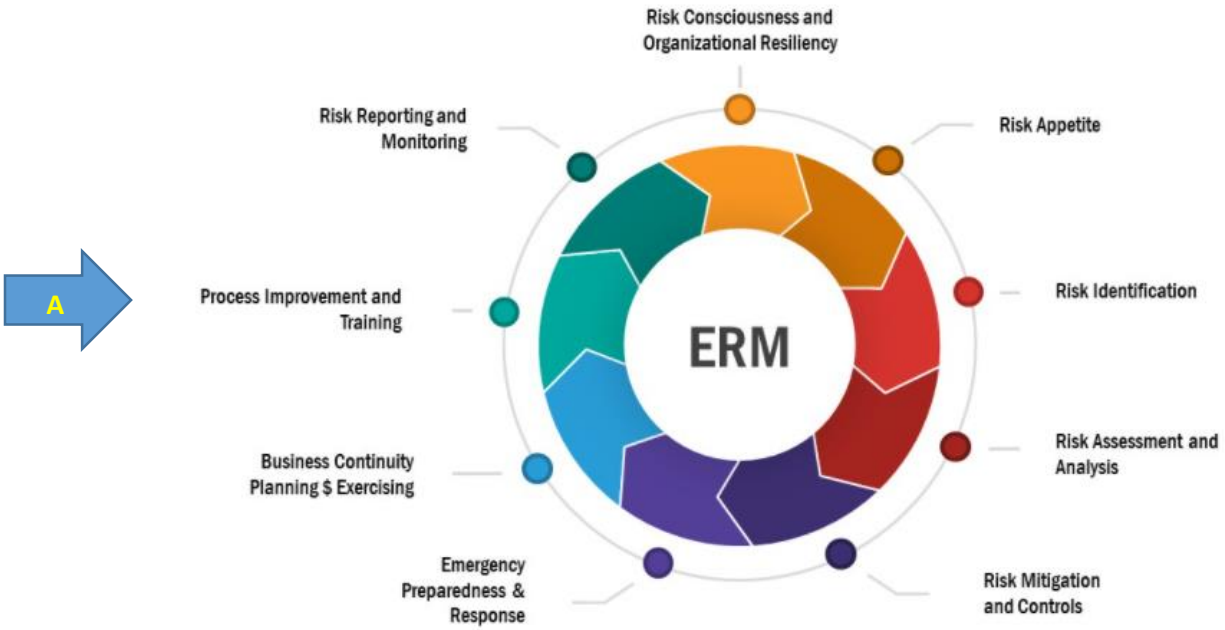
According to COSO's ERM Framework, enterprise risk management is a process carried out by an entity's board of directors and management to formulate strategies to identify possible occurrences that may affect the company. Risk should be kept within acceptable limits to achieve the entity's objectives.

Organizations implementing ERM have standards to adhere to, the two most common being COSO and ISO 31000. Both these standards released updated

[2] ('Thought Leadership in ERM - COSO. https://www.coso.org/Documents/COSO-KRI-Paper-Full-FINAL-for-Web-Posting-Dec110-000.pdf', 2004)

[3] COSO stands for: Committee of Sponsoring Organizations. The committee created the framework in 1992 and updated in 2013.

versions in 2017 and 2018, respectively. As a result of the numerous standards and instructions, businesses are left with a list of risks and practically no way of mitigating or managing them.



A holistic view of risk management can be presented according to the above chart.

FIGURE 1-2 A HOLISTIC APPROACH TO ENTERPRISE RISK MANAGEMENT (ERM)

Regarding risk measuring and reporting (Figure 1-2)[4], despite the fabulous work and research in ERM, there is a big gap in that area. For example, John Loxley has written that "while publications all call for risk to be measured, most do not indicate how that might be done" (Loxley, 2010, p. 70).

[4] **See arrow A presented in Figure 1-2.**

1.2.1 Existing gap:

Searching the relevant literature and many databases reveals that most books, research papers, and Ph.D. dissertations focus primarily on determining the mathematical aspects of the risk models and the general strategy. As a result, there is abundant literature on identifying risk elements, assessing the financial impact of an occurrence, and engaging in hedging operations to manage risk and comply with the regulator's reporting obligations.

However, once a risk mitigation plan is implemented, and when it comes to measuring its effectiveness and voluntary internal reporting not required by regulators, one will hardly find instructions and practical advice describing how to implement the program and measure its efficiency.

There are very few if at all, research papers in the airline industry answering the following questions:

- What are the primary elements of a risk management policy and principles that guarantees that risks are comprehended, handled, and disclosed?
- What are the appropriate decision-making sequences for all relevant stakeholders participating in risk mitigation activities?
- What are the most significant metric indicators the company should continuously monitor to verify if the mitigation implementation conforms to its strategy?
- What appropriate reporting tools are required to ensure management is aware of the situation?
- What should be the frequency of report submissions?
- What are the financial results of simulating different risk scenarios based on the current hedge program?

Except for the financial sector, which is highly regulated, this gap exists in most organizations that find themselves ill-equipped when measuring the continuous results of a mitigating plan. That lacuna is much more felt in the aviation industry.

1.2.2 Risk measurement and reporting gap:

Due to the heavy regulations faced by financial institutions, they have shown great interest in using measurable metrics or indicators that track exposure or loss. Those metrics called "key risk indicators[5]" (or "K.R.Is') are not new. However, they are much less researched and implemented in other industries.

K.R.Is seems to look like key performance indicators (K.P.Is') and are often mistaken for one another(Peček and Kovačič, 2019). While the K.P.Is' are focused on historical process performance, the K.R.Is are oriented toward future threats (Scarlat, Chirita, & Bradea, 2012; Beasley, Branson, & Hancock, 2010). Coleman (2009) defines K.R.Is as statistics or measurements that can provide a company's risk position perspective.

Developing effective K.R.Is is to identifying the relevant metrics that provide valuable insights into potential risks that may impact the organization's objectives (Beasley et al., 2010). Although the purpose of the metrics is well articulated and identified, one can rarely find practical research on how to implement such metrics and report them accordingly.

1.2.3 Internal governance gap:

The other gap identified in the literature is the absence of a policy statement for risk management. A policy that defines the risk management objectives, who is responsible for what, and the airline's risk appetite, as well as the principles, methods, and instruments required to monitor and report the airline's performance successfully, particularly amid market change.

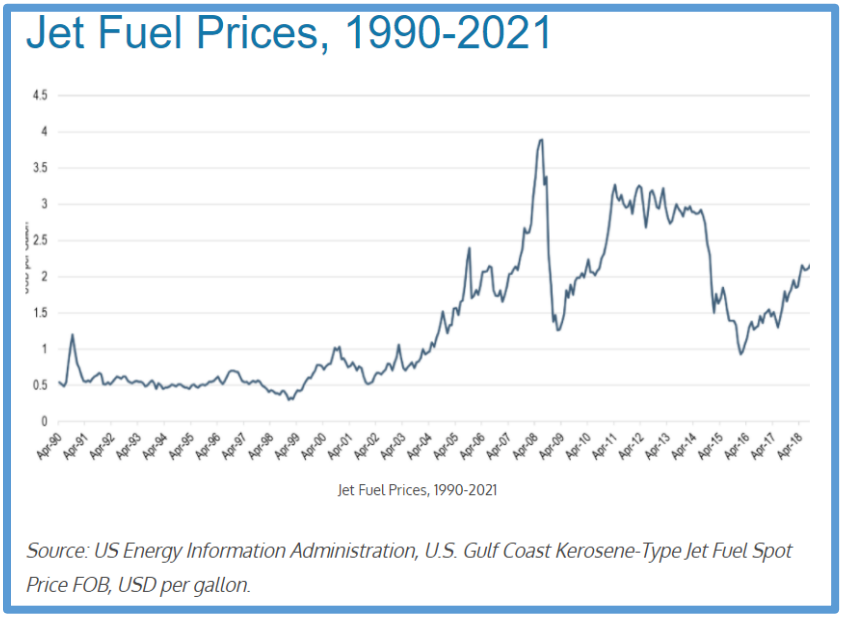
[5] **See full description in paragraph 2.4**

1.3 Motivation:

The aviation industry is a perfect example to demonstrate the necessity of risk metrics, procedures, and internal reporting to verify the efficiency of a risk mitigation strategy. It derives from the fact that the airline industry is exposed to the same risk of jet fuel prices, making this research universal in risk measurement practices.

Airlines must cope with a myriad of external forces that can adversely impact their profitability, and the overabundance of intense factors not under the direct control of the airline is overwhelming.

Besides increased competition, low-profit margins, skyrocketing and volatile fuel prices, changes in interest rates, and currency fluctuations represent a significant risk and considerably challenge the profitability of every airline.



Combining the volatility of jet fuel with the fact that its prices are a significant cost factor for airlines makes it an exceptional candidate for designing and utilizing metrics to test the effectiveness of the risk mitigation plan.

FIGURE 1-3 JET FUEL PRICES VOLATILITY.

In Figure 1-3, the volatility of fuel prices is well demonstrated. Looking at the chart, we see that the cost of 1 gallon of jet fuel was 1 dollar in 2000, climbed to 2.5 dollars in 2005, to 4 dollars in 2008, dropped to $1 per gallon in 2016, and currently trades at $2.85 per U.S. gallon.

Fuel constituted 33 percent of average operating costs in 2012, 22 percent in 2005, and 13 percent in 2001 (IATA1, 2012a). Delta Air Lines, for example, reported fuel expenses of 36 percent of total operating costs in 2012[6] (Delta Air Lines, 2013). The global airline industry's fuel bill is estimated to reach a total of $192 billion in 2022 (accounting for around 24% of operating expenses at an average price of $101.2/barrel Brent)[7].

As airlines cannot always increase ticket prices due to competition and market dominance, airlines put their efforts into hedging activities.

Airlines started implementing fuel hedging as a risk management strategy in the late 1980s. Before that, currency derivatives were mainly used to counteract exchange rate fluctuations (Morrell and Swan, 2006).

As a result, hedging and derivatives became part of the overall corporate risk management strategy (Batt, 2009; Nance, Smith, and Smithson, 1993).

The author of this thesis spent more than three decades managing all of the financial activities of an airline and is well aware of the lack of procedures and metrics so essential in monitoring risk mitigation. In addition, being a member of the IATA[8] financial committee for many years, the author knows that this lacuna in relevant risk metrics and reports prevails throughout the aviation industry.

[6] **See Figure 2-2-2**

[7] **Source: IATA Updated: 10/2021**

8 International Air Transport Association (IATA)

1.4 Problem statement:

The likelihood that a corporation may encounter a crisis that jeopardizes its business operations is rather significant in the business world. Hence, every risk management system must be capable of identifying deviations in real-time; otherwise, the impact on financial results might be catastrophic.

Detecting which important risk elements perform as predicted and which do not is a fundamental risk management task for a business to fulfill its objectives and meet its targets.

The airline sector possesses a sizable toolkit for risk mitigation. However, there is a significant disparity in using appropriate risk indicators and measures capable of detecting and forecasting deviations from set thresholds or financial stress early on.

Airlines' financial risks, primarily caused by volatility in jet fuel prices and other unstable factors, will almost certainly result in the airline having severe difficulties in meeting strategic objectives. This task requires an adequate, systematic, and continuous measurement methodology reflecting its position vis-à-vis its strategic plan.

Airlines are typically left with a list of risks and few means for measuring the mitigating strategy decided upon, significantly impairing their ability to respond.

The problems identified and addressed in this thesis are the airline industry's lack of well-defined methodology regarding the required processes and procedures to set up a risk management program and a poor application of proper key risk indicators capable of providing fast and accurate risk measurements.

1.5 Thesis aims and objectives:

Given the current status of research and the lack of known implementation of risk metrics to measure the efficiency of mitigating jet fuel risk in the airline sector, this thesis will aim to support airlines in:

- Addressing the literature gap and proposing practical solution that contributes to expanding knowledge on the issue.
- Assisting airlines in establishing and implementing risk indicators that indicate adequate monitoring of the specified risk strategy and anticipate future changes in jet fuel risk direction.
- Indicating a window of opportunity for developing industry best practices in jet fuel hedging aspects before and after adoption.
- Providing a realistic approach for internal governance and risk management indicators.
- Providing a platform for exchanging information, ideas, and concepts with peers engaged in jet fuel risk management, enabling the direct comparison of risk exposures with peers and a better understanding of mitigation initiatives.
- Developing a standardized structure, vocabulary, and terminology for treating risks frequently shared by airlines.
- Inspire other industries with a significant risk element in their operations, subject to high volatility.
- Motivate researchers to incorporate risk metric indicators as an integral part of their enterprise risk management research.

1.6 Research questions:

The thesis will answer the following questions referring to jet-fuel risk management:

1. What should the significant elements of a risk management policy and principles be?
2. What is the suggested flow of decisions that all relevant parties should take once the airline decides to implement a risk mitigation activity?
3. What are the essential elements of a key risk indicator program?
4. What is the actual hedge portfolio position versus the authorized policy in terms of:
    a. Tenor
    b. Hedging instruments.
    c. Thresholds.
    d. Mark to market exposure.
5. What is the expected monthly fuel cost (c/g) before/after hedging for the next 12/24 months?
6. What is the actual and expected credit exposure and margin calls/cash exposure to financial institutions for the next 12/24 months?
7. Is the credit exposure in line with credit policy?
8. What is the weighted average hedged price versus the market price for the next 12/24 months?
9. What is the total fuel expenditure with and without hedging?
10. Assuming an up and down movement by +/-5% around Brent's current known value, what would be the impact on:
    a. Effective barrel fuel cost due to the hedge program and the Brent curve deviations.
    b. Effective monthly fuel costs the airline faces due to the hedge program and the Brent curve deviations.

c. The airline's average fuel costs due to the hedge program and the Brent[9] curve deviations.
d. The airline's average yearly fuel cost due to the hedge program and the Brent curve deviations.

1.7 Significance of the study:

The contribution of this thesis will be to present:

- A well-defined policy and procedure to establish the airline's jet-fuel Risk Policy, including risk limits, collateral exposure, guiding principles, and specific reporting rules.
- Describe the procedures for updating, changing, and approving the policy as required.
- Techniques to monitor management's implementation of the Risk Policy.
- Process for approving policy exceptions where appropriate
- Develop and present a collection of quantifiable, specific, and proactive metrics that have been successfully implemented and helped take efficient steps in designing, implementing, and reporting key risk indicators for jet fuel risk mitigation.

The researcher will introduce a set of reports and metrics he designed and implemented during his many years of experience managing an international airline's financial activities.

This thesis will reinforce the practical aspects of the subject by adding more tools to better monitor potential future shifts in risk conditions or new emerging risks and help management more easily identify potential impacts.

[9] **See definition in chapter 7, section 7.2**

1.8 Limitations

Risk management, and more explicitly, hedging, is a vast and complex field of study, with many possible areas to explore, necessitating the need to narrow the scope of the thesis.

- Exchange currency and interest rate risk are significant airline exposures, but they vary from airline to airline, requiring tailor-made research to produce important risk indicators. This is why they are not included in the dissertation
- The thesis was prepared during the COVID-19 pandemic, one of the most challenging times for the airline industry. However, given the scarcity of global research and official publications on the efficacy of risk indicators that could serve as an early warning to mitigate the pandemic risk associated with jet fuel risk management, not many are included in this thesis
- The only risk indicator that eluded the emergence of a crisis was the one displaying credit risk regarding collateral posting and the need for additional management attention.
- Although the thesis gives a complete overview of two fundamental parts of any effective jet fuel hedge, it is mainly based on the researcher's significant expertise, a lengthy literature analysis, and not on an actual survey of various airlines. Such a survey would have needed a lengthy procedure specifically during the pandemic and a large budget.

1.9 Thesis structure:

The thesis includes the following chapters:

Chapter 1:

This is the introduction chapter. The thesis context and the research objectives are outlined. The research's benefits and limitations are highlighted.

Chapter 2:

In this chapter, previous and current research on the topic are identified by a review of the relevant literature.

Chapter3:

Chapter 3 details the methodology used in the research. It is based on a thorough review of current literature on the issue as well as the researcher's personal experience managing the financial activities of an international airline for over three decades.

The researcher developed a comprehensive set of processes and directions for monitoring an airline jet fuel risk management system, as well as real-world airline data that simulates risk situations, which were then used in a key risk indicator program of a hypothetical airline (ABC Airlines).

Chapter4:

Chapter 4 presents the results of the research. It includes an answer to all the research questions, including what should be the primary elements of a risk management policy and principles for all relevant stakeholders and what are the critical elements to be included as significant key risk indicators in any airline jet fuel management program.

Chapter5:

This chapter concludes the thesis by providing an overview of the significant study findings of the "hedge envelope" that wraps the relevant elements as defined in the dissertation regarding an aviation jet fuel risk management program.

Chapter6:

This chapter provides suggestions for future actions and research.

Chapter7:

This chapter includes several annexes required to understand correctly the various analyses included in the thesis. The annexes cover the following elements: A validation of airline data for jet fuel risk management; an overview of jet fuel-specific characteristics; an overview of hedge instruments; a general overview of the main agreements used in hedging activities (ISDA agreement), and a list of actual price derivatives collected and used in the research.

Chapter 8:

Chapter 8 includes the specific books, research papers, academic manuscripts, and Ph.D. theses read and cited in this dissertation.

CHAPTER 2: LITERATURE REVIEW

2.1. Overview:

This thesis's central argument revolves around two essential elements of a risk management program for jet-fuel risk mitigation in the airline industry:

- What should a comprehensive plan for a risk management guide of procedures and processes for jet fuel hedging in airlines include?
- What is the most efficient collection of quantifiable, specific, and proactive risk metrics that, if successfully implemented, will assist in taking effective measures for controlling and mitigating risks arising from jet fuel in the airline industry?

There are very few academic papers and official publications regarding those two components, and only very few describe what the process should include, especially in the airline industry.

Studies on how to identify risks, perform a qualitative risk analysis, conduct quantitative risk analysis, and develop risk responses are abundant in the literature; hence, they will not be expanded on in this thesis. Instead, this dissertation's literature review will focus on the two components outlined above.

Before reviewing the literature regarding risk mitigation plan procedures and risk metrics, it is important to briefly overview the particularities of the airline industry, followed by a discussion of the financial commodity that represents a significant risk faced by airlines.

2.2. Aviation industry and Jet-fuel exposure:

The airline industry is characterized by poor profit margins, high labor costs, and volatility in response to external variables such as jet fuel prices, interest rates, currency fluctuations, and other exogenous causes like the COVID-19 pandemic.

For airline operations, jet fuel[10] is a substantial factor in an airline's operating cost since every aircraft requires fuel to function and fluctuation in crude oil prices causes uncertainty in airline operating costs.

According to Aviation Monitor, the average net profit margin for the world's airlines during the previous 35 years has been 0.3 percent.

Figure 2-2-1 displays the airline profitability by regions from 1996 until 2020 (excluding the pandemic) as analyzed by I.A.T.A

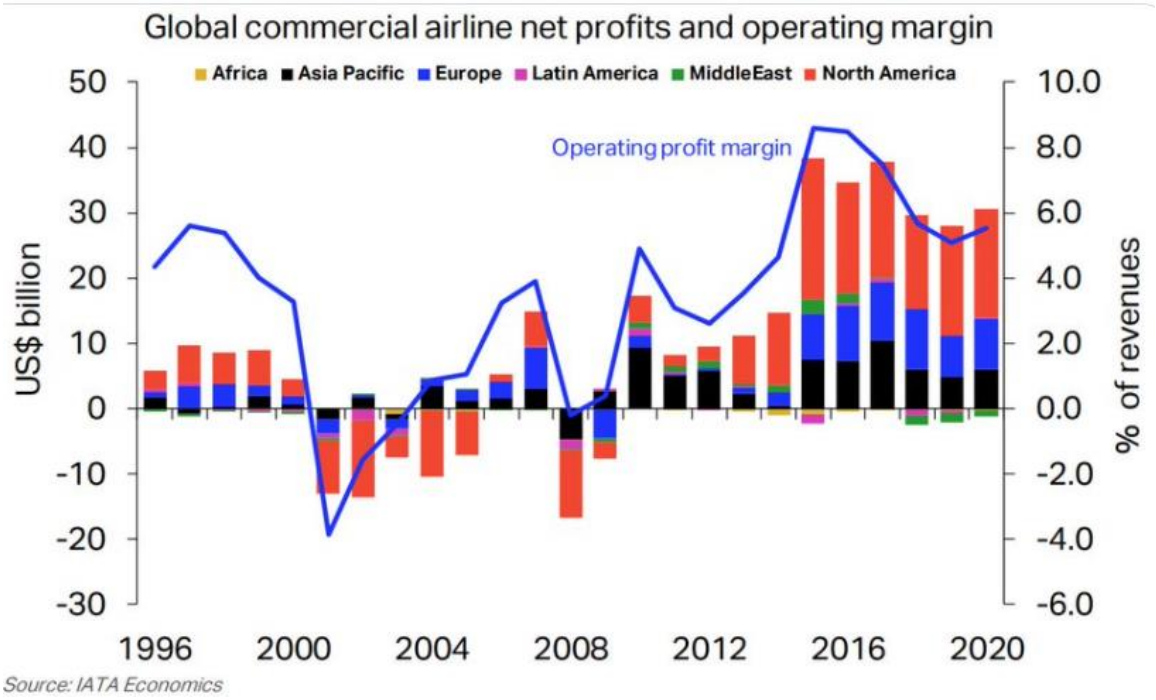


FIGURE 2.2-1 AIRLINE NET PROFITS AND OPERATING MARGINS

[10] See Chapter 7, section 7.2

Fuel is the airline industry's most significant expenditure category and is also the least reliable. It accounts for almost 30%[11] of total expenditure.

Fuel is such an expensive and variable commodity that it concentrates the industry's significant attention on improving fuel economy.

Airlines tend to hedge their fuel consumption or at least a significant proportion.

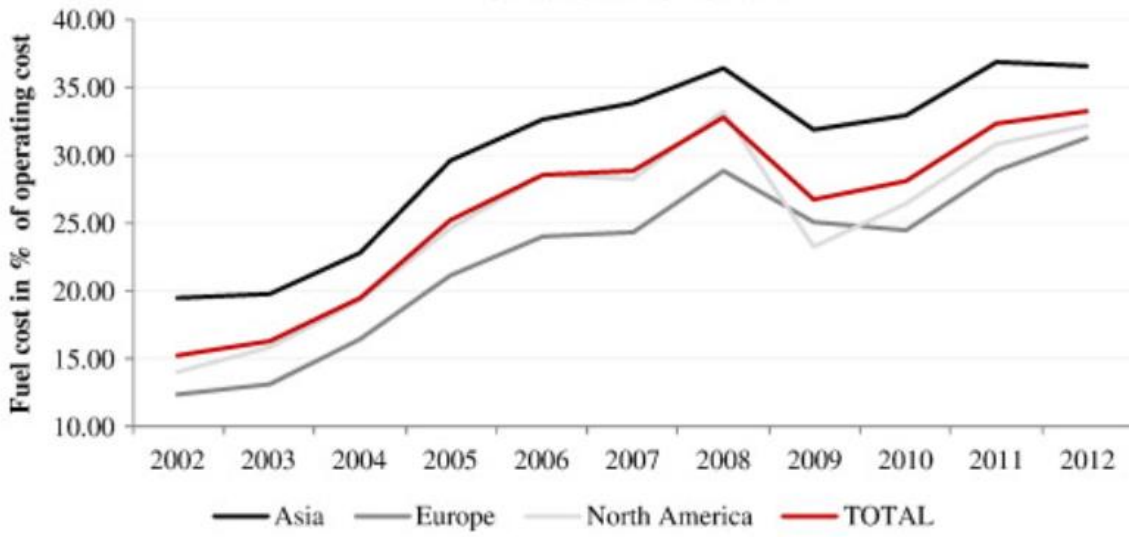


FIGURE 2.2-2 PERCENT OF FUEL COST OF OPERATING COST WORLDWIDE

According to the International Air Transport Association (IATA), a 1% decrease in fuel prices across the industry can save $2 billion in fuel costs(*Gourdin, KN 2015, A Profile of the Global Airline Industry, Business Expert Press, New York*, no date)

According to Loudon (Loudon 1988), fuel price risk affects firms negatively in the short term, and non-linearity effects are strong in the long term.

[11] See Figure 2.2-1 and Chapter 7 section 7.2

Treanor, Rogers, Carter, and Simkins (2014) analyze the link between corporate risk exposure, hedging policy, and firm value in the United States aviation sector. They discover that airline exposure increases when fuel prices rise. Second, airlines are more protected against fuel price fluctuations when oil prices are high due to their hedging activities.

As jet fuel[12] is a distillate of crude oil, Brent oil if sold in Europe and WTI if sold in the US, and is not extracted from natural fields, this means that the ability to hedge the risk exposure to jet fuel is worsened by the fact that it is traded over the counter (OTC). As a result, airlines must enter into customized OTC derivative contracts with no standardized exchange-traded contracts to hedge their risk exposure to jet fuel.

The fact that the entire industry is exposed to the same risk—jet fuel prices—makes the industry an excellent candidate for analyzing risk management and mitigation practices.

2.3. A holistic risk management approach:

The most essential and comprehensive tool in risk management that has developed gradually is enterprise risk management (ERM).

The concept of a holistic approach to risk management can be traced to the early 1970s when Gustav Hamilton of Sweden's Statsforetag proposed the "risk management circle" to describe the interaction of all elements in the risk management process (assessment, control, financing, and communication).

Enterprise risk management (E.R.M.) was adopted and gained popularity (Dumii, imeija, Pavkovi, & Andabaka, 2006; Spri, Tekavi, & Levi, 2008; Saudah, Chew, & McManus, 2014; Kozarevi & Bei, 2015; Daud, Yazid, & Hussin, 2010.

[12] See Chapter 7, section 7.2

Enterprise risk management is a method of coordinated risk management that emphasizes coordination between units to effectively manage the organization's broad spectrum of risks.

Many articles and research have been and are being written regarding ERM. As this is not the research core issue for this thesis, it is mentioned here to demonstrate the linkage with risk procedures and key risk indicators implementation.

2.4. Key Risk Indicators:

A Key Risk Indicator abbreviated K.R.Is, is a risk management metric used to determine the inherent risk of an event or the adequacy of its related controls. It is distinct from a Key Performance Indicator (KPI), a metric used to measure past activity efficiency.

K.P.Is' are focused on historical process performance, while K.R.ISs are oriented towards future trends.

Consequently, Key Risk Indicators (K.R.Is) are essential as a warning system.

While K.R.Is are intended to help identify risks, KPIs are used to quantify performance. Although many organizations use these terms interchangeably, they must be distinguished. Typically, KPIs provide a high-level perspective of an organization's performance. While these indicators may fail to meet or provide adequate early warning signs of rising danger, they are critical for analyzing trends and monitoring performance. KRIs emphasizes just the opposite.

Establishing successful KRIs is to select the appropriate indicators that give relevant insight into potential risks that might threaten the organization's objectives.[13]

According to Lam James (Lam, 2004), companies should develop a set of Key Risk Indicators (KRIs') for each risk category they face as part of a comprehensive ERM program.

KRIs' should be quantifiable, critical, relevant, and timely to provide objective feedback to managers on business direction and help focus action. In addition, they should be predictive enough to act as early warning signs for possible changes in an organization's risk profile.

In their study "Indicators and Metrics Used in Enterprise Risk Management," Scarlat, Chirita, and Bradea defineKRIs' as measures in credit risk scoring models used to forecast bankruptcy (Scarlat et al., 2012). They demonstrate how KRIs serve as the foundation for risk management decisions based on risk situations or discovering new risks. They separate KRIs and other risk measures, provide banks with information for decision-making, and respond appropriately based on the severity of the warning. For example, if the situation did not reach the red zone, involved personnel should resolve it, and upper management should take prompt action.

In their study, the researchers provide several critical risk indicators inside banks' divisions and departments, ranging from accounting, treasury, legal, buying, sales, engineering, and information technology.

[13] Beasley, M. S., Branson, B. S., & Hancock, B. V. (2010). Developing Key Risk Indicators to Strengthen Enterprise Risk Management – How Key Risk Indicators can Sharpen Focus on Emerging Risk. Retrieved from https://www.coso.org/Documents/COSO-KRI-Paper-FullFINAL-for-Web-Posting-Dec110-000.pdf

According to Davies, Mike Finlay, Tara McLenaghen, and Duncan Wilson, key risk indicators (KRIs') remain a top priority for most organizations, alongside scenario analysis. While KRIs are not new, attempts to deploy them have frequently been characterized as less than successful. KRIs are quantifiable measures or indicators that monitor risk loss. It becomes critical when the indicator is used to monitor a particularly significant exposure.

According to Lam. J (Lam, 2017) These are the fundamental questions that should be considered when implementing any K.R.Is' system:

- What risks can drive variability in actual versus expected performance?
- What key risk indicators (KRIs') quantify these risks' levels and potential loss?
- What are the worst-case scenarios for the business?

The main advantages of using KRIs are essential in:

- Determining existing exposure to risk and emerging risk trends.
- Emphasizing control deficiencies and providing an opportunity to strengthen weak controls.
- Facilitating the process of risk reporting and escalation.

Les Coleman, in his book "Risk Strategies – Dialing up Optimum Firm Risk Key", defines risk indicators as "statistics or measurements that can provide a perspective on a company's risk position and tend to be revised periodically (monthly or quarterly) to alert the company about the changes that may indicate risks." (Coleman, 2009)

A typical KRIs process should follow the steps illustrated in Figure 2.4.1

2.4.1. Building Key Risk Indicators:

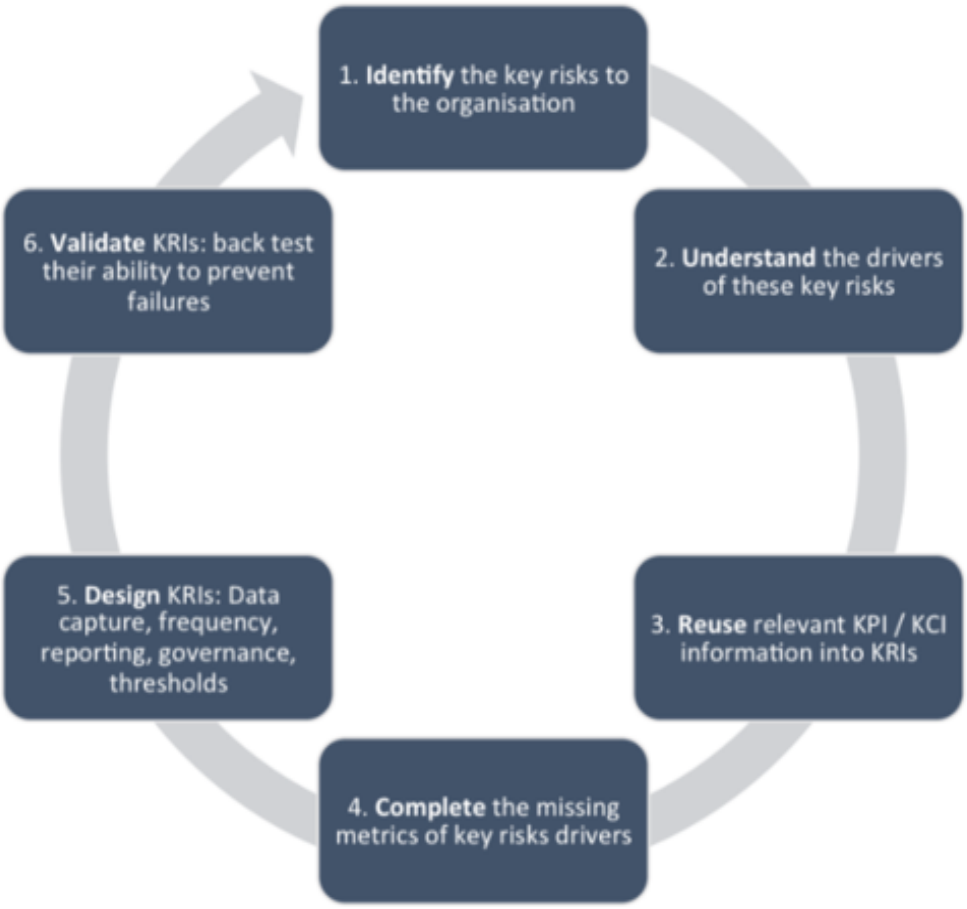


FIGURE 2.4-1 KEY RISK INDICATORS LIFE CYCLE- SOURCE CHAPELLE CONSULTING.

According to a published article by Chapelle consulting,[14] the life cycle of KRIs' should include the following elements:

- KRI Identification
- KRI selection
- Setting thresholds
- Risk Mitigation Plans

[14] What is the Life-cycle of K.R.IS's? Chapelle Consulting

2.5. Additional approaches to KRIS' building:

The Australian Department of Finance published in 2016 an interesting information sheet intended to assist specialists and executives who are required to design, implement, and embed an entity's risk management framework to fulfill their risk management responsibilities.

Effective KRIs are determined by first comprehending the entity's purpose and objectives. A well-designed set of KRI measures will shed light on potential risks that might jeopardize the achievement of goals or suggest the possibility of new opportunities.

The diagram in Figure 2.5-1 below illustrates the process.

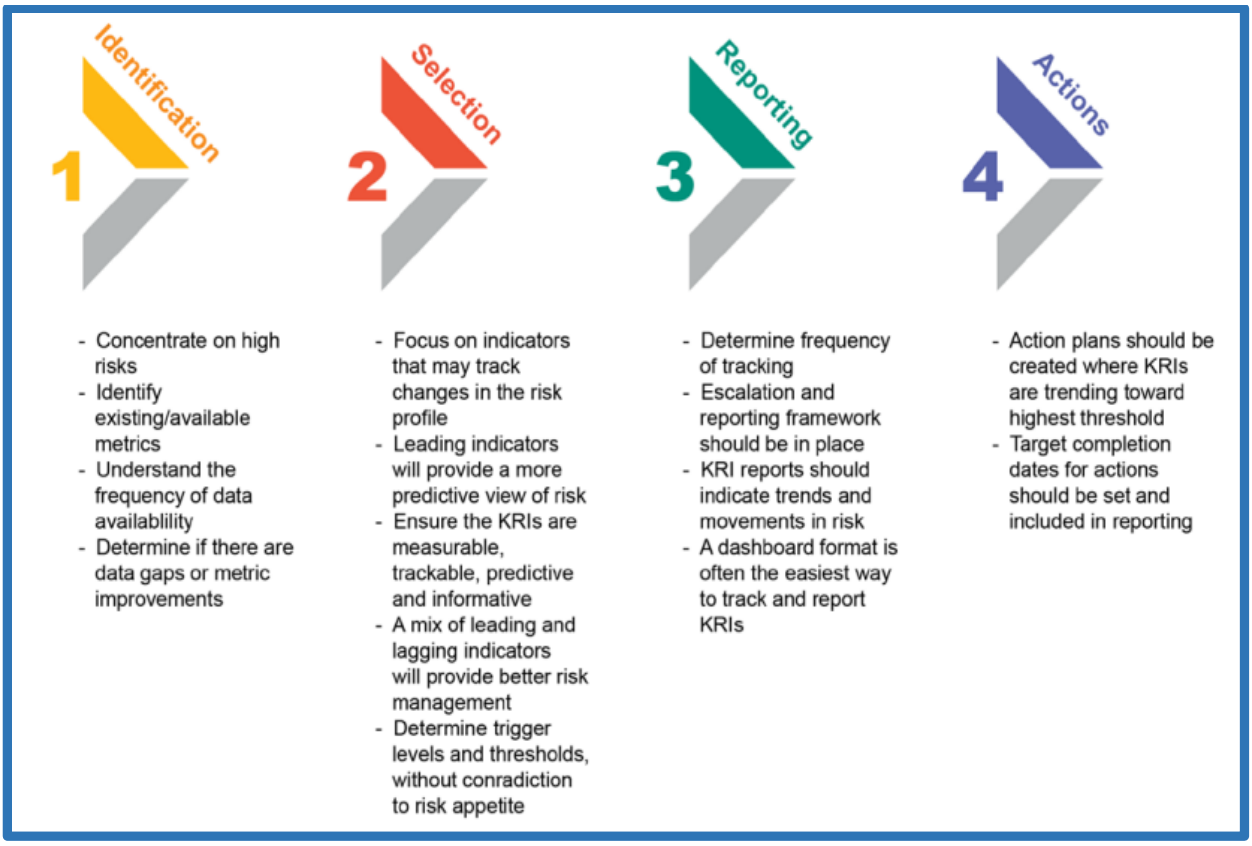


FIGURE 2.5-1 KRIS' BUILDING PROCESS

There is a particular emphasis on threshold launching and a recommendation that management should define the levels that will prompt action.

This approach leads to a more proactive strategy for risk management as it involves steps that reduce the likelihood of a risk event occurring and limit risk exposure to acceptable risk appetite levels.

KRI thresholds should be evaluated often to ensure that they are set so that the lower and upper triggers catch anticipated events or patterns. The thresholds should not contradict the entity's risk tolerance.

The following should be considered when establishing KRI thresholds and trigger points:

- Based on industry tolerance or internal acceptance.
- Approved by the relevant upper Management bodies and preferably by the Board of directors.
- Should coincide with the risk appetite statement.

2.5.1. The American KRIs' library (R.M.A):

In the United States, the Risk Management Association (R.M.A) oversees a project focused on helping businesses improve their risk management. This program is entitled "Library Services and Key Risk Indicators."

The project aspires to establish a level of reliability and uniformity that will allow for the comparison, analysis, and monitoring of key risk indicators at the management level.

Over 2500 indicators have been created to quantify and monitor various sorts of risk in the library. RMA expects that this plan will enable KRIs to become more productive

2.6. Chapter 2 conclusion:

Reviewing the literature leads to the following conclusions:

- There is a strong emphasis on ERM, particularly on using key performance indicators (KPIs'), primarily ex-post information sources based on previous data that might be insufficient for assessing future risks.
- Researchers who studied risk metrics' importance concluded that key risk indicators (KRIs') begin with a forward-looking view of risk. These metrics are a critical component of risk management since they improve risk monitoring and mitigation and streamline risk reporting.
- KRIs contribute significantly to risk management by identifying possible areas of high risk and enabling early intervention. In addition, K.R.Is' help businesses assess existing risk exposure and emerging risk trends, detect control gaps, and streamline the risk reporting process.
- Properly developed KRIs that are adequately communicated throughout the organization will assist in determining the organization's risk appetite and enable the organization to become more responsive and proactive in the presence of risk occurrences.
- Except for financial institutions mandated by regulators to develop and maintain elaborate risk management systems, the existing literature on risk management based on key risk indicators is in its infancy and insufficient in the aviation industry, especially in terms of jet-fuel risk reduction indicators.

CHAPTER 3: METHODOLOGY

3.1. Introduction:

The research methodology of this thesis intends to enable the development of governance and internal control systems that conform with board directives and policies. In addition, the process will support producing risk measurement indicators with present and forward-looking capabilities related to the efficiency of an airline's risk management system for jet fuel hedging in this highly volatile market.

Clear operational criteria and performance reviews will help the airline maintain competitiveness by evaluating what works and what doesn't.

The purpose is to design a program in which efficient management could implement a set of procedures and metrics indicators to monitor the changes in risk conditions and identify new risks to sustain operations and achieve the airlines' objectives.

The research is based on a thorough review of existing literature on the subject and the researcher's personal experience, who has served for over three decades in managing the financial activities of an international airline.

As the Chief Financial Officer of an international airline, the researcher was responsible, among other duties, for the company's entire financial system, including the management of market risks in all aspects, from the establishment of the system to the monitoring of its efficiency using specific key risk indicators.

As a result of his significant experience as a member of the IATA Finance Committee and his participation in the activities of the world's major airlines in fuel risk management and mitigation, the researcher has a deep understanding of

the subject. His active participation in this renowned committee allowed the researcher to learn from peers and exchange information regarding jet-fuel risk management, exchange ideas, and thoughts with them, as well as contribute to developing industry best practices and comparing exposures directly with peers.

3.2. Model:

The researcher presents his work through a hypothetical airline called ABC Airlines. As some of the metrics and analysis presented are currently applied from time to time by different airlines, it was essential to maintain anonymity.

An examination of the available literature on risk management concerning the airline industry revealed that it remains in its infancy in terms of practical governance and the application of key risk indicators. Exceptions have been found in companies not suitable for aviation, at least in terms of key risk indicators for jet fuel hedging.

To enhance the validity of the methodology used in this thesis, which seeks to contribute to the reduction of the gap caused by the lack of official publications describing the approach used to construct and communicate the essential risk indicators systematically, the researcher created a complete data system that simulates a real airline scenario, as described in section 3.3.

3.3. Data[15]:

Based on comparable airlines in the industry and his significant personal expertise, the researcher established the operational data for the hypothetical ABC airline.

- All market data like jet fuel curves and hedged transaction prices were taken as actual data from official publications.
- ABC Airline operating data such as yearly fuel consumption, the mix of hedge transactions, hedging instruments, hedging volumes, credit facilities, financial institutions, and other data needed for the research, as presented in the findings chapter, were assumed and determined by the researcher based on his years of experience in the field.
- Hedging policies, execution and follow-up procedures, and process flow charts are based on the researcher's experience and correspond to similar limits of airlines in the world.
- The simulations and behavioral scenarios of the defense policy are based on the researcher's experience.

[15] **See chapter 7, section 7.1**

CHAPTER 4: RESULTS and DISCUSSION

4.1. INTRODUCTION

This thesis addresses the issue of jet fuel risk management from a practical perspective. The program operates as a wrapper around critical aspects of aviation jet fuel risk management and mimics an envelope. It serves as a guide on building procedures and processes for jet fuel hedging in airlines and provides a collection of quantifiable, specific, and proactive risk metrics that, if successfully implemented, will assist in taking effective measures for controlling and mitigating risks arising from jet fuel in the airline industry.

The envelope encompasses two frequently disregarded essential components of risk management strategies:

- What should be the primary elements of good governance and organizational accountability for all stakeholders when implementing a jet-fuel risk management policy and principles? Moreover, what is the correct decision-making process and sequence for all those involved in a risk mitigation activity?
- What essential key risk indicators should be included in the risk mitigation policy of an airline when dealing with jet fuel risks to support the airline in predicting, measuring, managing, and reporting important jet-fuel risk exposure and serve as an early warning system?

When designing a risk management policy, these two often-overlooked factors integrate the policy with the overall business strategy and provide the right tools for determining the risk tolerance level to be incorporated into the complete risk management program.

The policy defines the risk management objectives of the airline and sets the principles, procedures, and tools necessary to effectively monitor the airline's performance, particularly during times of market changes.

The research is based on a comprehensive review of the existing literature on the subject and the personal experience of the researcher[16].

This chapter will include the following sections:

- Model description.
- Framework and structure for Board and risk committees' roles and functions.
- Risk Policy procedures and processes for ABC airlines.
- Data description.
- Reports and Key Risk Indicators (KRI) in use by the airline to adequately monitor and control the implementation of the policy and its efficiency.
- Impact of spot and forward price curve simulation on ABC Airlines' risk position.

4.2. The Model:

The researcher presents his work through a hypothetical airline named ABC Airlines. Most of the relevant parameters and analyses shown in the research are used by different airlines for risk monitoring and management. Still, there are almost no publications regarding the methodology for developing and presenting the hedging process and risk metrics comprehensively and systematically, hence the model's distinctiveness.

4.3. Model's data:

A. Monthly and yearly fuel consumption.
B. Consumption distribution by geographic area.
C. Forward jet-fuel curve.
D. Credit trade limits agreed between the parties.
E. Hedge transaction market prices.

[16] **See chapter 3, page 2 for further description of the researcher's experience.**

4.3.1. Role of the various participants:

A. Role of the Board.
B. Role of the Board Risk Committee (B.R.C).
C. Role of Risk Management Committee (R.M.C).
D. Role of the Chief Executive Officer C.E.O).
E. Role of the Chief Financial Officer (C.F.O).
F. Role of the Company Treasurer.
G. Role of the Head of the Risk Management Team (R.M.T).

4.3.2. Risk Policy elements:

The model addresses the following Risk elements:

- Framework for Risk Management Policy including:
    A. Maximum and minimum percentage of consumption hedged.
    B. Maximum yearly hedged volume.
    C. Hedge tenors.
    D. Allowed hedging instruments.
    E. Underlying asset selection.
    F. Collateral and margins.

4.3.3. Risk process decisions flow chart:

The model includes a detailed process flow chart:

A. Process prior decision-making.
B. Process for and after hedge execution.

4.3.4. ABCs' Reports and Key Risk Indicators:

A. Hedge status for 2022.
B. Hedge status for 2023.
C. Hedge instruments status.
D. Quarterly hedging figures.
E. Hedge Efficiency- Market vs. Hedged prices (monthly cost per gallon).
F. Hedge Efficiency- Market vs. Hedged prices (total fuel monthly costs).
G. Hedge Efficiency- Market vs. Hedged prices (total quarterly costs).
H. Market vs. Budget and Effective prices ($/gallon).
I. Fair Market Value of ABC AIRLINES hedged portfolio.
J. Credit Risk Report.
K. Brent curve fluctuation simulation and impact on hedge policy.

4.4. Data validation:

As previously indicated, ABC airline is a hypothetical airline with parameters assumed by the researcher based on comparable airlines in the industry and his extensive personal experience. To verify the validity of the selected data, the researcher provides relative comparative figures derived from the official publications of active airlines. The research includes details such as the total quantity of jet fuel consumed, the total annual expenditure on jet fuel, and the proportion of total consumption that is hedged. The comparative data are illustrated in Chapter 7 Section 7.1.

4.5. Framework for Board and Risk Committees:

4.5.1. Introduction:

Given the high volatility of jet fuel prices and their impact on ABC Airlines' financial results, the company adopts a Risk Management Policy. It conducts hedging activities to cope with significant changes in jet fuel prices that may substantially impact its profitability and sustainability.

The Policy's primary goal is to adequately hedge the company's cash flow. However, management must consider the policy's impact on the profit and loss accounts, balance sheet, and credit issues.

The management of ABC airline is required to implement a detailed Risk Management Policy that complies with the directives given by the board of directors.

Any variation from the Policy requires the specific approval of the board.

4.5.2. Board's role:

The primary functions of the Board in respect of Risk Management are:

- To nominate a Board Risk Committee (B.R.C) and,
- To approve after deliberations the Risk Management Policy submitted by the B.R.C.

4.5.3. Board Risk Committee roles and functions:

The Board Risk Committee is a subcommittee of the Board of Directors. The committee is composed of members of the Board.

The B.R.C will include Board members nominated by the Board and chaired by one of its members, preferably having accounting and financial knowledge.

The B.R.C will be responsible for the following activities:

- Approving ABC airline's Risk Policy presented by the airline management through the Management Risk Committees after deliberation and ensuring its conformity to its requirements, including Risk limits, collateral exposure, and detailed policies.
- Monitoring the implementation of the Risk Policy by management.
- Approving exceptions to the procedure where appropriate.
- The B.R.C will invite external specialists to evaluate the airline's Risk Policy from time to time.
- The B.R.C will conduct at least one meeting every quarter unless otherwise required. Such meetings will be with the participation of the Management Risk Committee and other specialists as needed from time to time and with the legal counsel to ensure that legal requirements are met.

4.5.4. Management Risk Committee (M.RC.) roles and functions:

The M.R.C will be responsible following activities:

To ensure that the proper implementation of the overall strategy of ABC airline is adequately secured by its Risk Management Policy.

The company's C.E.O will head the M.R.C committee.

In addition to the C.E.O, the Company Treasurer, the Chief Risk Officer, and the Risk Management Team will participate.

The committee will meet once every two weeks unless a more frequent meeting is required following market developments.

The functions of the M.R.C will include:

- Prepare the company's Risk Management Plan, present it to the Board Risk Management Committee, and obtain the Board of Directors' approval for its implementation.
- Bring the Risk Management procedure for approval and update it from time to time as needed.
- Implement the company's Risk Management Policy.
- Monitor the implementation of the Risk Management plan according to the established key risk indicators.
- Propose and obtain the approval of the B.R.C for deviations from the approved plan.

4.5.5. Chief Executive Officer (C.E.O) roles and functions:

The C.E.O is the officer who has an overview of all of the airlines' activities. In that capacity, he is the most appropriate person to supervise the actions required to mitigate risks and ensure that they conform to the airline's strategy.

- The C.E.O serves as Chairman of the M.R.C and is responsible for taking decisions according to the parameters and constraints of the Risk Policy.
- The C.E.O is responsible for updating the B.R.C for suggested deviations from the Risk Policy and obtaining the proper authorizations.
- The C.E.O will initiate a bi-monthly meeting with the M.R.C and a quarterly meeting with the B.R.C.
- In an abrupt change in market conditions, the C.E.O will convene an ad-hoc meeting with M.R.C and B.R.C.

4.5.6. Chief financial officer (C.F.O) roles and functions:

The C.F.O is the officer responsible for the financial risk mitigation plans for ABC Airlines and is accountable for establishing and implementing the Treasury Risk Team's hedging strategy.

The C.F.O will submit his explicit permission for hedging transaction execution via email to the Treasury Risk Team, including:

- Quantities to hedge
- Tenor
- Instruments
- Allowable premium-if and when required
- Restrictions
- Timing

The C.F.O is responsible for ensuring that the M.R.C meets with the C.E.O at least once a month to evaluate all areas of hedging performance, decisions, and challenges.

The C.F.O is responsible for informing the C.E.O about sudden market changes and Risk Management recommendations accordingly.

4.5.7. Company Treasurer Roles and functions:

The Company Treasurer is the highest authority in the Risk Management Team. He's responsible for designing and submitting recommendations to the company's C.F.O on all issues related to detecting, managing, and executing mitigation activities for market Risks.

His responsibilities include:

- Continuous updating of the hedge procedures.
- Developing and defining risk control measures.
- Developing and presenting risk metrics and key risk indicators (K.R.I).
- Responsible for the adequate implementation and execution of the Risk Management Policy as approved by the B.R.C.
- The Treasurer will maintain daily contact with the head of Risk Management and meet at least once a week with the Risk Management Team (R.M.T).
- Updating the C.F.O regarding unusual and unexpected changes in market conditions.
- Continuous monitoring of the impact of hedge positions on cash flow and credit exposures.
- Training and updating the Risk Management Team regarding new developments in the Risk Management field.

4.5.8. Risk management team (R.M.T) functions:

The Risk Management Team is the professional body in charge of implementing all of the activities as defined in the Risk Policy of ABC Airlines.

R.M.T includes the head of the team and risk analysts. The group operates under the direct supervision of the Company Treasurer and reports to him.

The head of the R.M.T will meet with the Company Treasurer twice a week and maintains daily contact with his team.

The head of the RMT is responsible for producing the key Risk indicators, presenting them to the Company Treasurer, and participating in bi-monthly meetings with the C.E.O and C.F.O.

4.5.9. ABCs' Risk Management meeting schedule[17]:

MEETING FREQUENCY	MEETING INITIATOR	MEETING WITH
DAILY	HEAD OF R.M.T	R.M.T.
BI WEEKLY	HEAD OF R.M.T	COMPANY TREASURER
WEEKLY	COMPANY TREASURER	C.F.O
BI MONTHLY	C.F.O	C.E.O
MONTHLY	C.E.O	B.R.C
QUARTERLY	B.R.C.	BOARD

TABLE 04-1 ABC AIRLINE RISK MANAGEMENT MEETING SCHEDULE

[17] **In case of sudden market changes the meeting schedule will be adjusted accordingly.**

4.5.10. Process prior decision making:

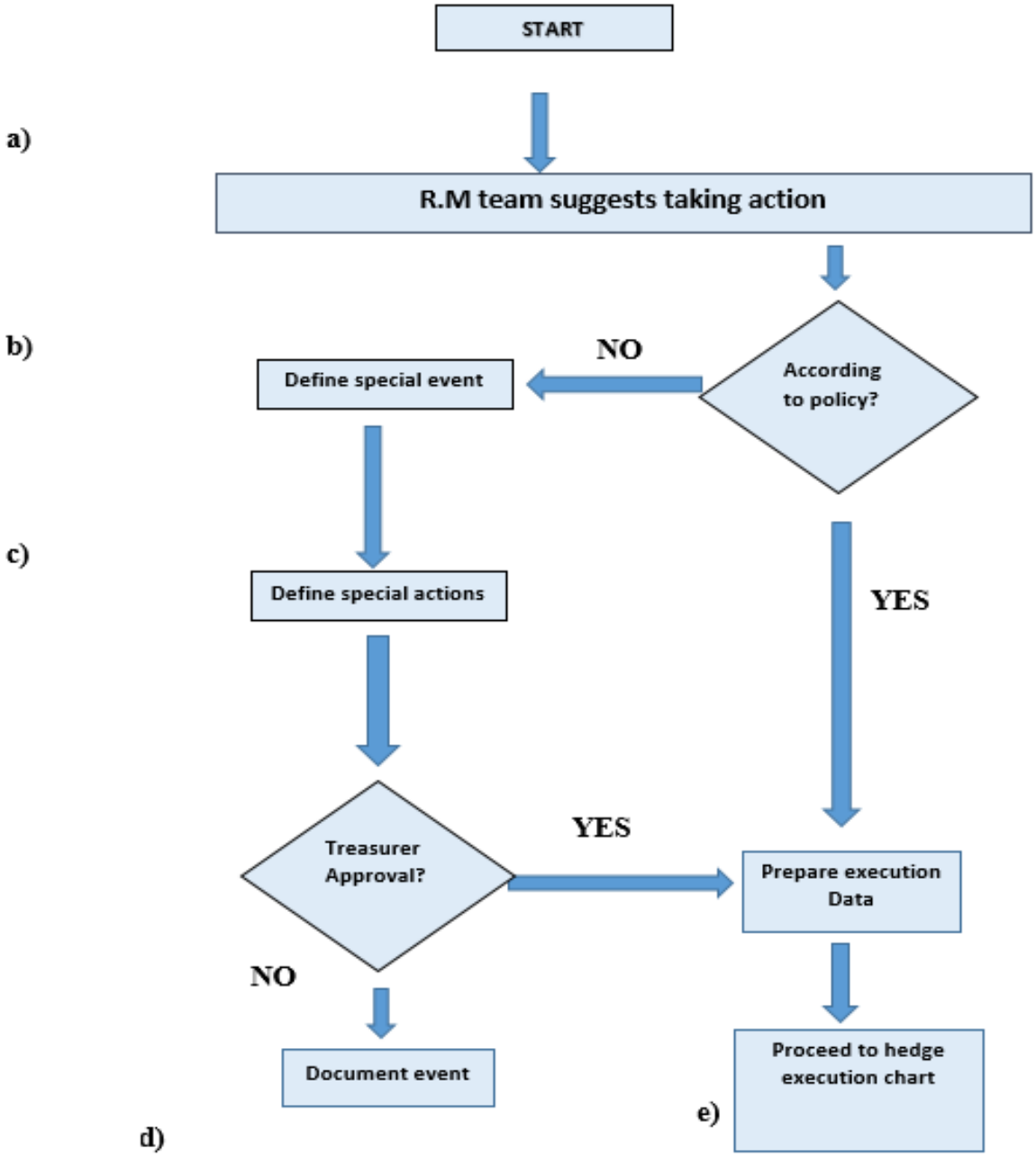


FIGURE 4-1 PROCESS PRIOR HEDGING

4.5.10.1. Flow description:

a) **R.M**: Risk Management Team. The composition of the Risk Management Team may differ from company to company, but the group must include the people who are fully involved in monitoring the company's Risks.
b) **Special event**: Risk Management is never static, and market conditions constantly change. Sometimes the magnitude of the changes is extreme such as an unexpected surge in jet fuel prices, disruption in airline activities, credit issues, and any other significant event not defined in the Risk Management Policy.
c) **Action definition**: The reaction to a special event can be one of the following possibilities that were defined at length in **Chapter 2**:
    i. Avoid.
    ii. Transfer.
    iii. Mitigate.
    iv. Accept.
d) **Documentation**: This is an essential part of the process. Every activity should be appropriately documented, and particular emphasis should be given to decisions that are not part of the standard Policy. According to Company Policy, the decision's rationale must be adequately explained and circulated at least to C.E.O unless otherwise defined in the internal procedure.
e) **Proceed to hedge execution**: Once the decision is taken to treat the event according to the mitigation plan, it has to be treated according to company procedure, including a complete analysis of:
    i. The price of the hedge transaction.
    ii. A complete analysis of credit exposure.
    iii. Impact on policy thresholds.
    iv. Risk metrics.
    v. Hedged price versus market price.
    vi. Jet fuel price simulation and possible impact on company's financials.

4.5.11. Process of hedge execution:

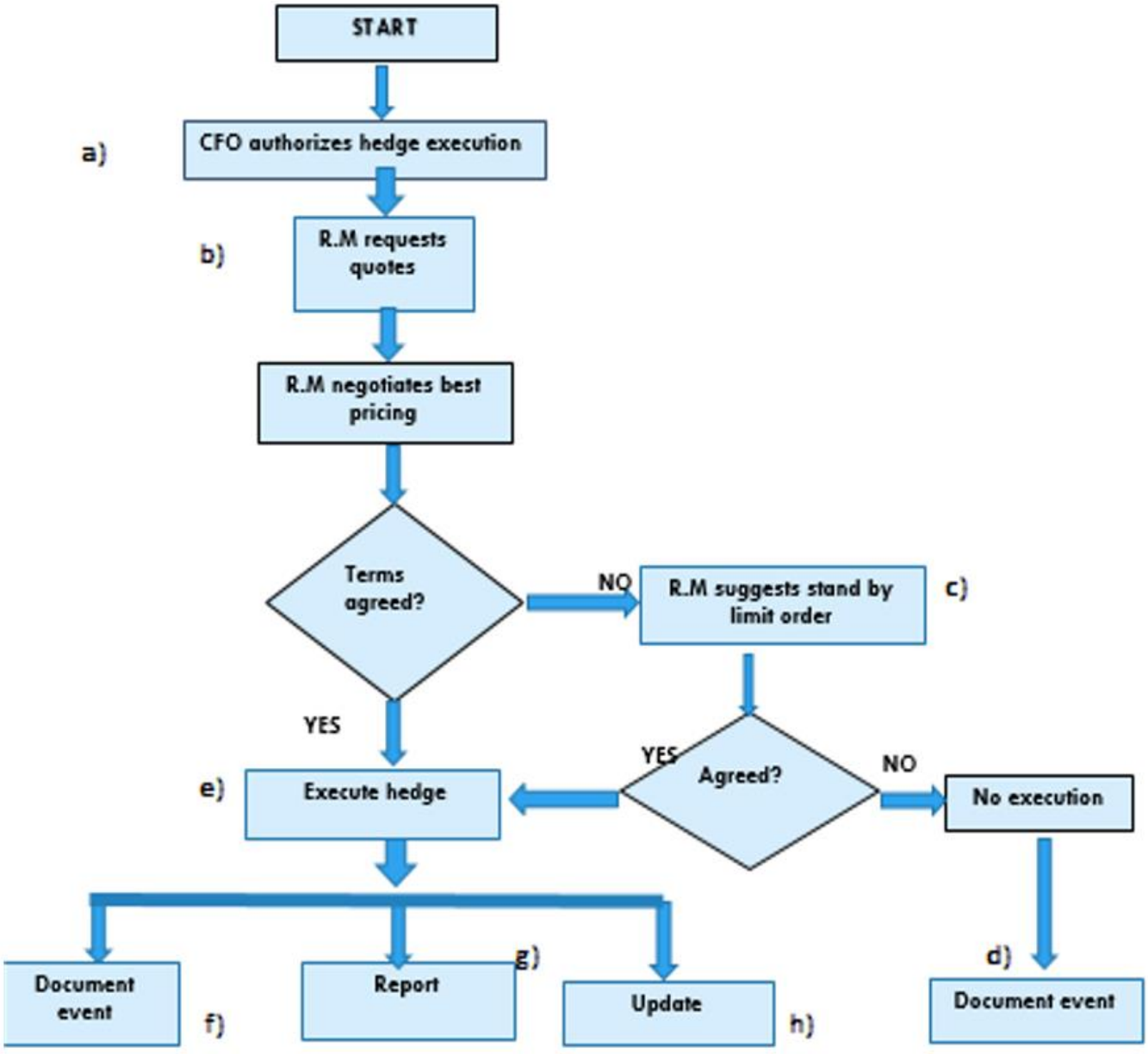


FIGURE 4-2 PROCESS OF HEDGE EXECUTION

4.5.11.1. Flow description

a) Chief Financial Officer authorizes by mail to the Risk Management Team the initiation of the hedging process, including:
   i. Volume to be hedged.
   ii. Tenor.
   iii. Instrument.
   iv. Timing.
   v. Permissible premium.
b) Risk Management Team should request offers from at least three bidders considering credit limits and diversification.
c) To increase competition between participants, leaving them with a target price is often advisable.
d) Documentation is an essential part of the process, even if no deal was struck.
e) The final authorization should be given by the relevant manager as defined in the Risk Management Procedure. In the majority of the cases, that person is the Company Treasurer.
f) A proper documentation of the deal has to be done immediately after execution according to IFRS[18] or US GAAP[19] requirements.
g) The deal must be appropriately reported to the Accounts Division and updated in the hedge metrics database.

[18] **Commonly known as IFRS, International Financial Reporting Standards are accounting standards established by the IFRS Foundation and the International Accounting Standards Board.**

[19] **US Securities and Exchange Commission has adopted Generally Accepted Accounting Principles as its accounting standard.**

4.5.12. Approved ABCs' hedging limits for the years 2022-2023

ABC Airlines will hedge proportions of its periodical jet fuel consumption within maximum and minimum percentage ratios as displayed in **chart 4-3.**

The total percentage hedged for 12 consecutive months should not exceed 100% of the first year of fuel consumption.

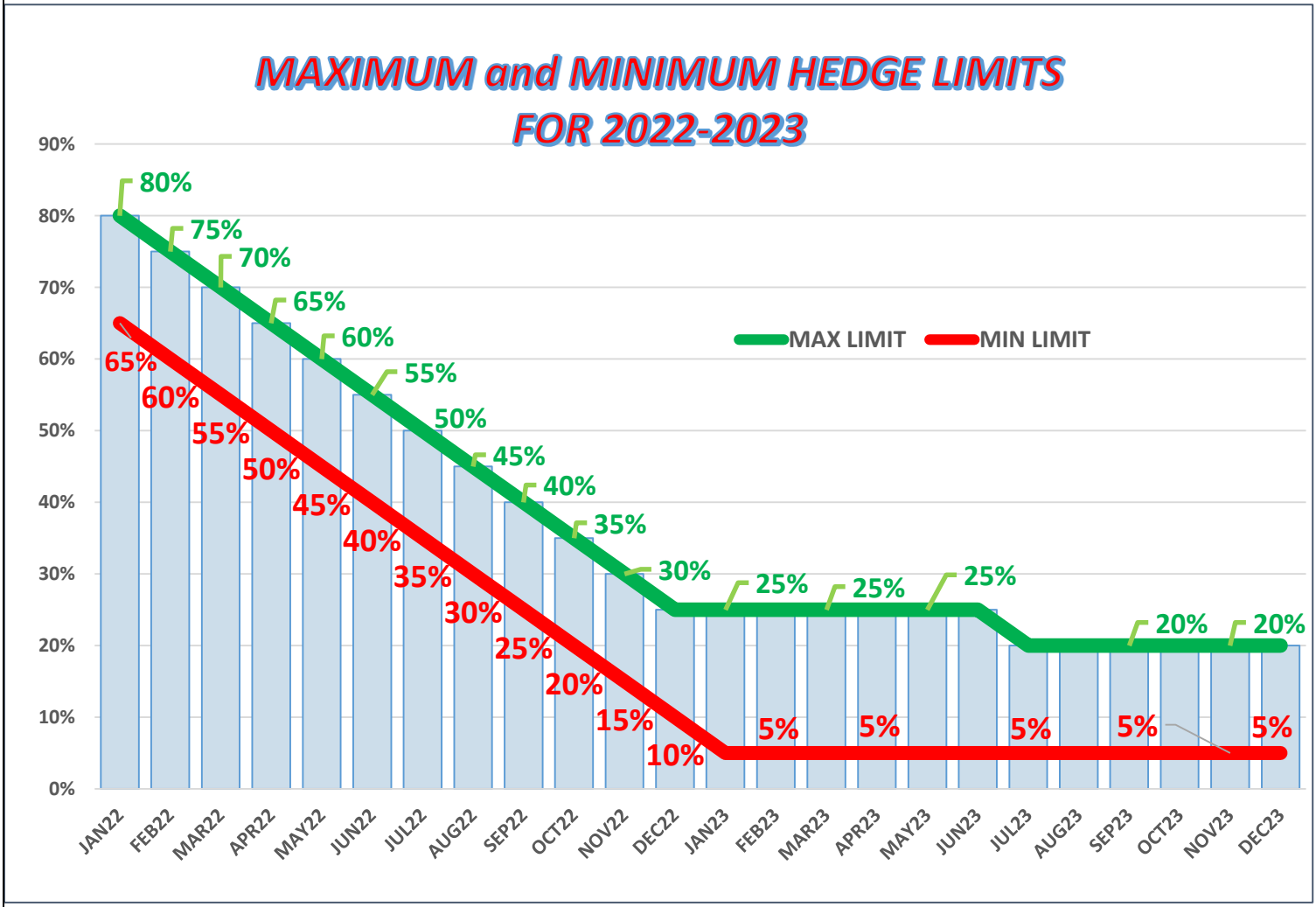


FIGURE 4-3 ABC AIRLINE APPROVED HEDGE THRESHOLDS

MONTH	MAX LIMIT	MIN LIMIT
JAN22	80%	65%
FEB22	75%	60%
MAR22	70%	55%
APR22	65%	50%
MAY 22	60%	45%
JUN22	55%	40%
JUL22	50%	35%
AUG22	45%	30%
SEP22	40%	25%
OCT22	35%	20%
NOV22	30%	15%
DEC22	25%	10%
JAN23	25%	5%
FEB23	25%	5%
MAR23	25%	5%
APR23	25%	5%
MAY 23	25%	5%
JUN23	25%	5%
JUL23	20%	5%
AUG23	20%	5%
SEP23	20%	5%
OCT23	20%	5%
NOV23	20%	5%
DEC23	20%	5%

TABLE 4-2 TABLE OF APPROVED THRESHOLDS.

4.5.13. Tenor:

The hedge tenor will be for at least 12 months but not more than 24 months on a rolling basis.

Hedge positions will be held to maturity.

4.5.14. Instruments:

ABC Airlines is authorized to perform its hedging Policy using Swaps[20] and Zero Cost Collars[21].

4.6. ABC AIRLINE's model data

Monthly and yearly fuel consumption:

	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	TOTAL
MONTHLY CONSUMPTION (M/GAL)	82	73	87	100	97	105	123	120	100	97	84	89	1,156

TABLE 4-3 ABC AIRLINE MONTHLY FUEL CONSUMPTION

ABC Airlines is expected to maintain approximately the same flight schedule in 2023 as 2022. Therefore, and for simplicity, it is assumed that the consumption for 2023 will be similar to that of 2022. This assumption has no impact on the results of the study.

[20] **See chapter 7, section 7.3**

[21] **See chapter 7, section 7.3**

4.6.1. Consumption by geographic location:

ABC Airlines has several purchasing fuel contracts. The quantities purchased are directly proportional to the flight hours flown to those destinations, and the airline does not maintain a physical fuel stock. The airline consumes approximately 1,200 million/gallons a year.

Suppliers Distribution			YEARLY QUANTITY (M/GALLON)
CONTINENT	JET FUEL	%	
EUROPE	F.O.B MED[22]	40%	463.00
EUROPE	F.O.B ROTTERDAM[23]	5%	58.00
EUROPE	C.I.F N.W.E[24]	10%	116.00
U.S	U.S GOLF[25]	20%	231.00
ASIA	SINGAPORE[26]	5%	58.00
MISCELLANEOUS[27]		20%	231.00
		100%	1,156.00

TABLE 4-4 CONSUMPTION BY GEOGRAPHIC AREA

[22] **Jet fuel purchased in the Mediterranean market.**
[23] **Jet fuel purchased in Rotterdam market.**
[24] **Jet fuel purchased in North West Europe market.**
[25] **Jet fuel purchased in the United States golf market.**
[26] **Jet fuel purchased in the Singapore market.**
[27] **Charter and non-scheduled flights.**

4.6.2. Actual and Forward curves:

The Brent and jet fuel curves are used in the model to perform all the relevant calculations required to understand the current and future risk situation of ABC Airlines.

As Brent and jet fuel may not be intuitive products to every reader, they are fully described in **chapter 7, section 7.1**.

4.6.3. Brent[28] curve forecast:

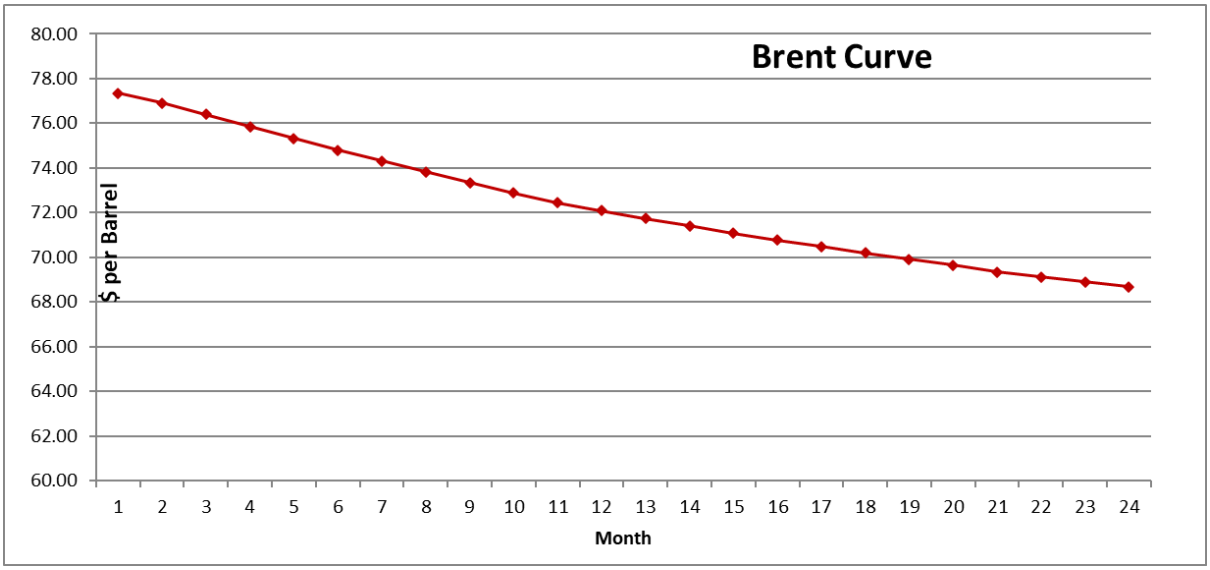


FIGURE 4-4 BRENT CURVE FORECAST

[28] **The most commonly traded North Sea crude oil. The Brent is a mix of crude from the Shell UK-operated Brent field and the BP-operated Ninian field. It is commonly referred to simply as Brent.**

4.6.4. Jet Basket cost:

The price of a fuel gallon is best represented using the weighted average method, which calculates the proportion of the price paid at a given location relative to the total fuel cost.

Given that the overall price that ABC Airlines pays for its jet fuel purchases depends on the flight destinations **(i)** and cost of purchase, the actual weighted average price **(P)** that the airline pays is equal to the sum of each quantity (**Qi)** purchased multiplied by the price **(Pi)** paid at that specific location divided by the total quantity purchased **(Q).**

This weighted average cost is the average jet basket price that ABC Airlines faces, as presented in the next formula:

$$P\ (\$/gal) = \frac{\sum (Pi \times Qi)}{\sum Qi}$$

4.6.5. ABCs' jet fuel basket cost calculation:

The calculation for **January – 2022**[29] is presented herewith:

TABLE 4-5 BASKET PRICE OF EFFECTIVE FUEL GALLON EXAMPLE

JET FUEL	%	Q(i) JAN 22 CONSUMPTION M/GAL	P(i) PRICE $/GAL	Q*P
F.O.B MED	40%	32.8	2.06	67.568
F.O.B ROTERDAM	5%	4.1	2.11	8.651
C.I.F N.W.Europe	10%	8.2	2.33	19.106
U.S GOLF	20%	16.4	2.2	36.080
SINGAPORE	5%	4.1	2.04	8.364
MISCELENEOUS	20%	16.4	2.01	32.964
	100%	82.00		172.733

BASKET PRICE ($/GALLON) FOR JAN 22

$$P = \sum Pi \times Qi / Q$$

$$P = 172.733/82 = 2.107$$

[29] The same calculation procedure is applied to calculate Basket price for each month.

4.6.5.1. ABCs' Jet fuel basket for 2022-2023 $/gallon[30]

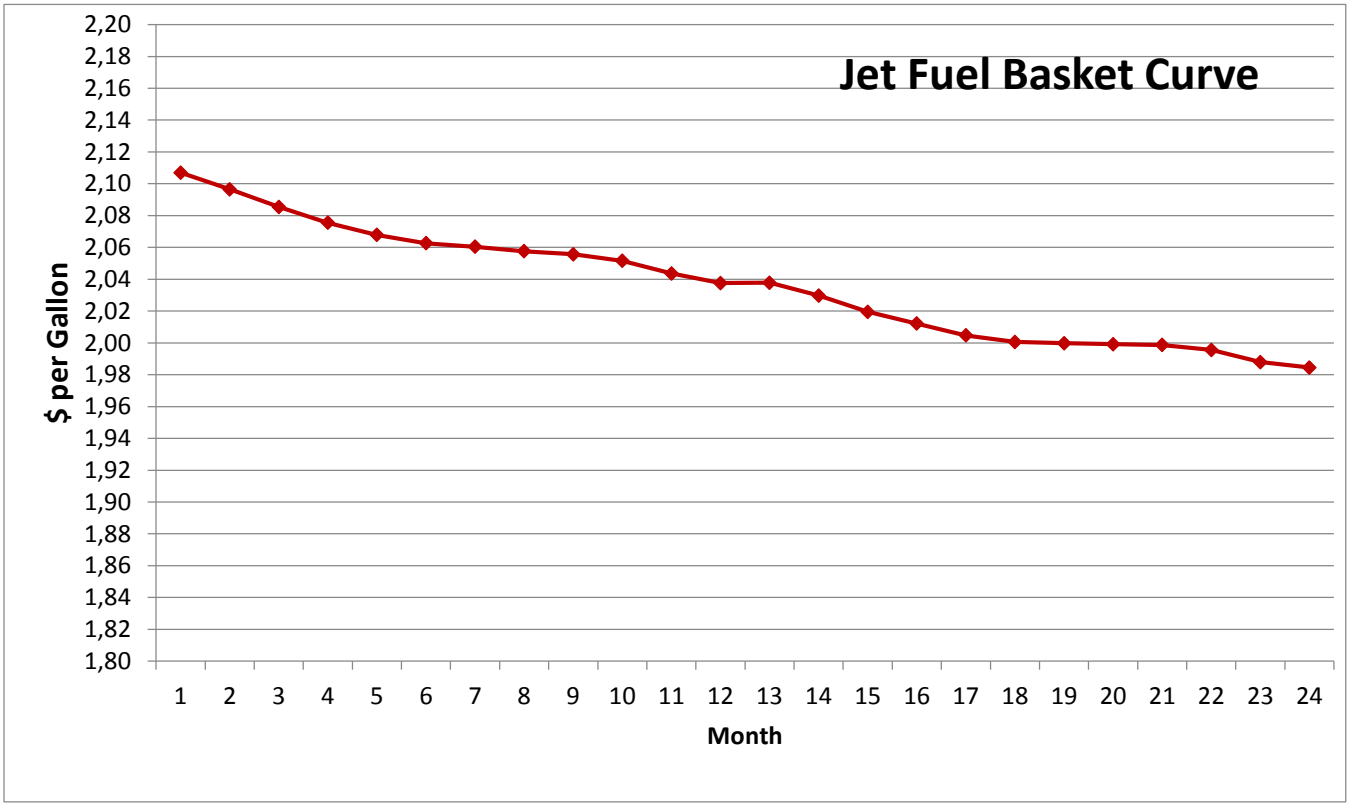


FIGURE 4-5 BASKET PRICE CURVE FORECAST FOR 24 MONTHS

The above curve, which represents the forecasted jet fuel basket prices, is the leading curve used throughout the research.

[30] **Calculated according to the formula in section 4.4.4**

4.6.6. ABCs' Credit trade limits agreed by parties:

The jet fuel market is an over-the-counter (O.T.C) market and is not traded in a regulated commodities market[31].

An O.T.C contract requires mitigating counterparty credit risk. Counterparty Credit Risk is when the other party defaults on the contract. According to ISDA, the hedged transaction must be collateralized.

ABC Airlines negotiated the agreed-upon degree of exposure for completing transactions without collateral. Deviation from agreed-upon higher limits will necessitate collateral.

CREDIT RISK LIMITS	
Bank/counterparty	**Agreed upon no collateral upper limit-(M$)**
INSTITUTION #1	**35.0**
INSTITUTION #2	**30.0**
INSTITUTION #3	**20.0**
INSTITUTION #4	**15.0**
INSTITUTION #5	**15.0**
INSTITUTION #6	**15.0**
INSTITUTION #7	**10.0**
TOTAL	**140.0**

TABLE 4-6 CREDIT TRADE LIMITS

The exposure to posted cash collateral will not exceed USD 140M.

[31] **See chapter 7, section 7.2**

4.6.7. ABCs' hedge transaction market prices:

All hedge activities are performed at the actual market price with accurate quotes. The following chart represents a sample of all derivatives "negotiated" and constitutes an integral part of the calculations.

The complete list of price negotiated deals, including strike, put, and call quotes, is presented in chapter 7, section 7.5.

Asset	Trade Date	Class	Buy/Sell	Volume	Asset unit	Strike	Call/Put	Notional in currency	Begin Date	End Date	Market Price
Jet Fuel FOB Med	15/2/21	Single Swap		12,437	ton	519.0		6,455,013	1/1/22	31/1/22	2,028,292
Jet Fuel FOB Med	15/3/21	Single Swap		12,437	ton	558.0		6,940,072	1/1/22	31/1/22	1,543,233
Jet Fuel FOB Med	15/3/21	Single Swap		11,050	ton	558.0		6,166,013	1/2/22	28/2/22	1,343,152
Jet Fuel FOB Med	15/4/21	Single Swap		12,437	ton	550.0		6,840,573	1/1/22	31/1/22	1,642,732
Jet Fuel FOB Med	15/4/21	Single Swap		11,050	ton	550.0		6,077,612	1/2/22	28/2/22	1,431,554
Jet Fuel FOB Med	15/4/21	Single Swap		13,077	ton	550.0		7,192,570	1/3/22	31/3/22	1,667,892
Jet Fuel FOB Med	15/5/21	Single Swap		12,437	ton	572.0		7,114,196	1/1/22	31/1/22	1,369,110
Jet Fuel FOB Med	15/5/21	Single Swap		11,050	ton	572.0		6,320,716	1/2/22	28/2/22	1,188,449
Jet Fuel FOB Med	15/5/21	Single Swap		13,077	ton	572.0		7,480,273	1/3/22	31/3/22	1,380,189
Jet Fuel FOB Med	15/5/21	Single Swap		15,094	ton	572.0		8,633,489	1/4/22	30/4/22	1,555,537
Jet Fuel FOB Med	15/6/21	Single Swap		12,437	ton	610.0		7,586,817	1/1/22	31/1/22	896,488
Jet Fuel FOB Med	15/6/21	Single Swap		11,050	ton	610.0		6,740,624	1/2/22	28/2/22	768,542
Jet Fuel FOB Med	15/6/21	Single Swap		13,077	ton	610.0		7,977,214	1/3/22	31/3/22	883,248
Jet Fuel FOB Med	15/6/21	Single Swap		15,094	ton	610.0		9,207,042	1/4/22	30/4/22	981,984
Jet Fuel FOB Med	15/6/21	Single Swap		14,612	ton	610.0		8,913,159	1/5/22	31/5/22	919,517
Jet Fuel FOB Med	15/7/21	Single Swap		12,437	ton	603.0		7,499,755	1/1/22	31/1/22	983,550
Jet Fuel FOB Med	15/7/21	Single Swap		11,050	ton	603.0		6,663,273	1/2/22	28/2/22	845,893
Jet Fuel FOB Med	15/7/21	Single Swap		13,077	ton	603.0		7,885,672	1/3/22	31/3/22	974,789
Jet Fuel FOB Med	15/7/21	Single Swap		15,094	ton	603.0		9,101,388	1/4/22	30/4/22	1,087,638

TABLE 4-7 TRANSACTION PRICES SAMPLE

4.7. ABCs' Reports and Key Risk indicators results

The following reports will be presented in the research:

- ABC AIRLINES HEDGE STATUS FOR 2022
- ABC AIRLINES HEDGE STATUS FOR 2023
- HEDGE INSTRUMENTS STATUS
- QUARTERLY HEDGING FIGURES 2022-2023
- HEDGE EFFICIENCY- hedged gallon price versus market price
- HEDGE EFFICIENCY- TOTAL MONTHLY COSTS
- HEDGE EFFICIENCY- TOTAL QUARTERLY COSTS
- MARKET Vs BUDGET AND EFFECTIVE PRICES
- FAIR MARKET VALUE OF HEDGED PORTFOLIO
- CREDIT RISK REPORT

4.7.1. ABCs' hedge status for 2022:

	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	TOTAL
MONTHLY CONSUMPTION (M/GAL)	82	73	87	100	97	105	123	120	100	97	84	89	1,156
HEDGED QUANTITIES (M/GAL)	66	55	61	65	58	58	61	54	40	34	25	22	599
HEDGE USING SWAP (M/GAL)	49	40	43	45	39	37	37	30	20	15	8	4	367
HEDGED USING CYLINDERS (M/G)	16	15	17	20	19	21	25	24	20	19	17	18	231
HEDGED RATIO %	80%	75%	70%	65%	60%	55%	50%	45%	40%	35%	30%	25%	52%
HEDGED RATIO USING SWAPS %	60%	55%	50%	45%	40%	35%	30%	25%	20%	15%	10%	5%	32%
HEDGED USING CYLINDERS %	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%

TABLE 4-8 ABC AIRLINE HEDGE STATUS FOR 2022

Analyzing the above report clearly shows that ABC Airlines strictly implements Risk Management hedging instructions as specified in **section 4.4.12 of this chapter**.

The ratio of hedged consumption starts at an 80% level and declines gradually till the end of the specified period of 12 months.

The report also shows the ratio of the different instruments used in the activities of the hedge. Swaps are intensively used in the initial period and decline with time.

The yearly picture is also shown in the report.

During the B.R.C meeting, the presentation of the report gives a rapid and accurate understanding of the hedge status of the airline. It is also compared to any previous meeting reports.

4.7.2. ABCs' hedge status for 2023:

	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23	TOTAL
MONTHLY CONSUMPTION (M/GAL)	82	73	87	100	97	105	123	120	100	97	83.65	89.36	1,156
HEDGED QUANTITIES (M/GAL)	21	18	22	25	24	26	25	24	20	19	17	18	258
HEDGE USING SWAP (M/GAL)	4	4	4	5	5	5	0	0	0	0	0	0	27
HEDGED USING CYLINDERS (M/G)	16	15	17	20	19	21	25	24	20	19	17	18	231
HEDGED RATIO %	25%	25%	25%	25%	25%	25%	20%	20%	20%	20%	20%	20%	22%
HEDGED RATIO USING SWAPS %	5%	5%	5%	5%	5%	5%	0%	0%	0%	0%	0%	0%	2%
HEDGED USING CYLINDERS (M/G)	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%

TABLE 4-9 ABC AIRLINE HEDGE STATUS FOR 2023

Further, to all the comments described in **section 4.6.1 of this chapter** and applied to this section, by using this report, the B.R.C is capable of monitoring the dynamic management of the M.R.C and the implementation of the Policy.

The ratio of swaps is at a low level in month 13 and declines to 0 by July 2023. However, as time passes by, and ABC Airlines gains confidence regarding future ticket sales, M.R.C will in most likelihood add swap transactions at future stages.

4.7.3. Hedge instruments status:

The data described in **sections 4.6.1 and 4.6.2** are best illustrated in the chart below, which shows a two-year picture of the total level of month-to-month hedging and the ratio of each instrument used.

This chart is a handy tool to get an overall picture.

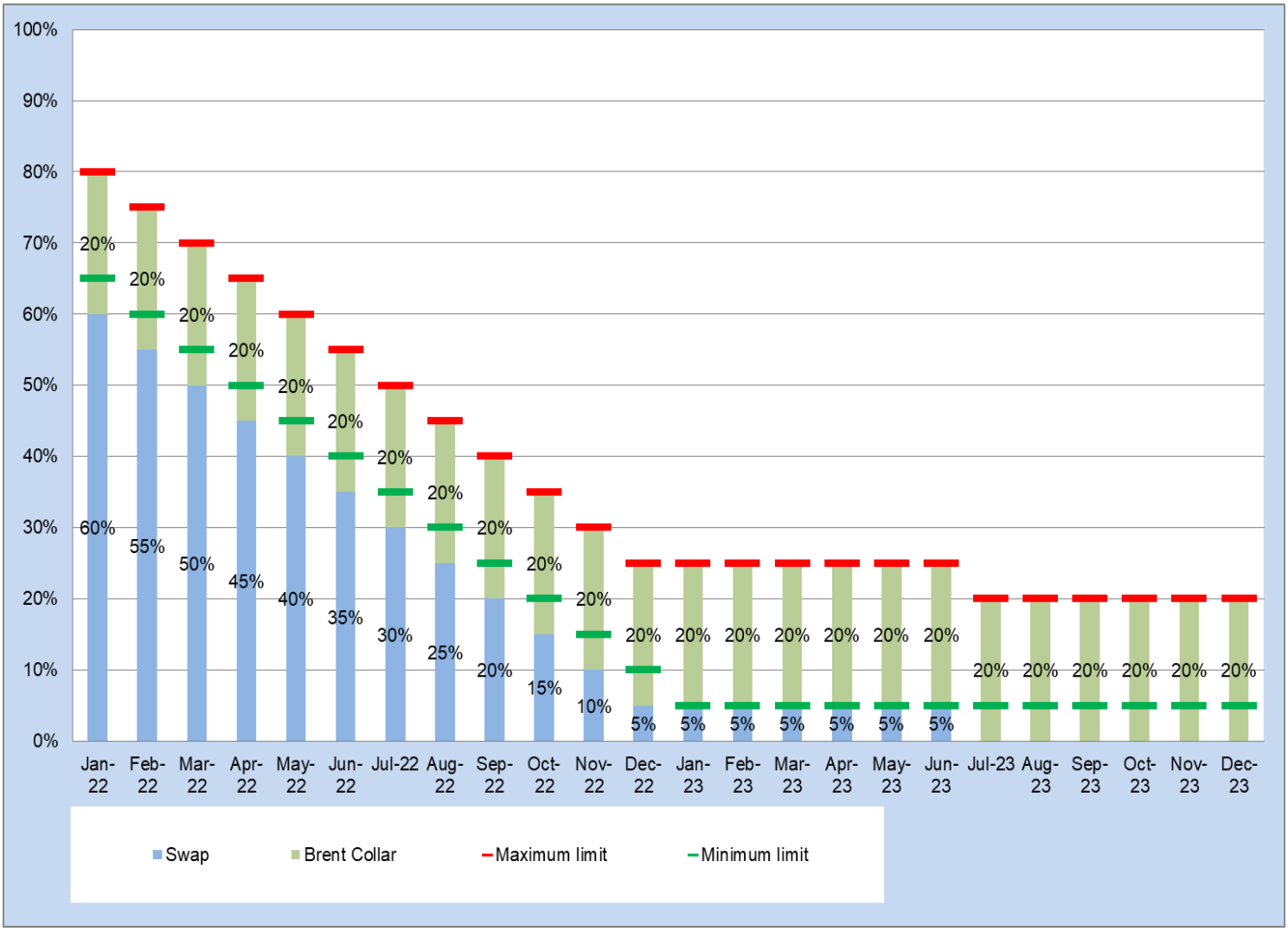


FIGURE 4-6 HEDGE INSTRUMENT STATUS 2022-2023

4.7.4. Quarterly hedging figures 2022-2023:

As a publicly-traded company, the financial statements are reported quarterly. Therefore, the display of quarterly figures for Risk analysis is essential for the management and all the planning people in the company, who usually collect the results and present them quarterly. Hence the importance of this report.

The report is presented for the years 2022 and 2023 by calendar quarter. That display allows management to see the forecasted performance given the Brent curve at the report date.

	2022					2023				
	QI	Q2	Q3	Q4	TOTAL	QI	Q2	Q3	Q4	TOTAL
QUARTERLY CONSUMPTION (M/GAL)	242	301	343	270	1,156	242	301	343	270	1,156
HEDGED QUANTITIES (M/GAL)	181	181	155	81	599	61	75	69	54	258
HEDGE USING SWAP (M/GAL)	133	120	87	27	367	12	15	0	0	27
HEDGED USING ZERO COST CYLINDERS (M/G)	48	60	69	54	231	48	60	69	54	231
HEDGED RATIO %	75%	60%	45%	30%	52%	25%	25%	20%	20%	22%
HEDGED RATIO USING SWAPS %	55%	40%	25%	10%	32%	5%	5%	0%	0%	2%
HEDGED RATIO USING ZERO COST CYLINDERS (M/G)	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%

TABLE 4-10 QUARTERLY HEDGING FIGURES 2022-2023

4.7.5. Hedge efficiency:

The reports in this section, as shown in figure 4-7 and table 4-11 illustrate the efficiency of the hedging activity. The comparison is between the market[32] price for each gallon ABC Airlines would have paid with no hedge activities and the effective cost for such a gallon after hedges[33]. The effective costs include both hedged and unhedged fuel, up to the monthly quantities required to maintain the scheduled flight hours.

The results show a consistent monthly advantage deriving from the hedging activities, as the effective cost of each gallon is lower than market prices.

The impact of the above advantage in terms of total monthly, quarterly, and yearly costs is shown in **sections 4.6.6 and 4.6.7**

[32] **Market price represents the spot price of ABC consumptions for a specific month in $ per gallon.**

[33] **Hedged price represents the total cost of ABC airlines basket consumption including hedged and unhedged quantities for a given month in $ per gallon.**

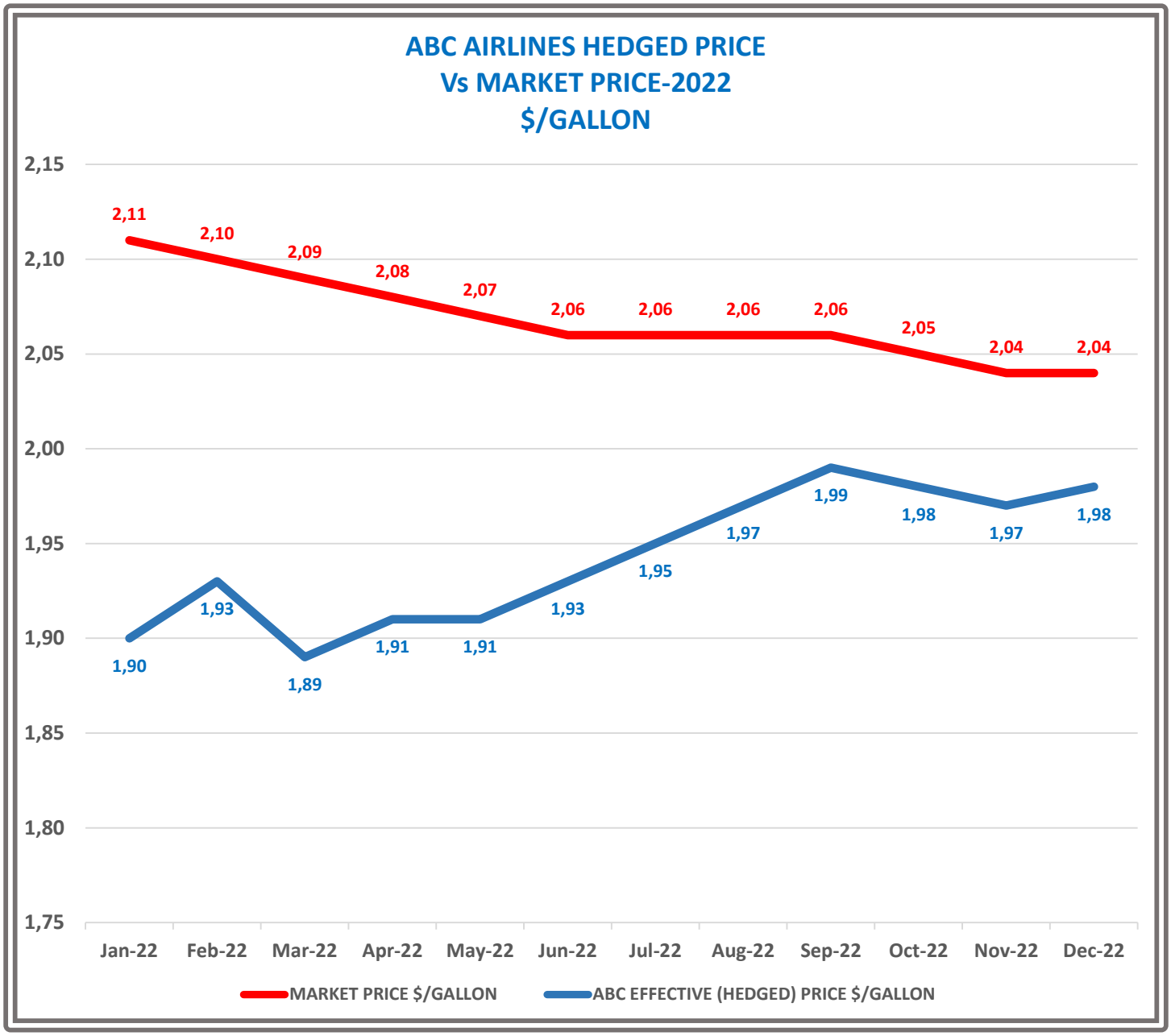


FIGURE 4-7 ABC AIRLINE HEDGED GALLON PRICE VERSUS MARKET PRICE

MONTH	Jan-22	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22
MARKET PRICE $/GALLON	2.11	2.10	2.09	2.08	2.07	2.06	2.06	2.06	2.06	2.05	2.04	2.04
ABC EFFECTIVE (HEDGED) PRICE $/GALLON	1.90	1.93	1.89	1.91	1.91	1.93	1.95	1.97	1.99	1.98	1.97	1.98

TABLE 4-11 MONTHLY TABLE OF HEDGED GALLON PRICES VERSUS MARKET

4.7.6. Hedge efficiency- total monthly costs[34]

An essential indicator of the hedging efficiency is the measurement of the monthly fuel costs with and without hedging at the specific time of reporting with the known Brent curve at that date.

The reports in this section show those two monthly figures for the current reporting date and the forecast for the end of the year.

The data exhibited a positive monthly difference between total costs at market pricing and costs after hedging efforts. Consequently, the positive hedge total is anticipated to yield 140 million dollars.

The results are displayed in Figures 4-8, 4-9, and, tables 4-12 and 4-13.

[34] **ABC Total monthly fuel costs include the hedged and unhedged fuel monthly consumption.**

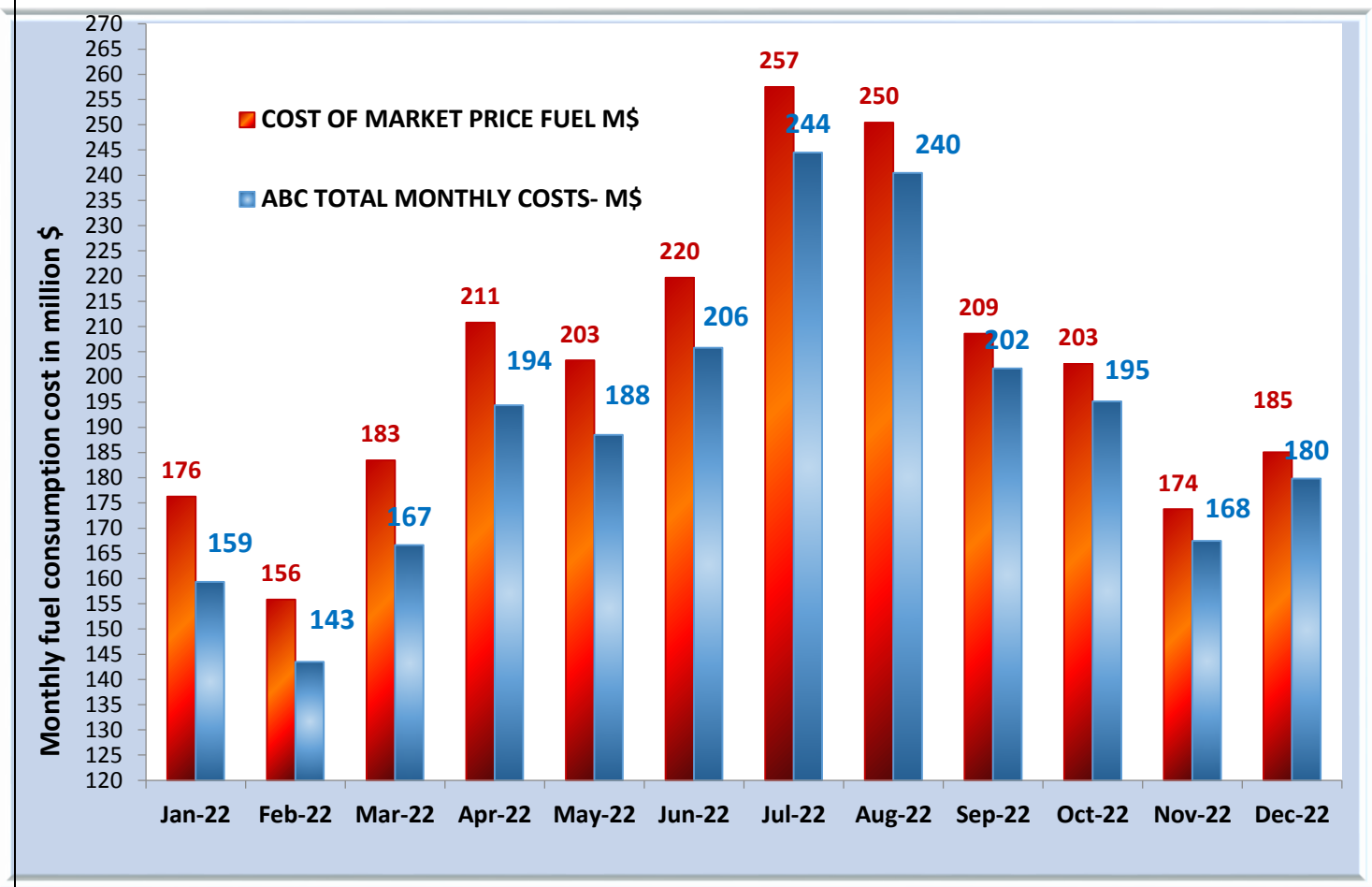


FIGURE 4-8 ABC AIRLINE TOTAL EFFECTIVE MONTHLY FUEL COSTS

	JAN22	FEB22	MAR22	APR22	MAY22	JUN22	JUL22	AUG22	SEP22	OCT22	NOV22	DEC22	TOTAL
COST OF MONTHLY SPOT FUEL PRICE M$	176	156	183	211	203	220	257	250	209	203	174	185	2,427
ABC TOTAL MONTHLY FUEL COST- M$	159	143	167	194	188	206	244	240	202	195	168	180	2,287
DIFFERENCE- M$	17	12	17	16	15	14	13	10	7	7	6	5	140

TABLE 4-12 ABC AIRLINE TOTAL EFFECTIVE MONTHLY AND YEARLY FUEL COSTS

4.7.7. Hedge efficiency- total quarterly costs[35]

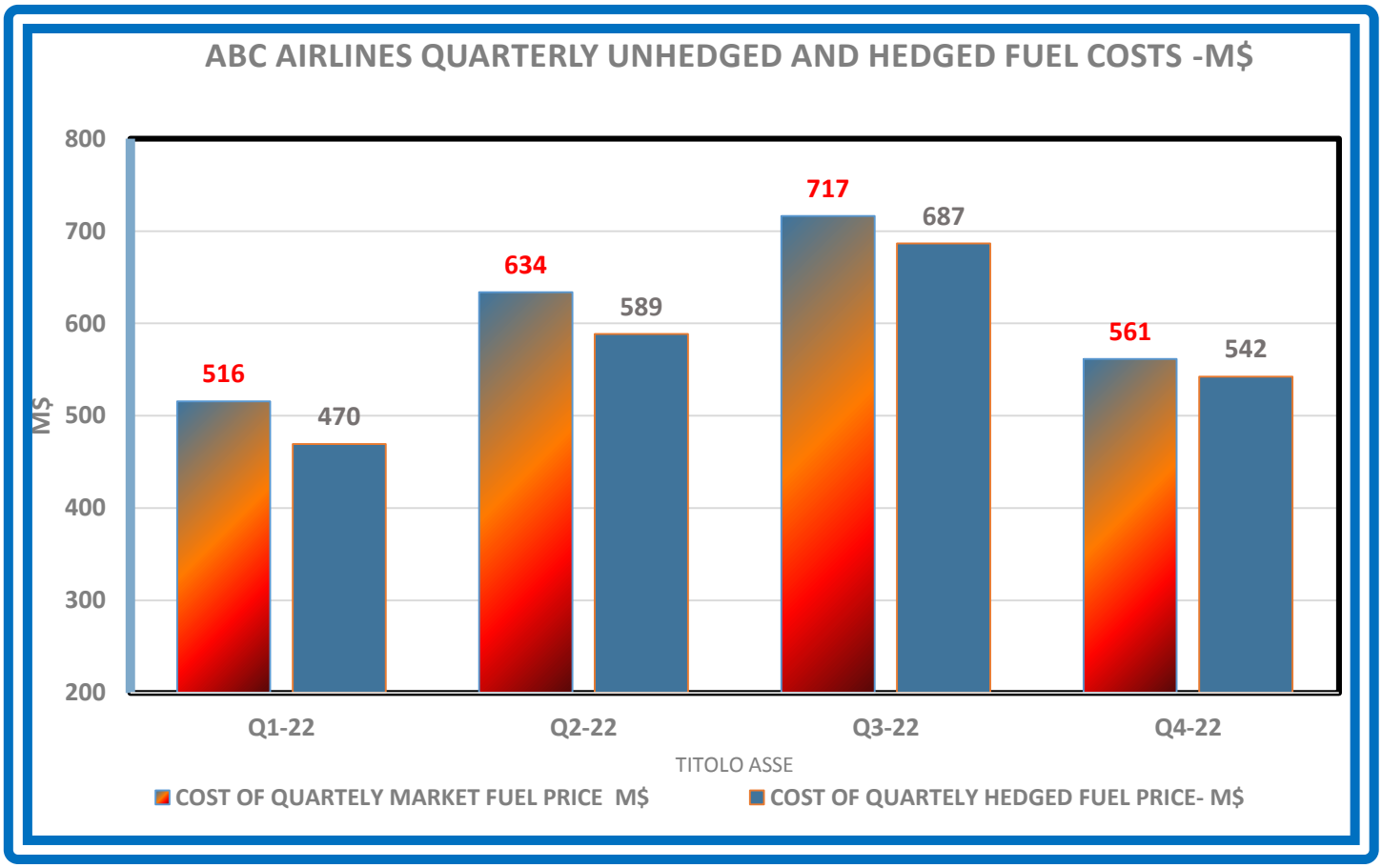


FIGURE 4-9 ABC AIRLINE TOTAL EFFECTIVE QUARTERLY FUEL COSTS

	Q1-22	Q2-22	Q3-22	Q4-22	TOTAL
COST OF QUARTERLY MARKET FUEL PRICE M$	516	634	717	561	2,427
COST OF QUARTERLY HEDGED FUEL PRICE- M$	470	589	687	542	2,287
DIFFERENCE- M$	46	45	30	19	140

TABLE 4-13 ABC AIRLINE TOTAL EFFECTIVE QUARTERLY AND YEARLY FUEL COSTS

[35] ABC Total quarterly fuel costs include the hedged and unhedged fuel quarterly consumption

4.7.8. Market Vs Budget and effective prices:

Monitoring budget figures, comparing them to actual data, and reevaluating forecasts are essential in any business, especially in the airline industry.

The K.R.IS presented in this section and displayed in Figure 4-10 compares the market price of a fuel gallon purchased without any hedging intervention to the effective cost of a basket gallon that includes hedged and non-hedged quantities to the estimated prices included in the budget.

The chart is presented well ahead of time, allowing for rectifying hedging activities if required.

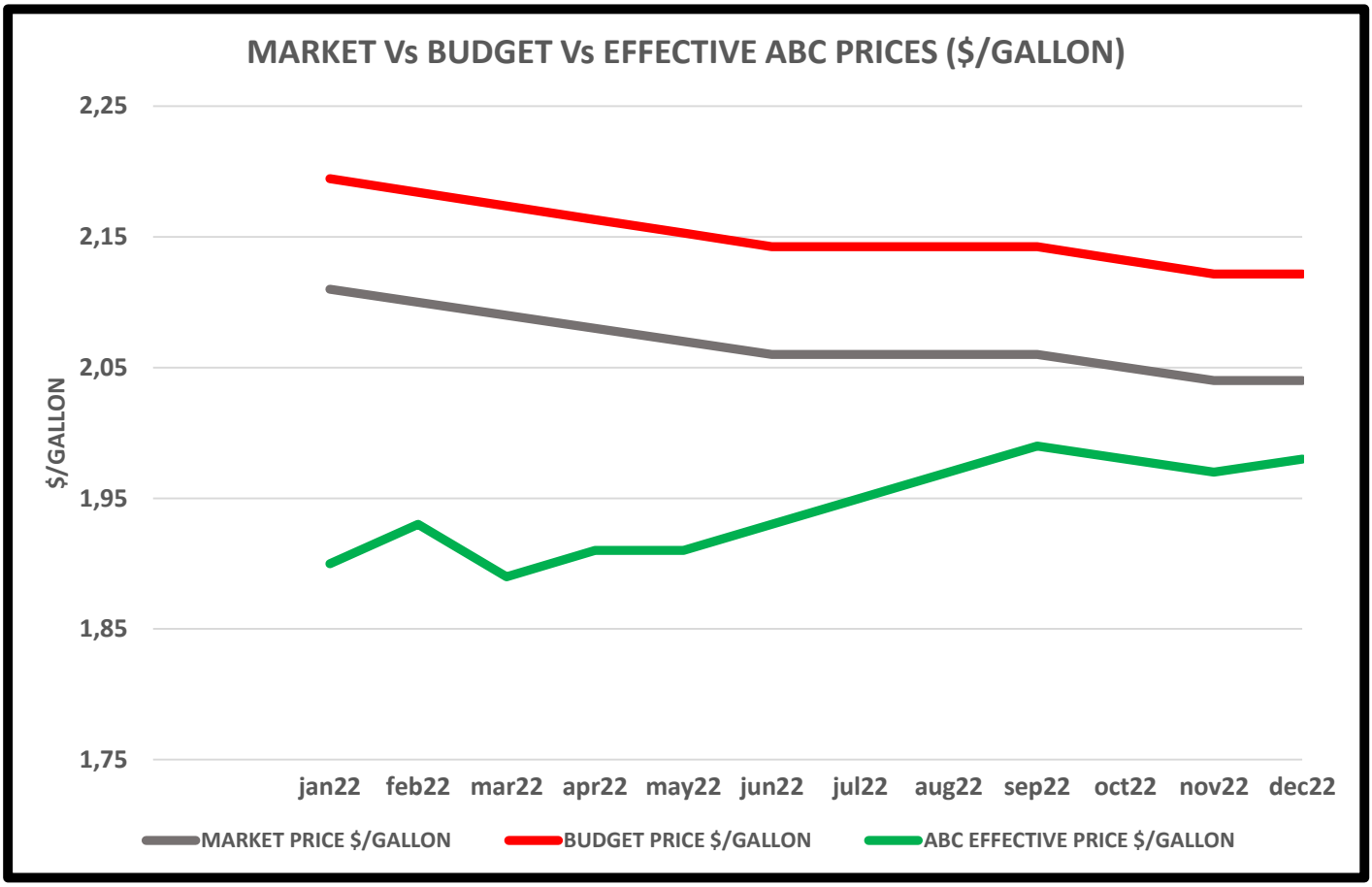


FIGURE 4-10 MARKET VS EFFECTIVE AND BUDGET PRICE OF A FUEL GALLON F0R 2022

The chart shows that the effective cost of a fuel gallon is lower than the estimated budget cost. However, the airline should pay attention to the trend of the hedged prices that tends to converge towards the end of the year to the budget prices and reevaluate the overall hedging activity.

4.7.9. Fair market value of hedged portfolio:

Fair market value is the price at which a willing buyer and a willing seller exchange hands, both knowing the relevant information. The importance of this report, which is based on the current Brent curve, is to demonstrate what would be the price of liquidating the whole hedge portfolio in the market.

The calculation is of great interest to the Treasurer for reasons of cash flow, to the financial reporting division for inclusion on the balance sheet as an asset or a liability, and to the Board as an added input to show the efficiency of the Risk Management program.

At the specific time of reporting and according to market indications, the fair market value of the hedge portfolio of ABC Airlines is 184M$.

This figure is updated upon each new management report.

FAIR MARKET VALUE OF ABC DERIVATIVES PORTFOLIO-M$				
	F.O.B MED	CIF N.W.E	BRENT	TOTAL
SWAPS	31	0	0	31
ZERO COST COLLAR	0	33	120	153
TOTAL	31	33	120	184

TABLE 4-14 FAIR MARKET VALUE OF ABC AIRLINE PORTFOLIO

4.7.10. Credit risk report:

ABC AIRLINES has a no-collateral upper limit of 140M$ for performing its hedging activities without posting collaterals.

The report in this section, as displayed in Table 4-15, shows that the airline has already used all its transaction volume capacity with institutions #5 and 6. It is also clear that the airline is quite near reaching the limits with institutions #1 ad 3.

Based on the above report, the airline has to take active steps to increase its no-collateral basis and diversify its list of financial institutions.

CREDIT RISK REPORT			
Bank/counterparty	**Agreed upon no collateral upper limit- M$**	**FAIR MARKET VALUE- M$**	**DIFFERENCE M$**
INSTITUTION #1	**35.0**	**40.0**	**5.0**
INSTITUTION #2	**30.0**	**41.0**	**11.0**
INSTITUTION #3	**20.0**	**25.0**	**5.0**
INSTITUTION #4	**15.0**	**30.0**	**15.0**
INSTITUTION #5	**15.0**	**15.0**	**-**
INSTITUTION #6	**15.0**	**15.0**	**-**
INSTITUTION #7	**10.0**	**18.0**	**8.0**
TOTAL	**140.0**	**184.0**	**44.0**

TABLE 4-15 CREDIT RISK REPORT

If the airline does not succeed in any of the above tasks and uses its remaining balance of 44M$, it will be compelled to post collaterals for every new transaction based on the relevant I.S.D.A[36].

Credit Risk control and exposure evaluation have become vital issues, especially during the COVID-19 crisis due to a massive drop in passenger traffic and flight hours, leading to an over-hedge and the need to submit collateral to cover the airline engagements.

This report has become essential in the monitoring process.

[36] **See ISDA definition in chapter7, section 7.4**

4.8. SIMULATION

The purpose of the simulation is to find out ahead of time the market conditions that could endanger ABC Airlines and can also serve as a tool for budget purposes.

A deviation of +/-5% was applied to the actual Brent curve, and the effective barrel and total costs were calculated monthly.

The simulation includes:

- MONTHLY FUEL BARREL COST SIMULATION
- MONTHLY FUEL COSTS SIMULATION
- YEARLY AVERAGE BARREL COSTS SIMULATION
- YEARLY AVERAGE BARREL COSTS CHART
- TOTAL YEARLY COSTS SIMULATION
- TOTAL YEARLY COSTS SIMULATION CHART

4.8.1. MONTHLY FUEL BARREL COST SIMULATION:

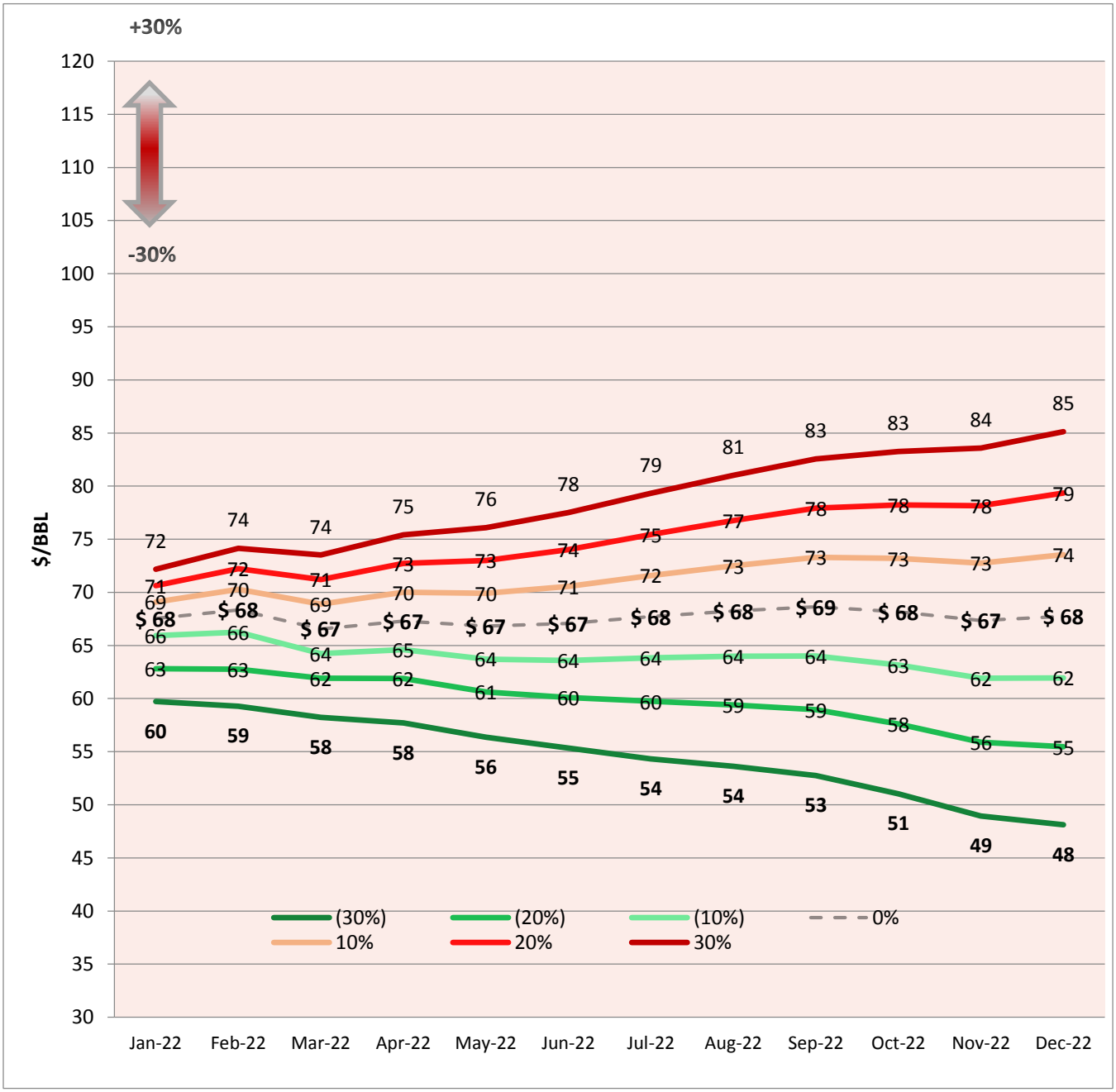


FIGURE 4-11 MONTHLY BARREL COST SIMULATION $/BARREL

4.8.2. MONTHLY FUEL COSTS SIMULATION:

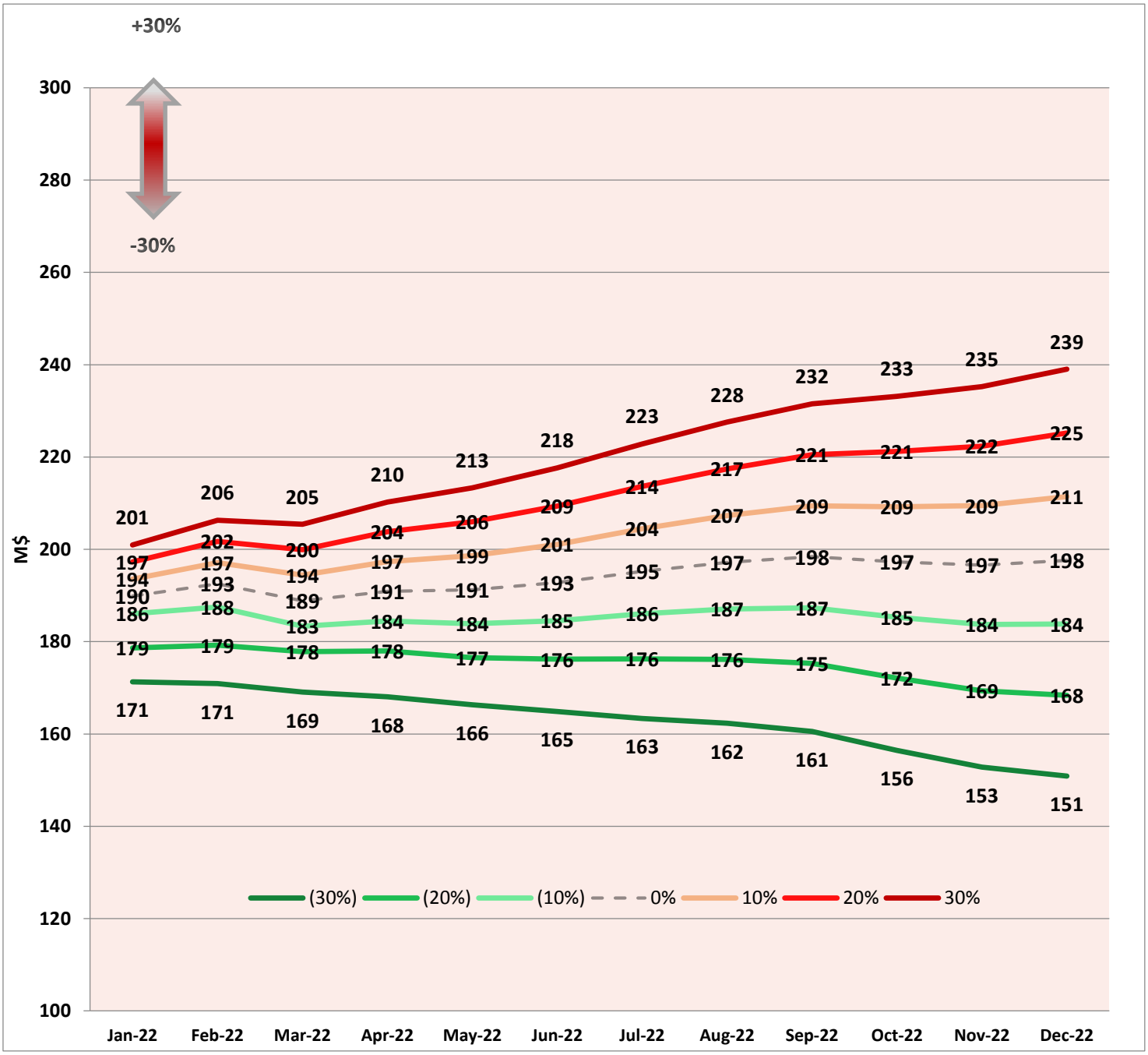


FIGURE 4-12 MONTHLY FUEL COST SIMULATION M$

4.8.3. YEARLY AVERAGE BARREL COSTS SIMULATION ($/BBL):

CURVE MARKET CHANGES	MARKET BARREL PRICE($)	ABC EFFECTIVE HEDGED BARRELL PRICE($)
50%	111.2	85.7
45%	107.4	83.9
40%	103.5	82.1
35%	99.6	80.2
30%	95.8	78.4
25%	91.9	76.6
20%	88	74.7
15%	84.2	72.9
10%	80.3	71.1
5%	76.4	69.2
0%	72.6	67.4
-5%	68.7	65.5
-10%	64.8	63.7
-15%	61	61.7
-20%	57.1	59.5
-25%	53.2	57
-30%	49.4	54.4
-35%	45.5	51.8
-40%	41.6	49.2
-45%	37.8	46.5
-50%	33.9	43.9

TABLE 4-16 YEARLY AVERAGE BARREL COST SIMULATION

4.8.3.1. YEARLY AVERAGE BARREL COST CHART:

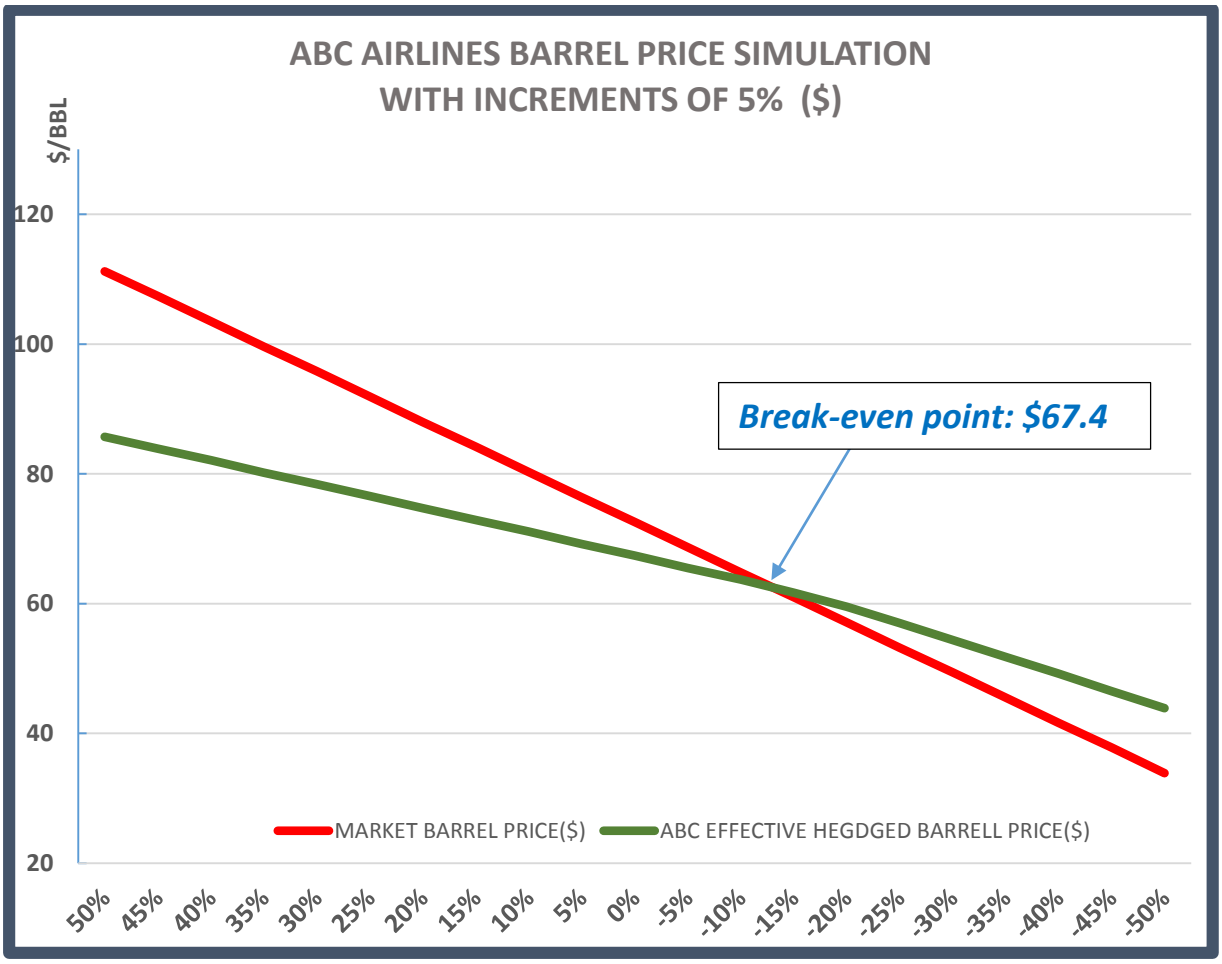


FIGURE 4-13 AVERAGE BARREL COST SIMULATION WITH MARKET CHANGES

The arrow position represents the average barrel break-even price. As long as the market price is higher than $67.4 per barrel, ABC Airlines' total fuel costs will be lower than what it would have paid without hedging. This price level is 15% lower than existing prices, estimated at $72.6.

4.8.4. TOTAL YEARLY COSTS SIMULATION (000$):

CURVE MARKET CHANGES	MARKET PRICE-NO HEDGE(000$)	ABC AIRLINES BASKET PRICE-AFTER HEDGE(000$)
50%	3,492	2,801
45%	3,385	2,749
40%	3,279	2,698
35%	3,172	2,647
30%	3,066	2,595
25%	2,959	2,544
20%	2,853	2,493
15%	2,747	2,441
10%	2,640	2,390
5%	2,534	2,339
0%	2,427	2,287
-5%	2,321	2,236
-10%	2,214	2,184
-15%	2,108	2,130
-20%	2,001	2,069
-25%	1,895	1,999
-30%	1,788	1,926
-35%	1,682	1,854
-40%	1,576	1,781
-45%	1,469	1,708
-50%	1,363	1,636

TABLE 4-17 TOTAL FUEL COSTS SIMULATION FOR FUEL MARKET CHANGES.

4.8.4.1. TOTAL YEARLY COSTS SIMULATION CHART (000$):

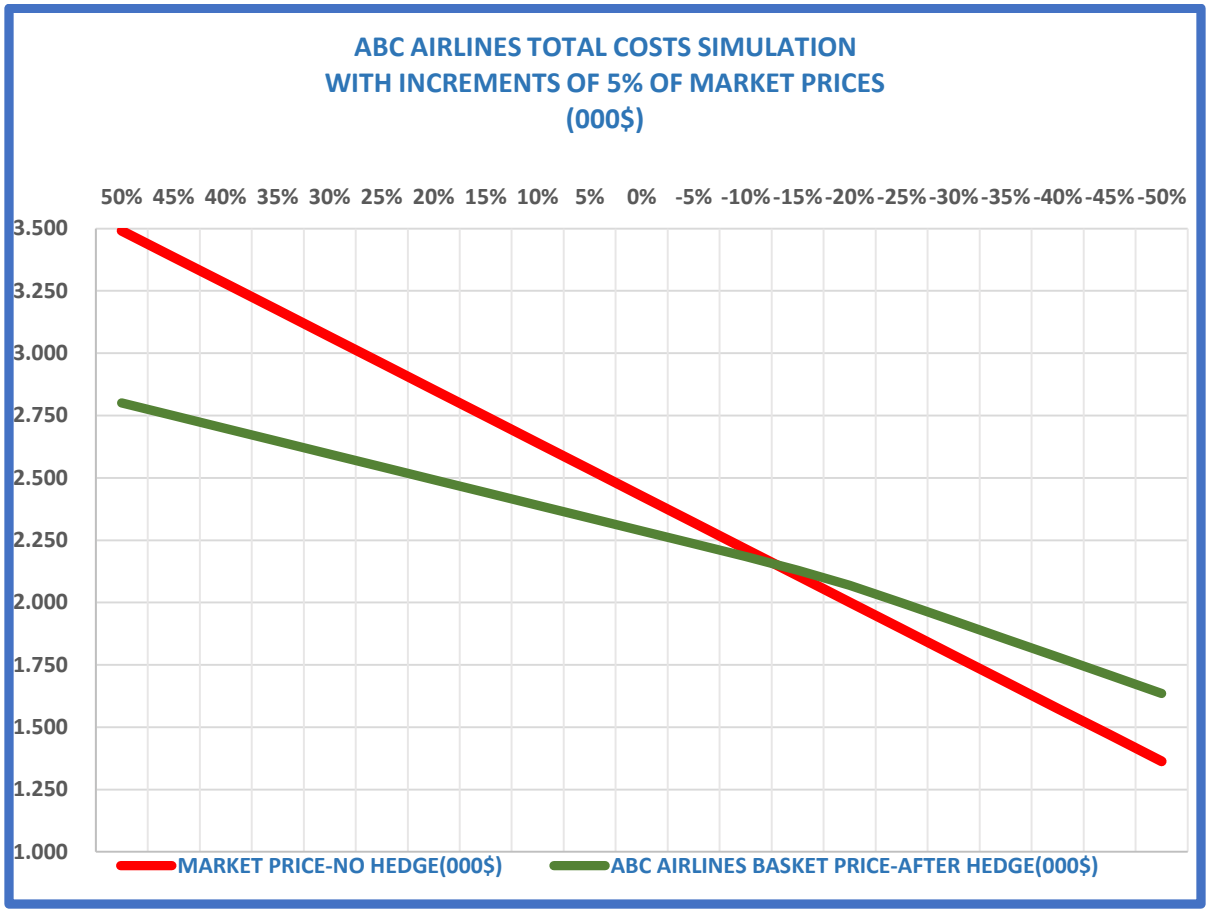


FIGURE 4-14 ABC'S TOTAL HEDGED BASKET FUEL COST SIMULATION.

4.8.5. SIMULATION ANALYSIS AND CONCLUSIONS:

According to the results described in **sections 4.7.2 and 4.7.3 as shown in Figures 4-12 and 4-13**, it can be seen that the further away from the current month, the more significant the gap between the effective price per hedged barrel compared to the market price and, as a result also, in terms of the total cost of fuel expenses. For example, on January 22, an increase of 30% in the Brent curve would increase the effective price of the hedged barrel by less than 6%, whereas the same 30% increase in Brent on December 22 has an impact of 21% on the effective barrel price and total cost.

The efficiency of the hedging program is well demonstrated in **sections 4.7.4 and 4.7.5.**

One of ABC Airlines' questions is how well the given Policy and execution protect the average barrel cost yearly. The annual average effective barrel price was calculated for that purpose, and a simulation of the Brent curve adjustments with +/-5% steps was applied.

The result shows that ABC Airlines is protected from deviations of the Brent curve as long as it does decline from its current level of more than 15%.

4.9. CHAPTER SUMMARY:

When creating a risk management program, two crucial aspects are frequently forgotten. This dissertation chapter addresses this omission as part of the fuel risk management program of ABC Airlines. The first enforces the hedging process through a thoroughly documented protocol, and the second focuses on the key

risk indicators utilized by the airline to monitor and regulate the effectiveness of its hedging program.

The policy sets a road map for those involved in the process, strengthening controls, aligning with the overall corporate philosophy of the airline, and providing management with the adequate framework to analyze, hedge, and monitor jet fuel hedging activities.

The policy is required to ensure that the hedging activities of the risk management team at ABC Airlines receive the appropriate level of attention and oversight.

The policy presented in the chapter includes:

1) Clear objectives of the financial goal to protect the airlines' cash flow, a clear definition of the threshold including the overall exposures, percentages of exposure to be hedged according to managements' risk tolerance, the maximum tenor of hedges, and types of hedge instruments allowed.

2) Roles and responsibilities of the appropriate individuals in the organization involved in the hedging process, as well as the necessary approvals and the frequency of meetings to monitor policy implementation and performance.

3) A crucial aspect of the policy is ensuring that all stakeholders, from the Board ranks down to the executive levels of the airline, comprehend the process, support it, and are invested in the success of the Risk Management operations.

ABC Airlines' program to monitor performance and ensure that objectives and milestones are fulfilled is demonstrated in this research using Key Risk Indicators (KRI) specially created for that purpose.

The KRIs provide visibility into the airline's risk management and control environment and support the implementation of an evaluation process.

The process starts by reporting to the Risk Management Committee and subsequently to the Board if the airline is on track to maintain the thresholds set by the official bodies of the airline.

Sections 4.6.1 and 4.6.2 of chapter four display:

- If hedge ratios are adequately implemented according to the approved policy.
- If management uses only approved hedge instruments.
- If the mix between the different hedge instruments is adequate.

Deviations from the approved thresholds would have appeared in the report and alerted management to elevated risk exposure.
According to the known jet fuel curve future development, the reports expose the results for 2022 and 2023 and are updated consistently towards every risk committee meeting.

For clarity purposes and to help managers who are not too well versed in tables, the reports are also displayed using a graph in **section 4.6.3**

As the airline is publicly traded on the stock exchange, it analyses the results and the forecast of its risk control activities every quarter, hence the report in **section 4.6.4**

Hedge effectiveness testing is an essential aspect of the airline risk management program. Therefore, it is fully disclosed and reported regularly to ensure that threats that may adversely affect its achievements are identified and dealt with adequately.

The included KRIs are:

- KRI for comparing market prices for each gallon ABC Airlines would have paid with no hedge activities and the effective cost for such a gallon after hedges. Under the known jet fuel curve. The results show a consistent

monthly advantage deriving from the hedging activities, as the effective cost of each gallon is lower than market prices, as detailed in **section 4.6.5.**

- KRI for comparing ABC Airlines' total monthly fuel costs with and without the hedging activities. The results are given at a specific reporting time according to the known Brent curve, which is updated for each report, as detailed in **section 4.6.6**.

  Based on this reported KRI, management sees that according to the approved risk policy and the actual Brent curve, the hedged fuel costs are lower than fuel market prices monthly and yearly. As a result, the amount of yearly savings for that specific report time is 140 M$ and represents a 5.8% on the annual fuel bill.

- KRI for reporting the results of **section 4.6.6** compiled quarterly to present the figure that may appear in the quarterly financials of the airline, as detailed in **section 4.6.7**.

- KRI for monitoring the forecasted hedged fuel costs per gallon compared to the budget prices that include initial hedged quantities according to the risk policy and unhedged market prices, as detailed in **section 4.6.8**.

  This forecasted cost of the hedged gallon is according to the actual Brent curve and is updated at each reporting date.

  This KRI is of high importance to all of the planning divisions of the airline, helping them realize the direction of fuel costs for the reported period.

  The results of this KRI show that ABC Airlines' budget prices are higher than market fuel prices.

This result gives confidence regarding the stability of the forecasted fuel costs, especially when verifying the efficiency of the hedging policy and comparing budget and market prices.

For all the reported periods, hedged prices are lower than budget prices. However, the airline should pay attention to the fact that the effective hedged prices gradually increase and converge to the budget prices toward the end of the year.

As a result of this trend, it may be necessary to change the hedge instructions as implied by this KRI.

- KRI for reporting the fair market value of the hedge portfolio of ABC Airlines as detailed in **section 4.6.9**.

  This key performance indicator reflects the robustness of the airline's hedging program's outcomes. The plan is more successful when the portfolio's dollar value is higher. This report has a material value for the Treasurer's cash flow, the financial reporting division's inclusion on the balance sheet as an asset or liability, and the Board as an additional input to demonstrate the risk management program's efficiency and robustness. At the time of reporting and based on market data, the fair market value of ABC Airlines' hedge portfolio is 184 million dollars.

- KRI for monitoring credit risk management and the exposure assessment of ABC Airlines. This KRI had become critical, particularly during the COVID-19 crisis, when passenger traffic and flight hours plummeted, resulting in an over-hedge and the requirement to present collateral to guarantee airline contracts, as detailed in **section 4.6.10**.

  Based on the KRI report, the airline has already exhausted its transaction volume capacity with several institutions, and it is dangerously close to exceeding it with more institutions.

This result should ignite a flashing yellow light and warn airlines' management that future hedging transactions will require additional collaterals unless some more credit facilities are granted to the airline.

4.9.1. CHAPTER CONCLUSION:

The results of the research chapter demonstrate how the program works like an envelope that surrounds critical aspects of jet fuel risk management and monitoring. It covers processes and procedures and presents a set of quantifiable, specific proactive risk metrics to monitor hedge activities and their efficiency.

Chapter 5: THESIS CONCLUSION

5.1. Introduction:

This chapter concludes the thesis by summarizing the key research findings concerning the “Hedge envelope” that wraps essential elements of the management program for jet fuel risk in ABC Airlines.

This is not another academic paper on financial derivatives, even though it does have an appendix regarding the main instruments used to hedge jet fuel. The present research provides a comprehensive yet pragmatic guide to the hedge envelope as defined while minimizing complicated models as much as possible.

The "Hedge Envelope," as referred to in this thesis, encompasses the internal corporate governance stage concepts and the metrics indicators necessary to analyze the performance and correctly generate an early warning system.

A series of research questions are raised and addressed, including many practical examples to support the people engaged in monitoring performance, the management, and the board, who bear the ultimate responsibility for the program's success.

The thesis presents a comprehensive policy for sound risk management and proper governance, which assists the airline in anticipating, quantifying, managing, and a thoroughly detailed flowchart decision-making process that reports essential parts of any jet fuel market risk exposure program and fosters organizational responsibility for all stakeholders.

The thesis shows how, by tracking adequate key indicators to monitor jet fuel risks, airlines can see how they perform against their planned budget and anticipate and mitigate future risks.

5.2. Thesis elements:

The thesis addresses two fundamental components of a jet fuel risk management policy. The first refers to internal corporate governance that guarantees that risks are comprehended, handled, and disclosed, and the second relates to the key risk indicator required to monitor risk mitigation.

5.2.1. Internal corporate governance element:

Chapter four of the thesis covers the essential duties that the board should perform. They include assessing and leading corporate risk policy and ensuring that proper risk management systems are in place.

The explicit components of the policy included and presented in the results emphasize and describe the board's responsibility for establishing the risk policy by stating the types and level of risk tolerance the airline is ready to assume in pursuit of its objectives. It also includes a description of the approval process and the supervision mechanism required to adequately monitor the airline's risk management policy.

The chain of activities is described from the board level down to the execution level. The board also assesses business strategy alignment with risk appetite and the internal risk management framework.

Separate from the listing of board responsibilities, there is a complete disclosure of all other participants' duties in the process, including the risk management committee, the Chief Executive Officer, the Chief Financial Officer, the Company Treasurer, and the Head of the Risk Management Team.

The policy framework includes specific instructions regarding the permissible maximum and minimum percentage of consumption hedged.

The choice of those percentages defines the risk appetite the board is willing to assume to align with the airline's overall strategy. The policy also describes the maximum yearly hedged volume, the hedge tenors, the allowed hedging instruments, the underlying asset selection, and the guidelines for collateral and margins that have become a crucial element, especially after the COVID crisis.

The model introduces a process flow chart of the required activities before and after the hedge.

5.2.2. Key Risk Indicators element:

The key risk indicators selected and presented in this thesis are essential metrics that evaluate and measure the efficiency of ABCs' airline risk management program.

A prioritization process was applied to the hundreds of potential risk metrics available to mitigate existing risks and detect emerging ones effectively. As a result, the indicators presented are the most important ones for the airline, and they ensure that the risk management team does not drown in a sea of data they cannot efficiently analyze.

According to the thesis, how critical risk information is communicated to the board and senior management and how risk management performance is monitored and reported are crucial considerations in selecting risk indicators for reporting and monitoring.

Once the core elements of the risk strategy are defined, a link is established between the airline strategy and the principal risk elements to answer the question of where the airline is heading when controlling and mitigating its risks.

The indicators presented and analyzed thoroughly cover the following:

A. Hedge status for 2022.
B. Hedge status for 2023.
C. Hedge instruments status.
D. Quarterly hedging figures.
E. Hedge Efficiency- Market vs. Hedged prices (monthly cost per gallon).
F. Hedge Efficiency- Market vs. Hedged prices (total fuel monthly costs).
G. Hedge Efficiency- Market vs. Hedged prices (total quarterly costs).
H. Market vs. Budget and Effective prices ($/gallon).
I. Fair Market Value of ABC AIRLINES hedged portfolio.

J. Credit Risk Report.
K. Brent curve simulation and impact on hedge policy.

Each key risk, as defined above, is reported using a specifically designed report that indicates how well the analyzed risk is performing given current and future market conditions as determined by the prices of the underlying commodity.

Deviations from the set risk appetite level as defined by the board appear immediately in the report and can be dealt with on the spot by the management and the risk team.

The financial impact of the risk policy on monthly, quarterly, and yearly costs is an integral part of the designed reporting system.

The efficiency of the risk strategy, defined as the cost of the fuel hedged compared to market prices, is displayed using several indicators in different scenarios.

As credit risk is a significant element in the key risk indicator monitoring process, a specific indicator serves as a warning device about the airline's capability to undertake other hedging activities without providing extra collateral or if there is a need to make other proper arrangements.

Given that low-profit margins characterize the profitability of airlines, mainly because of skyrocketing fuel costs and the high volatility of jet fuel prices, it is vital to perform simulations of the financial results by fluctuating fuel prices and verify that the airline is capable of achieving its targeted budget or it has to revisit its risk management strategy. Such simulation is presented as part of the reports included in the thesis.

5.3. CONTRIBUTION OF THE STUDY:

A good risk management program must involve systematic and well-defined procedures, processes, and roles of the many stakeholders, as is widely recognized. It also necessitates indicators that measure and quantify the risk mitigation strategy's success to indicate the degree to which the firm meets important risk elements continuously.

Professional literature is abundant on financial risk management. However, very little research focuses on these two elements developed and presented in this thesis, specifically regarding airline jet fuel risk management.

This thesis addresses this gap and suggests a realistic solution that the author, who has many years of experience in airline financial management and risk reduction, has adopted. Moreover, doing so contributes to expanding knowledge on that subject.

The thesis can help airlines establish and apply risk indicators that reflect if they are moving in the right direction, considering possible future developments concerning jet fuel risk management.

The thesis presents an opportunity to assist in developing industry best practices for airlines concerning the elements included whenever an airline considers implementing a hedge policy and needs a practical guide for internal governance and risk indicators to manage it.

The several indicators presented in the thesis constitute a basis for exchanging information, ideas, and concepts with peers dealing with jet fuel risk management. It can also allow the opportunity to compare risk exposures with peers directly and better understand mitigation programs.

Another contribution of the thesis derives from developing a standard language, terminology, and a framework for treating risks commonly shared by airlines.

5.4. CLOSING REMARKS:

Throughout my long career in airline financial management, I've seen countless cases when firms are left with a list of risks but no adequate internal governance, a clear perspective of risk appetite, or a defined system for who does what and when.

Furthermore, in many situations, the focus is on the company's historical performance as measured by key performance indicators rather than key risk indicators that provide real-time information on emerging threats.

The aviation business is one that seldom finds thorough and coherent hedge procedures, as well as a list of reports of critical risk indicators.

In the last couple of decades, ERM (Enterprise Risk Management) has gained traction as a risk management method to consider as a holistic approach. However, it is often so complicated and advanced that it can be challenging to comprehend and use. The jet fuel risk management literature is densely packed with formulas and academic jargon and lacks practical aspects of implementation procedures and monitoring tools.

This is why I've chosen to write this dissertation. The essential need for a clear and practical guide that demonstrates how to effectively set up rules and procedures and use risk measurements and indicators—a guide for those who want to deal with real-world applications.

In my professional life experience, I've seen numerous instances where airlines create risk management frameworks that are overly complex and time-consuming, resulting in bureaucratic roadblocks that serve as a deterrent to change.

The proposed program is a lean, adaptable, and simple-to-use approach to the "Hedge Envelope" of a risk management program and can serve as a springboard for further research into the topic.

CHAPTER 6: Future research

Risk management is a continuous learning process. Risk is always present, and someone somewhere on the planet is always looking for ways to reduce it, as it is assumed that it cannot be eliminated.

The thesis presented is yet another attempt to add an extra layer of directives to serve better the goal of managing, controlling, and anticipating upcoming events that could negatively impact the airline's performance.

However, given the limitations and constraints of such a dissertation, I recommend several initiatives to research to add more tools to jet fuel risk management in the airline industry, which is still in its infancy stages.

1-I recommend that the body of the international airline community (I.A.T.A.) create a specific task force for creating a common language of key risk indicators referring to market risks. Such a project’s results will enhance benchmarks and improve visibility.

2- The Covid-19 pandemic had an immense impact on the airline industry, and the risks of over-hedge inflicted severe credit lines issues that were not detected adequately by existing indicators. I recommend a survey/research be initiated amongst airlines to learn from their experience.

3-I recommend creating an international forum of managers who will exchange views and knowledge regarding risk management and indicators concerning jet-fuel exposure.

4- I recommend to the American and European libraries of K.R.I's to create a specific department that concentrates on managing, controlling, and anticipating market risks in the airline industry, particularly regarding jet-fuel risks.

CHAPTER 7: ANNEXES

7.1 AIRLINE DATA:

As detailed in the methodology chapter (3), ABC airline is a hypothetical airline with operational data specified by the researcher based on comparable airlines in the industry and his extensive personal experience. The data provided in Table 7-1 are all taken from the official publications of the airlines.

Given that in 2020, airline activities were heavily impacted by COVID-19 pandemic, the author provides data relating to 2019.

The relevant figures for fuel hedging are:

- The total quantity of jet fuel consumed
- The total annual expenditure on jet fuel
- The proportion of the hedge from whole consumption

AIRLINE	TOTAL GALLONS (MILL-GALLONS)	COST OF FUEL (MILL-$)	HEDGE RANGE FOR NEXT 12 MONTH	COMMENTS
EL AL	238.00	480.00	50%	
AIR LINGUS	254.00	516.00	75%-80%	
VIRGIN AIRLINES	415.00	838.00	NA	
JET BLUE	885.00	1,847.00	10%	
EASY JET	890.00	1,806.00	68%	
ABC AIRLINES	1,156.00	2,287.00	52%	
KLM	1,300.00	2,560.00	60%	
RYAN AIR	1,352.00	2,717.00	50%	
DELTA AIRLINES	4,214.00	8,519.00	NA	MONROE OWN REFINERY

TABLE 1-1 VARIOUS AIRLINE DATA

It should be noted that the proportion of fuel hedged is almost always presented as a rolling percentage that declines monthly. For simplicity, Table 7-1 illustrates the average yearly quantity hedged for the next 12 months.

It is evident from the above data that ABC airlines is very similar to a European airline in terms of yearly fuel consumption and costs. The proportion hedged depends very much on the risk appetite of every company and its ability to secure credit facilities to perform the hedges.

7.2 FUEL:

Jet fuel prices are undoubtedly outside of an airline's ability to regulate, and the markets ultimately determine them. The incapacity of an airline to exercise control over its most significant expense, which represent around 30% of total costs as displayed in Table 7.2.1, is a substantial source of risk for airlines. Jet fuel is one of the most critical expenditures that any company does not have direct control over, and this is the case in the aviation business.

	Airline						
Year	American	Alaska	Delta	JetBlue	Southwest	United	**Average**
2001	14.87%	15.77%	13.25%	14.71%	16.89%	14.19%	14.95%
2002	13.81%	14.26%	12.89%	15.09%	16.21%	12.00%	14.04%
2003	16.44%	16.14%	14.89%	18.76%	16.53%	14.87%	16.27%
2004	22.70%	21.53%	19.20%	23.50%	18.26%	18.03%	20.54%
2005	28.87%	25.60%	26.64%	31.55%	21.49%	24.11%	26.38%
2006	31.47%	28.64%	27.50%	35.61%	28.00%	31.36%	30.43%
2007	32.06%	28.24%	27.88%	37.06%	29.87%	32.47%	31.26%
2008	38.76%	39.43%	34.46%	43.73%	37.26%	42.58%	39.37%
2009	28.25%	22.94%	27.92%	33.76%	32.36%	27.68%	28.82%
2010	30.67%	28.90%	27.55%	34.63%	34.53%	32.61%	31.48%
2011	35.60%	36.22%	31.01%	42.05%	40.03%	37.33%	37.04%
2012	37.22%	37.79%	31.25%	41.26%	39.64%	38.34%	37.58%
2013	37.71%	36.24%	35.48%	39.94%	37.26%	35.45%	37.01%
2014	34.94%	34.23%	37.88%	37.91%	34.56%	33.93%	35.58%

TABLE 2-1 YEARLY JET FUEL EXPENSE AS A PERCENT OF TOTAL OPERATING EXPENSES

Due to the large percentage of jet fuel dollar value in airline operating costs, even a relatively small increase or decrease in fuel prices can significantly affect an

airline's total operating expenses. Therefore, the rise in volatility enhances the airline's risk of not accomplishing its financial objectives.

The airline will hedge to limit the risk of unfavorable price fluctuations and mitigate ABC airline's exposure to unanticipated fuel price changes.

Airlines tend to hedge their fuel consumption using crude oil contracts or heating oil contracts, which closely correlates with fuel jet oil.

As jet fuel is not a commodity traded directly this section will go over the elements that allow the airlines to choose the underlying asset as close as possible to the jet fuel in order not to increase additional risks.

The refining process of a barrel of crude oil converts 45% into gasoline, 28% into diesel fuel and heating oil, 10% into jet-fuel oil, 4% into heavy fuel oil, 5% into liquefied petroleum gas (LPG), and 8% into other products such asphalts.

The percentage distribution of a barrel of crude oil is described in Figure 7-2-1

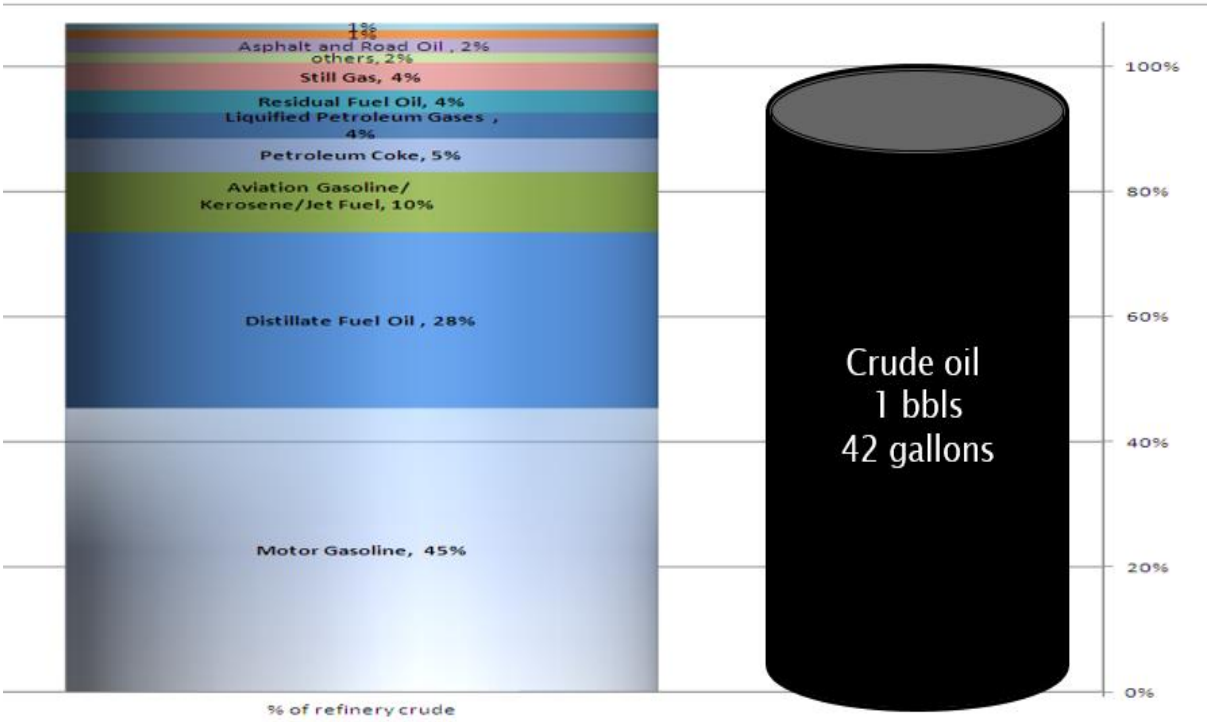


FIGURE7- 2-1 *PERCENT OF REFINED BARRELS OF CRUDE OIL*

Hedging with jet kerosene accurately reflects price fluctuations in the commodity that the airline needs to fly its aircraft.

Since the “over-the-counter” contracts are the only ones possible for jet-fuel, there are no marketplace “futures” for aviation fuel, excluding illiquid markets. Crude oil is the most liquid market for the product to which it is most closely connected, with contracts available in both Brent and US WTI crudes.

The over-the-counter (OTC) market for jet-fuel derivatives is virtually illiquid, and airlines must pay a significant illiquidity premium when trading kerosene futures on the OTC market.

To handle kerosene price fluctuations, airlines frequently prefer to employ financial instruments on other oil products as the basis for their hedging strategy. Therefore, a successful cross-hedging process necessitates the presence of a substitute oil product with remarkably similar price behavior.

A typical hedging method is the use of crude oil (WTI in the United States or Brent in Europe).

Brent and WTI futures are exchanged on a massive scale, with approximately 130 million barrels "bought and sold" daily in automated trading. Algorithms that adjust to price changes with thousands of dealers.

Figures 7-2-2 and 7-2-3 demonstrate the high correlation between Jet-fuel kerosene, Brent, and WTI crude oil.

Given the high liquidity of Brent crude, ABC airline hedges for shorter-term periods using Jet-fuel over-the-counter transactions, and for the longer term, it uses Brent crude oil as its underlying asset base.

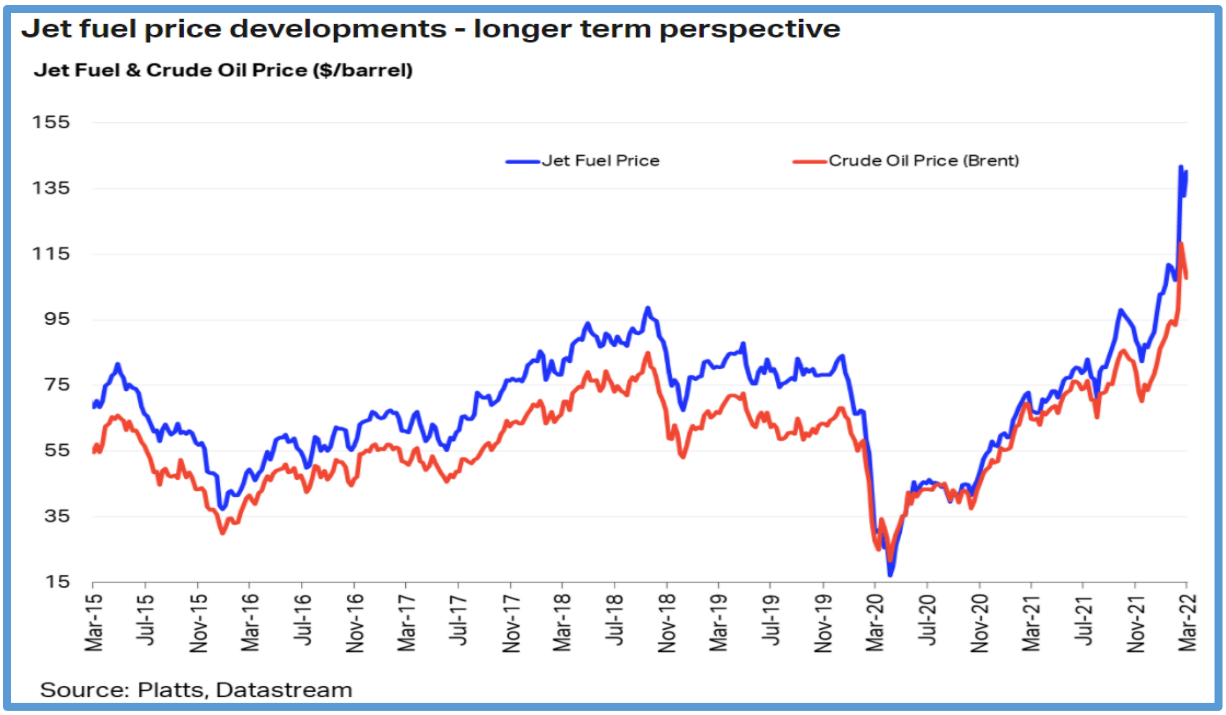


FIGURE7- 2-2 JET FUEL AND BRENT CRUDE CORRELATION

FIGURE7- 2-3 *WTI AND BRENT* CORRELATION

7.3 HEDGING INSTRUMENTS:

The number of possible hedge instruments used by airlines is enormous and is extensively researched and explained in the literature. Therefore, this thesis will only briefly describe those financial instruments used by ABC Airlines and are very popular amongst others in implementing their hedge program.

The most popular and frequent method for risk mitigation is through financial instruments.

A derivative hedge is a method that enables a company to lock in a specific price for an asset it will require in the future. Derivative products represent a generic term for the range of trading instruments that have grown up around securities and currency and commodity trading.

Commodity forward contracts are usually not deliverable. The commodity itself is not provided, and only the price differences are settled after the agreement's expiration date.
ABC airlines' most popular hedge instruments are swaps and Zero cost collars.

Swaps:

Swaps are agreements between two parties to trade a variable price for a fixed price at a mutually agreed rate.

The underwriter of the swap would get paid a fixed rate by the airline and would be paid if the price of the underlying commodity rose above the fixed rate.

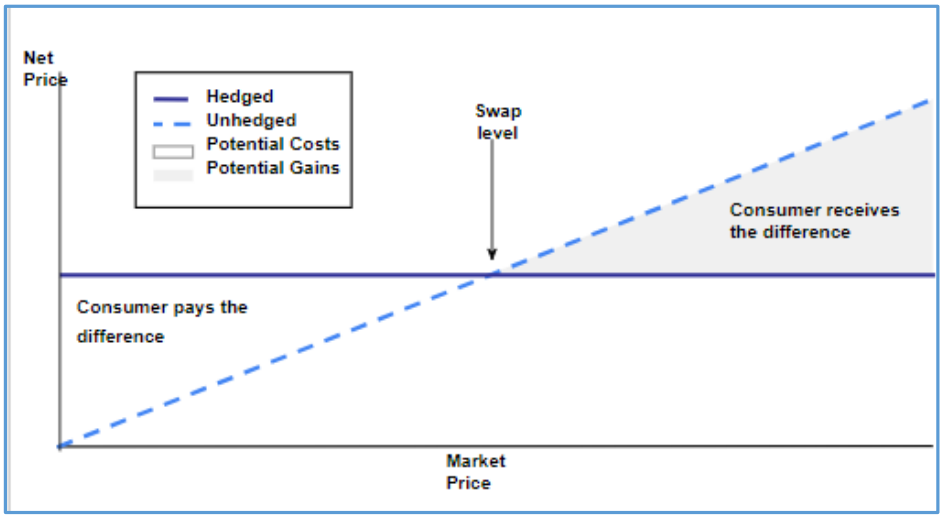


FIGURE 3-1 *SWAP*

As described in Figure 7-3-1, when the market price is above the strike price agreed upon between the parties, ABC airline receives the difference between strike and market; and vice versa, ABC airline, pays the financial institution when the market price is lower than the agreed-upon strike price.

Zero cost collar:

A classic collar is a mixture of an acquired call option, which acts as the ceiling (or cap), and a sell put option, which works as the floor.

A conventional collar does not entail any added expenses. In other words, when jet fuel prices have risen, the call option covers the airline business, and the put option is placed on funding the price of the call, ending in the collar being free of cost for the airline company.

It would be best for the airline firm if the price of jet fuel turned out to be higher than the strike price of the call, as this would decrease the cost of funds spent on jet fuel.

The worst potential outcome is when the actual cost of jet fuel is lower than that of the put's strike price. That implies that the business will not be able to attain the full advantages of the decreased jet fuel costs.

Because none of the options are advantageous between the two strike prices, they will not be exercised, and the airline firm will be required to purchase the jet fuel directly from the spot market.

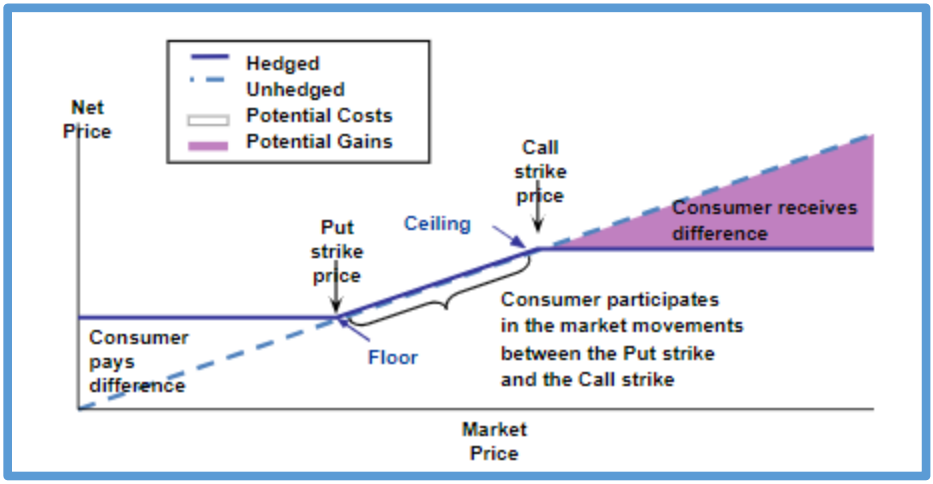


FIGURE 7-3-2 ZERO COST COLLAR

To illustrate the mechanism of the zero-cost collar, I will use the following example.

ABC airline purchased a Call option with a strike of $120.0 per barrel and a Put option with a strike of $90.0 per barrel.

The scenario of ABC Airlines for gain or losses deriving from that transaction is described in figure 7-3-3.

FIGURE 7-3-3 ZERO COST COLLAR EXAMPLE

ABC airline will pay market prices for the fuel it purchases as long as the fuel barrel costs are between $90.0 and $120.0.

If market prices exceed $120.0, the airline will be reimbursed for the difference between prevailing prices and the call strike level ($120.0).

On the other hand, if market prices are lower than $90.0, the airline will have to pay the difference to the financial institution.

7.4 ISDA AGREEMENT:

The ISDA master agreements set out standard terms and conditions applicable to parties' transactions and a schedule.

The international agreement document is published by the International Swaps and Derivatives Association, Inc. ("ISDA"), and it is used to provide specific legal and credit protection for parties who engage in over-the-counter (or "OTC") derivatives transactions is known as the ISDA Master Agreement (or "Master Agreement").

The schedule allows the parties to adjust the master agreement to their requirements by completing blanks, selecting alternative operative provisions, and amending the master agreement where appropriate.

Due to the dynamic nature of the current economy, the need to adequately establish and negotiate ISDA agreements has brought a whole new level of importance. Market vulnerability and risk protection are issues that must be addressed from the beginning. When it comes to negotiating the conditions of ISDA agreements, the risks and exposures of each institution will create customized issues.

The master agreement is the essential document in an ISDA transaction since it contains the contract clauses that apply to all of the transaction details that have been negotiated and agreed upon between the participants. The master agreement covers netting, withholding tax, events of default, termination events, and governing legislation that are usually standard in the master agreement.

Some important terms are subject to parties' negotiations and amendments and are worth paying attention to. They are mentioned in the ISDA schedules, and when negotiating the schedule for the master agreement, it is crucial to keep the following points in mind:

A) Joint and several responsibilities between parent-subsidiary groups. This is especially true in cases of large international airlines. The airline must aim to disconnect each subsidiary.

B) Cross-default provisions, which vary from transaction to transaction, are defined as follows: While various compromises are conceivable, airline management should exercise extreme caution when attempting to link defaults that are not directly related to the individual transaction to other defaults across the organization.

In discussing an ISDA agreement, credit support documentation and collateral posting requirements are critical considerations to keep in mind. Critical collateral posting mechanics are detailed in the standard ISDA credit support annex (CSA); however, parties must pay close attention to timing requirements outlined in the standard agreement to ensure that they do not present an unacceptable level of risk and that all timing requirements can be met.

7.5 TRANSACTION PRICES LIST

The prices displayed in the following charts represent the market prices of the transactions negotiated or retrieved from an online system.

Jet Fuel FOB Med-single swap

Trade Date	Buy/Sell	Volume	Asset unit	Strike	Call/Put	Notional in currency	Begin Date	End Date	Market Price	Intrinsic Value
15/2/21		12,437	ton	519		6,455,013	1/1/22	31/1/22	2,028,292	2,028,291.98
15/3/21		12,437	ton	558		6,940,072	1/1/22	31/1/22	1,543,233	1,543,233.19
15/3/21		11,050	ton	558		6,166,013	1/2/22	28/2/22	1,343,152	1,343,152.20
15/4/21		12,437	ton	550		6,840,573	1/1/22	31/1/22	1,642,732	1,642,732.43
15/4/21		11,050	ton	550		6,077,612	1/2/22	28/2/22	1,431,554	1,431,553.82
15/4/21		13,077	ton	550		7,192,570	1/3/22	31/3/22	1,667,892	1,667,891.54
15/5/21		12,437	ton	572		7,114,196	1/1/22	31/1/22	1,369,110	1,369,109.52
15/5/21		11,050	ton	572		6,320,716	1/2/22	28/2/22	1,188,449	1,188,449.35
15/5/21		13,077	ton	572		7,480,273	1/3/22	31/3/22	1,380,189	1,380,188.75
15/5/21		15,094	ton	572		8,633,489	1/4/22	30/4/22	1,555,537	1,555,537.36
15/6/21		12,437	ton	610		7,586,817	1/1/22	31/1/22	896,488	896,488.14
15/6/21		11,050	ton	610		6,740,624	1/2/22	28/2/22	768,542	768,541.63
15/6/21		13,077	ton	610		7,977,214	1/3/22	31/3/22	883,248	883,247.57
15/6/21		15,094	ton	610		9,207,042	1/4/22	30/4/22	981,984	981,983.90
15/6/21		14,612	ton	610		8,913,159	1/5/22	31/5/22	919,517	919,516.53
15/7/21		12,437	ton	603		7,499,755	1/1/22	31/1/22	983,550	983,549.97
15/7/21		11,050	ton	603		6,663,273	1/2/22	28/2/22	845,893	845,893.05
15/7/21		13,077	ton	603		7,885,672	1/3/22	31/3/22	974,789	974,789.36
15/7/21		15,094	ton	603		9,101,388	1/4/22	30/4/22	1,087,638	1,087,638.48
15/7/21		14,612	ton	603		8,810,877	1/5/22	31/5/22	1,021,799	1,021,798.68
15/7/21		15,827	ton	603		9,543,724	1/6/22	30/6/22	1,080,989	1,080,989.02
15/8/21		12,437	ton	584		7,263,444	1/1/22	31/1/22	1,219,861	1,219,860.67
15/8/21		11,050	ton	584		6,453,319	1/2/22	28/2/22	1,055,847	1,055,846.91
15/8/21		13,077	ton	584		7,637,201	1/3/22	31/3/22	1,223,260	1,223,259.95
15/8/21		15,094	ton	584		8,814,611	1/4/22	30/4/22	1,374,415	1,374,415.21
15/8/21		14,612	ton	584		8,533,254	1/5/22	31/5/22	1,299,422	1,299,421.66
15/8/21		15,827	ton	584		9,243,010	1/6/22	30/6/22	1,381,703	1,381,703.39
15/8/21		18,572	ton	584		10,845,944	1/7/22	31/7/22	1,611,106	1,611,105.57
15/9/21		12,437	ton	630		7,830,590	1/1/22	31/1/22	652,715	652,715.01
15/9/21		11,050	ton	630		6,957,208	1/2/22	28/2/22	551,958	551,957.65
15/9/21		13,077	ton	630		8,233,531	1/3/22	31/3/22	626,931	626,930.53
15/9/21		15,094	ton	630		9,502,875	1/4/22	30/4/22	686,151	686,151.06
15/9/21		14,612	ton	630		9,199,549	1/5/22	31/5/22	633,127	633,126.51
15/9/21		15,827	ton	630		9,964,725	1/6/22	30/6/22	659,989	659,988.91
15/9/21		18,572	ton	630		11,692,819	1/7/22	31/7/22	764,230	764,230.48
15/9/21		18,089	ton	630		11,388,956	1/8/22	31/8/22	723,568	723,567.75
15/10/21		12,437	ton	733		9,121,593	1/1/22	31/1/22	-638,288	-638,287.62
15/10/21		11,050	ton	733		8,104,219	1/2/22	28/2/22	-595,053	-595,053.44
15/10/21		13,077	ton	733		9,590,965	1/3/22	31/3/22	-730,504	-730,503.54
15/10/21		15,094	ton	733		11,069,582	1/4/22	30/4/22	-880,555	-880,555.50
15/10/21		14,612	ton	733		10,716,247	1/5/22	31/5/22	-883,572	-883,571.66
15/10/21		15,827	ton	733		11,607,575	1/6/22	30/6/22	-982,861	-982,861.18
15/10/21		18,572	ton	733		13,620,574	1/7/22	31/7/22	-1,163,525	-1,163,524.66
15/10/21		18,089	ton	733		13,266,615	1/8/22	31/8/22	-1,154,091	-1,154,090.55
15/10/21		15,080	ton	733		11,059,566	1/9/22	30/9/22	-972,500	-972,499.91

15/11/21	12,437	ton	694	8,629,071	1/1/22	31/1/22	-145,766	-145,766.38
15/11/21	11,050	ton	694	7,666,631	1/2/22	28/2/22	-157,465	-157,465.40
15/11/21	13,077	ton	694	9,073,100	1/3/22	31/3/22	-212,639	-212,638.52
15/11/21	15,094	ton	694	10,471,879	1/4/22	30/4/22	-282,852	-282,852.42
15/11/21	14,612	ton	694	10,137,622	1/5/22	31/5/22	-304,947	-304,946.92
15/11/21	15,827	ton	694	10,980,823	1/6/22	30/6/22	-356,109	-356,109.12
15/11/21	18,572	ton	694	12,885,130	1/7/22	31/7/22	-428,081	-428,080.50
15/11/21	18,089	ton	694	12,550,283	1/8/22	31/8/22	-437,758	-437,758.49
15/11/21	15,080	ton	694	10,462,404	1/9/22	30/9/22	-375,338	-375,337.61
15/11/21	14,674	ton	694	10,180,721	1/10/22	31/10/22	-388,417	-388,416.95
15/12/21	12,437	ton	654	8,139,038	1/1/22	31/1/22	344,267	344,267.37
15/12/21	11,050	ton	654	7,231,253	1/2/22	28/2/22	277,913	277,912.61
15/12/21	13,077	ton	654	8,557,850	1/3/22	31/3/22	302,611	302,611.03
15/12/21	15,094	ton	654	9,877,194	1/4/22	30/4/22	311,832	311,831.96
15/12/21	14,612	ton	654	9,561,920	1/5/22	31/5/22	270,755	270,755.46
15/12/21	15,827	ton	654	10,357,236	1/6/22	30/6/22	267,478	267,477.52
15/12/21	18,572	ton	654	12,153,400	1/7/22	31/7/22	303,649	303,649.29
15/12/21	18,089	ton	654	11,837,568	1/8/22	31/8/22	274,956	274,955.74
15/12/21	15,080	ton	654	9,868,258	1/9/22	30/9/22	218,809	218,808.71
15/12/21	14,674	ton	654	9,602,571	1/10/22	31/10/22	189,733	189,732.95
15/12/21	12,636	ton	654	8,269,059	1/11/22	30/11/22	122,696	122,696.46
15/12/21	13,499	ton	654	8,833,725	1/12/22	31/12/22	100,297	100,297.33

TABLE 7- 5-1 JET FUEL FOB MED SINGLE SWAP TRANSACTIONS

Jet CIF- single swap

Trade Date	Buy/Sell	Volume	Asset unit	Strike	Call/Put	Notional in currency	Begin Date	End Date	Market Price	Intrinsic Value
15/7/20		12,437	ton	448		5,565,739	1/1/22	31/1/22	3,169,424	3,169,423.87
15/8/20		11,050	ton	455		5,032,263	1/2/22	28/2/22	2,686,857	2,686,856.90
15/9/20		13,077	ton	417		5,448,045	1/3/22	31/3/22	3,647,810	3,647,809.83
15/10/20		15,094	ton	428		6,460,023	1/4/22	30/4/22	3,996,913	3,996,912.94
15/11/20		14,612	ton	427		6,233,366	1/5/22	31/5/22	3,858,667	3,858,667.16
15/12/20		15,827	ton	473		7,490,953	1/6/22	30/6/22	3,414,691	3,414,690.80
15/1/21		18,572	ton	499		9,265,482	1/7/22	31/7/22	3,521,217	3,521,217.48
15/2/21		18,089	ton	539		9,755,502	1/8/22	31/8/22	2,678,105	2,678,105.12
15/3/21		15,080	ton	575		8,675,441	1/9/22	30/9/22	1,679,293	1,679,292.75
15/4/21		14,674	ton	572		8,396,380	1/10/22	31/10/22	1,656,385	1,656,384.80
15/5/21		12,636	ton	587		7,421,177	1/11/22	30/11/22	1,194,869	1,194,868.88
15/7/21		12,437	ton	613		7,617,910	1/1/23	31/1/23	852,957	852,957.22
15/8/21		11,050	ton	600		6,633,437	1/2/23	28/2/23	870,093	870,093.00
15/9/21		13,077	ton	635		8,301,533	1/3/23	31/3/23	545,458	545,458.34
15/10/21		15,094	ton	704		10,625,833	1/4/23	30/4/23	-444,655	-444,654.87
15/11/21		14,612	ton	683		9,981,277	1/5/23	31/5/23	-160,437	-160,436.86
15/12/21		15,827	ton	658		10,412,631	1/6/23	30/6/23	200,529	200,529.00

TABLE 7- 5-2 JET CIF SINGLE SWAP TRANSACTIONS

Brent Crude Oil- Asian swap

Trade Date	Buy/Sell	Volume	Asset unit	Strike	Call/Put	Notional in currency	Begin Date	End Date	Market Price	Intrinsic Value
15/1/20	Sell	392,074	Barrel	45	Put	17,474,755	1/1/22	31/1/22	0	0
15/1/20	Buy	392,074	Barrel	70	Call	27,445,207	1/1/22	31/1/22	3,128,329	2,881,747
15/2/20	Sell	348,345	Barrel	42	Put	14,675,754	1/2/22	28/2/22	-4,964	0
15/2/20	Buy	348,345	Barrel	70	Call	24,384,115	1/2/22	28/2/22	3,065,896	2,403,577
15/3/20	Sell	412,249	Barrel	35	Put	14,408,118	1/3/22	31/3/22	-5,737	0
15/3/20	Buy	412,249	Barrel	60	Call	24,734,967	1/3/22	31/3/22	7,334,880	6,756,769
15/4/20	Sell	475,805	Barrel	29	Put	13,960,119	1/4/22	30/4/22	-6,939	0
15/4/20	Buy	475,805	Barrel	60	Call	28,548,300	1/4/22	30/4/22	8,538,043	7,536,751
15/5/20	Sell	460,618	Barrel	30	Put	13,731,010	1/5/22	31/5/22	-17,849	0
15/5/20	Buy	460,618	Barrel	58	Call	26,715,819	1/5/22	31/5/22	9,093,090	7,977,896
15/6/20	Sell	498,930	Barrel	34	Put	17,113,285	1/6/22	30/6/22	-104,359	0
15/6/20	Buy	498,930	Barrel	58	Call	28,937,917	1/6/22	30/6/22	9,909,116	8,382,017
15/7/20	Sell	585,455	Barrel	34	Put	20,110,365	1/7/22	31/7/22	-159,927	0
15/7/20	Buy	585,455	Barrel	60	Call	35,127,275	1/7/22	31/7/22	10,726,211	8,377,855
15/8/20	Sell	570,240	Barrel	39	Put	22,108,216	1/8/22	31/8/22	-369,848	0
15/8/20	Buy	570,240	Barrel	60	Call	34,214,418	1/8/22	31/8/22	10,436,253	7,886,423
15/9/20	Sell	475,375	Barrel	36	Put	16,989,885	1/9/22	30/9/22	-196,884	0
15/9/20	Buy	475,375	Barrel	60	Call	28,522,470	1/9/22	30/9/22	8,500,568	6,346,250
15/10/20	Sell	462,576	Barrel	34	Put	15,898,731	1/10/22	31/10/22	-283,520	0
15/10/20	Buy	462,576	Barrel	60	Call	27,754,549	1/10/22	31/10/22	8,434,608	5,957,977
15/11/20	Sell	398,338	Barrel	33	Put	13,021,661	1/11/22	30/11/22	-229,874	0
15/11/20	Buy	398,338	Barrel	60	Call	23,900,266	1/11/22	30/11/22	7,228,337	4,959,305
15/12/20	Sell	425,539	Barrel	37	Put	15,851,324	1/12/22	31/12/22	-455,433	0
15/12/20	Buy	425,539	Barrel	60	Call	25,532,334	1/12/22	31/12/22	7,684,417	5,140,510
15/1/21	Sell	392,074	Barrel	36	Put	13,973,531	1/1/23	31/1/23	-399,034	0
15/1/21	Buy	392,074	Barrel	65	Call	25,484,835	1/1/23	31/1/23	5,804,008	2,642,581
15/2/21	Sell	348,345	Barrel	45	Put	15,515,264	1/2/23	28/2/23	-807,259	0
15/2/21	Buy	348,345	Barrel	65	Call	22,642,393	1/2/23	28/2/23	5,143,365	2,232,888
15/3/21	Sell	412,249	Barrel	44	Put	18,200,813	1/3/23	31/3/23	-981,841	0
15/3/21	Buy	412,249	Barrel	75	Call	30,918,709	1/3/23	31/3/23	3,880,916	0
15/4/21	Sell	475,805	Barrel	44	Put	20,968,726	1/4/23	30/4/23	-1,202,042	0
15/4/21	Buy	475,805	Barrel	75	Call	35,685,375	1/4/23	30/4/23	4,506,706	0
15/5/21	Sell	460,618	Barrel	47	Put	21,736,543	1/5/23	31/5/23	-1,508,139	0
15/5/21	Buy	460,618	Barrel	75	Call	34,546,318	1/5/23	31/5/23	4,343,201	0
15/6/21	Sell	498,930	Barrel	50	Put	24,826,737	1/6/23	30/6/23	-2,025,363	0
15/6/21	Buy	498,930	Barrel	77	Call	38,417,580	1/6/23	30/6/23	4,293,788	0
15/7/21	Sell	585,455	Barrel	50	Put	29,436,656	1/7/23	31/7/23	-2,530,188	0

15/7/21	Buy	585,455	Barrel 77	Call	45,080,003	1/7/23	31/7/23	5,037,154	0
15/8/21	Sell	570,240	Barrel 49	Put	27,861,941	1/8/23	31/8/23	-2,307,145	0
15/8/21	Buy	570,240	Barrel 77	Call	43,908,503	1/8/23	31/8/23	4,901,976	0
15/9/21	Sell	475,375	Barrel 50	Put	23,873,308	1/9/23	30/9/23	-2,177,889	0
15/9/21	Buy	475,375	Barrel 80	Call	38,029,960	1/9/23	30/9/23	3,570,538	0
15/10/21	Sell	462,576	Barrel 57	Put	26,306,687	1/10/23	31/10/23	-3,183,177	0
15/10/21	Buy	462,576	Barrel 85	Call	39,318,945	1/10/23	31/10/23	2,790,065	0
15/11/21	Sell	398,338	Barrel 57	Put	22,617,618	1/11/23	30/11/23	-2,816,381	0
15/11/21	Buy	398,338	Barrel 85	Call	33,858,710	1/11/23	30/11/23	2,432,947	0
15/12/21	Sell	425,539	Barrel 53	Put	22,379,090	1/12/23	31/12/23	-2,463,338	0
15/12/21	Buy	425,539	Barrel 85	Call	36,170,806	1/12/23	31/12/23	2,623,518	0

Table 5-3 BRENT CRUDE OIL -ASIAN SWAP TRANSACTIONS

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