Turun yliopisto
University of Turku

JET FUEL PRICE RISK MANAGEMENT AND EXPOSURE IN SMALL AIRLINES

Evidence from the Nordic Countries

Master´s Thesis
in Accounting and Finance

Author:
Joonas Hänninen

Supervisors:
Ph.D. Terhi Chakhovich
Ph.D. Oana Apostol

30.11.2017
Turku

Turun kauppakorkeakoulu • Turku School of Economics

Table of Contents

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

1.1 Background

Fuel and labour costs represent the two largest items for airlines' operating expenses (O'Connor & Willliam 2000, 80). In 2001, fuel accounted for 13.4% of the global airline industry's operating costs, while labour costs were 36.2%, whereas in 2008 the fuel and labour stood at 34.2% and 21.5% of the total operating expenses respectively. The shift of fuel costs to the largest operating expense item for the airline industry is largely due to the increase in the price of oil but also the widening of the refining margin[1] between jet fuel and crude oil. While in 2003, the average price of jet fuel per barrel was USD34.7, it had almost quadrupled to USD126.7 in 2008. In addition, restructuring of operations and increasing labour productivity have contributed to the shift of fuel expenses to the largest operating expense item. (IATA Economic Briefing 2010.)

Kerosene (jet fuel) is a refined oil product distilled from crude oil and, thus, its price is highly correlated with crude oil price changes (Berghöfer & Lucey 2014). The price of crude oil is affected by a variety of local and global factors that translate into fuel prices. In addition to the typical demand and supply drivers, oil prices are subject to weather conditions that cause disruptions in production, political tensions and decisions, comments from influential country leaders, production decisions made by the Organization of the Petroleum Exporting Countries (OPEC), and changes in legal as well as tax systems. (James 2003, 1–18.) In fact, the international airline industry has faced severe fuel price increases over the last few decades unlike any other transportation industry (Wensveen 2007, 187–188).

Commodity prices are highly volatile and therefore exhibit a significant source of risk for non-financial firms (Bartram 2005). Therefore, volatile fuel prices affect the airline industry's profitability, and airlines have restructured their operations in order to cut other expenses. As a result, the airline industry's sensitivity to fuel price changes has increased. For example, the International Airline Transportation Association (IATA) downgraded the industry's profit forecast by USD500 million mostly due to the increase in expected oil prices (Rising Oil Prices – – 2012). However, airlines can try to mitigate this commodity price risk and the related exposure by hedging with derivatives instruments. In fact, most of the largest U.S. and European airlines do exactly this (Morrell & Swan 2006).

---

[1] Refining margin is the spread of jet fuel price over crude oil price. Jet fuel is distilled from crude oil.

Volatile commodity prices have an impact on airlines’ profits. According to Morrell and Swan (2006) airlines’ profits are volatile because they cannot quickly adapt their operating costs to changes in revenue and demand. Another reason is that many airlines have acquired their assets with debt capital or via leasing contracts. As a result, small changes in operating profits are magnified in large swings in earnings. Consequently, commodity price risk management can reduce the impact of the volatile commodity prices to a company’s earnings. While hedging against commodity price risk can reduce the volatility in a company’s operating profit and earnings, it can also result in severe losses. For example, Cathay Pacific, the Hong Kong based carrier, reported a fuel hedging loss of HKD7.6 billion (USD979.9 million) for the fiscal year 2008 (Hedging Bites Cathay Pacific – – 2009).

Commercial passenger airlines cannot pass increased fuel prices on to customers very easily. However, on the cargo side, airlines have long included fuel price surcharges in their fares. For example, the logistics giant FedEx does not hedge any of its jet fuel because it can vastly rely on passing the increased fuel prices on to the cargo customers. (Morrel & Swan 2006.) On the contrary, it is not that simple to adjust ticket prices for passenger airlines.

Passenger airlines have been exposed to increased competition due to deregulation, especially in Europe. Deregulation of the aviation industry has brought in a large number of new entrants on to the market and has introduced a number of low-cost carriers as well. This has led to lower margins and, in fact, in Europe there is evidence that airlines cannot recover their full cost, which over a longer term is condition for sustainable business. (Button, Costa & Cruz 2011.) Likewise, the consumer demand for low prices and passengers’ perception of air transportation being an undifferentiated commodity often drive prices down to levels where airlines often fail to cover fully allocated costs (Wensveen 2007, 189).

Hedging with financial derivatives, typically requires immediate cash outlays in the form of initial margins and the consequent margin calls, especially the exchange-traded products (Hull 2009, 26–27). The initial margin represents typically as much as 10% of the hedged position’s nominal value (James 2003, 35). The positions are settled on a daily basis and, therefore, additional margin deposits may be required for both the airlines, which are short on fuel, and the risk bearing counterparties. (Hull 2009, 26–27.) This might pose a problem for smaller carriers that do not have adequate cash available for the margins on top of the fuel bill.

1.2 Aim of the Thesis

Recent literature has mostly focused on the impact of commodity price risk on firm value. The impact of financial risk management on the value of a firm has been studied in several research papers (see Smith & Stulz 1985; Froot, Scharfstein, and Stein 1993; Allayannis and Weston 2001; Peréz-González and Yun 2014; Jin and Jorion 2004; Carter, Rogers, and Simkins 2002; Cobbs and Wolf 2004). However, the commodity price exposure is less studied and, in the case of aviation, mostly for large international airlines. Of particular interest for the research is the effect of jet fuel price changes on the airline stock returns. Studying fuel price risk management and jet fuel exposure in the Nordic countries sheds light on how the Nordic airlines manage their fuel price risk. This is of particular interest since the Nordic airliners are small airlines in the global context and may have less financial resources available for risk management activities. In addition, the thesis will provide evidence as to whether the exposure is different from that, which has been found among the major U.S. and European airlines.

The aim of the thesis is to study the effect of jet fuel price risk exposure on the Nordic countries' listed airlines over the time period of 2006 to 2014. The listed airlines in the Nordic countries include Finnair, Scandinavian Airlines, Incelandair Group, and Norwegian Air Shuttle. The exposure is measured as the sensitivity of stock price returns to the underlying source of exposure as in Jorion (1996). The exposure studied in the thesis is the price return of jet fuel. This approach has a clear benefit: instead of having to estimate the exposure with an indirect measure, such as Tobin's Q, the approach allows the exposure coefficients to be estimated on stock returns.

In addition, the thesis investigates how airlines in the Nordic countries manage fuel price risk, and whether they prefer some products to others given that they are rather small in size. This is done in a multi-year context which enables to draw conclusions on how systematic the hedging is over time. It may be that the publicly traded derivatives instruments with their margin requirements are not feasible for smaller Nordic carries, due to the required liquidity for initial margins and additional margin calls. What is more, the data allows analysing whether the exposure is different for low-cost carrier when compared to traditional full service airlines and whether the hedging practices are different since one (Norwegian Air Shuttle) of the four listed airlines in the Nordic countries is a low-cost carrier.

1.3 Methodology

The thesis employs both quantitative and qualitative methods. Using the publicly listed stock return data of the airlines from the Nordic countries, the extent of jet fuel price exposure is estimated. Eight years of stock return data on the four carries was gathered from Datastream database.

The qualitative approach analyses the fuel price risk management practices among the carriers. The qualitative part is conducted by researching the annual reports, financial reports, and interim reports of the publicly traded airlines in the Nordic countries. The analysis covers the same period as in the quantitative analysis. Consequently, the thesis yields information how the hedging practices have evolved, and how systematic the airlines are with their hedging practices over a longer time period. To supplement the data gathered from the published materials, an interview of an industry practitioner responsible for risk management operations is included in the thesis so as to further elaborate the practicalities of jet fuel hedging. The interview was semi-structured in nature, which allows the interviewee to discuss the fuel price risk management instruments and practices relatively broadly. What is more, studying the financial statements of the airlines for several years enhances the data because detailed information about risk management policies, commodity price risk hedging, and company’s views on fuel price risk can be found from the statements.

By combining both quantitative and qualitative research methods, the study aims at further understanding the fuel price risk exposure and potentially finding supporting evidence or reasoning behind the quantitative results. To the best of the writer’s knowledge, the thesis is the first to employ mixed-methods approach in studying jet fuel price exposure and hedging.

1.4 Structure of the Thesis

In the second chapter, the relevant literature and research behind managing commodity price risk is discussed. The third chapter analyses the price development of crude oil and jet kerosene. In addition, the price formation of crude oil is discussed and the potential for unconventional energy sources is also discussed. The fourth chapter introduces how airlines can manage fuel price risk using derivatives instruments. In the fifth chapter, the focus is on jet fuel exposure of the Nordic airlines and how they manage fuel price risk. The sixth chapter provides the conclusions and the final chapter includes a summary of the thesis.

2 RISK MANAGEMENET

2.1 Concept of Risk

Risk is inherent in all human activities and it stems from the fact that many future events are unknown in nature. Therefore, risk can be defined as "the exposure to uncertainty". Consequently, when studying risk, two concepts must be segregated and analysed separately. The first one being the uncertainty itself, and the second one being the exposure of an individual, company, or entity to that very uncertainty. (Lhabitant & Tinguely 2001, 345.)

Uncertainty could be described as the possible occurrence of one or multiple events that can be estimated with probability distributions, so any possible realization of all the possible events can occur with a given probability. As a result, future events must be precisely described and their probability distributions determined in order to study the uncertainty. Therefore, analysing uncertainty is often difficult since the probability distributions of events are not known and they must therefore be inferred. In addition, possible realizations on any event are difficult to determine. (Lhabitant & Tinguely 2001, 345.) The abovementioned concept of uncertainty was introduced by Knight (1921) in his famous dissertation Risk, Uncertainty and Profit. Knight proposed that uncertainty cannot be measured and that is why it is different from the concept risk. Hence, the immeasurable uncertainty is often cited as the *Knightian uncertainty*. Uncertainty may also be ambiguity when it cannot be quantified, but the probabilities of different events can be ranked according to their relative likelihood (Krause 2006, 707).

While uncertainty is one important factor in assessing risk, the exposure to the uncertainty is another critical component of the concept of risk. Different activities, individuals, companies, and entities are not similarly affected by the same uncertainty. For example, future weather, which clearly cannot be known at present, affects groups heterogeneously. Weather conditions may be crucial for agriculture, while they have very little impact on a number other economic activities. Therefore, the exposure to uncertainty plays a significant role in whether one is faced with a given risk or whether it is of no significance at all. Consequently, identifying the exposures to given uncertainties is essential in initiating risk management. (Lhabitant & Tinguely 2001, 345.)

Risk management is not about avoiding risk entirely nor is it about seeking it. In fact, risk itself is neither good nor bad. Rather, companies should take risks in order to stay in business and gain competitive advantage. What is important, however, is that companies identify and manage risks properly. Identifying risks and managing them properly may even become a source of profit for companies. (Lhabitant & Tinguely

2001, 345.) What is more, firms must decide how much risk to assume. On one hand assuming a lot of risk (that is, not transferring any risk at all) has the potential to carry large positive cash flows. On the other hand, it bears the potential to large losses as well. Assuming little risk leads to lower potential cash flows but at the same time lessens the potential negative impact on cash flows. Put differently, the more risk a company assumes the higher the standard deviation of the expected cash flows. (Keown, Titman, and Martin 2011, 651–652.) On the contrary, mismanaged, wrongly priced, misunderstood, and unidentified risk can adversely affect an organization's profits. Therefore, risk management is about optimizing risk, and thus successful companies ought to take necessary risks to achieve goals but avoid excessive risk taking. (Lhabitant & Tinguely 2001, 345.)

2.2 Financial Risks

Companies are faced with several kinds of risks when engaging in business activities. They include market risk, credit risk, liquidity risk and basis risk. They can be analysed with regards to business in general and with respect to derivatives contracts.

Market risk as a broad concept includes any potential loss due to adverse change in market variables. These variables include interest rates, foreign exchange rates, equity prices, and commodity prices. They may have a direct or indirect impact on companies. The erosion of company's operating margins due to increase in input prices is an example of a direct impact. On the contrary, if suppliers are exposed to changes in some market variables and, as a consequence, face difficulties, a company faces an indirect impact. (Lhabitant & Tinguely 2001, 346.) In the energy market, market risk is often referred to as price risk, and producers will typically face a loss when prices fall. In contrast, energy users are adversely affected when the prices rise. (James 2003, 2.) This commodity price risk is especially evident for airlines. If the price of oil soars, the cost for airlines also increases. Commodity price risk can also be very subtle in some unusual instances. A case in point is aluminium production in Iceland. The production of aluminium requires a lot of electricity as a primary input. However, the aluminium producers in Iceland enjoy electricity produced from the country's abundant geothermal energy sources. Thus, when the price of oil increases the costs for their competitors rise, while the input costs of Icelandic manufacturers remain unchanged resulting in competitive advantage. On the contrary, when the price of oil decreases and the cost for competitors decrease, the Icelandic aluminium producers lose the competitive advantage. (Smith, Smithson & Wilford 2003, 346.) Regardless of the industry or source of price risk, market risk by definition can be transferred in the market. (Lhabitant & Tinguely 2001, 346.)

Credit risk stems from the fact that counterparty may be unable to perform an obligation (Olson & Wu 2008, 18). There is a possibility that borrowers, bond issuers, or counterparties in derivatives transactions will default (Hull 2010, 289). In fact, most transactions involve some credit risk. They range from failing to pay an amount when due, defaulting on conventional loans, to trade credits and receivables being written off. (Lhabitant & Tinguely 2001, 346.) In the case of derivatives contracts, it is said that a hedge[2] is only as reliable as the credit worthiness of the counterparty. Especially in the energy industry, credit risk management has become a top priority due to the Enron disaster and the credit crunch. (James 2003, 2.)

Liquidity risk is related to the ease of converting an asset into cash amount equal to its current market value. (Lhabitant & Tinguely 2001, 347). In addition, a liquid position means that it can be converted into cash on short notice (Hull 2010, 385). The liquidity risk arises typically from insufficient market depth or if the market faces disruptions. What is more, the liquidity risk is particularly high in over-the-counter markets. (Lhabitant & Tinguely 2001, 347). Liquidity risks can be triggered by financial crises. If one has to liquidate an asset into cash, it then could lead to fire-sale of the asset. If the market for a given asset becomes illiquid, it translates into larger bid-offer spreads[3]. Therefore, liquidating the asset could lead to losses. Liquidity risk can also be related to the size of position. For example, in publicly listed large companies the liquidity risk is typically of no concern. Whether the position is 10 000 stocks or 100 stocks, it can easily be easily liquidated on short notice. However, a $100 million investment in non-investment grade company bond might be difficult to liquidate close to the market price in short time period. What is more, the bid and offer prices are also affected by the quantity in the transaction. Typically, the larger the quantity in a selling transaction, the higher the offer price. Similarly, the larger the quantity when buying, the lower the bid price. (Hull 2010, 385–387.) In energy derivatives contracts, the market can become illiquid due to political and military conflicts. For example, during the Gulf War there was such high market volatility that several banks and oil traders would not present bid or offer prices. As a result, companies exposed to the market could not always close out their positions or could only do so at a great discount. (James 2003, 3.)

---

[2] A contract or action aimed at reducing the risk profile of company’s future cashflows.
[3] Bid-offer spread is the price difference between the bid price at which an asset can be sold and the offer price at which the asset can be bought on the market. The better the liquidity the narrower the spread.

Companies that use derivatives instruments in price risk management are also exposed to a risk particular to the derivatives contracts – that is, basis risk. The basis is the difference between the spot price of the asset being hedged and the price of the derivatives contract being used. (Hull 2009, 51–52.) Therefore, if the price difference between the two prices (often different products) collapses or moves adversely, it could lead to a loss. In price risk management, it means that the price of the hedge (derivatives contract) may not move in sync with the underlying asset that is being hedged. Typically, the movements in the energy sector can be triggered by several factors such as poor weather conditions, political and military developments, or changes in regulation. (James 2003, 4–5.)

The basis risk is composed of locational basis and time basis. Locational basis emerges if a company uses a derivatives contract that is priced against exactly the same commodity but trades in a different geographical region. Consequently, the price in the two regions (the location of the physical commodity being used and the location where the derivatives contract is priced) may diverge due to local supply/demand factors, political tensions, or pipeline problems. For example, if a company consumes European gasoil and the derivatives contract used in hedging is Singapore gasoil, the locational basis risk emerges. (James 2003, 5.)

The time basis results when the physical consumption of the commodity takes place at another time than the hedge expires. The hedger may be uncertain as to when the exact physical transaction of the asset is taking place. It is also possible that hedger must close out the hedged position before the expiry of the contracts. (Hull 2009, 51.) For example, an electricity producer that expects higher natural gas prices (an input in energy production) in the summer time hedges its position by buying August contracts in natural gas. However, if heat waves arrive early in the summer, say in June, the price for natural gas would spike then, and could already be substantially lower in August. As a result, the contract would not provide sufficient protection due to time disparity. (James 2003, 5.) When there is more than one mismatch between the underlying in the hedging instrument and the physical consumption of commodity, a mixed basis risk arises. For example, if an airline uses a March Jet Kerosene swap to hedge January Gasoil Cargo consumption, both a time and product basis exposures emerge. (James 2003, 5.)

2.3 Hedging

At a general level risk management is the decisions and actions taken by a company to alter the risk profile of its future cash flows. An attempt to reduce risk through these actions is considered hedging, while increasing the exposures a company faces is considered speculation. Therefore, it is important to distinct between these two when considering risk management. However, one should note that hedging does not alter the risk itself but only transfers it to a counterparty willing to bear it. (Lhabitant & Tinguely 2003, 347.)

Companies can have different approaches towards risk. They can *ignore the risk*, which typically means not taking any measures in managing risks. However, this is not really a relevant option because the public, regulators, investors, and customers demand greater accountability from the companies, and the management is often held personally accountable for large losses. Then, companies can try to *limit risks*. In doing so, higher level of management can place limits on how much risk the lower levels of management are allowed to assume. The effectiveness of such measures, however, is dependent on how well both the higher and lower management can measure and monitor the exposures. In addition, companies can *diversify risks*, that is, take several uncorrelated risks. This is typically integrated, at least to some degree, in the operation of large firms that have several product and/or service lines. However, this is not the case with smaller firms that are far more specialised in their business operations. Lastly, companies can *manage risks*. However, managing risks does not necessarily mean that all the risks are transferred. Instead, a company may choose which risks the company sees as a part of its core operations, and which risks the company wishes to transfer to other parties using derivatives instruments. As there is not one optimal solution to risk management, managing risks is often company specific. Individual companies need therefore to consider alternatives that best suit their business objectives, general views of world, and obviously their budgets. (Lhabitant & Tinguely 2003, 347–349.)

At the core of risk management is the assessment of which risks a company should retain and which risks to mitigate by transferring the risk to outside parties. For example, historically oil and gas exploration and production companies did not hedge against the price fluctuation of oil and gas because they viewed that investors wanted to remain exposed to these risks. Management viewed that it was the main reason why they had invested in these sectors in the first place. More recently, however, these very companies have started to hedge against the commodity price risk because they view that their business is oil and gas exploration and production, not speculation in energy prices. Companies now view that they can operate more efficiently as they are not fully exposed to future commodity price fluctuations. (Keown et al. 2011, 651.)

Airlines, can try to mitigate fuel price risk using different approaches that are not mutually exclusive and can be used simultaneously. Airlines may improve fuel efficiency of their operations, try to pass fuel price increases on to customers either using fuel surcharges or fare increases, or hedge fuel price exposures using derivatives markets or physical commodity markets. (Morrell 2003, 188–190.)

Typically, airlines buy fuel at major airports around the world, and large multinational fuel companies or their subsidiaries supply it. The supplier companies are responsible for the storage and delivery of the jet fuel at the airport. Purchasing contracts with large oil companies typically include a clause that allow for adjusting the prices in accordance with world market price movements. Therefore, the fuel prices for airlines typically increase with little time lag with regards to crude oil price increases. Occasionally, airlines have co-operated and jointly purchased and stored fuel at some airports, in order to assure fuel supply at a reasonable price with better bargaining power. (Morrel 2003, 188–190.) However, these consortiums are not large in scale. In fact, they are not necessarily even airline alliance[4]-wide consortiums. (Holloway 2008, 288.) Moreover, airlines can try to pass price increases on to customers or introduce fuel surcharges, but these measures are more feasible on the cargo side of the industry. (Morrel 2003, 188–190.) Unlike any other airline before, the American-based Delta Air Lines took a novel and unconventional approach in managing fuel price risk and bought its own oil refinery to refine jet fuel from crude oil. According to the company, they especially aim at managing the crack spread (the spread between jet fuel and crude oil prices), or the refining margin, of jet fuel over crude oil. What is more, the airline highlighted that it seeks to benefit from sourcing potentially cheaper crude oil sources from the states of North and South Dakota. (CAPA 2012.)

In the short-term, increasing fuel efficiency relies on operating procedures such as flying at an optimal cruise speed, or using tankering policies. Tankering means that airlines tank up more fuel at a destination than would be the minimum required fuel level, taking into consideration the reserve fuel levels, if the cost of fuel is significantly lower there. Normally, for the short or medium haul flights, airlines need not to refill at the destination airport unless they tanker. Although, the extra fuel must be carried and it increases the fuel consumption as the weight of the plane increases, it might reduce the overall fuel bill. (Morrell 2003, 188–190.) Another potential operating procedure reducing fuel consumption and, therefore, fuel costs, is flying direct routing. Direct routing means flying straight from point A to B, where possible. For example, flying straight from Bangkok to Tokyo, instead of several waypoints, would reduce the route length by 20 nautical miles. This would result in 190 kilograms less fuel consumed on an average Airbus A330 wide-body aircraft (an aircraft with two passenger ailes) operating the route. On the same route, flying as little as 2000 feet below the optimum flight path altitude results in 600 kilograms more fuel consumed. Also, making sure that the cruising speed is optimal reduces fuel consumption. If the cruising speed on the

[4] Airline alliance is a group of airlines closely coopearating. They offer the whole route network of the alliance to customers wihtout having to fly to every destination themselves airline by airline. They also share the customer loyalty programs to benefit the travelers using the airlines in the alliance.

Airbus A330 is 0.01 Mach above the optimum, it will burn 800 kilograms more fuel on this 2500 nautical mile route. Lastly, making sure that only needed catering is carried on the plane, results in less fuel consumption as well. For example, on the Bangkok-Tokyo route, every 100 liters of unused drinking water causes a 15-kilogram increase in fuel consumption. (Weselby 2012.) The operating procedures, however, cannot be dramatically altered due to strict safety requirements, but small changes can add up to significant savings in total. (Morrel 2003, 188–190.)

Over the longer term, airlines can also replace the fleet using more fuel efficient aircrafts, but it can only take place gradually. However, once replaced, the more fuel efficient fleet has the same impact as financial hedging, as it reduces profit volatility resulting from fuel price swings. (Morrell 2003, 188–190.) Modern aircrafts are very fuel efficient when comparing to jet airliners of the past decades due to advances in technology. Since the introduction of the commercial jet airliner, the fuel consumption per seat has decreased by as much as 70% to date. The introduction of composite materials in aircrafts results in significantly lower fuel consumption. For example, the Airbus A350 has more than 50% of composite materials in it. When compared to similar wide-body aircraft Boeing 777, an aircraft with much less composite materials, the A350 burns 25% less fuel. (Weselby 2012.) Similarly, the American plane manufacturer Boeing has introduced its wide-body aircraft, b787 Dreamliner, with significant fuel efficiency gains. When compared to the Boeing 777, it burns about 20% less fuel. Also, composite materials play an essential role in the manufacturing process. The Dreamliner is 50% made out of composite materials, whereas the 777 has only 12% composite materials in it. (Boeing Program Fact Sheet 2014.)

Lastly, companies can manage financial risk by employing derivatives contracts. Commodity producers and users can transfer the commodity price risk to speculators that are willing to bear the risk. The commodity users typically take long positions[5] in the futures market, as they are short[6] the underlying commodity. For example, airlines typically engage in taking long positions in order to hedge against rising fuel prices. As airlines hedge against price fluctuations of future cash position in a commodity, they are considered hedgers. The counterparties, that have no physical requirements for the commodity, are the speculators. They, however, facilitate the risk transformation and are in fact the largest participants in the market. Without the speculators that seek to profit from falling and rising prices, there would not be sufficient liquidity in the market. (Fabozzi, Fuss & Kaiser 2008, 5–6.) There are several derivatives instruments

[5] By having a long hedge in derivatives, a company mitigates the impact of a price increase of an input. Therefore, it can be considered as an input hedge.

[6] In physical markets, a short position means that a company uses the physical commodity as an input and is adversely affected should the price of the input increase. Note that in derivatives a short hedge is typically used to mitigate price decrease of an output.

that airlines, and other companies for that matter, can use in hedging activities. They include forward contracts, futures contracts, options, and swaps. What is more, airlines can use combinations of derivatives instruments and construct different hedging structures. These will be covered in more detail in the following chapters. Hedging requires capital, for example, in the form of initial margins and margin calls. Therefore, most young passenger airlines do not engage in financial hedging at first because they use their credit to finance their potentially high growth rates. (Morrell 2007, 190–191.)

2.4 Finance Theory and Risk Management

According to the capital asset pricing model (CAPM), investors are only interested in beta, which represents the market risk, and not the idiosyncratic risk, which is a company-specific risk. This is because, unlike the idiosyncratic risk, the market risk cannot be diversified away. (Welch 2014, 221.) CAPM implies that investors diversify away the company specific risk by investing in a diversified portfolio and are only willing to pay for reduction in the non-diversifiable market risk (Morrell & Swan 2006, 715). If a company hedges against a company-specific exposure, investors with diversified portfolios will not appreciate this if the hedging incurs additional expenses for the company. The rationale behind this is that the company specific risk has very little significance in the overall portfolio risk and its value. (Fite & Pfleiderer 1995, 142.) What is more, some managers choose not to hedge because they believe financial manipulation is not within the firm’s expertise and investor should do it instead. The argument goes that companies are in the business of producing goods and services, not to speculate in the financial markets. Similarly, many managers believe that the cost of hedging systematically exceeds the potential benefits. (Lhabitant & Tinguely 2001.) However, in the case of state-owned airlines hedging can be justified. A state is not typically a portfolio investor. Therefore, the portfolio of the state is not highly diversified among different companies and different sectors. The better the diversification of the portfolio, the less risk remains in the overall portfolio. Consequently, the risk is not diversified away in the overall state portfolio. As a result, hedging against fuel price risk may be justified in the special case of state ownership. (Morrel 2007, 192–193.)

It is not obvious however, that eliminating market risk will have an impact on a company’s value or that the company will gain from it. Unexpected oil price shocks are an example of a pervasive risk that has an impact on several companies. However, oil price shocks affect different companies in different ways. Typically oil price increases benefit oil producing companies and their earnings increase as a result. On the contrary, airlines’ earnings will decrease as a result. Therefore, an investor with a diversified portfolio is at least partly hedged against this market risk if he/she holds both the oil companies' and airlines' shares. If airlines have a long position in oil futures contracts obtained from oil companies (as they typically do), and oil companies a corresponding short position (hedge against falling prices), the exposure of an investor holding both the airlines' and oil companies' stocks remains unchanged. (Fite & Pfleiderer 1995, 142–143.)

In their famous study, Modigliani and Miller (1958) conclude that a company's financing decisions concerning debt and equity are irrelevant under perfect market conditions. This can be extended to the company's risk hedging policy as well. Similar to the company's financing decisions, investors can hedge on their own using the same derivatives instruments or undo the company's hedging decisions by taking the exact opposite position. However, Lhabitant and Thinguely (2001) point out that due to market imperfections, such as transaction costs, companies should execute the hedging instead of the individual investors. For example, the scale of the derivatives trading conducted by companies provides them with lower transaction costs when compared to individual investors. What is more, hedging against fuel price risk is beneficial for airlines when near bankruptcy, even under the efficient market conditions (Morrell & Swan 2006). According to Pulvino (1998), airlines with financial constraints and low spare debt capacity are often forced to liquidate their assets when the overall industry faces difficulties. The study found that financially weak airlines received an average discount of 14% in distressed asset sales when compared to the average market prices of aircrafts. Morrell and Swan (2006) suggest that this could incur additional losses to financially distressed airlines.

Financial distress and bankruptcy cause other direct costs as the need for legal, auditing, and other expert services increase. However, the associated indirect financial distress costs are claimed to be even more substantial. These include diverting the top management's attention from managing the daily business of the company, the unwillingness of suppliers to engage in longer-term contracts, and the customers being more reluctant to buy the company's products or services. (Fite & Pfleiderer 1995, 154.) For airlines, financial distress incurs additional costs because they might have to engage in fire sale of their assets in order to remain as a going-concern. In this kind of operational environment, it is justifiable to hedge against fuel price risk since it may result in avoiding bankruptcy in case of sudden increase in the price of jet fuel. (Morrell & Swan 2006.) Reducing the earnings volatility by hedging can lower the probability of the financial distress and the related costs (Lhabitant & Thinguely 2001). However, it is in these very instances that the distressed airlines do not have the resources needed to acquire derivatives contracts for hedging because of the required cash margins. The cash margins ensure that the airline can honour the contract even if it becomes unprofitable for the airline. (Morrell & Swan 2006.)

According to Morrell and Swan (2006), the expected value of a commodity price hedge is zero. If airlines are making profits with fuel hedging and are expect to do so in the future, they should have a separate proprietary desk for hedging because they no longer are hedging but rather speculating. In reality, positions between sellers and buyers of the derivatives instruments in oil are evenly balanced between the two groups. Therefore, it is a zero-sum game and while one party gains from a contract, the other party faces the exact opposite loss. In addition, the markets are deep and liquid meaning that there is a lot of participants including professional traders, commodity suppliers, and significant portfolio investors. Airlines' hedges, on the contrary, are rather insignificant in proportion to the overall market volume. Consequently, airlines' transactions have no impact on the market prices, which represent a well-examined consensus. However, the idea that airlines profit only by chance and should expect zero profits over the long term, does not imply that hedging is not justified. Airlines hedge in order to reduce volatility in expenditures and profits; to keep profits closer to an average.

There is indeed evidence that managing fuel price risk can reduce the income volatility of an airline. Rao (1999) studied the impact of fuel price hedging on an airline's quarterly income using an average airline that was based on the ten largest US carriers' quarterly income, cost and revenue data. Heating oil futures contracts where used as the hedging instrument for quarterly fuel consumption. The results exhibited a more than 23% reduction in quarterly pre-tax income volatility. The results are in line with Morrell & Swan's (2006) reasoning of reducing the income volatility instead of aiming at long-term profits. Rao (1999), much like Morrel & Swan (2006), also notes that while there is a potential to offset fuel price increase and the results in current period earnings, the objective of hedging is very much to reduce the earnings volatility over time instead of the current period.

2.5 Price Risk Management and Company Valuation

A wide body of literature concerning risk management has been focused on the relation between hedging various risks and their effect on firm value. Here we introduce the relevant literature and its results.

In their study, Smith and Stulz (1985) developed a positive theory of hedging and firm value maximisation. They found that hedging increases firm valuation if a company faces a convex tax function, that is, the marginal tax rate does not increase linearly with regards to pre-tax firm value but rather is zero up until a certain pre-tax income level and from there on increases as a convex function. For example, if a company's pre-tax value increased by a given procentage, the corporate tax bill would not increase linearly but less up until a point where the increase would be similar. Similarly, the post-tax firm value is a concave function of the pre-tax income, meaning that increasing the pre-tax value would increase the post-tax valuation more, but the post-tax value increase would diminish at a certain pre-tax valuation and the increased tax liability would undo the increased pre-tax value. Therefore, as long as the cost of hedging does not exceed the increase in post-tax firm value, the post-tax valuation increases more than the corporate tax liability. In addition, firms can benefit from hedging since it can reduce the expected bankruptcy costs, even though the hedging might be costly. Similarly, Froot, Scharfstein, and Stein (1993) studied rationales behind corporate financial hedging and concluded that hedging can significantly reduce the costs of external funding and, thus, alleviate underinvestment problem and therefore increase firm value.

The hedging of specific risks and their impact on firm valuation has also been studied in various papers. Allayannis and Weston (2001) examined the effect of foreign exchange hedging and the relative firm valuation using the Tobin’s Q. Tobin’s Q is derived by dividing the market value of the company’s assets by the replacement cost of the assets in place. Firm’s that earn negative excess returns and aren’t utilizing their assets efficiently have a value of less than 1.0. On the contrary, companies that employ their assets efficiently are typically trading at Tobin’s Q of over 1.0. (Damodaran 2012, 538.) The results by Allayanis and Weston (2001) showed that foreign exchange hedging increased firm valuation as measured by Tobin’s Q. They interpret the results as hedging the foreign currency risk is positively related to firm value and it increases the relative valuation of the company. Likewise, Peréz-González and Yun (2014) studied the effects of hedging with weather derivatives contracts for gas and electric utilities companies. They found that companies that started employing weather derivatives contracts saw at least a 6% increase in market-to-book ratios. In addition, they discovered that hedging led to more aggressive financing policies and higher investment levels. This is in line with the Froot, Scharfstein, and Stein (1993) and their alleviation of underinvestment problem. However, Jin and Jorion (2004) studied the hedging activities of U.S. oil and gas producers against gas and oil price risk. They came up with contradicting results and concluded that there is no clear evidence that hedging gas and oil price risk affects firm valuation as measured by Tobin’s Q. They question if the positive firm value found in other studies is solely due to financial hedging or could it be the total impact of hedging activities, including operational hedging as well.

There is evidence that fuel hedging makes economic sense to airlines. Carter, Rogers, and Simkins (2002) studied the effect of jet fuel hedging on firm value among 26 U.S. airlines. As measured by Tobin’s Q, they found a hedging premium of 14.94–16.08% for the airlines that engage in jet fuel hedging. In addition, they reported that initiating a jet fuel hedging program increased firm valuation by 12.55–13.68% when compared to non-hedgers. They argued that the hedging premium was due to the fact that during high jet fuel prices the airline industry has low cash flows and investment possibilities are positively related to high jet fuel prices. Therefore, hedging fuel price risk protects cash flows during high jet fuel price periods, and enables the airlines to buy assets from distressed airlines at a discount. Again, the interpretation is in line with Froot, Scharfstein, and Stein (1993) where they concluded that hedging might alleviate the underinvestment problem. However, in a revised study on jet fuel hedging and firm valuation, Carter, Roger and Simkins (2006) found a hedging premium that was less than in the original paper. The hedging premium in the revised study was between 5–10%.

Cobbs and Wolf (2004) studied the relationship between the level of hedging and firm valuation among U.S. airlines. They concluded that the more of the upcoming fuel consumption was hedged the higher the company's valuation. In addition, they found that the companies employing a systematic fuel price risk management program paid the average market price or less for jet fuel, whereas the companies not systematically hedging fuel price risk paid the average market spot price or more for the fuel.

2.6 Commodity Price Risk and Exposure

Most of the previous literature has focused on hedging and firm valuation. However, commodity price risks and related exposures are less studied. Even tough, they have the benefit of allowing the researchers to analyse the direct impact of a given exposure to company's stock returns instead of having to deal with indirect measures such as the Tobin's Q.

In a large study on commodity price exposures on non-financial firms, Bartram (2005) studied the effect of various commodity price exposures to different non-financial industries. In the study including 490 nonfinancial firms, he found that the commodity price exposures were significant for the sample firms. However, the fraction of companies with statistically significant firm exposure was similar to interest rate exposures found in other studies. Despite the fact that the commodity prices exhibit higher volatility than interest rates, Bartram suggests that, on one hand, the commodity price exposures might have little impact on the overall cash flows for some companies. On the other hand, the companies are somewhat successful in hedging the commodity price risks.

Among the airline industry there is only few papers studying the direct exposure to jet fuel price risks. Carter, Rogers, Simkins, and Treanor (2014) studied the extent of jet fuel price risk exposure to publicly traded U.S. airlines. They found that the exposure coefficients are larger when jet fuel prices are high or on the rise. With similar approach, Berghöfer and Lucey (2014) studied the jet fuel price exposure between the U.S, European, and Asian carriers. They found the Asian carriers to be more exposed than European airlines but less than their American counterparts. In addition, the differences between the regional exposures were statistically significant. Similarly, Carter, Rogers, Simkins, and Treanor (2014) found that the jet fuel exposure was of statistical significance for all the continents' airlines.

In addition to United States, Asia, and Europe, Loudon (2004) studied the financial risk exposures in New Zealand and Australia. In the paper, Loudon investigated and compared the Australian flagship carrier, Qantas, and the New Zealand's national carrier Air New Zealand. The results were ambiguous. With regards to fuel price risk the results varied between the companies and different time-horizons. For Qantas, the fuel price exposures were all negative, and more significant over the longest periods of 52 and 156-week time-horizons. However, there were differences among the two carriers. Surprisingly, the Air New Zealand had a positive jet fuel price risk coefficient for the time horizons of 4, 13, and 52 weeks, with the 52-week time-horizon being statistically significant. The sample period was from 1996 to 2003.

3 PRICE OF OIL AND JET FUEL

3.1 Oil Price Development During the 2000s

The price of crude oil has been quite volatile in the 21st century. In addition, the overall price level has increased quite significantly. Figure 1 displays the monthly spot prices per barrel of the Brent crude oil, jet kerosene (Cargoes CIF[7] Northwest Europe), and the difference between the two known as the crack spread or, alternatively, refining margin. The data is collected from Thomson-Reuters Datastream database.

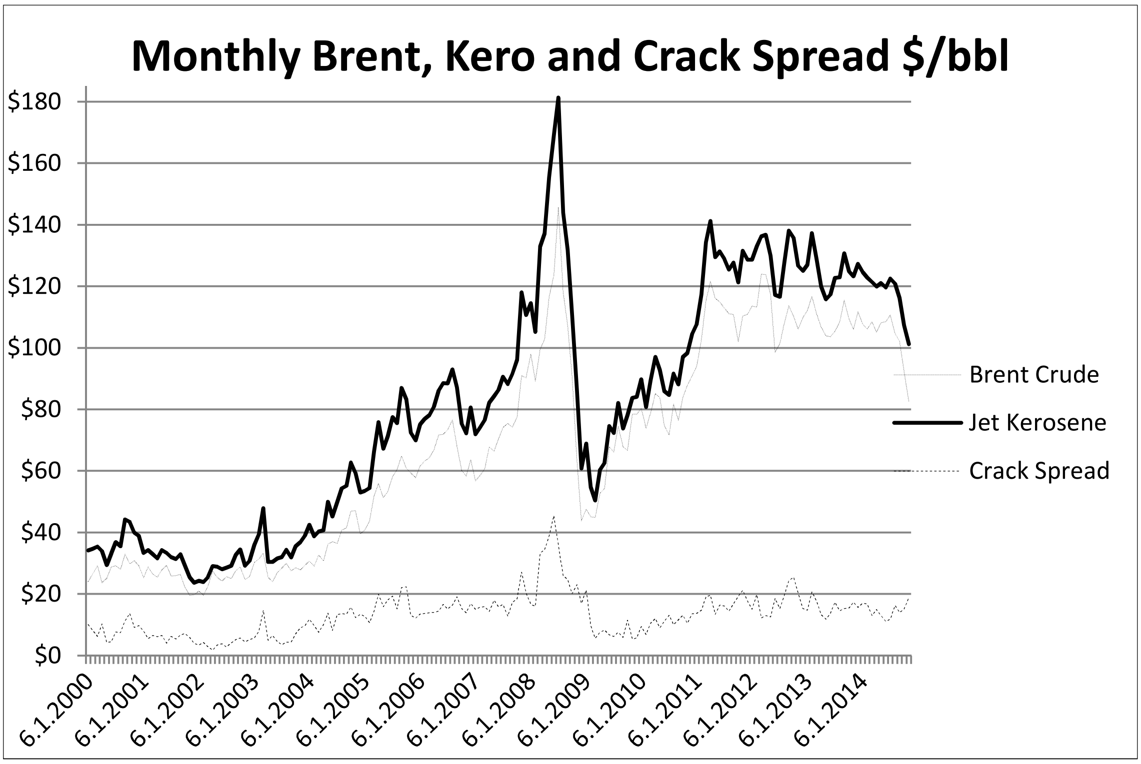


Figure 1 Price of Brent crude, jet kerosene, and crack spread

It can be seen from the Figure 1 that the price of crude oil has been mostly on the increase since the beginning of the 2000s. In January 2000, Brent crude traded at USD24.09 per barrel and from there on it mostly kept rising, until peaking at USD145.65 in July 2008. However, the Global Financial Crisis caused the price of crude oil to fall sharply down to USD43.84 in only five months. The price rebounded quite quickly to about USD120 per barrel and has been trading at more than USD100 for the last few years.

[7] In the Incoterms of International Chamber of Commerce CIF stands for cost, insurance, and freight.

Jet fuel is refined from crude oil and thus exhibits high correlation with the price of crude oil, as can be observed from the Figure 1. However, the crack spread, which represents the refining margin over the price of crude oil, does not seem to remain constant over the time period. In January 2001, the crack spread stood at USD10 per barrel but has varied over time. Two observations concerning the crack spread can be made from the Figure 1. First, the refining margin was lower when the crude traded at lower prices during the first five years. In addition, the refining margin has been higher during last few years when oil has been trading at USD100 or more. Secondly, the refining margin tends to widen during higher volatility of crude oil prices. Morrell (2008) argues that the refining margin tends to widen during eras of military conflict when the need for jet fuel by the military sharply increases. This has been the case in the beginning of the 1970s, 1980s, and the 2000s.

3.2 Price Formation of Oil

Jet fuel is refined from crude oil and, therefore, the development of crude oil price influences the jet fuel prices significantly. In order to better understand the volatile nature of jet kerosene prices, it is important to study the price formation of crude oil.

The crude oil market is the largest commodity market in the world with production valued at USD2.7 trillion in 2012. Since crude oil has high yield in energy production in relation to low production costs, it is the most significant source of fuel for transportation and other industrial applications. (Valiante 2013, 74.) All crude oil varieties are priced against benchmark crudes, the most important of which are the West Texas Intermediate (WTI), ICE Brent, and DME Oman – the newest of the benchmarks. ICE and DME are also major oil exchanges. The function of these benchmark crudes is to facilitate the price discovery between the global marginal demand and supply. Although the crude oil price should stand at a level where the marginal cost of production is equal to marginal utility from the consumption, the crude oil price tends to trade at a level above the lowest marginal cost of production. For example, the marginal cost of producing WTI from the Gulf States' fields could be as low as USD6.00 per barrel. Instead, the price of crude oil tends to reflect approximately its value in use, and not its marginal cost of production. This is due to the fact that consumers compete over crude oil supply at unprecedented levels, which pushes the oil demand schedule outwards. The demand from developing countries, especially China, has significantly contributed to this phenomenon. (Garis 2009, 421–422.)

Futures markets play a significant role in deriving the crude oil spot market prices. The futures market represents the expected future price of oil that serves as a proxy for pricing the commodity in the present. In the futures markets, hedgers try mitigate their price risk while their counterparties, the speculators, assume the price risk in order to make a potential profit from bearing the risk. Consequently, the futures market can be seen as a market for insurance against price risk. To shed light on the scale of the crude oil futures market, the daily volume of futures contracts is 20-fold when compared to the physical commodity. In fact, the crude oil futures market is the largest commodity futures market in terms of volume. However, this does not risk the sufficient availability of the actual crude oil because most of the contracts are closed before the delivery by taking the exact opposite position, resulting in a net zero position in the physical market. (Garis 2009, 422–424.)

Despite the futures market, the pricing of commodities fundamentally has demand and supply factors behind them. As the global economy grows, it increases the demand for crude oil, which translates into increasing oil prices. Currently, increasing demand in emerging economies is one of the most significant demand drives for crude oil as well as other commodities. The demand growth especially in China has been of significant importance over the last 10–15 years. (Valiante 2013, 282–284.) Similarly, according to the International Energy Association (IEA) (2011), the growth in oil demand will remain the highest in Asia where the GDP growth outpaces the rest of the world. Consequently, IEA forecasts that the region will account for 75% of the increase in the global oil demand. For example, the sudden increase in oil demand from China and India in the beginning of the 2000s lowered the global oil reserves. This was a typical demand shock that caused both the oil price and the volatility to increase. (Guo & Kliesen 2005, 674.)

The oil industry, including the production, distribution, and refining, is a cyclical industry as a whole. On one hand, when crude oil is trading at low levels, producers have very little incentive to invest and expand the infrastructure. On the other hand, when oil is trading at a high price, and the industry is investing, expansion projects take about five years to be completed, which cause further price increases. Therefore, there is typically too little production capacity to meet the global demand, when the prices are at reasonable or low levels, or too much production capacity to keep the prices at levels that allows the expansion investments to remain profitable once they have been completed. The cause of the imbalance is that over time the demand function of crude oil is a continuously increasing function whereas the supply is non-continuous with discrete increases. (Garis 2009, 437.) As a result, the short-term supply schedule of crude oil can be very steep depending on the existing reserves available to market and production capacity limitations (Barsky & Kilian 2004, 131).

In addition to production capacity, supply shocks can cause price spikes as well. These could be a result of wars, production limitations, and political decisions (Morrell & Swan 2006, 725). For example, in both March 1997 and March 1998, OPEC decided to cut production in order to put a halt to falling oil prices (Fattouh 2007, 1). The falling oil prices were a result of the financial crisis in Asia and the related negative demand shock. Similarly, the Gulf War caused oil prices to soar in the early 1990s. (Barsky & Kilian 2004, 127–131.)

While the fundamental demand and supply drivers form the basis for oil price formation over the long-term, the psychological aspects behind the market cannot be overlooked. In fact, the psychological aspects dominate the price formation in certain instances. For example, the daily oil balance and the views on the volume of surplus capacity that could supply the market if needed influence the regime of price discovery. When there is consensus that there is sufficient surplus capacity in case of any unexpected events, the demand and supply fundamentals dominate. However, if the available surplus production capacity falls below some trigger level, the pricing based on supply and demand no longer form the basis for price formation. Instead, fear and greed take over, and the psychological factors dominate the price behaviour in crude markets. In 2007, this psychological trigger level for available surplus production capacity was estimated to be 2 million barrels per day. (Garis 2009, 420–430.)

The market participants in the crude oil futures markets include both hedgers and speculators. The hedgers are typically companies that use crude oil or refined oil products as an input or companies selling the product – for example, refineries or oil distributors. Speculators, on the other hand, do not have any concrete need for crude oil. Instead, they try to gain from oil price movements and are therefore willing to bear the risk. The speculators include hedge funds that employ leverage in order to even further gain exposure to the oil price movements. The actual oil futures transactions are executed via traders who work at commodity exchanges. In addition to taking in orders, the traders can also act as source of information for the market participants concerning the potential future market developments. (Garis 2009, 420–425.)

In spot markets, future expectations play a significant role in price formation. Even if the ex-ante expectations are solely based on one’s own perceptions of other market participants’ response to an exogenous event. When the market participants strongly view that a certain event will have certain consequences on the market, they will act based on this view. Therefore, the resulting market effects are a consequence of the market participants’ own actions based on their ex-ante perceptions, instead of the market effects being a result of the actual event even occurring. For example, if there are news headlines that the Northeast in the U.S. and Europe, both of which are major heating oil consumers, are expected to face an unusually cold winter, the market participants expect the price of crude oil to increase in these markets as a result of related demand. In fact, the price oil will likely increase even though there is enough surplus capacity to meet the weather-related demand increase because the market participants expect the demand to increase during the winter ex-ante. The traders buy the oil immediately after the news before its price soars because they assume they will have to pay more for it later on. Consequently, even if there was enough surplus oil supply, the resulting oil price increase is a result of market participants' own buying behaviour instead of the actual increase in the demand for the heating oil resulting from an exceptionally cold winter. (Garis 2009, 426–427.)

The tendency of the market to a one-sided view on either upward or downward markets exacerbates the phenomenon known as the fallacy of composition in economics. According to the phenomenon, individuals that react rationally in response to market signals cause instability in the market because all the rational market participants react similarly to these market signals. For example, if OPEC announces that the oil market is sufficiently supplied at current production levels, it is rational behaviour to buy crude oil before the price appreciates. As a result the markets face abnormal returns. The price increase is steeper and it levels off at a higher level because everyone acted similarly in response to the OPEC's announcement. (Garis 2009, 433.)

Commodity markets are highly volatile due to substantial use of leverage, especially among speculators, and their relatively short time horizon. This also translates into very high sensitivity to news. (Garis 2009, 431.) For example, the ten largest 12-month oil futures' price changes between the April 1983 and December 2004 took place on the very days when the Wall Street Journal reported about exogenous shocks. The largest daily price changes were in response to news concerning the political instability in the Middle East and OPECs production decisions. (Guo & Kliesen 2009, 674.) In fact, it has been estimated that the political instability in the Middle East contributed a risk premium of USD18–24 for crude oil in 2006 and 2007 (Garis 2009, 422).

3.3 Unconventional and Alternative Energy Sources

While conventional crude oil is widely used as a main source for refined petroleum products, there are also other products that may play an increasing role in the future. These include shale oil and other alternative energy sources. Amid high fuel prices during the past few years, technological advances and entrepreneurial take have resulted in the introduction of hydraulic fracturing, or "fracking", that facilitates the utilisation of shale oil (Gaston 2014).

Oil shale is fine-grained sedimentary rock that yields substantial amounts of oil and combustible gas during destructive distillation. Whether shale oil deposits can be developed and are viable depends on several factors. First, there is the location of a shale oil reservoir. The geological location of the source greatly dictates if a deposit can be recovered. For example, shale oil can be found from populated areas, parks, or wildlife refuges that cannot be entered. However, technological advances may allow fracking from locations that have been previously unobtainable. Second, the physical and chemical characteristics of the resource are of primary importance in determining the viability of shale oil production from particular location. There is a lot of variation in the organic content and oil yield of shale oil. The yield can range from 100 to 200 litres per metric ton of rock. Consequently, U.S. Geological Survey has adapted a lower limit of approximately 40 litres per metric ton of rock for oil-shale land classification. Ultimately, the availability and price of conventional petroleum dictates if oil-shale production and industry are economically viable over the longer term. At current, only few discovered deposits could be mined and processed to oil shale as an economically competing alternative to traditional petroleum. Still, some countries that have vast shale oil resources but lack petroleum reserves deem it as expedient to invest in and develop the oil-shale industry. What is more, the supply of conventional petroleum is likely to diminish in the future, and, therefore, its price will likely increase. As a result, the shale oil has the potential to become of much greater importance as a production source of electricity, fuel, and other industrial products including petrochemicals. (Dyni 2009, 77–80.)

While fossil fuels are currently major sources of fuel in aviation and other transportation industries, there have been experimentations using alternative fuels as well. According to IATA (2014) 21 airlines had used alternative fuels for a commercial flight. In fact, it was only six years ago that such a scenario was considered purely hypothetical. When considering alternative fuels for jet kerosene, there had not been approved alternatives until the ASTM approved to produce alternative HEFA fuels, that is, fuels made by hydro processing vegetable oils and animal fats. What is more, the commercial availability of biofuels is still very limited and, there is no routine production of alternative jet fuel. However, there are now signals that there would be regular production of alternative jet fuel in the near future. Even though, the technology for producing alternative fuels already exists, it is the economics and regulatory policies that dictate the feasibility of bio jet fuels. As airlines operate in a highly competitive and low-margin industry, it can be expected that biofuels do not overtake conventional fossil fuels unless they are cost-competitive with the conventional jet kerosene. The competiveness, on short term, could stem from policies that give incentives to produce and use alternative jet fuels. (IATA Report on Alternative Fuels 2014).

In order for alternative biofuels to be viable in replacing the conventional jet fuel in large scale, there are several requirements that must be met. First, the alternative bio fuels should be both sustainable and have a smaller carbon footprint when taking into consideration other factors, such as production, as well. Second, it is required that alternative jet fuels can be mixed with conventional jet fuel and do not require the modification or adaptation of aircraft or engines. In addition, it should be possible to distribute the alternative jet fuels using the same supply infrastructure as the conventional jet fuel. Third, the alternative jet fuels should have similar specifications than the conventional jet fuel in order to be sustainable in use. Especially, the resistance to cold should meet the -40°C of Jet A and the -47°C of Jet A-1 standards. What is more, the energy density should be at least the 42.8 megajoules per kilogram, that of the conventional jet fuel. Obviously, should the energy content be significantly lower, the aircrafts could not fly sufficient distances with the same volume of fuel. Consequently, automotive bioethanol and biodiesel are not feasible alternatives. Fourth, the alternative fuels should meet the sustainability criteria. These include reducing the lifecycle carbon emissions, meeting the limited fresh water requirements, not contributing to deforestation, and not competing with food production. Such alternative sources of biomass that could meet the criteria include camelina crops, switch grass, used cooking oils, municipal waste, and algae. Lastly, the main challenges behind large-scale adaptation of biofuels are commercial and political, not so much technical. Currently, bio fuels are significantly more expensive than conventional kerosene. In addition, investment in the production infrastructure is low. Therefore, carefully assessed policies are needed to increase the investment in the production and development of bio jet fuels. (IATA Fact Sheet: Alternative Fuels 2014.)

4 MANAGING FUEL PRICE RISK USING DERIVATIVES INSTRUMENTS

How airlines can employ derivatives contracts in fuel price risk management is introduced in this section. Furthermore, how these instruments can mitigate the fuel price exposure is explained and further elaborated with examples. The instruments discussed here include swap, forward, futures, and option contracts.

4.1 Swaps

A swap contract is an agreement in which two parties agree to exchange specified cash flows at predetermined intervals in the future (Smith et al. 2003, 354). The term swap stems from the nature of the contract itself. Two counterparts entering into the contract, that is the buyer and the seller (long and short position), exchange a fixed price at present to an unknown floating price in the future. Swap contracts are in legal terms purely financial contracts that never go to physical delivery of the underlying asset or commodity. Only the cash flows are exchanged. Therefore, swap contracts allow companies to take advantage of price movements in the underlying asset that the swap price is linked to. In a swap agreement, contract parties must agree on the fixed price of the underlying and the reference price to which the floating price is linked to. What is more, the start and end date must be decided, so as to have a date when the contract becomes effective and when it terminates. Likewise, pricing period must also be agreed on, that is, how often the difference between the fixed and the floating price is calculated. Lastly, a payment due date is also in the swap contract terms. In commodity markets, over-the-counter[8] derivatives typically price out on a monthly basis, so even if the price difference is calculated on quarterly basis, one third of the contract volume will be settled after each month. (James 2003, 15–16.)

Swap contracts are typically tailor-made contracts that airlines can have, for instance, with jet fuel suppliers. For example, an airline can enter into a swap contract that is effective for a calendar year. The contract would ensure a fixed-price monthly delivery of a specified quantity of jet fuel for the airline. Over the effective time period, the realized reference prices are compared to the predetermined fixed swap price. If the realized reference price is higher than the fixed price, the fuel supplier pays the difference between the fixed and floating price multiplied by the quantity of monthly fuel delivery. (Morrell & Swan 2006, 716.) Consequently, only the difference between

[8] Over-the-counter instruments are not publicliy listed instruments. Instead, they are tailormade agreements between the contract parties.

the fixed and floating price is exchanged instead of the notional principal of the contract (James 2003, 17).

There are several types of swaps contracts available for market participants in the energy markets. The most basic type of swap contract is the *plain vanilla*. In a plain vanilla swap contract, a floating price of an underlying asset is exchanged to a fixed price in the future or vice versa. It is a monthly swap, so the floating price is calculated as a monthly average and is then compared to the fixed price. Next, there are *differential swaps*. A differential swap is much like a plain vanilla swap, but instead of a fixed price being compared to a floating reference price, it is based on a price difference between two underlying assets. Therefore, it allows for exchanging a floating price difference, or spread, to a fixed difference. For example, the refining margin of jet fuel over crude oil could be hedged using a differential swap. In fact, the most popular differential swap contract in the oil sector is the Jet Kero versus Gasoil, also known as the regrade swap. Then, there are *participation swaps* that are otherwise similar to plain vanilla swaps, but the participation in the unfavourable price difference is not 100%. For example, if a counterpart buys a fixed price, and the reference is lower, the counterpart only pays an agreed percentage of the difference between the fixed and the floating reference price. Similarly, a participant selling a fixed price in exchange for floating price does not pay 100% if the fixed price is lower than the floating reference price. What is more, the lower the participation rate, the lower the fixed price quoted for participation swap for a seller of fixed price. On the contrary, the lower the participation rate, the higher the fixed price for seller of floating price when compared to a normal plain vanilla swap. (James 2003, 16–18.)

Figure 2 illustrates how an airline can use a fixed-price swap contract to hedge against fuel price fluctuations.

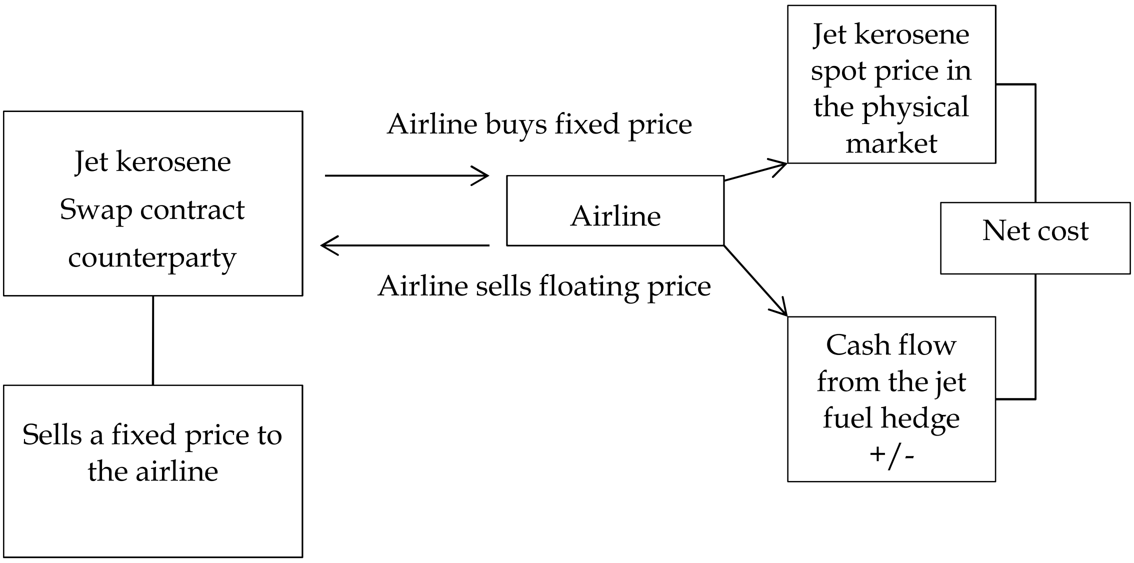


Figure 2 A fixed price swap contract for hedging jet fuel exposure (James 2003, 178)

In figure 2, the airline enters into swap contract and swaps the floating price to a fixed price. The counterparty, on the other hand, agrees to receive fixed price instead of floating price. For example, the airline buys a fixed price for a monthly jet fuel delivery of 50 000 barrels. The contract is effective for a calendar year. The counterparty in the swap agreement can be an investment bank, for example, that agrees to receive a fixed price in exchange for floating price. The reference price used in the contract is Jet Cargoes CIF NWE (cost insurance and freight, North West Europe) price index. The reference price, to which the fixed price is compared to, is calculated monthly as the arithmetic mean of daily spot price quotations from the Platts price information service that provides energy industry information and bench mark prices for commodities. (see Schofield 2007, 146.)

Over the course of the effective contract period the monthly average price is calculated for the floating reference price and compared to the fixed price. If the fixed price is, for instance, USD40 per barrel of jet kerosene, and the average price for the floating Jet Cargoes CIF NWE delivery is more than USD40, the counterparty pays the airline the difference multiplied by the contract volume, which was 50 000 barrels in the example. On the contrary, the airline pays the difference multiplied by the contract volume if the fixed price is higher than the monthly average price for the reference jet fuel. Therefore, the net cost for jet fuel for the airline is *the jet kerosene spot market price* ± *cash flow from the hedge*. (see Schofield 2007, 146 and James 2003, 178–190.)

Table 1 provides monthly cash flows of the USD40 fixed price jet kerosene swap contract from the airline’s point of view. In addition, the total cash flow impact is presented in the table to highlight the net effect of the hedge on fuel price. Note that the monthly average prices for Jet Cargoes CIF NEW are fictional and for illustrative purposes only.

Table 1 Monthly cash flow settlements of the jet kerosene swap contract

2010	Volume	Fixed Price $	Monthly Reference $	Monthly Settlement $
Jan	50 000	40	38	-100000
Feb	50 000	40	39	-50000
Mar	50 000	40	42	100000
May	50 000	40	43	150000
Jun	50 000	40	41	50000
Jul	50 000	40	40	0
Aug	50 000	40	39	-50000
Sep	50 000	40	39	-50000
Oct	50 000	40	42	100000
Nov	50 000	40	41	50000
Dec	50 000	40	40	0
Total	**550 000**	**barrels**	**$**	**200000**

From table 1 we can observe that the monthly settlement varies depending only on the monthly floating reference price. In January the monthly average price is USD38, and the fixed price the airline bought stands at USD40. Therefore, the airline pays the difference USD2 multiplied by the contract volume to the counterparty in addition to physical spot market price. For example, in January the net cash flow from the hedge for the airline is as follows: $USD(38-40)\ per\ barrel * 50\,000\ barrels = -USD100\,000$ so the airline pays the counterparty USD100 000. On the contrary, the airline receives $USD(42-40)\ per\ barrel * 50\,000\ barrels = USD100\,000$ in October from the hedge. This, in turn, is paid by the counterparty. The total effect of the swap contract for the airline's cash flows is positive by USD200 000 over the course of the hedge.

In the commodities market, it is of common practice to derive the price of jet fuel from the price of gasoil or heating oil. This due to fact that both distilled products are refined from crude oil and have similar product characteristics. Typically, the price of jet kerosene is the price of gasoil or heating oil with a premium on top because the product quality requirements are stricter for jet fuel than heating oil or gasoil. Airlines, however, can hedge themselves against the divergence of the two prices using the differential swap contract. The differential swap fixes the jet fuel premium over the heating oil, and the fixed price is then compared to the floating price difference between the two products. (Schofield 2007, 146–147.)

4.2 Futures

A futures contract is a commitment to buy or sell an asset in the future at a predetermined price. Futures are standardized contracts that are traded on exchanges such as Chicago Mercantile Exchange (CME) and Intercontinental Exchange (ICE). A counterpart agreeing to buy an asset in the future at a predetermined price has a long position. On the contrary, a counterpart committing to selling an asset in the future at a specified price has a short position. The agreed price is the current futures price of the underlying asset for future delivery at a given date. (Hull 2009, 6, 21–22.)

In a standardized energy futures contract, the follow details are specified (James 2003, 34–35):

- *Underlying asset*: the energy commodity or price index to which the contract is based on
- *Contract size*: the volume of the underlying in one futures contract
- *Delivery cycle*: the months for which the contract can be traded
- *Expiration date*: the date on which the trading month of the contract in question will cease to exist and all the related obligations will terminate
- *Grade or quality specification of the underlying and the delivery location*: a detailed description of the energy commodity or other underlying in question including higher or lower quality and its alternate delivery locations available at a premium or discount
- *Settlement*: the terms for physical delivery or cash settlement of the futures contract (typically the unit price is the only non-standard feature of a futures contract)

There are also other predetermined limits on several futures contracts. Many contracts have price limits on the daily price movements. Should a futures contract price decrease from the previous trading day by an amount equal to the daily price limit, the contract would be limit down. Likewise, should the contract's price soar by the amount of daily price limit, the contract would end up being limit up. Once a limit move is reached, the trading is typically ceased for the day. Despite the limits, the exchange has, in some instances, the authority to intervene and change the limits. The price limits prevent large price moves resulting from speculative excesses. In addition to price changes, there are limits to the size of the position one can have in a given contract. The size limits are aimed at preventing the speculators from exercising excessive influence on the market. (Hull 2009, 25.)

In exchange traded futures contracts, hedgers need not to bear any counterparty risk. This due to the fact that the clearing house of the exchange guarantees the performance of the contracts traded on the exchange. This is possible because the clearing house requires counterparts to deposit an initial margin in a margin account that typically amounts to about 10% of the notional value of the futures contract. (James 2003, 13, 35.) At the end of every trading day, the positions of the counterparties are adjusted to reflect the gain or loss from the futures contract. This marking-to-market is done by adjusting the balances between the margin accounts. If the balance on the margin account falls below the maintenance margin, the investor is required to top up the margin account. This is known as the variance margin. Conversely, if the balance on the margin account is above the maintenance margin due to favourable price movements, any excess balance can be withdrawn from the account. (Hull 2009, 26–27.) If one is using a broker to execute the trading, the broker will do these daily settlements given that the customer has a credit line (James 2013, 13).

Airlines typically take long position when hedging against fuel price risk with futures contracts. A long position is ideal for a company that must buy a commodity in the future and the price of which it wants lock in beforehand. (Hull 2009, 47.) Futures contracts on jet kerosene are only available on the Tokyo Commodities Exchange (TOCOM) and the open interest on these contracts is rather low (Morrel 2007, 191). In addition, these contracts are denominated in Japanese yen. Therefore, airlines employ oil or gasoil futures in hedging the price risk of jet kerosene. (Cobbs & Wolf 2004, 3.) For example, gasoil is widely used in hedging because of its high correlation with the price of jet kerosene (Rao 1999, 39). Furthermore, the price of jet fuel has been tracking the price of crude oil as well (Morrell 2007, 191).

Airlines are exposed to basis risk when managing fuel price risk with futures. It is possible that the spot price and the futures price are not moving in tandem. The basis can be defined as the difference between the spot price and the futures price of the underlying at any time t. The basis risk can be related to time basis and product basis. If there is not a futures contract available on the underlying, the product basis risk arises. Likewise, if the hedged position must be closed out before its maturity, it can cause a time basis risk. Therefore, one must consider carefully which underlying asset to use in the futures contract. Typically, the futures price and spot price of the underlying converge toward the expiry of the futures contract. (Hull 2009, 51–53.) Consequently, the market is said to be in contango when the price for prompt delivery of the commodity is lower than that for deferred delivery. Conversely, the market is in backwardation when the price of prompt delivery is higher than the future delivery of the commodity. (Bellalah 2009, 7–8.) When entering into the futures contract, the current spot price, the current futures price and maturity are known, so the future basis is the only unknown variable in the hedge. For long hedges that airlines typically have, the unexpected strengthening of the basis worsens the hedger's position. In contrast, the unexpected weakening of the basis benefits the owner of the long position. (Hull 2009 51–53.)

In practice, airlines hedge jet fuel price risk using futures with other underlying commodities than jet kerosene. Consequently, they are engaged in a practice known as cross hedging. (Hull 2009, 55.) This, in turn, exposes the airlines to basis risk because the underlying commodity and jet fuel do not have a perfect correlation (Cobbs & Wolf 2004, 3). Only the jet kerosene futures truly, fully reflect the price changes in jet fuel prices (Morrell 2007, 191). Therefore, the hedger must consider the hedge ratio, that is, the size of position taken in the futures contracts in relation to the size of the underlying exposure in the physical commodity market. If the underlying exposure being hedged and the underlying of the futures contract are the same asset or commodity, it is natural to employ a hedge ratio of one. However, in the case of cross hedging, the hedge ratio of one may not yield the optimal result. (Hull 2009, 54–55.)

In cross hedging, the optimal hedge ratio, denoted as $h*$, is the minimum variance hedge ratio. The optimal hedge ratio, h^*, can be calculated from the following equation:

$$h^* = \rho \frac{\sigma_S}{\sigma_F}$$

Where σ_S is the standard deviation of spot price changes of the underlying, σ_F the standard deviation of the futures price changes, and ρ the correlation coefficient between the spot and futures price changes. If the correlation coefficient between the futures and spot price changes is one, then h^* yields 1.0. However, if the correlation coefficient remains constant at 1.0, but $2\sigma_S = \sigma_F$, then optimal hedge ration would be 0.5 (Hull 2009, 54–55.)

Let us assume that an airline chooses to hedge its fuel consumption for May with gasoil futures. The futures price for May gasoil delivery stands now at USD0.80 per gallon. At the end of April, the airline closes out its future position. At that moment the spot price of jet fuel is USD1.10 per gallon and the futures price of gasoil is USD0.95 per gallon. Consequently, the airline pays the spot price of the jet fuel that is USD1.10 per gallon and gains USD0.15 per gallon [$USD(0.95 - 0.80)/gallon$] on the futures contract. As a result, the airline pays USD0.95 per gallon net for its May jet fuel delivery, that is $USD(1.10 - 0.15)/gallon = USD0.95/gallon$, for the part that was hedged with the futures contract. The net cost of jet fuel is therefore USD0.15 below the physical spot price.

The benefit of the futures contacts is that the hedger is not exposed to counter party risk. That is, that the counterparty would fail to meet its obligation. This is because the clearing house of the exchange guarantees the performance of the futures contracts traded on the exchange. What is more, the pricing of the futures contracts is transparent since they are quoted on the stock exchange. (James 2003, 13.) In addition, the standardized futures contracts traded on exchanges are highly liquid. However, for very long maturities, only crude oil futures have good liquidity and open interest. Consequently, there are crude oil futures available for monthly delivery up to two years' maturity, and thereafter, for biannual deliveries with maturities of up to three years. (Morrel & Swan 2006, 716–717.) What is more, the futures contracts typically do not go into physical delivery. Instead, most of the futures contracts are settled in cash before the delivery by taking the exact opposite position in the futures contract. Therefore, most of the futures contracts result in being net-zero in the physical underlying commodity. This is especially the case with the crude oil futures contracts, where the volume of the futures contracts is many fold when compared to actual physical deliveries. (Garis 2009, 422–424.)

4.3 Forwards

Forward contracts are used to establish a price of a commodity for a future date and also to secure supply of a commodity. A forward contract is a tailor-made, bilateral agreement for the two parties entering into the contract. The bilateral agreement specifies the terms of the forward contract, such as the underlying commodity, the forward price paid at maturity, the terms for delivery and receipt, and the settlement of the payment. Long position in a forward contract implies that the party takes the delivery of the commodity, whereas the short position translates into selling and delivering the commodity. In the hedging context, a long forward position is taken so as to lock in the future price, and to remove uncertainty about the future cash flows regarding the commodity purchase. (Evans & Hunt 2009, 706.) Forwards are typically bilateral agreements and they are not traded on exchange. Therefore, they are over-the-counter (OTC) contracts (Morrell 2007, 190.)

Forward contracts are not standardized contracts, so the terms can be freely discussed and determined between the contract parties. The expiry of the contract and, therefore, the delivery time must be agreed on. Typically, it is one predetermined date in the future instead of several delivery dates or periods. What is more, the contract parties' positions are not marked to market daily. Instead, the settlement takes place at the expiry of the contract. The position are settled with either physical delivery of the commodity or cash settlement. (Hull 2009, 39.)

Airlines can also use forward contracts in hedging against the fuel price risk. They can enter into a forward contract with fuel suppliers such as Air BP. In forward contracts, the contract parties must bear full counterparty risk. Consequently, it is possible that the other party in the contract faces bankruptcy before the maturity of the forward contract. (Morrell 2007, 190.) In addition, OTC contracts typically lack price transparency because they are not quoted on exchanges unlike listed contracts such as futures. (James 2003, 14). Therefore, exiting the position in a forward contract is difficult. One must find an entity with the exact same needs concerning the commodity, maturity, and quantity as well as the delivery location. What is more, due to the counterparty risk, neither party can simply give their position to some other party. Instead, they must first get an approval from the initial contract party, and it cannot be taken for granted. (Evans & Hunt 2009, 706.)

Recently, however, clearing houses have begun to accept OTC contracts in to their guarantee systems. Therefore, the distinction between the on-exchange and over-the-counter contracts has become more ambiguous. As a result, the bilateral contracts can be transferred to clearing houses. Consequently, the clearing house acts a counterparty in the contract for both the long and short position holders, that is, the clearing house acts as the central counterpart in the contract. The exposure to the original counterparty risk can be significantly reduced by transferring the contract to a clearing house. Despite this, clearing houses have not been used in significant amounts in the oil market, and the development has been very gradual. However, newer gas and energy markets have adopted this procedure, which has led to greater price transparency because now parties can see the prices from their computer terminals much like in the futures market. (James 2009, 14.) In the case of airlines, forward contracts are typically tailored for each airlines' specific requirements. This, in turn, means that they are not very appealing instruments for third parties or speculators. (Morrell & Swan 2006, 715–716.)

Using a forward contract to hedge against fuel price risk is rather straight forward. Let us assume that an airline enters into a forward contract with a jet fuel supplier. The airline agrees to buy 100 000 gallons of jet fuel three months into the future at USD1.50 per gallon. After three months, when the contract expires, the spot price for jet fuel stands at USD1.80 per gallon. Therefore, airline gains USD0.30 per gallon on the hedge, that is $\text{USD}(1.80 - 1.50)/gallon = USD0.30/gallon$. The airline pays USD150 000 for the fuel delivery of 100 000 gallons, that is $100\,000\; gallons * USD1.50/gallon$. Had the company not entered the hedge, it would have paid USD180 000 for the fuel delivery. On the contrary, had the spot price been below the agreed forward price, the airline would have made a loss on the hedge.

4.4 Options

Options are different from other derivatives instruments discussed thus far. An option gives a right to buy or sell the underlying in the future for a predetermined price, but the owner of the option is not obligated to exercise the option. (Hull 2009, 179.) On the contrary, the writer of the option faces an obligation if the buyer of the option chooses to exercise the option (Evans & Hunt 2009, 707). A call option gives a right to buy the asset at a predetermined strike price, whereas, the put option gives a right to sell the asset at a predetermined strike price. (Hull 2009, 179.) There are both European and

American options available. The difference is the flexibility concerning the exercise time. An American option can be exercised at any time in the future up until the expiry of the contract. In contrast, the European option can only be exercised on the expiration date, not at any time before the expiry. Thus, American options provide more flexibility. (Keown et al. 2011, 662.)

Options are also different from other derivatives instruments because one must pay a premium for options (Evans & Hunt 2009, 707). Black & Scholes (1973) developed the famous formula for pricing European options. According to their model the premium paid for an option depends on the strike price, the expected price volatility of the underlying, maturity, risk free interest rate, and the spot price of the underlying asset. Typically, American style option premiums are higher than the European options due to the higher flexibility on the exercise date. (James 2003, 21–23.)

It is possible to acquire options both on exchange and over-the-counter. Energy options provide energy consumers with an opportunity to hedge against energy price risk for a premium. In practice, companies that use energy commodities as an input in significant amounts, can set a maximum price (a cap) that they are willing to pay for the commodity over a given time period. This can be achieved by buying a call option at this cap strike price. In contrast, the issuer of the call option is obligated to deliver the quantity specified in the option at a given date in exchange for the option premium should the holder of the option wish to exercise its right. In practice, however, vast majority of the option contracts never go into physical delivery of the commodity. Instead, the positions are typically settled with cash. Therefore, the option holders typically benefit from the corresponding cash flows. While actual trading of the commodities takes place in the physical spot markets. (James 2003, 107.)

Airlines can acquire options in jet fuel from the over-the-counter market in addition to more heavily traded commodities. The counterparty in these option contracts may be, for example a bank. What is more, options provide airlines with more flexibility concerning the future prices because they provide protection against price increases over the option strike price, but at the same time allow them to benefit from decreasing fuel prices. However, there is the option premium that must be paid up front for the flexibility and protection that the option contracts provide. (Morrell 2007, 190.)

The payoff from option contracts is dependent on the premium paid for the option as well as the spot price of the commodity at the expiration of the contract. Figure 3 illustrates the payoff diagram.

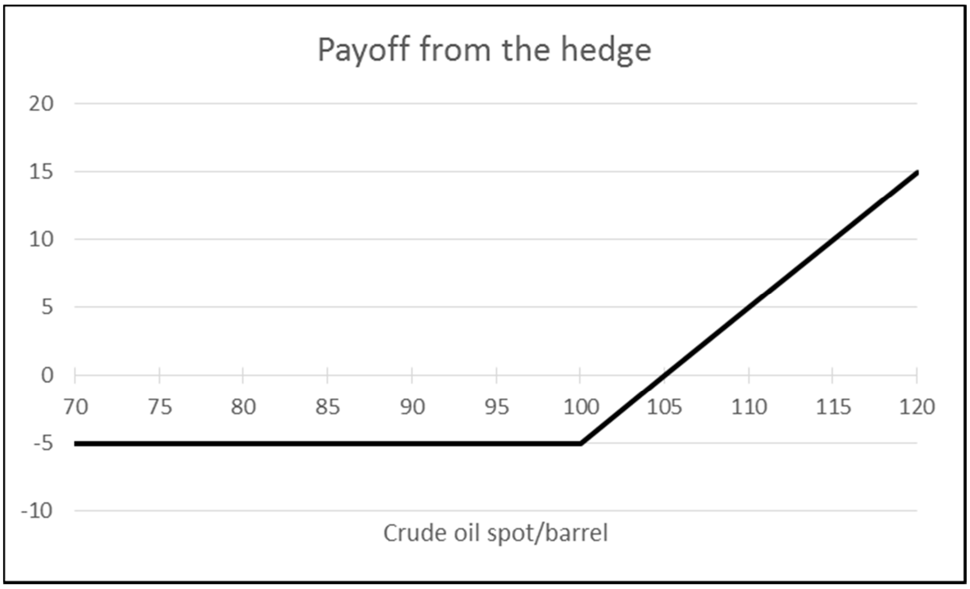


Figure 3 Payoff diagram for a $100 long call (see Keown et al. 2009, 663)

The payoff diagram in Figure 3 is for a long call option that is used to hedge against the price of crude rising above USD100 per barrel. The option premium for the call option is USD5. Therefore, the payoff from the hedge is USD5 negative up until the break-even point of USD105. If the spot price at the expiry of the contract is below USD100 per barrel, the hedger foregoes the option because the spot price in the physical market is more affordable. Although, the strike price is USD100, the premium paid for the option must also be covered in order for the hedge to break even. Onwards from the USD105 threshold, the payoff is positive and increases linearly.

Option contracts can also be used to structure various type of payoffs, and different risk profiles can be constructed using options. In the energy and commodity markets, a popular option structure among companies that use significant amounts of energy as an input is a *collar structure*. (James 2003, 117.) In addition, the collar structure has become more and more popular among airlines as well partly due to the fact that it helps covering the option premiums paid for the call options. In a collar structure, an airline sets a price cap for the fuel price by acquiring a call option for a premium. In addition, the airline writes a put option with a strike price lower than the strike price of the acquired call option. By writing a put option, the airline foregoes the ability to benefit from fuel prices below the strike price of the put option. However, the airliner receives the option premium from the written put option that, in turn, is used to cover at least part of the acquired call option. Therefore, the net cost for the collar structure is the difference between the premium paid for price cap and the premium received from the written put option. As a result, the airline can lock in the price of jet fuel between two known values with less cash paid upfront when compared to a simple long call position. (Morrell & Swan 2006, 716.) In fact, it is possible to construct a costless collar structure. In such case, an airline acquires a long call option and writes a sufficient amount of put options, or a put option with a high enough strike price, so that the cash flow received from the written put option(s) covers the entire premium paid for the call option. This particular structure is known as zero-cost collar or costless collar. (James 2003, 117.)

Figure 4 depicts the use of a collar structure in hedging against fuel price risk in airlines.

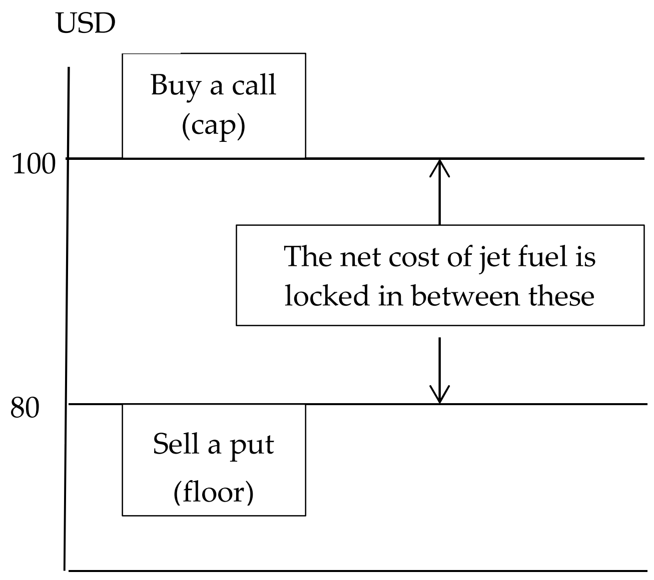


Figure 4 A collar structure in airlines (James 2003, 191)

In figure 4, the airline acquires a call option with a strike price of USD100 and pays a premium for it. The call sets the cap for the cost of jet fuel at USD100 per barrel. Simultaneously, the airline writes a put option(s) with a strike price of USD80 to the extent that the premiums received from the option(s) covers the premium that must be paid for the call option. Should the price of jet fuel increase above the USD100 per barrel cap, the airline exercises its option, and the net cost for the fuel stands at USD100. However, if the spot price of jet fuel is between the cap and the floor, that is USD80 and USD100 per barrel, the airline foregoes its call option and pays the current spot price. Lastly, in the event of spot prices falling below the USD80 per barrel floor, the airline must pay the USD80 per barrel because the owner of the put option exercises its right to sell at USD80 that is above the current spot market price.

Figure 5 exhibits the payoff form the zero-cost collar structure with a USD100 per barrel call option and written put option at USD80 per barrel.

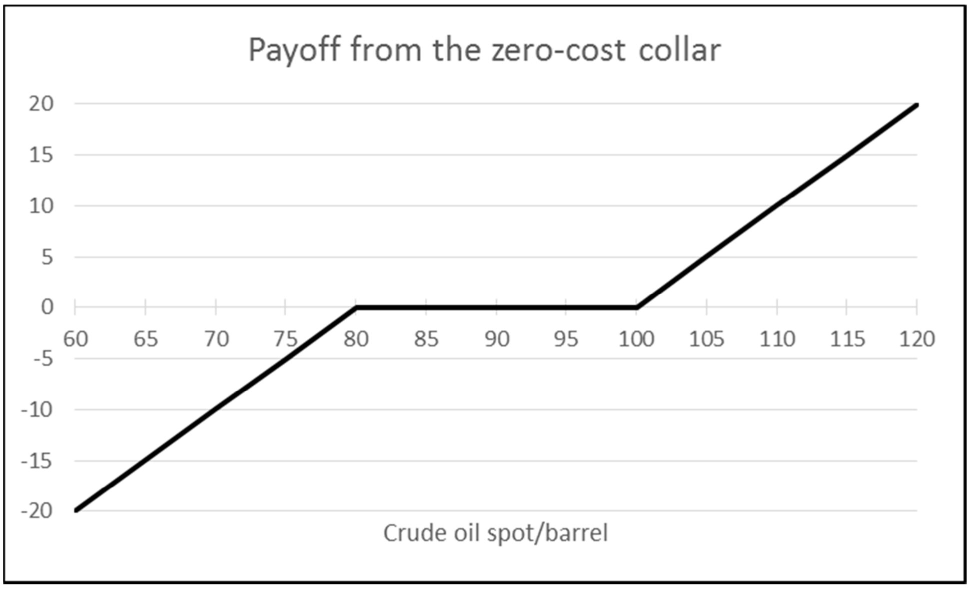


Figure 5 Payoff from a zero-cost collar

From figure 5, it can be seen how the net cost of jet fuel is locked in between the USD100 cap and the USD80 floor. On the horizontal axis is the spot price of jet fuel, and on the vertical axis is the payoff from the collar structure. When the price is between the two values, the airline pays the spot market price. However, when the spot is above the USD100, the airline pays the spot price less the payoff from the hedge resulting in net cost of USD100 per barrel. Should the spot price of jet fuel fall below the USD80 per barrel at maturity, the counterparty would exercise its put option that the airline had written. The airline still pays the spot price in the physical market, but pays the counterparty the difference between the put options' strike price and the spot price. Therefore, the net cost for the airline is the spot price plus the payoff for the counterparty. By issuing put option, the airline finances the call option. However, at the same time, the airline foregoes the potential to benefit from spot prices lower than the strike price of the written put option.

The benefit of options for energy consumers is that the cash flows are limited only to the premium paid for the option, in the case of over-the-counter options. For example, an airline can hedge against rising jet fuel prices without giving in the opportunity to benefit from falling fuel prices. (James 2003, 108.) However, the OTC options pose a counterparty risk. (Morrell 2007, 191.) Whereas, the options traded on exchange do not pose the counterparty risk, but participants are required to deposit a margin, like in the case of futures contracts, that is about 10% of the notional value of option contracts. These initial margins are settled on a daily basis to reflect the changes in the contract parties' positions. What is more, the contract parties are also required to deposit an additional variation margin should the initial margin turn out to be insufficient. (James 2003, 23–24.) As a result, not all the airlines can enter into abovementioned derivatives contracts due to difficulties in gaining access to credit limits (Asian Airlines Wrestle – – 2004).

5 EMPIRICAL PART

5.1 Methodology

To study and understand the jet fuel price exposure and the means to hedge against this particular price risk, a combination of qualitative and quantitative research is undertaken in the thesis. The research paradigm in the thesis is therefore mixed methods research. Caracelli, Graham, and Greene (1989) first introduced mixed methods research as a study that includes one qualitative method and one quantitative method. However, the number of quantitative and qualitative methods in the research is not limited to one; there can be several of them. Later Johnson, Onwuegbuzie, and Turner (2007) constructed a better, and more defined consensus definition by evaluating the 19 definitions of the 21 published mixed-methods researchers. They concluded that mixed methods research allows a researcher to combine elements of both qualitative and quantitative approaches to the research in order to come up with breadth and depth of understanding as well as corroboration.

Currently, instead of a single definition, more emphasis is given to the definition of core characteristics in mixed methods research. Creswell and Plano Clark (2011, 5–6) have concluded these core characteristics of the mixed methods research, and it combines not only methods but also a philosophy and research design as well. In a mixed methods approach the researcher collects and analyses both quantitative and qualitative data and mixes both categories of data by embedding one with another, or by sequentially building one over the other form of data. What is more, the researcher can give priority to only one form of data depending on what the emphasis of the study is. Then, these procedures are framed with philosophical worldviews and theoretical lenses. Therefore, the mixed methods research provides an ideal approach for this thesis. The quantitative analysis provides evidence with regards to the jet fuel price exposure, and the most appropriate approach to analyse the exposure is through regression analysis. However, should the results be unexpected, the researcher still has the qualitative analysis that can possibly provide reasoning concerning the quantitative results. Thus, employing qualitative methods in addition to quantitative analysis can further enhance the breadth and depth of the studied phenomenon. For example, should the regression analysis provide insignificant exposure as a result, the qualitative analysis of the jet fuel hedging practices may suggest that the hedging is in fact effective to such an extent that there remains no or very little exposure to the jet fuel price risk.

In the thesis, the researcher, on one hand, studies the extent of the jet fuel price exposure, and, on the other hand, how the jet fuel price risk is managed in Nordic countries' listed airlines that are relatively small in size when compared to the global aviation context. The Nordic countries' listed airlines where chosen as the sample since they are all quite small on a global scale. What is more, they are all based in the same region and faced with similar regional competition that adds to the homogeneity of the sample airlines. Lastly, and most importantly, there is no previous research concerning the Nordic countries airlines to the knowledge of the researcher. Therefore, the research provides evidence from the Nordic countries with regards to jet fuel price exposure and hedging practices.

The paradigm typically implied with quantitative approach is postpositivism. The postpositivist worldview may be used in seeking knowledge based on detailed measures and observations of variables. (Creswell & Plano Clark 2011, 41.) Therefore, to study the jet fuel price exposure, a quantitative approach with this paradigm provides the researcher with adequate tools to assess whether or not any significant exposure can be found among the sample airlines. When assessing the extent of the exposure, the interest is in the stock returns of the publicly traded Nordic Countries' airlines: to what extent does jet fuel price returns affect the returns of the airline stocks in the Nordic countries? In the quantitative part, the exposure is measured by building an regression analysis with using the overall local stock market index as the control variable.

Quantitative research cannot explain cultural and social construction of the variables that are studied. Hence, qualitative research aims at understanding reality and phenomena as socially constructed. Therefore, qualitative approach is typically employed to interpret and understand a phenomenon, while the quantitative approach is concerned with explanation, statistical analysis, and testing of hypotheses. (Eriksson & Kovalainen 2008, 5.) Qualitative business research typically aims at answering to questions such as what, how, and why. Likewise, the qualitative research aims at thoroughly describing and exploring situations, states and processes. What is more, it is characteristic of qualitative business research to answer or explain phenomena in qualitative terms. Therefore, it aims at shaping the understanding of the phenomenon at hand and offers explanations as to why states, situations, and processes are such as they are. (Eriksson & Kovalainen 2008, 44.) Consequently, to understand how airlines in the Nordic countries manage fuel price risk, a qualitative take is appropriate to explain and understand the fuel price risk management practices of the Nordic countries' listed airlines. The thesis strives to answer how the airlines hedge against the fuel price risk. What is more, the hedging practices will be described and explored thoroughly, so as to enhance understanding of the phenomenon in question.

While the ontological worldview in quantitative research is typically objectivism, qualitative research is often concerned with a subjective worldview known as constructionism. In objectivism it is assumed that the reality and social world exists independent of people, actions, and activities. Therefore, the reality exists without the researcher. On the contrary, in constructionism, social actors through interaction produce the reality. This implies that the social actors can change their views and perceptions both through interaction and over time. What is more, the reality is also influenced by the researcher's subjective views and interpretations. (Eriksson & Kovalainen 2008, 8–9.) Therefore, the researcher must acknowledge all these factors when analysing and interpreting the qualitative data, and more importantly realize, that achieving complete objectivism is not really quite feasible.

The research design in the thesis follows an explanatory sequential design. In mixed methods research, the explanatory sequential design is constructed in a way that first the quantitative data is gathered and analysed. Then, the qualitative data is collected and analysed. After these research phases, follows the interpretation of the results. In both phases, the respective research questions are answered. Lastly, both results are interpreted, and the researcher analyses how the qualitative results could help explaining the quantitative results. (Creswell & Plano Clark 2011, 68–71.) This research design is suitable for the thesis, as the qualitative research could provide reasoning for the quantitative results should some unexpected results arise from the quantitative analysis. Likewise, the level of interaction between the qualitative and quantitative strands in the thesis is independent. Independent level of interaction means that the researcher conducts both the quantitative and qualitative research independently. This implies to the data collection and analysis. It is only at the time of interpreting the results that the distinct strands are mixed and the overall interpretation is done. (Creswell & Plano Clark 2011, 64.)

In addition, the point of interface in the thesis follows the approach of mixing during the interpretation. It means that the two methods are mixed in the interpretation which is the final stage of the research process after the researcher has collected, analysed and reported the results from both sets of data. (Graswell & Plano Clark 2011, 66.) This research design is appropriate for the thesis since the quantitative and qualitative data are collected irrespective of each other. Then, the quantitative data is modelled and analysed using the regression analysis. After that, the qualitative data is analysed and the respective research questions answered. Finally, the qualitative data and analysis may provide some reasoning when interpreting the overall results of the quantitative data.

The qualitative part in the thesis is conducted as an extensive case study research. In extensive case study, the focus is on issues that can be studied by using several cases. The interest is in elaborating, investigating, and explaining a phenomenon. Therefore, not any individual company is of specific interest per se for the study. What is more, the companies in the study should either be similar enough in order to generate new knowledge or diverse enough to facilitate meaningful comparisons and there should be four to ten companies. Furthermore, the empirical data collected from the companies in an extensive case study should be similar enough in order for the researcher to able to describe and explain the phenomenon of interest. In contrast to intensive case study, the extensive case study approach produces rather thin descriptions of the case companies. The cases are not studied in high level of detail because the researcher has a predefined interest for the research. (Eriksson & Kovalainen 2008, 127—131.) The extensive case study approach is appropriate for the qualitative part because the interest lies in understanding a phenomenon within a group of rather homogenous companies. Instead of exhaustingly studying one case, four companies are analysed and similar data gathered form the companies in order to elaborate and understand the phenomenon of hedging against jet fuel price risk in the Nordic countries' listed airlines.

In the thesis both primary and secondary sources of data are employed. The data used in the quantitative part is gather from the Datastream database, which is secondary data. The data includes stock price data of the sample airlines as well as market index data. In the qualitative part, there is a combination of primary and secondary data, the emphasis being on the latter one. The secondary data is collected from the airlines' financial statements, interim reports and annual reports. These include plenty of data with regards to financial risks that the airlines face, including the fuel price risk. What is more, there is information about the risk management policies in place and the extent to which the airlines are hedged against fuel price exposure. Likewise, information about the derivatives instruments used in the hedging can be found from the financial statements and annual reports.

On top of gathering the data from financial statements and annual reports, there is primary data gathered in the form of an interview. The researcher interviewed an industry practitioner involved in the hedging and financial risk management of the Finnish flag carrier Finnair. The interview was semi-structured in form and the questions were mostly open-ended. Semi-structured interviews are a type of qualitative interview in which topics, issues, and themes are discussed. The semi-structured interviews typically provide answers to questions that are in form of both what and how. The advantage of semi-structured interview is that it allows for the interviewer to vary wording and sequence of questions. Although, the interview is rather systematic, the tone during the interview can be informal and conversational. On one hand, the semi-structured take allows the interviewee to highlight and raise topics and important views that are not guided by the interviewer. On the other hand, this interview type allows the interviewer to obtain additional, in-depth information. Lastly, open-ended questions provide the interviewee with more take on what is discussed in the interview and usually this produces more detailed responses to the questions and topics. (Eriksson & Kovalainen 2008, 85–89.) Conducting an additional interview, in addition to secondary data (financial statements and annual reports), should provide the research with valuable information and tacit knowledge. The researcher views that the interview will further elaborate the reasoning and decisions behind the risk management and hedging practices, and, hopefully, introduce new viewpoints concerning the hedging practices in airlines.

5.2 Nordic Listed Airlines Overview

5.2.1 Finnair

Finnair is the Finnish flag carrier based in Helsinki-Vantaa airport and it is one of the oldest operating airlines in the world. The company specializes in flights between Asia and Europe and aims at providing the smoothest connections in the northern hemisphere via its hub in Helsinki. Finnair Group consists of two business areas: Airline Business and Travel Services. At the end of June 2014, the Finnish government was the largest shareholder with 55.8% of the company's shares. (Finnair Group.)

The company flies to more than 70 destinations in Finland, Europe, Middle-East, Asia, and North-America. As a member of oneworld alliance, the network is further enhanced by code-share routes with the alliance members and bilateral agreements. In addition, Finnair operates leisure flights to approximately 60 destinations depending on the tour operators' programs and season. (Finnair Group.)

Finnair operates a fleet of 45 planes of which it owns 22 and has leased 23 aircraft. 20 of those are on operational leasing and three on financial leasing. The average age of the fleet stood at 10.2 years at the end of 2014. In addition, Finnair has orders on 19 Airbus A350 wide-body aircrafts with which it plans to replace the existing Airbus A340 wide-bodies. The company also owns another 22 narrow-body (single-aisle) aircraft that are operated by Flybe Finland mainly on domestic and European routes. (Finnair Financial Statements 2014.)

During the year 2014, the company carried 9.63 million passengers with a load factor[9] of 80.2%, and the turnover for 2014 was €2.285 billion. The company's capacity was 30 889 million available seat kilometers (ASK[10]), and it flew 24 772 million revenue passenger kilometers (RPK[11]). Fuel expenditures for the year 2014 where 28% of the total operating expenses. Cost per available seat kilometer (CASK) was €0.0637 while the CASK excluding fuel stood at €0.0431. (Finnair Financial Statements 2014.)

[9] Load factor measures how effectively an airline has managed to sell available seats on its flights.
[10] ASK is the number of available seats times the kilometres flown in a given time period.
[11] RPK is the distance traveled by paying customers in a given period.

At the end of 2014, Finnair employed a total of 4 981 employees of which 3 772 where working at the Airline Business (Finnair Annual Report 2014.)

5.2.2 Scandinavian Airlines (SAS)

Scandinavian Airlines (SAS) is the flag carrier of Sweden, Denmark, and Norway. SAS is listed on the Stockholm, Oslo, and Copenhagen exchanges. The company aims at being the leading airline in the Scandinavia. SAS states that its main focus in on short-haul flights and it aims at being the airline for the frequent Scandinavian flyers. (SAS Annual Report 2013/2014.)

The company is 50% owned by the Swedish, Danish, and Norwegian governments. The Swedish Government Offices has a 21.4% stake, Danish Statens Administration (FSC) has 14.3%, and the Norwegian Ministry of Trade, Industry and Fisheries poses 14.3% of the shares as well. (SAS Annual Report 2013/2014.)

SAS flies to 125 destinations globally. The destinations are in Europe, United States, and Asia. The airline is a member of the Star Alliance. The membership enhances the destinations available to customers flying. SAS operated a fleet of 138 aircraft at the end of the October 2014 with an average age of 11.2 years. Of the 138 operated aircraft, 39 are owned and 99 are on lease. The company has also ordered 12 Airbus wide-bodies and another 30 Airbus A320 NEOs that will be delivered between the years 2015 and 2021. In addition, SAS has leased out nine narrow body aircrafts, and another four are being parked. (SAS Annual Report 2013/2014.)

During its fiscal year 2013/2014, Scandinavian airlines carried 28.4 million passengers, creating a turnover of SEK38 billion (~€4.07billion). The load factor stood at 74.9% for the fiscal 2013/2014. Fuel costs accounted to 23.3% of the total operating expenses. Total available seat kilometers where 45 158 million kilometers, and for the scheduled traffic ASK was 40 971 million kilometers. Total revenue passenger kilometers for the fiscal was 34 714 million kilometers and the total unit cost was SEK0.75 (~€0.0804). The average number of employees in the service during the fiscal amounted to 12 329. (SAS Annual Report 2013/2014.)

5.2.3 Norwegian Air Shuttle

Norwegian Air Shuttle is a low-cost carrier based in Norway. Norwegian Air Shuttle is the second largest carrier in the Scandinavia. The company aims at offering competitive and low-fare flight services for customers. The company is listed on the Oslo Stock Exchange. (Norwegian Air Shuttle – Our Company 2014.) The largest shareholders of

Norwegian Air Shuttle are HBK Invest AS (27.02%), the Government Pension Fund of Norway (Folketrygdfondet) (6.94%), and Skagen vekst, an equity fund, (4.12%). (Norwegian Annual Report 2013.)

The company flies to 130 destinations. The destinations are in Europe, the United States, North Africa, the Middle East, and Thailand. Norwegian Air Shuttle is not currently a member of any airline alliance. (Norwegian – Our Company 2014.) The company currently has 17 operational bases in Europe, the United States, and in Thailand. The number of employees working for the company is approximately 4 500. (Norwegian Air Shuttle Corporate Fact Sheet.) These include also non-permanent staff such apprentices, hired staff, and hired pilots. At the end of the fiscal 2014 the number of full-time equivalent employees was 4 314. (Norwegian Annual Report 2014.)

Norwegian Air Shuttle operates a fleet of 95 aircrafts. The fleet is all Boeing and consists of 84 Boeing 737-800, 5 Boeing 737-300, and 7 Boeing 787-8 Dremliner wide-bodies. In January 2012, the company placed orders for 222 narrow-body aircrafts. In addition, the company has ordered 17 more Boeing 787-8 Dreamliners to its long-haul fleet. (Norwegian Fleet 2015.) The average age of the fleet was 4.2 years at the end of the fiscal 2013 (Norwegian Annual Report 2014).

In 2014, Norwegian Air Shuttle carried a total of 24 million passengers (Norwegian Our – Company 2014). During its fiscal year 2014 the revenue was NOK19.540 billion (~€2.328 billion). Available seat kilometres stood at 46 479 million, while the revenue passenger kilometres amounted to 37 615 million. The load factor for the fiscal was 80.9%. The unit cost per available seat kilometre (CASK) was NOK0.42 (€0.05) while the CASK excluding fuel was NOK0.29 (€0.0345). (Norwegian Annual Report 2014.)

5.2.4 Icelandair Group

Icelandair Group is operating in the international airline and tourism sectors. The company is based in Iceland, and the business concept is built on the airlines' route network. Icelandair Group's main focus is to operate flights to and from Europe and North America via its Reykjavik hub in Iceland. The largest shareholders are the Pension Fund of Commerce (14.58%), and an investment fund Stefnir - ÍS 15 (11.07%). All other shareowners pose a share of less than ten per cent. (Icelandair Group Annual Report 2014.)

The company flies to 39 destinations with the emphasis on connecting European destinations with North American destinations. In Europe, Icelandair Group operates flights to 25 cities. Likewise, the company flies to 14 destinations in North America. Iceland air is not a member of any airline alliance, and, therefore, the network is not further expanded with code-share operations. (Icelandair Group Annual Report 2014.)

Icelandair Group operates a fleet of 37 aircrafts. The company owns 28 of the aircrafts, whereas 9 are leased. Out of the 37 aircrafts, Iceland air operates 21 Boeing 757 in its international network operations. Seven narrow body aircrafts are operated by the regional Air Iceland. The company has placed orders on 16 Boeing 737 MAX8 and MAX9 airliners, that are to be used for fleet expansion, not fleet replacement of the of older Boeing 757s. The new 737s will yield a 20% reduction in fuel consumption per seat in comparison to older 757s. (Icelandiar Annual Report 2014.) According aviation consultancy Air Insight (2014), the b757 fleet averages 18.9 years. Icelandair Group uses the rest of the fleet to selling capacity solutions for other carriers and tour operators under the brand Loftleider Icelandc. These include leasing out the aircraft and providing maintenance for long term as well as charter operations. In addition, the company provides ACMI (aircraft, crew, maintenance, and insurance) contracts in which the crew and insurance are also provided by the company. (Icelandiar Annual Report 2014.)

During its fiscal year 2014, the company carried a total of 2.893 million passengers. The total revenue for the year was USD1.113 billion (~€991 536 338). The total ASK for the group stood at 9 820.9 million, of which 9 673.3 million ASK was for the international flights and 1 47.6 million ASK for the regional and Greenland operations. Load factor on international routes was 80.4%, whereas in regional operations it was 71.5%. Revenue passenger kilometres for the group where 7 788 million kilometres. The cost per available seat kilometre was USD0.0976 (€0.087). The Icelandair Group employed an average of 3 109 full-time employees in the fiscal year 2014. (Icelandair Group Annual Report 2014.)

5.2.5 Comparison of the Airlines

Despite being rather homogenous airlines, there is some variation among the sample companies with regards to key figures discussed above. Table 2 lists the airlines' key information in order to facilitate comparison among the sample airlines.

Table 2 Key Information on Nordic listed airlines

Nordic Listed Airlines				
	Finnair	SAS**	Norwegian	Icelandair Group
Ownership	55.8% Government	50% Government	Private	Private
No. of destinations	>70	125	130	39
Fleet size (no.)	45	138	95	37
Average fleet age (yrs)	10.2	11.2	4.2	18.9*
No. of passengers	9.63m	28.4m	24.0m	2.6m
Load factor (%)	80.2%	74.9%	80.9%	80.4% (intl.)
Turnover (€)	2.284,5bn	4.07bn	2.328bn	0.991,5bn
RPK (km)	24 772m	34 714m	37 615m	7 888m
ASK (km)	30 889m	40 971m	46 479m	9 821m
CASK (€)	0.0637	0.0804	0.05	0.087
No. of employees	4 981	12 329	4 314	3 109

*Boeing 757 fleet
**Scandinavian Airlines

From Table 2 it can be observed that Norwegian Air Shuttle serves most destinations (130) while the Icelandair Group has the least destinations (39). Scandinavian Airlines is close to Norwegian Air Shuttle with 125 destinations, and Finnair operates to some 70 destinations, which is the third most among the Nordic listed airlines. With regards to fleet size, Scandinavian Airlines has the largest fleet (138 aircrafts) while Icelandair Group has the smallest fleet (39 aircrafts). Finnair has 45 planes in its fleet while Norwegian Air Shuttle the second most planes (95). In terms of the average fleet age, Norwegian Air Shuttle has significantly newer fleet than the other Nordic airlines. The average age of the fleet is 4.2 years. In contrast, Icelandair Group fleet is the oldest at an average age of 18.9 years, whereas Finnair fleet is 10.2 years old, and Scandinavian Airlines comes close at 11.2 years.

In terms of passenger figures, Scandinavian Airlines is the largest of the companies. The airline carried a total of 28.4million passengers during the fiscal year 2014. Scandinavian Airlines also generated the largest turnover that was €4.07billion. In contrast, Icelandair Group was the smallest carrier in terms of passengers carried and turnover. The figures for Icelandair Group were 2.6million and €0.991,5billion respectively. Norwegian Air Shuttle carried the second most passengers (24million) and generated a turnover of €2.328billion. Finnair, however, generated the second largest turnover of €2.284,5billlion while carrying the third most passengers (9.63million). The largest company measured by the employees is Scandinavian Airlines with 12 329 employees. Finnair has the second largest number of employees (4981) while Norwegian Air Shuttle has 4 314 full-time equivalents. Icelandair Group is the smallest employer among the airlines with 3 109 employees.

When analysing capacity, its utilisation, and efficiency there is also variation among the companies. Norwegian Air Shuttle offers the most available seat kilometres (46 479million) and also flew the most revenue passenger kilometres (37 615million). Scandinavian Airlines ranks second with 40 971million available seat kilometres and 34 714million revenue passenger kilometres. Finnair offered 30 889million available seat kilometres and flew 24 772million revenue passenger kilometres. Icelandair Group offers the smallest capacity, 9 821million available seat kilometres, and the company flew the least revenue passenger kilometres, 7 888million. However, Icelandair Group ranked second in selling the offered capacity. When assessing the achieved load factor, there is little variation among the three best carriers. The load factor for Icelandair Group was 80.4% in the international traffic. Norwegian Air shuttle had the highest load factor of 80.9%, while Finnair achieved a load factor of 80.2%. Scandinavian Airlines, on the contrary, achieved a load factor that was quite different when comparing to other sample airlines. The load factor for the company stood at 74.9%. In terms of operational efficiency Norwegian Air Shuttle is the leading carrier among the chosen airlines. The airline had the lowest unit cost per available seat kilometre which was €0.05 euros. Finnair had the second lowest unit cost at €0.0637. Likewise, Scandinavian Airlines' unit cost per available seat kilometre was €0.0804. Icelandair Group had the highest unit cost at €0.087.

All in all, there is variation among the Nordic countries listed airlines with respect to size, load factor, and efficiency. Load factors where rather similar except for the Scandinavian airlines, which had a load factor of less than 80%. What is more, Norwegian Air Shuttle had the lowest unit cost of €0.05 per available seat kilometre and the highest load factor of 80.9%. This is not very surprising when considering that Norwegian Air Shuttle is the only low-cost carrier among the companies.

5.3 Jet Fuel Price Exposure

5.3.1 Data

The quantitative data used is from Thomson Datastream database. The data is daily data transformed into weekly return data. The weekly frequency was chosen due to less noise in the data and it is of common practice with long financial time series. The data includes OMX Helsinki, OMX Stockholm, OMX Iceland, and Oslo bors stock indices.

For the jet fuel, the Platts Jet Fuel Cargoes CIF North-West Europe was chosen because significant part of jet fuel procurement is priced against this index. The data is for the period 2006 to 2014, except for Icelandair Group. The collected data for Icelandair Group is from December 22nd 2006. The airline was not listed at the beginning of 2006.

Figure 6 highlights the performance of the Nordic countries' listed airlines performance over the sample period.

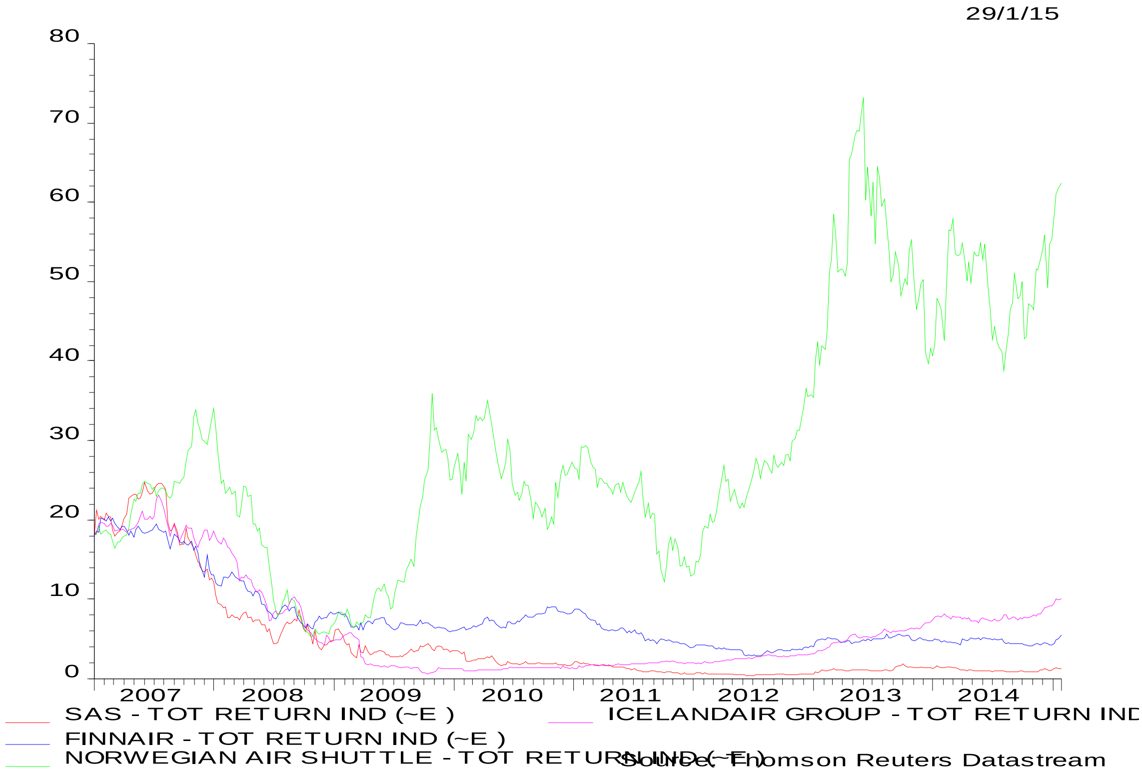


Figure 6 Total return indexes for the Nordic listed airlines (Source: Thomson Datastream)

From the figure 6 one can observe that Norwegian Air Shuttle has performed far superior when compared to its Nordic counterparts. On the contrary, Finnair, Scandinavian Airlines, and Icelandair Group have performed more in tandem, although there is variation among the airlines. Over the sample period, Scandinavian Airlines has performed the poorest while Finnair has yielded better returns. However, Icelandair Group has performed better than Finnair and Scandinavian Airlines from 2011 onwards. After the Financial Crisis, Norwegian Air Shuttle soared and its return index diverted from the rest of the airlines. Table 3 summarises the descriptive statistics for the weekly logarithmic returns of the airlines, stock indices, and jet fuel.

Table 3 Descriptive statistics

	Finnair	OMX HEL	Icelandair	OMX Iceland	Norwegian	Oslo bors	SAS	OMX Stockholm	Jet fu
Mean	-0.003204	-8.41E-05	-0.003581	-0.000636	0.002919	0.000604	-0.005794	0.000962	0.0001
Median	-0.002407	0.002013	3.24E-05	0.000000	0.000000	0.004555	-0.006233	0.004434	0.0020
Maximum	0.173272	0.103822	0.075520	0.459532	0.248180	0.168338	0.364873	0.109859	0.1266
Minimum	-0.175302	-0.179758	-1.091263	-0.932951	-0.226304	-0.247826	-0.379214	-0.230497	-0.1755
Std. Dev.	0.043959	0.032495	0.060047	0.094451	0.068042	0.037261	0.082929	0.030581	0.0385
Observations	469	469	419	419	469	469	469	469	469

Out of the airlines, Scandinavian Airlines had the highest standard deviation (0.082929). What is more, all the airlines, except for Norwegian Air Shuttle had a negative mean weekly logarithmic return. The median returns were negative for Finnair and Scandinavian Airlines. Norwegian Air Shuttle and Icelandair Group had approximately 0 median return. Then, Scandinavian Airlines exhibited the single highest weekly logarithmic return of 0.363873. The mean return for jet fuel was 0.000179 for the period and the median 0.002086. Likewise, the standard deviation for jet fuel was 0.038515.

5.3.2 Regression analysis

To study the jet fuel price risk exposure, a multivariate regression is used. To control for the stock market effects, respective local stock market index returns are included as the control variable. According to Loudon (2004), including market returns is of common practice in evaluating exposures. It attenuates the omitted variable bias and includes the wider market influences, such as macroeconomic factors, on individual stock returns. Instead of simple returns, logarithmic returns are used. The logarithmic returns exhibited less kurtosis and skewness in the analysis of the data. The regression model to test for the jet fuel exposure is as follows:

$$R_{i,w} = \alpha + \beta_{i,w} R_{mkt,w} + \gamma_{i,w} R_{JF,W} + \epsilon_{i,w}$$

where:

$R_{i,w}$ is the weekly log return for airline *i* for week *w*,
$\beta_{i,w}$ is the market risk factor for airline *i* for week *w*,
$R_{mkt,w}$ is the weekly log return for the corresponding market,
$\gamma_{i,w}$ is the jet fuel exposure factor for airline *i* for week *w*,

$R_{JF,w}$ is the weekly log return for jet fuel for week w, and
$\epsilon_{i,w}$ is the residual for airline i for week w.

The model does by no means aim at exhaustively explaining airline stock returns, but rather providing evidence if there is any statistically significant jet fuel exposure among the Nordic countries' listed airlines. As jet fuel is the largest operating expense item among the airlines in the study, it is reasonable to assume that changes in the price of jet fuel would have an impact on the companies. What is more, an increase in the price of jet fuel should have a negative impact on the airlines. Therefore, the hypothesis tests if the jet fuel exposure of the airlines is different from zero and negative.

5.3.3 Results

After estimating the model and running the regressions, the independent variables where tested for multicollinearity. The variance inflation factors where all less than 1.5, implicating that multicollinearity is not present to a significant degree. However, the data for the Iceland OMX stock exchange exhibited signs of structural change. Figure 7 graphs the OMX Iceland stock market index.

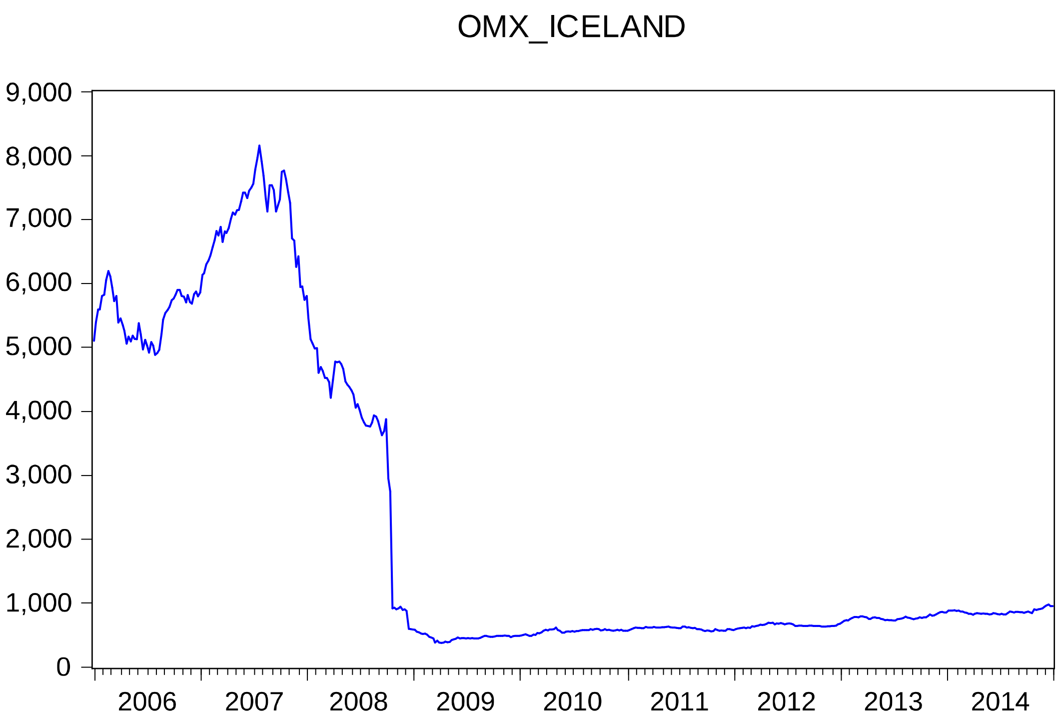


Figure 7 OMX Icealand Stock Market Index (data: Thomson Datastream)

From the figure one can observe the collapse of the stock market index during the Financial crisis. In the aftermath, the stock market levelled off. Therefore, the sample period for the Icelandair Group begins from the last week of the year 2008 yielding 314 observations. Table 4 reports the result of the model for each airline.

Table 4 Jet fuel exposures

Finnair

	Coefficient	Std. Error	t-Statistic	Prob.
Fuel Exposure	0.016205	0.052043	0.311371	0.7557
OMX Helsinki	0.511174	0.061685	8.286884	0.0000***
C	-0.003164	0.001879	-1.683674	0.0929*
Adj. R^2 0.143032	S.E. of regression	0.040694	Obs	469

Scandinavian Airlines

	Coefficient	Std. Error	t-Statistic	Prob.
Fuel Exposure	-0.047626	0.091404	-0.521046	0.6026
OMX Stockholm	1.323473	0.115121	11.49633	0.0000***
C	-0.007058	0.003364	-2.098074	0.0364**
Adj. R^2 0.229047	S.E. of regression	0.072815	Obs	469

Norwegian Air Shuttle

	Coefficient	Std. Error	t-Statistic	Prob.
Fuel Exposure	-0.361564	0.085630	-4.222379	0.0000***
Oslo Bors	0.978136	0.088514	11.05063	0.0000***
C	0.002392	0.002794	0.856159	0.3923
Adj. R^2 0.209229	S.E. of regression	0.060506	Obs	469

Icelandair Group

	Coefficient	Std. Error	t-Statistic	Prob.
Fuel Exposure	-0.333226	0.111949	-2.976593	0.0031***
OMX Iceland	0.264468	0.178416	1.482310	0.1393
C	0.001379	0.003882	0.355168	0.7227
Adj. R^2 0.024749	S.E. of regression	0.068612	Obs	314

Note: ***,**,and * Significicant at the 0.01, 0.05, and 0.10 levels respectively

The results for the Nordic listed airlines are somewhat ambiguous. The jet fuel exposure factor for Finnair was 0.016205. What is more, the term is positive, but it is not statistically significantly different from zero. The weekly stock market return had a positive coefficient of 0.511 and was significant even at the 0.01 confidence level. Likewise, the adjusted R squared was 0.143032. It is quite ambiguous to find the exposure term to be positive tough not statistically significant. For Scandinavian Airlines, the jet fuel exposure was -0.0476 and the stock market coefficient 1.323. The jet fuel exposure term was negative but not statistically significant. The stock market term was significant even at the 0.01 confidence level. The adjusted R squared for Scandinavian Airlines was 0.229. In the case of Norwegian Air Shuttle, the results exhibited negative fuel exposure. The jet fuel exposure term for the company was -0.361564, and it was statistically significant even at the 0.01 confidence level. Likewise, the stock market variable was 0.9781 and significant at the 0.01 confidence level. The model had an R squared of 0.209220 in the case of Norwegian Air Shuttle. The Icelandair Group also exhibit negative jet fuel exposure, however with less observations (314) than the rest of the airlines (469). The jet fuel exposure term was -0.333 and it was statistically significant at the 0.01 confidence level. Likewise, the stock market term was 0.2644 and significant at 0.01. The adjusted R squared of the model for Icelandair Group was 0.0247, which is much lower than for the rest of the airlines.

The results are ambiguous with regards to previous literature regarding the price exposure. The results are not in line with Carter, Roger, Simkins, and Treanor (2014). They found the jet fuel exposure to be statistically significant for the U.S. listed airlines. In the thesis only two of the airlines exhibited a negative jet fuel exposure. However, the results are partly in line with Berghöfer and Lucey (2014) where they found the jet fuel exposures to be higher for the U.S. listed airlines than for the European listed airlines. However, they found the exposures to be statistically significant for the European carries as well, which is not entirely in line with the thesis’ results. One possible explanation is that the U.S. stock market and the U.S. listed airlines are more traded than the Nordic stock exchanges and the Nordic listed airlines. Likewise, the European airlines in the Berghöfer and Lucey (2014) included large and more heavily traded airlines such as Lufthansa, IAG (Iberia, British Airways, and Vueling), and Airfrance-KLM. The airlines in the thesis, in turn, are small carriers in the European periphery listed in less traded Stock exchanges. On the contrary, the results of the thesis are more inline with Loudon (2004) where the results also exhibited ambiguity. He found the jet fuel exposure to be negative and statistically significant for Australian Qantas Airways, whereas the exposure for Air New Zealand was positive and statistically significant for longer time period. Likewise, the evidence from the thesis is in line with Bartram (2003) in which he found not all the companies have a significant commodity price exposure. Bartram also concluded that some companies are somewhat successful in hedging the commodity price exposures. One plausible reason for the thesis’ results might be that Scandinavian Airlines and Finnair have more successful jet fuel hedging practices in place.

5.4 Hedging Practices

In this section, the emphasis is on how the Nordic countries' listed airlines hedge against jet fuel price risk. Furthermore, each of the sample airlines' hedging practices between the years 2006 and 2014 are individually analysed. In addition, there is comparison of the individual airlines' hedging practises.

5.4.1 Finnair

Finnair manages its jet fuel price risk and other financial risks in accordance with its risk management policy. According to Finnair's Annual Report (2015), the risk management policy is approved by the Board of Directors, and the policy dictates the minimum and maximum levels allowed for each specific financial risk. In addition, the financial risk management is both directed and supervised by the Financial Risk Steering Group. However, the implementation of the risk management policy is conducted by the finance department of the company. (Finnair Annual Report 2014, 2015.)

The airline states that the future development of jet fuel price is one of the most significant near-term risks and uncertainties the company faces. What is more, the fuel price development has a significant impact on the company's result because fuel costs are the most significant expense item. According to Finnair (2015), a ten percent change in the world jet fuel prices would have an impact of approximately 16million euros on the operating result taking the hedging into account. Without the jet fuel hedges in place, the effect would be 43million euros at an annual level. (Finnair Annual Report 2014, 2015.)

The hedging is conducted with the principle of time diversification since it is done on a rolling basis. Figure 8 illustrates the jet fuel hedging policy at Finnair.

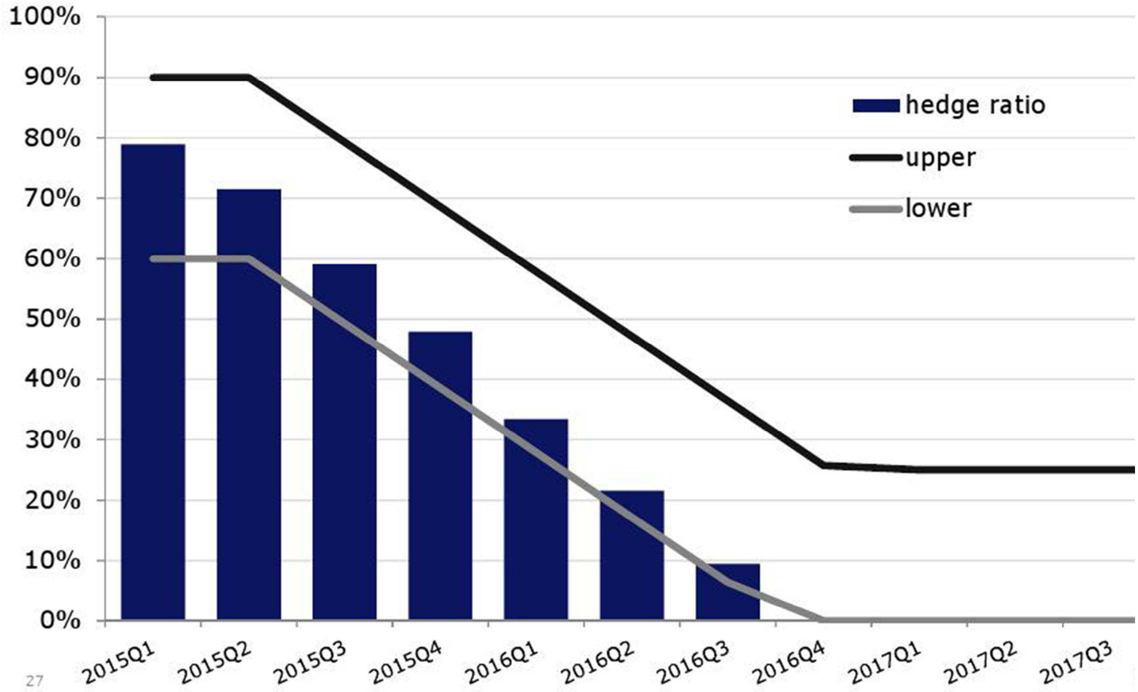


Figure 8 Jet fuel hedging profile (source: Finnair Q4 Interim Report 2014)

The risk management policy sets the minimum and maximum limits for the hedging for each coming quarter as can be seen from the figure 8. The company currently hedges 24 months forward with the upper and lower hedging limits being 90% and 60%, respectively. Then, the hedging limits decrease approximately 10% per quarter for the next 18 months. The hedges must fall between the predefined hedging limits at the end of each quarter. This layered hedging profile is replicated on a rolling basis. Consequently, at the end of the following quarter, the hedging levels are increased so that the hedging is in accordance with the hedging policy. Again, this is done at the end of the following quarter, so the layered hedging profile remains constant over time. The hedging provides time diversification since the hedges are bought incrementally as the time passes. As a result, the fuel prices are not locked in at one point in time but over longer time horizon at different price levels. According to Pasi Keski-Karhu (interview 11.5.2015), the Director of Treasury Operations, responsible for jet fuel risk management and hedging, at Finnair, the risk management policy would allow deviating from the hedging limits in between the quarters as long as the hedging ratios would be in accordance with the risk management policy at the end of each quarter. However, he states that he has not deviated from the policy guidelines because the essence of hedging is not to speculate but to consistently and prudently hedge over time.

Since the commodity prices are highly volatile and jet fuel such a significant expense item, the company engages in jet fuel hedging. Mr. Keski-Karhu states that by hedging, the company aims at providing a platform for business planning over medium and longer term. For example, investment in new fleet can be done even years in advance and the planes will operate in service even up to 10 to 15 years. Consequently, the capital budgeting would be extremely difficult if the company remained fully exposed to jet fuel price changes. Therefore, the hedging aims at consistency, stability, and continuance. By hedging the airline seeks predictability in how fuel price changes would impact the company. (Pasi Keski-Karhu)

> *If we didn't hedge and remained fully exposed to fuel price fluctuations, the planning of business operations would be very difficult. It would be much like tossing a coin.*
>
> (Pasi Keski-Karhu, Director of Tresury Operations at Finnair)

Only options and swap contracts are currently employed in the jet fuel hedging at Finniar. However, Paski Keski-Karhu points out that the risk management policy would allow employing other derivatives instruments as well. In the extreme price increases of petroleum products options are preferred over swaps. For example, during the outbreak of the Libyan crisis in 2011 the price of oil soared and Finnair preferred options over swap contracts. Swaps, however, are much employed during low price regimes notes Mr. Keski-Karhu. Options are used to built option structures. The risk management policy dictates what option structures can be used. In addition, it requires that the option structures are all zero in cost. Therefore, simple call options are not feasible. According to Mr. Keski-Karhu the option premiums would be extremely expensive due to high volatility of commodity prices. Therefore, most of the airlines use zero-cost structures except for some large airlines such as Germany's Deutsche Lufthansa which has also used simple cap options in its jet fuel hedging. Finnair uses both collar and three-way collar[12] structures in jet fuel hedging.

All the derivatives instruments Finnair employs in jet fuel hedging are over-the-counter. Pasi Keski-Karhu highlights that listed derivatives would be very expensive due to actual daily settlement of the cash flows resulting from the hedges. It would pose a significant risk should the hedges fall deep out of the money[13] because the airline should settle the losses daily. What is more, there is lack of availability in listed jet fuel products. Over-the-counter contracts can be tailored to meet airlines' hedging needs and they are settled only at maturity. The daily value of the contracts is calculated and they only affect the credit line obtained from the counterparty. Therefore, if the hedges are

[12] Three-way collar is similar to a regular collar but in the case of airlines, in addition to selling a put option and buying a call option, airline sells an additional call option with a strike price higher than the strike of the acquired cap. Consequently, the acquired cap protects the airline from price increases until the strike proce of the written call option. From there on, the net effect of the call options equals the spot market price.

[13] Hedge is out of the money for an airline when the strike price is higher than the underlying's sport price.

deep out of the money, actual settlements are not conducted. Instead, they only affect the credit line. In other words, the credit line limits how much of exposure the counterparty will tolerate from the airline. The only underlying instrument currently used in hedging is jet fuel, although the mandate allows hedging with other distillates as well. According to Pasi Keski-Karhu, jet fuel is widely used as the underlying partly because it is rather simple without the basis risk and partly because there is poor data available on the crack spread. For example, Bloomberg terminal updates the crack spread only once a day. He also notes that jet fuel is widely used as the underlying among the carriers as well.

Finnair has also invested in modern fleet and engages in operational hedging measures in addition to financial hedging. According to the Annual Report 2014, investment in next generation aircrafts aims at lowering the fuel consumption. The Airbus A350s on order will reduce the fuel consumption by 25% when compared to Airbus A340s in service. In addition, Finnair introduced an economical flying training program in 2012 aimed at all its pilots. The program implements operating practices to increase overall fuel economy of flights. The measures include flying at optimal airspeed, altitude, and the most direct route available, as well as operating continuous descent approaches whenever possible. In continuous descent approach the flight continuously descents with less throttle or idle throttle resulting in less fuel burned when compared to conventional approach in which descending takes takes place with discreet descents to several flight levels. What is more, the planes taxi using only one engine whenever possible, which also reduces fuel consumption. Likewise, Finnair has reduced the empty weight of the aircraft by investing in the fleet modernisation. For example, the company has used light weight materials in its cabin and seats. Finnair also replaced all luggage containers in its narrow-body fleet with composite material containers that are lighter in weight than the conventional containers. (Finnair Annual Report 2014, 2015.) Mr. Keski-Karhu notes that while finding marginal ways to improve efficiency and reduce the empty weight of the planes may sound trivial, the fact that the airline operates numerous flights a year cause marginal improvements to add up to significant figures on an annual level. For example, Finnair weighed the seat back magazines and estimated that the removal of the magazines would yield savings of several million euros a year due to lower fuel consumption. The analysis, however, was conducted few years ago during a higher fuel price regime, but provides a concrete example of the significance of even marginal improvements.

Finnair currently does not systematically employ alternative fuels in its flight operations. In 2014, the airline operated a flight from Helsinki to New York with biofuel mixture partly manufactured from cooking oil. However, according to Finnair (2015) the broader use of biofuels is not really feasible due to lack of availability. What is more, the price of alternative biofuels is three times the price of conventional fossil jet fuel. (Finnair Annual Report 2014, 2015.) Pasi Keski-Karhu views that bio fuels will not be a relevant alternative in the near future. He states that the current bio fuel flights among airlines have been more about gaining positive publicity. However, the emergence of unconventional fuel sources, such as shale oil, is in Keski-Karhu’s view a very positive development. He views that additional supply not coming from the Middle East and OPEC should lessen the impact of these very producers’ actions in the commodity markets. Still, Mr. Keski-Karhu views that, over a very long time horizon, alternative fuels will likely replace fossil fuels to a large extent at least in the industries where possible.

The hedging practices of Finnair have evolved over time to some degree. However, the jet fuel hedging appears to be very consistent over the studied time period. Table 5 highlights the jet fuel hedging practices of Finnair over the time period of 2006–2014.

Table 5 Hedging of jet fuel price risk at Finnair 2006–2014 (source: Company Annual Reports, Financial Statements, and Interim Reports)

	Finnair								
Year	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
% Hedged for the next year	63%/42%	70%/43%	75%/54%	73%/51%	75%/60%	75%/58%	76%/59%	74%/57%	75%/54%
Time horizon (yrs)	3	3	2,5	2,5	2	2	2	2	2
Instruments	Forwards, swaps, options	Forwards, swaps, options	Forwards, swaps, options	Forwards, swaps, options	Forwards, swaps, options	Swaps, options	Swaps, options	Swaps, options	Swaps, options
Underlying	Jet fuel, jet differential and gasoil	Jet fuel, jet differential and gasoil	Jet fuel, jet differential and gasoil	Jet fuel, jet differential	Jet fuel, jet differential	Jet fuel	Jet fuel	Jet fuel	Jet fuel
% of Operarting Costs	19,0 %	20,1 %	24,2 %	21,4 %	21,2 %	23,8 %	27,6 %	28,4 %	28,0 %
% of Turnover	19,4 %	20,0 %	24,6 %	24,5 %	21,3 %	25,0 %	27,4 %	28,7 %	28,7 %
Hedging Lmits	>60%/next 6 months, decreasing thereafter	>60%/next 6 months, decreasing thereafter	>60%/next 6 months, decreasing thereafter	>60%/next 6 months, decreasing thereafter	60-90%/next 6 months, decreasing 10%/quater	60-90%/next 6 months, decreasing 10%/quater	60-90%/next 6 months, decreasing 10%/quater	60-90%/next 6 months, decreasing 10%/quater	60-90%/next 6 months, decreasing 10%/quater

Finnair's hedging ratio between the years 2006–2014 has not varied substantially, as can be observed from the table 5. At the end of the fiscal year the company reports the hedging ratios for the next six months and for the second half separately. Finnair had hedged 63% of its anticipated fuel consumption for the coming six months at the end of the financial year 2006 and 42% for the rest of the year. The single largest change in the hedging ratio for the coming six months took place between the years 2006 and 2007. At end of the financial year 2007 the hedging ratio between was 70% for the first half of 2008 (an increase of 7 percentage points). The hedging ratio for the second half of the coming financial year increased the most from 2007 to 2008, by a total of 11 percentage points. At the end of 2008 this ratio was 54%, whereas in 2007 it was 43%. From 2008 onwards, the hedging ratios remained somewhat similar and exhibited relatively little variation. The time horizon of jet fuel hedging was three years in 2006 and 2007. Then, the time horizon was 30 months, and from 2010 onwards it has remained at 24 months.

In terms of derivatives instruments used in hedging and the underlying commodity, the airline has exhibited consistency. During the years 2006 and 2010, Finnair hedged jet fuel price risk with forward contracts, swaps, and options. From the year 2011 onwards, the company have foregone forwards and only employs swaps and options. As the underlying instrument, Finnair has used jet fuel, gas oil, and jet differential between the years 2006 and 2008. Because the company engaged in cross hedging by hedging with gasoil, the basis was managed with jet differential contracts. During 2009 and 2010, the underlying instruments were jet fuel and jet differential, latter of which was likely a remainder from the previous years' gasoil cross hedging. From 2011 onwards, only jet fuel has been used as the underlying asset in jet fuel hedging.

The fuel expenses share of total operating expenses and its volume relative to company turnover has mostly been on an increase over the observed period, except for the slight decrease after the year 2008. Fuel spending represented 19% of the total operating costs in 2006, and in the year 2014 it was already 28% of the total operating expenses. The most significant year-on-year increase in relative fuel costs took place between 2007 and 2008. In the year 2007, fuel expenses where 20.1% of total operating expenses whereas in 2008 they where 24.2%, an increase of 4.1 percentage points. Following the 2008, the figure tumbled to 21.4% in 2009 and further to 21.2% in 2010 before returning to growth path. Fuel costs as a percentage of turnover have developed similarly with a growing trend except for the drop in 2010. It is interesting to notice that the decrease took place in 2010, whereas the fuel cost relative to total operating expenses already fell in 2009. In 2006 the fuel costs where 19.4% of turnover, and in 2014 they stood at 28.7%.

The hedging limits with regards to jet fuel consumption have remained quite constant. For the period 2006–2009, Finnair's hedging policy required hedging more than 60% of consumption for the next six months. Thereafter, the hedging ratio fell until being zero three years in advance. Then, the hedging policy changed in 2010 and have remained unchanged for the rest of the observation period. In the new policy an upper limit was introduced, and the level by which the hedging ratio would decrease on a quarterly basis was also introduced. In this very policy, the hedging ratio for the coming six months is 60–90%, and from thereon the hedging ratio falls 10% each quarter up until being zero after 24 months. All in all, the hedging levels and practices are quite constant at Finnair, and the hedging has been systematic over the time period.

5.4.2 Scandinavian Airlines

Scandinavian Airlines states that it manages financial risks, including jet fuel price risk, through hedging. By engaging in hedging, the company aims at countering short term fluctuations in market prices as well as providing scope to manage any changes. What is more, the hedging strategy of the company aims at enabling the company to act promptly when changes in jet fuel market prices are advantageous. All risk management is conducted centrally in accordance with the financial policy adopted by the Board. (Scandinavian Airlines Annual Report 2013–2014, 2015.)

The airline highlights that jet fuel costs are its largest operating expense item. The company estimates that a one percent change in the price of jet fuel would have an impact of approximately SEK88million (~9.28million euros) on the result of its airline operations. If the change is positive, the effect would be negative, and vice versa. (Scandinavian Airlines Annual Report 2013–2104, 2015.) In the jet fuel price hedging, Scandinavian Airlines currently employs a mixture of call options and swap agreements. In fact, the company lowered its hedging level for the Q1 2015 from 100% down to 79% due to out-of-the-money call options. (Scandinavian Airlines Interim Report Q4 2013–2014, 2014.)

The jet fuel hedging policy for Scandinavian Airlines is currently rather straightforward. The company hedges 40–80% of its forecasted consumption 12 months in advance. However, it appears that the company employs some time diversification in its hedging. According to the Annual Report 2013–2014 (2015), the company was 79% hedged for the next quarter and 72% for the following quarter. Then, the hedging fell to 26% and only 6% for the following quarters. While there appears to be time diversification, the risk management policy does not require that. Instead, only the 40–80% limits apply for the coming 12 months. (Scandinavian Airlines Annual Report 2013–2014, 2015.)

Scandinavian Airlines has also taken operational measures to lower the fuel consumption in order to mitigate the jet fuel price risk. The company has equipped its existing fleet with lighter seats, so as to reduce the fuel consumption. Likewise, the company has refitted its planes with new, less fuel consuming engines. In addition, fuel consumption has decreased due to investment in new, more fuel efficient fleet. For example, in its fiscal year 2013–2014, the company phased out its old McDonnel Douglas MD80s and replaced them with Airbus A320s which have better fuel efficiency. In addition, Scandinavian Airlines has placed orders on eight next generation Airbus A350 wide body aircrafts, the first of which will begin service in late 2015. The airline also continuously seeks ways to reduce fuel consumption on daily flight operations. The measures include more efficient operation of the aircraft in air and on the ground. In addition, the company states it seeks measures to reduce the weight of the aircrafts. (Scandinavian Airlines Annual Report 2013–2014, 2015.) However, detailed information is not given about the operational measures used in the air nor on the ground to reduce the fuel consumption.

Scandinavian Airlines does not employ alternative jet fuel on a large scale. The company flew a few flights in 2014 with using a mixture of synthetic jet fuel JET A1. In addition, a decision was made to purchase the alternative jet fuel for flights operated from Oslo in 2015, however, only with a small quantity mixed in with the conventional jet fuel. Scandinavian Airlines also continues its efforts to accelerate the large-scale commercialisation of alternative fuels via the Nordic Initiative established in 2013. The initiative aims at making bio fuels a reality in larger scale in the near term, and the airline was one of the founding members of the initiative. (Scandinavian Airlines Annual Report 2014.)

Jet fuel hedging at the Scandinavian airlines appears to be quite constant over the long time horizon. Table 6 highlights the hedging practices of Scandinavian airlines between the years 2006–2014.

Table 6 Hedging of jet fuel price risk at Scandinavian Airlines 2006–2014 (source: Company Annual Reports, Financial Statements, and Interim Reports)

	Scandinavian Airlines								
Year	2006	2007	2008	2009	2010	2011	2012	2013	2014
% Hedged for the next year	57%	41%/40%	60%/32%	62%/50%	54%/55%	56%/49%	63%/37%	90%/14%	76%/16%
Time horizon (yrs)	1	1	1	1	1.5	1.5	1.5	1.5	1
Instruments	Options, swaps	Options, swaps	Options, swaps	Options, swaps	Options, swaps	Options, swaps	Options, swaps	Options, swaps	Options, swaps
Underlying	Jet fuel	Jet fuel	Jet fuel	Jet fuel	Jet fuel	Jet fuel	jet fuel	Jet fuel	Jet fuel
% of Operarting Costs	18,0%	17,3%	18,0%	17,0%	16,3%	20,2%	22,9%	24,5%	23,3%
% of Turnover	17,8%	15,5%	18,0%	17,1%	16,2%	18,8%	22,3%	21,4%	23,2%
Hedging Lmits	40-60%	40-60%	40-60%	40-60%	40-70%	40-80%	40-80%	40-80%	40-80%

From the table 6 we can observe that Scandinavian Airlines has hedged its anticipated fuel consumption with quite some variation among the hedging ratios. The figure before the slash is the hedging level for the next six months and after the slash for the second half of the coming fiscal year (except for 2006, where only the annual ratio was available). At the end of the year 2006, the airline had hedged 57% of its anticipated fuel consumption for the coming year. The next year, significantly less of the anticipated fuel consumption was hedged for the following six months as well as the second half of the year. The hedging ratios at the end of the fiscal year 2007 where 41% and 40% respectively, which is approximately 16 percentage points less than in the previous year. During the 2008 and 2009, the hedging ratios for the coming year stood at around 60% for the first half of the following year before falling down to around 55% for 2010 and 2011. Then, the single largest increase (27 percentage points) in the hedging ratio took place in 2013, when as much as 90% of the fuel consumption for the first half of the year was hedged. However, only 14% of the second half’s anticipated fuel consumption was hedged at the end of 2013. The hedging horizon has been very constant during the observed period. From the year 2006 to 2009, the hedging horizon was 12 months for Scandinavian Airlines. Then, from 2010 to 2013, the time horizon was extended to 18 months. Again from 2014 onwards it has been reduced back to 12 months.

Scandinavian Airlines has been very consistent with the derivatives instruments employed in the hedging. From the table 6, one can observe that the airline has employed only options and swaps throughout the sample period. The options also include collar structures over the sample period. Although, the company does not systematically state the underlying commodity used in fuel price risk management, it can be found in the annual reports and interim reports that the underlying asset is jet fuel. This is because at the end of financial year, the company states the fixed prices and the respective proportions of jet fuel in its hedging portfolio for the next fiscal year. Therefore, if the underlying asset would have been other than jet fuel the basis risk related to cross hedging would make it unfeasible to estimate the price paid for jet fuel in advance.

Scandinavian Airlines has some degree of variation in the fuel expenses relative share of total operating expenses as well as in fuel expenses relative to turnover during the period 2006–2014. In 2006 the fuel expense share of total operating expenses was 18%. During the period 2007–2010 the share remained between 16–18%, whereas in 2010 the figure reached 20.2% and peaked in 2013 at 24.5% while decreasing to 23.3% in 2014. It can be observed that the fuel costs’ share of operating expenses have increased. When comparing to turnover, it can be observed from the table that the there is a similar trend. In 2006 the fuel costs relative to turnover where 17.8%, whereas in

2014 the figure was 23.2%. During the period, the figure was at its lowest at 15.5% in 2007.

The hedging limits concerning the fuel price hedging have been quite constant. During the period 2006 to 2009, the hedging limits where 40 at the bottom and 60% at the top. In 2010, Scandinavian Airlines increased the upper hedging limit to 70%, and again in 2011 to 80%. Between the years 2011 and 2014, the hedging limits have remained constant, the lower limit being 40% and the upper limit 80%. The limits are on a rolling basis for the coming 12 months.

5.4.3 Norwegian Air Shuttle

At Norwegian Air Shuttle, financial risk management and hedging are based on the group’s risk management policy. Financial risk management is implemented and conducted by the central treasury department in accordance with the risk management policy. Group’s operating units together with the group treasury identifies, evaluates, and hedges against the risks. (Norwegian Annual Report 2014, 2015.)

According to Norwegian Air Shuttle (2015), jet fuel costs are a substantial expense item among its operating expenses, and, therefore, the price fluctuation of jet fuel impacts its anticipated cash flows. By implementing the jet fuel hedging strategy, the company seeks protection from both sudden and significant jet fuel price increases. Meanwhile, the company states that it wants to retain access to price reductions as well. (Norwegian Annual Report 2014, 2015.) In its Q4 2014 interim report, the airline estimated that a one percent decrease in jet fuel spot market price, would result in NOK44million (~EUR4.86million) increase in income on an annual level, without the jet fuel hedging taken into consideration. (2014 Q4 Interim Report Norwegian, 2015.)

The group manages jet fuel price exposure with derivatives instruments. The only derivatives instrument used in the jet fuel hedging is fuel forward contracts. Unlike the other listed airlines in the Nordic countries, the company does not employ options nor swap contracts. What is more, the group treasury has a mandate to hedge up to 12 months in advance. Similar to derivatives instruments, the risk management policy sets the limits with regards to hedging ratios. The policy allows currently hedging up to 100% of the anticipated jet fuel consumption for the next 12 months. However, there is no minimum required hedging level dictated by the risk management policy. (Norwegian Annual Report 2014, 2015.) Therefore, the policy allows the airline to remain fully exposed to jet fuel spot market price fluctuations and is not very prudent.

With regards to operational measures in reducing the jet fuel consumption and, therefore, the price exposure, the airline has engaged in operational hedging as well. Norwegian Air Shuttle operates the youngest fleet of the Nordic countries’ listed airlines (4.2 years), and the company has heavily invested in new, fuel efficient fleet. For example, in 2012, the airline placed an order of 222 short-haul aircrafts. In addition, the company operates and has placed additional orders on the Boeing 787 wide-body aircraft. The airline estimated that the realized fuel saving per seat with Boeing 787s has been more than 20% when compared to other similarly sized aircrafts that are not built from the composite materials. According to the company (2015), via investment in modern fleet, the airline has managed to decrease fuel consumption by 20% since the year 2008. (Norwegian Annual Report 2014, 2015)

In addition to investment in new fleet, Norwegian Air Shuttle has taken other operational measures as well. In 2014, the airline flew its first flight using biofuel. However, the use of biofuels is not systematic nor has the company stated anything about employing them in larger scale in the near future. What is more, the airline operates continuous descent approaches whenever possible. In addition, the company has fitted all its Boeing 737-800 series narrow-body aircrafts with winglets, that reduce the drag and, thus, fuel consumption. The winglets are fins located at the end of the wingtips. Likewise, the airline aims to minimize the empty weight of the aircraft, which likely stems from the low-cost business model. Lastly, the company conducts a special engine wash on each aircraft two to three times a year, to reduce the fuel consumption. (Norwegian Annual Report 2014.)

Norwegian Air Shuttle appears to have quite some variation in its hedging practices over the observed period. Table 7 exhibits the jet fuel hedging between the years 2006 and 2014 at Norwegian Air Shuttle.

Table 7 Hedging of jet fuel price risk at Norwegian Air Shuttle 2006–2014 (source: Company Annual Reports, Financial Statements, and Interim Reports)

	Norwegian								
Year	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
% Hedged for the next year	50%/25%	0 %	7.3%	25 %	16 %	2 %	1 %	0 %	27 %
Time horizon (yrs)	1	1	1	1	1	1	1	1	1
Instruments	Forwards	Forwards	Forwards	Forwards	Forwards	Forwards	Forwards	Forwards	Forwards
Underlying	Jet fuel	Jet fuel	Jet fuel	Jet fuel	Jet fuel	Jet fuel	Jet fuel	Jet fuel	Jet fuel
% of Operarting costs	29,7 %	24,2 %	31,2 %	21,1 %	26,7 %	32,0 %	32,0 %	32,0 %	32,2 %
% of Turnover	23,9 %	23,4 %	32,2 %	19,5 %	24,3 %	29,4 %	29,1 %	30,2 %	32,3 %
Hedging limits	up to 100%	up to 100%	up to 100%	up to 100%	up to 100%	up to 100%	up to 100%	up to 100%	up to 100%

Norwegian Air Shuttle has been quite inconsistent in hedging its jet fuel consumption between the years 2006 and 2014. The hedging levels for the coming year have shown variation as can be seen from table 7. At the end of the fiscal year 2006, the airline was 50% hedged for the first half and 25% hedged for the second half of the coming year. Then, the company seem to have remained fully exposed to jet fuel price fluctuations because it had hedged 0% of the jet fuel consumption for the coming year. Likewise, Norwegian Air Shuttle had hedged only 7.3%, a 7.3 percentage point increase from the previous year, at the end of the fiscal 2008 before reaching 25% hedging ratio at the end of the fiscal 2009. However, the company decreased the hedging for the year 2011 as it was 16% hedged at the end of 2010 and for the coming years remained basically unhedged. Only in 2014, the airline started hedging again and was 27% hedged at the end of the year. The single largest decrease in the hedging ratio for Norwegian Air Shuttle is 25 percentage points, and the single largest increase is 27 percentage points.

Norwegian Air Shuttle, however, has kept its maximum hedging horizon and derivatives instruments constant over the observation period. Form the table 7, it can be seen that the airline has had a maximum hedging horizon of one year throughout the observation period, although the company have at times remained fully exposed to jet fuel price fluctuations. Likewise, consistency can be seen in the hedging instruments. Norwegian Air Shuttle only employs forward contracts in its jet fuel hedging, and the underlying is jet fuel. Consequently, the company foregoes the flexibility of the options, but is not exposed to basis risk related to cross hedging.

The fuel costs’ share of total operating expenses and fuel costs’ relative to the turnover show some variation. From the table 7 it can be seen that the fuel costs have represented 21.1%–32.2% of the total operating expenses. The fuel costs share have remained at 32% from 2011 onwards. The fuel costs relative to turnover, except for the years 2007, 2009, and 2012, have increased from the previous year, and they exhibit a growing trend. From 2011 onwards, the figure has remained approximately around 30%, whereas in 2006, it was 23.9% of the turnover.

An interesting point with Norwegian Air Shuttle is the hedging limits. The company is allowed to hedge up to 100% of its fuel consumption for the coming year, although the company never hedged more than 50% of the anticipated consumption. What is more, Norwegian has no required minimum level in its hedging ratio. Therefore, the hedging policy allows it to remain fully exposed to fuel price fluctuations. Consequently, the company remained unhedged or less than 10% hedged on five years out of nine during the observation period.

5.4.4 Icelandair Group

Risk management is conducted in line with risk management policy guidelines set by the Board of Directors. The Board of Directors defines the risk management policy measures so as to reduce the exposure to financial risks. The measures set by the policy, in turn, dictate the framework and parameters that must be considered in financial risk management aimed at mitigating the exposure from price volatility. The implementation of risk management policy is conducted by an internal risk management committee, that is chaired by the chief executive officer. In addition, the risk management policy is reviewed on a regular basis. (Annual Report 2014 Icelandair Group, 2015.)

Icelandair Group states that jet fuel is a significant component of the company's cost structure. For example, the company commented that the recent drop in jet fuel price can have a significant impact on its operation's profitability over the longer term. In fact, the decrease in jet fuel price is the most significant item responsible for the increased EBITDA during the fiscal year 2014. The objective of risk management at the airline is to manage and control price exposures in order to maintain them at an acceptable level. (Annual Report Icelandair Group 2014, 2015.)

With regards to financial risk management, the airline employs a mixture of swaps and options in jet fuel hedging. The policy does not allow employment of any other financial derivatives instruments. At current, the company hedges between 40–60% of the anticipated jet fuel consumption. However, should the forward ticket sales exceed the 40% minimum level of anticipated consumption, forward ticket sales then set the minimum hedging level. The time horizon for hedging is currently 9–12 months forward. Icelandair Group also sates that basis risk is avoided. (Annual Report 2014 Icelandair Group, 2015.) Therefore, it can be the assumed that the airline only employs jet fuel as the the underlying asset in its jet fuel hedging. However, the airline did not explicitly mention the underlying in its financial statements.

Icelandair Group also utilises other measures in mitigating jet fuel price fluctuations in addition to traditional derivatives instruments. The company utilises contractual risk transfer where feasible. What is more, the company states that ticket pricing is an important tool over the medium term to mitigate the jet fuel price volatility. Likewise, production management may become a relevant option over the longer term in coping with fuel price trends according to Icelandair Group. However, Icelandair Group has not utilised alternative sources of fuel and does not provide any evidence of aiming at the utilisation of biofuels. Nonetheless, the airline has a Fuel Management Committee that actively monitors and evaluates new ideas to reduce fuel consumption. The operational measures in place include fitting most of the aircraft with winglets. What is more, the company placed orders on 16 narrow body Boeing 737 MAX and 737 MAX9 planes in

2013. The first of which will be delivered in 2018. (Annual Report 2014 Icelandair Group, 2015.)

In terms of jet fuel hedging, Icelandair Group is the only airline in the study that has actually diverted from its hedging policy during the observation period. Table 8 exhibits the jet fuel hedging practices at Icelandair Group between the years 2006 and 2014. In fact, the the risk management policy was revised in 2014 and the extension of the hedging tenor of up to 12 months forward was introduced.

Table 8 Hedging of jet fuel price risk at Icelandair Group 2006–2014 (source: Company Annual Reports, Financial Statements, and Interim Reports)

	Icelandair Group								
Year	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
% Hedged for the next year	N.A.	55-60%	41.5%/16.5%	0 %	N.A.	33%/10.33%	34.83%/6.83%	47.83%/13.67%	54.17%/38.5%
Time horizon (yrs)	1,5	1	1	1	0,75	0,75	0,75	0,75	1
Instruments	Options, swaps	Options, swaps	Options, swaps	Options, swaps	Options, swaps	Options, swaps	Options, swaps	Options, swaps	Options, swaps
Underlying									
% of Operarting costs	19,0 %	16,8 %	24,0 %	18,4 %	19,8 %	25,4 %	27,9 %	27,6 %	28,4 %
% of Turnover	16,9 %	15,4 %	23,0 %	16,5 %	17,0 %	22,7 %	24,5 %	23,7 %	24,4 %
Hedging limits	40-80%	40-80%	40-80%	40-80%	up to 60%	40-60%/6m, 20%/7-9m	40-60%/6m, 20%/7-9m	40-60%/6m, 20%/7-9m	40-60%

Icelandair Group reports less information concerning the fuel hedging practices and also exhibits quite some variation in the hedging levels. The company did not report the hedging level at the end of the fiscal year 2006. However, the company revealed in its 2006 annual report that during the fiscal year the company's hedging level was closer to lower bound of the hedging limit, which stood at 40% of the jet fuel consumption. From 2007 the company has mostly reported its year-end hedging portfolio except for the year 2010. In 2007, the company had hedged 55-60% of its anticipated jet fuel consumption for the coming year. Likewise, the figure for the coming six months at the end of 2008 was 41.5% and for the second half of the coming year it was 16.5%. The company reported that it had sold put options in order to lower exposure of fixed-price swaps and collar structures, and the company also made an exception to the lower hedging ratio of 40%. At the end of 2009, there were no fuel hedges in place. Therefore, the company remained fully exposed to market price fluctuations. The hedging level at the end of year 2010 was not reported, and the company stated that they are still diverting from the lower hedging limit of 40% and instead the company hedged at least the forward ticket sales volume for the coming year. The company did not reveal hedging levels at the end of 2010, but in 2011 the airline was 33% hedged for the first half of the year, and 10.3% for the second half. The hedging levels remained somewhat similar before increasing in 2013 and 2014, when the company had hedged 54.2% of the anticipated fuel consumption for the first half of the coming fiscal year, and 38.5% for the second half.

The airline has a little variation in the hedging time horizon and the trend has been towards shorter time horizons, but the derivatives instruments seem to have remained very constant over the period. In 2006, the time horizon for jet fuel hedging was 1.5 years. However, the following year, the time horizon was reduced to 1 year which remained the policy until 2010, when the hedging period was cut down to nine months. The hedging horizon was kept at nine months in advance, until in 2014 it was extended back to 12 months. The company has reported to employ options and swaps in its jet fuel hedging throughout the observation period. Interestingly, Icelandair Group reported that it had sold put options in order to offset the exposure of its swap contracts and collar structures during the financial year 2008. None of the other airlines reported any such counteraction in the hedges that had already been in place.

Fuel costs' share of the total operating expenditures have exhibited some fluctuation. In the year 2006, the fuel expenses represented 19% of the total operating expense. The following year, the figure was down to 16.8% (the lowest over the time period) before leaping to 24%. From the table 8 one can observe that the fuel costs share fell down to 18.4%, and remained there, before hitting 25.4%. The figure has roughly remained there before, and in 2014 the figure was 28.4% which is the highest during the observation period. Comparing the fuel expenditures to the company turnover yields similar results. The fuel bill as a percentage of the company turnover was 16.9% in 2006, and in 2014 the respective figure was 24.4%. In addition, the fuel expenses relative to turnover have been higher during the later years of the observation period when compared to first years of the observation period, excluding the year 2008 when the figure soared to 23%.

5.4.5 Results on Jet Fuel Hedging Practices

Among the carries, there is some similarities in jet fuel hedging practices. However, substantial differences can be found as well over the observation period.

In terms of how the Nordic countries' listed airlines perceive jet fuel expenditures, is very homogenous. All the airlines considered jet fuel price as a significant factor affecting the operations and earnings as well. What is more, all the airlines stated that the jet fuel is either the most significant operating expense or at least a very significant expense item. Figure 9 exhibits the share of jet fuel of the total operating expenses for all the carriers during the period 2006–2014.

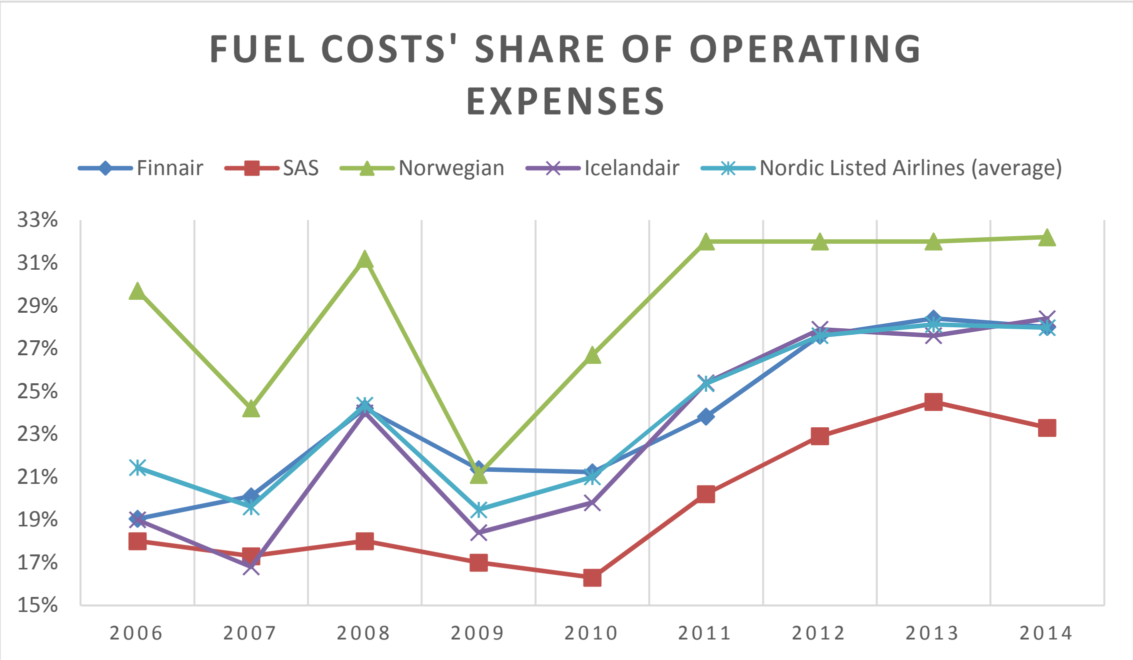


Figure 9 Fuel costs of total operating expenses (data: company financial statements)

From the figure 9 one can observe that among the operating expenses, the share of fuel costs has increased overall during the observation period. However, the figure fell quite a bit in the aftermath of the financial crisis when the oil and fuel prices collapsed. Since then, the figure has mostly been on the rise. Scandinavian Airlines (SAS) has the lowest fuel costs relative to operating expenses. In contrast, Norwegian Air Shuttle has the highest figure over the observation period. It is not really surprising since the airline is the only low-cost carrier and low-cost carriers typically have slimmer overall cost structures when compared to traditional network carries.

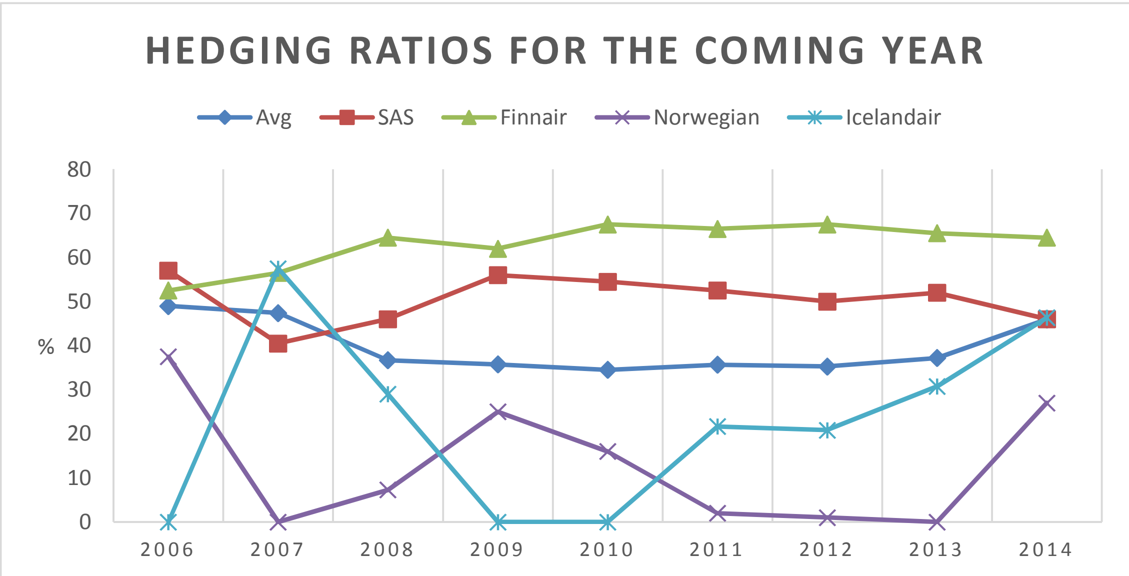
All the Nordic listed airlines have a similar approach to jet fuel price risk management. At the airlines, there appears to be either a risk management policy in place or financial policy includes the risk management policy as well. Furthermore, The Board of Directors typically sets the risk management policy that dictates the guidelines for the jet fuel price risk management. The actual risk management is conducted in group treasury function except for the Icelandair Group where there is an internal risk management committee that executes the hedging. At Finnair, it is solely the director of treasury operations that conducts the hedging in accordance with the risk management policy.

In terms of derivatives instruments used in the jet fuel hedging, there appears to be some variation among the airlines, but the instruments used in individual airlines remained very consistent over the observation period. 75% of the of the companies employed a mixture of derivatives instruments in jet fuel hedging over the observation period. Only Norwegian Air Shuttle solely used simple forward contracts throughout the period 2006–2014. Between 2006 and 2011, Norwegian Air Shuttle and Finnair used forward contracts in jet fuel hedging. However, from 2011 onwards only Norwegian Air Shuttle employed forwards in jet fuel hedging as Finnair no longer employed jet fuel forwards. What is more, 75% of the airlines employed swap contracts in the jet fuel price risk management. The figure remained constant the whole period. In addition, three of the airlines also used options in jet fuel hedging throughout the years 2006–2014. From 2011 onwards 75% of the Nordic listed airlines have hedged using a mixture of options and swaps. What is more, the airlines typically employ option structures in jet fuel hedging so as to create costless structures such as collars or three-way collars.

With regards to underlying instruments, all the airlines have hedged using jet fuel contracts over the sample period. The only airline that has hedged with other underlying instrument in addition to jet fuel is Finnair. During the period 2006–2008, the airline had gasoil derivatives in addition to jet fuel contracts. The company used jet fuel differential contracts as well to account for the product basis risk stemming from the cross hedging. However, only jet fuel has been employed in the jet fuel hedging since then. Because there is not sufficient availability on listed jet fuel derivatives, it can be assumed that all the airlines use over-the-counter contracts. What is more, the daily settlement of the positions would pose significant strains on the cash accounts should the hedges fall deep out of the money.

The hedging policies and profiles are quite similar among the airlines except for Finnair. Likewise, all the airlines hedge on a rolling basis meaning that the hedging ratio is in accordance with the hedging policy at the beginning of each quarter. All the airlines except Finnair have constant upper and lower hedging limits for the hedging tenor. Scandinavian Airlines 40–80%, Icelandair Group 40–60%, and Norwegian Air Shuttle 0–100%. On the contrary, Finnair has the most detailed hedging profile in place. The hedging policy sets the minimum and maximum hedging ratios up to three years in advance. The profile is layered hedging profile meaning that the upper and lower limits decline around 10% per quarter. Over the observation period, the hedging policies have evolved namely with regards to hedging limits. Only one company deviated from the hedging policy during the hedging period. However, Norwegian Air Shuttle's hedging limits are quite trivial and require no hedging at all. In fact, the company had the least systematic jet fuel hedging over the period. With regards to hedging tenor dictated in the hedging policy, Finnair had on average the longest hedging tenor over the observation period (2.33 yrs). Scandinavian Airlines and Norwegian Air Shuttle both had an average hedging tenor of one year while Icelandair Group's stated policy was on average 0.94 years in advance.

Jet fuel hedging has seen some variation among the airlines over the period. Figure 10 captures the hedging ratios of the anticipated jet fuel consumption for the next 12 months at the end of each financial year.



*Hedging ratio was not available for Icelandair Group in 2006 and 2010 as the financial statements did not include sufficient data for calculation.

Figure 10 Hedging ratios for the coming year, % of the anticipated jet fuel consumption (source: Airline Annual Reports and Financial Statements)

In 2006, on average 49% of the next year's anticipated fuel consumption was hedged. The figure dropped down to 36.7% in 2009 and remained around there up until the year 2013. Then the hedging on average was almost 46%. The hedging levels have remained quite constant at Finnair, and moderately constant at Scandinavian Airlines. In fact, these two airlines have been the most systematic and prudent in jet fuel hedging over the study period. On the contrary, at Icelandair Group there is more variation and inconsistency. In 2006 and 2010 the hedging ratio was not reported. Icelandair Group had no hedges in place in 2009 and the company has deviated from its hedging limits over the study period. However, hedging has been the least systematic at Norwegian Air Shuttle. In 2006, the airline had hedged 37.5% of the anticipated fuel consumption for the coming year. The next year, the company remained fully exposed and had no hedges in place. The hedging has been less than 10% of the anticipated consumption in five years during the period 2006–2014. The finding is quite surprising when considering the fact that the fuel expenses represented the highest share of the total operating expenses for Norwegian Air Shuttle during the whole period.

All the airlines employ operational hedging, but the use of alternative fuels is not systematic and has typically been employed in one-time occasions. The only airline not mentioning anything about alternative fuels is Icelandair Group. The airline also operated the oldest fleet. Furthermore, the Icelandair Group is the only airline that considered pricing an effective way to reduce the impact of fuel price increases, where as the other airlines didn’t find it feasible. With regards to current fleet, the airlines have refitted their old planes with lighter seats and materials so as to reduce the empty weight of the planes. Likewise, refitting the planes with new engines and installing winglets seems to be of common practice to reduce fuel consumption and thus price exposure. The airlines also operate aircrafts with fuel efficient operational practices such as the continuous descent approach and aim at flying direct route. In addition, all the carriers have acquired or have on order new, more fuel-efficient planes made out of composite materials to a much larger extent than the traditional aluminium-bodied planes.

6 CONCLUSIONS

All the listed airlines in the Nordic countries engage in jet fuel hedging by using derivatives instruments. The hedging is dictated either by the risk management policy or financial policy. In addition, most of the carriers employ a mixture of derivatives instruments which is line with Morrel (2007). Over the observation period a combination of swaps and options have been the most common in jet fuel hedging. The usage of forwards is less common. In fact, since 2011 only Norwegian Air Shuttle has employed forward contracts in jet fuel hedging.

Most of the airlines employed operational hedging practices that aim at reducing fuel consumption in the short term, except for Icelandair Group. The operational measures where similar to those discussed in Morrel (2003). What is more, only Icelandair Group claimed passing the fuel surcharge onto customers as way to hedge against fuel price increases in short term. This supports Morrel and Swan (2006) that cargo airlines are better positioned to pass on the fuel bills to customers.

The actual hedging practices, however, are not quite homogenous. Especially, the hedging ratios have varied among the carriers between the years 2006 and 2014. Finnair and Scandinavian Airlines have had the highest hedging ratios over the observation period, and they have also been the most systematic in the jet fuel hedging over time. What is more, all the airlines employ over-the-counter contracts, and zero cost structures in options are most common. One reason for this is likely that listed products would pose significant strains on liquidity due to actual daily settlements, and the option premiums in simple call options would add up to significant amounts which supports Morrel and Swan (2006) in the discussion of required cash margins. Furthermore, the jet fuel is not broadly available as a listed product. However, the wide use of jet fuel as the underlying and not using futures contracts in hedging is not in line with previous research, especially Cobbs and Wolf (2004). One potential reason could be that their study focused on U.S. airlines.

The results for jet fuel exposure are mixed. Only Norwegian Air Shuttle and Icelandair Group exhibited negative and statistically significant jet fuel exposure terms. The exposure terms where -0.362 and -0.333 respectively, and both were statistically significant at the 0.01 confidence level. However, Scandinavian Airlines had an exposure term of -0.048 and Finnair a positive term of 0.016. Neither of the terms were not statistically significant.

Norwegian Air Shuttle, which was the only low-cost carrier, had the lowest hedging ratios over the observation period, and the most variation in hedging ratios. Furthermore, the hedging policy was quite trivial as well, anything between 0 and 100% of the anticipated consumption. Consequently, the airline exhibited the largest fuel price exposure and fuel expenditures for the airline where the highest in relation to operating costs over the observation period. When compared to other carries, the low-cost carrier was the least systematic in hedging and its jet fuel price exposure was the highest.

Icelandair Group was not very systematic either in its jet fuel hedging, and the airline was the only to deviate from its hedging policy over the observation period. Similar to Norwegian Air shuttle, Icelandair Group had a negative and statistically significant jet fuel exposure term. On the contrary, Scandinavian Airlines had more systematic jet fuel hedging practices over the observation period, and it did not exhibit statistically significant jet fuel exposure, although the exposure term was negative but much closer to zero than with Norwegian Air Shuttle or Icelandair Group. In addition, Scandinavian Airlines had the second highest hedging ratios during the sample period. Similarly, Finnair did not exhibit statistically significant exposure term, and the term was actually positive, although very close to zero. What is more, Finnair had the highest hedging ratios over the observation period and was the most prudent in its jet fuel hedging. Furthermore, Finnair was the only airline with a layered hedging profile and had the longest hedging tenor which was on average more than twice longer than with the rest of the Nordic listed airlines. The airline also exhibited the least exposure in its jet fuel hedging over the period of 2006 to 2014. The results are similar to those of Loudon (2004) where there was ambiguity in the findings.

It seems that the higher the hedging ratio and the longer the hedging tenor, the less jet fuel exposure the airline faces. What is more, prudency and consistency yields less or no exposure at all in the light of the results. In contrast, the least systematic hedgers with the lowest hedging ratios seem to exhibit greater and statistically significant jet fuel exposure. The evidence supports Bartram’s (2005) conclusions that some companies are more successful in hedging, and, therefore, exhibit less commodity price exposure. The exposures, however, are not in line with Carter, Roger, Simkins, and Treanor (2014) where they found the exposure to be negative and statistically significant for the listed U.S. airlines. The results, however, support Berghöfers and Luceys (2014) findings that the U.S. carriers are more exposed to jet fuel price changes than their European peers. The thesis only studied the relatively small Nordic carriers and the model did not by no means exhaustively explain the logarithmic return of the airline stocks in the Nordic countries.

Operational hedging is considered an important part in the effort to reduce jet fuel consumption, and, thus, jet fuel exposure. The airlines had invested in new fleet and also put effort into reducing the empty weight of the existing fleet. Most commonly, the airlines had replaced the seats with lighter seats and fitted the planes with winglets. Also, marginal improvements are considered significant because the planes fly hundreds of flights a year. However, alternative fuels are not systematically used in flying operations, only in few one-time occasions. This could be interpreted that the flying few one-time flights using biofuels is more about green wash and public relations activities than about truly putting effort into employing alternatives in broader scale.

7 SUMMARY

This thesis has focused on studying the jet fuel price exposure and hedging practices in the listed airlines in the Nordic countries. The airlines in the thesis included Finnair, Icelandair Group, Norwegian Air Shuttle, and Scandinavian Airlines. According to the best of the writer's knowledge, the thesis is the first to study the jet fuel price exposure and jet fuel hedging practices in a mixed-methods framework. What is more, the study is the first one to qualitatively analyse the jet fuel hedging practices in a multi-year context, so as to provide evidence of the jet fuel hedging practices over a longer time period of 2006 to 2014. Since the sample airlines where small and from a narrow geographical market, the thesis could provide deeper understanding of the jet fuel hedging and exposure instead of simple time series analysis.

The jet fuel costs are the most significant operating expense item for the airlines in the Nordic countries much like in the rest of the world. Managing this exposure is of common practice in the Nordic countries. The airlines can hedge jet fuel by using derivatives instruments, such as forwards, swaps, options, and futures. In addition, operational hedging can also be considered a way to mitigate jet fuel exposure. In the thesis, a multivariate model was established to test for the exposure. The exposure was measured as the airline's stock price sensitivity to jet fuel price changes returns. Respective stock market returns where used as the control variable. All the returns where transformed to logarithmic returns and the frequency was weekly returns.

In the Nordic countries all the listed airlines hedge against the jet fuel price exposure by using derivatives instruments. Nordic listed airlines hedged mostly by using a combination of options and swaps. Forwards where less common and futures non-existent. The airlines typically hedged using jet fuel as the underlying. Likewise, the derivatives where over-the-counter. This was mostly due to listed product's daily settlement and the poor availability of listed jet fuel products.

The airlines with the least systematic jet fuel hedging exhibited negative and statistically significant jet fuel exposures, where as the most systematic hedgers with the highest hedging ratios did not exhibit statistically significant jet fuel exposure. Systematic hedging and higher hedging ratios could explain why Finnair and Scandinavian Airlines did not exhibit statistically significant jet fuel exposures. What is more, operational measures where also common among the airlines in mitigating the jet fuel price risk. These included continuous descent approaches, flying direct route, refitting planes with lighter seats and materials, and installing winglets on the planes among others. Investment in modern fuel efficient fleet was also common at the airlines.

Although, the multivariate regression analysis did not exhaustively explain the airline stock returns, it provided evidence with regards the jet fuel price exposure of the relatively small listed carriers in the Nordic countries. What is more, the qualitative analysis of the hedging practices combined with the time series analysis provided reasoning for the existence or absence of the jet fuel exposure. For further research, researchers should study the relationship of jet fuel exposure with both the consistency of the jet fuel hedging practices and the level of the hedging ratios with larger sample, so as to see if supporting evidence for the results could be found.

REFERENCES

Air Insight (2014) *Icelandair Group and the 757*. <http://airinsight.com/2014/09/11/Icelandair Group-757s/#.VR-tqZSsWHw>, retrieved 28.3.2015

Allayannis, G. – Weston, J. P. (2001) Exhange Exposure Hedging, and the Use of Foreign Currency Derivatives. *Review of Financial Studies*. Vol. 14, 243–276.

Asian Airlines Wrestle With Jet Hedging Strategies (2004) *International Petroleum Finance* 5.11.2004.

Barsky, Robert B. – Kilian, Lutz (2004) Oil and the Macroeconomy since the 1970s. *Journal of Economic Perspectives*. Vol. 18 (4), 115–134.

Bartram, Shönke M. (2005) The Impact of Commodity Price Risk on Firm Value – An Empirical Analysis of Corporate Commodity Price Exposures. *Multinational Finance Journal*, Vol. 9 (3), 159-185.

Bellalah, Mondher (2009) *Derivatives, Risk Mangement & Value*. World Scientific Publishing Co., Singapore.

Berghöfer, Britta – Lucey, Brian (2014) Fuel hedging, operational hedging and risk exposure – Evidence from the global airline industry. *International Review of Financial Analysis*, Vol. 34 (1), 200–211.

Black, Fisher – Scholes, Myron (1973) The Pricing of Options and Corporate Liabilities. *Journal of Political Economy*. Vol. 81 (3), 637–654.

Boeing 787 Dreamliner Program Fact Sheet. Boeing Corporation. <http://www.boeing.com/boeing/commercial/787family/programfacts.pag p>, retrieved 15.12.2014.

Button, Kenneth – Costa, Álvari – Cruz, Carloz (2011) Problems of cost recovery by European airlines since market liberalization. *Transportation Planning and Technology*. Vol. 34 (2), 125–138.

CAPA – Center for Aviation (2012) *Delta's unconventional fuel hedging strategy to be put to the test as its refinery opens*, < http://centreforaviation.com/analysis/deltas-unconventional-fuel-hedging-strategy-to-be-put-to-the-test-as-new-refinery-opens-82467>, retrieved 15.12.2014.

Caracelli, V. J. – Graham, W. F. – Greene, J. C. (1989) Toward a Conceptual Framework for Mixed-Method Evaluation Designs. *Educational Evaluation and Policy Analysis*. Vol. 11 (3), 255–274.

Carter, David, A – Rogers, Daniel, A. – Simkins, Betty, J. (2002) *Does Fuel Hedging Make Economic Sense? The Case of the U.S. Airline Indusrty.* American Finance Associates San Diego Meetings 2004. < http://papers.ssrn.com/sol3/papers.cfm?abstract_id=325402>, retrieved 19.10.2014.

Carter, David, A – Rogers, Daniel, A. – Simkins, Betty, J. (2006) Does Hedging Affect Firm Value? Evidence from the US Airline Industry. *Financial Management.* Vol. 35, 53–86.

Carter, David, A – Rogers, Daniel, A. – Simkins, Betty, J. – Stephen, Treanorm D. (2014) Exposure, Hedging, and Value: New Evidence from the U.S. Airline Industry. *International Review of Financial Analysis*. Vol. 34, 200–211.

Cobbs, Richard – Wolf, Alex (2004) Jet Fuel Hedging Strategies: Options Available for Airlines and Survey of Industry Practices. <http://www.kellogg.northwestern.edu/research/fimrc/papers/jet_fuel.pdf >, retrieved 19.11.2014.

Cresswell, John W. – Plano Clark, Vicki L. (2011) *Designing and Conducting Mixed Methods Research*. SAGE Publications. Thousand Oaks, California.

Damodaran, Ashwath (2012) *Investment Valuation: Tools and Techniques for Determing the Value of Any* Asset. 3rd ed. Wiley & Sons Inc, Hoboken, New Jersey.

Dyni, John R. (2009) Geology and Resources of Some World Oil-Shale Deposits. In: *Oil Shale Developments*. Ed. Bussell, Ike S, 77–150. Nova Science Publishers, Inc., New York.

Eriksson, Päivi – Kovalainen, Anne (2008) *Qualitative Methods in Business Research*. SAGE Publications Ltd, London.

Evans, Joanne – Hunt, Lester, C. (2009) *International Handbook on the Economics of Energy*. Edward Elgar Publishing, Cheltenham, UK.

Fabozzi, Frank J. – Fuss, Roland – Kaiser, Dieter G. (2008) *The Handbook of Commodity Investing*. John Wiley & Sons Inc., Hoboken, New Jersey.

Fattouh, Bassam (2007) OPEC Pricing Power: The Need for a New Perspective. Oxford Institute for Energy Studies. <http://www.oxfordenergy.org/2007/03/opec-pricing-power-the-need-for-a-new-perspective/>, retrieved 10.11.2014.

Finnair Annual Report 2014. <http://www.finnairgroup.com/linked/en/konserni/Finnair_Annual_RepoRe_A4_final.pdf>, retrieved 22.3.2015.

Finnair Financial Statements 2014. <http://www.finnairgroup.com/linked/en/konserni/Finnair2014_financialf_final.pdf>, retrieved 22.3.2015.

Finnair Group <http://www.finnairgroup.com/group/group_1.html>, retrieved 22.3.2015.

Fite, David – Pfleiderer, Paul (1995) Should Firms Use Derivatives to Manage Risk? In: *Risk Management: Problems & Solutions*, eds, Beaver, William H. – Parker, George, 139-169. McGraw-Hill, New York.

Froot, K. – Scharfstein, D. – Stein, J. (1993) Risk Management: Coordinating Investment and Financing Policies. *Journal of Finance*, Vol. 48, 1629–1658.

Gaston, Greg (2014) The "Shale Gale": What It Is and How It Will Reduce the U.S. Trade Deficit and Make Some American Companies More Competitive In World Markets. *International Journal of Business and Social Science*, Vol. 5 (3), 59–65.

Guo, Hui – Kliesen, Kevin L. (2005) Oil Price and U.S. Macroeconomic Activity. *Federal Reserve Bank of St. Louis Review*, Vol. 87 (6), 669–683.

Holloway, Stephen (2008). *Straight and Level: Practical Airline Economics*. Ashgate Publishing Company, Hampshire, England.

Hull, John C. (2009) *Options, Futures, and Other Derivatives*. 7th ed. Dorling Kindersley

Hull, John C. (2010) *Risk Management and Financial Institutions*. 2nd ed. Pearson Education Inc, Boston, MA.

IATA Economic Briefing. International Air Transport Association. <http://www.iata.org/whatwedo/Documents/economics/Airline_Labour_Cost_Share_Feb2010.pdf>, retrieved 20.09.2014.

IATA Fact Sheet: Alternative Fuels (2014) International Air Transport Association. <https://www.iata.org/pressroom/facts_figures/fact_sheets/pages/alt-fuels.aspx>, retrieved 03.01.2015.

IATA 2014 Report on Alternative Fuels. International Air Transport Association. <https://www.iata.org/publications/Documents/2014-report-alternative-fuels.pdf>, retrieved 02.02.2015.

Icelandair Group Annual Report 2014. <http://vefbirting.oddi.is//Icelandair Group/Annual_Report_2014/index.html#30>, retrieved 27.3.201.

James, Tom (2003) *Energy Price Risk: Trading and Price Risk Management*. Palgrave Macmillan, Basingstoke, Hampshire.

Jin, Yanbo – Jorion, Philippe (2006) Firm Value and Hedging: Evidence from the U.S. Oil and Gas Producers. *The Journal of Finance*, Vol. 61 (2), 893–919.

Johnson, R. B. – Onwuegbuzie, A. J. – Turner, L. A. (2007). Toward a Definition of Mixed Methods Research. *Journal of Mixed Methods Research*. Vol. 1 (2), 122-133.

Keown, Arthur J. – Martin, John D. – Titman, Sheridan (2011) *Financial Management. Principals and Applications*. 11th ed. Pearson Education, Boston, MA.

Keski-Karhu, Pasi, Director of Treasury Operations, Finnair. Interview 12.10.2012.

Knight, Frank H. (1921) Risk, Uncertainty and Profit. Houghton Mifflin Co, Boston, MA. <http://www.econlib.org/library/Knight/knRUPCover.html>, retrieved 04.01.2015.

Lhabidant, Francois-Serge – Tinguely, Oliver (2001) Financial Risk Management: An Introduction. *Thunderbird International Business Review*, Vol. 43 (3), 343–363.

Michaels, Daniel – Jeffrey, Ng (2009) Hedging Bites Cathay Pacific. *The Wall Street Journal*. 12.3.2009, B2. <http://search.proquest.com.ezproxy.utu.fi:2048/business/docview/399047851/13422BF990C74F82PQ/1?accountid=14774>, retrieved 5.11.2014.

Miller, Merton – Modigliani, Franco (1958) The Cost of Capital, Corporation Finance, and the Theory of Investment. *American Economic Review*, Vol. 48 (3), 261–297.

Morrell, Peter – Swan, William (2006). Airline Jet Fuel Hedging: Theory and Practice. *Transport Reviews*, Vol. 26 (6), 713–730.

Norwegian Air Shuttle Corporate Fact Sheet. <https://www.norwegian.com/globalassets/global/norway/omnorwegian/dokumenter/corporate-fact-sheet/norwegian-air-shuttle-corporate-fact-sheet-january-2015.pdf>, retrieved 2.4.2015.

Norwegian Fleet (2015). <https://www.norwegian.com/uk/about-norwegian/our-company/fleet/>, retrieved 2.4.2015.

Norwegian – Our Company (2014). <https://www.norwegian.com/uk/about-norwegian/our-company/>, retrieved 2.4.2015.

Norwegian Annual Report 2014. <http://www.norwegian.com/globalassets/global/english/aboutnorwegian/ir/doc/annualreports/2014-norwegian_ipdf.pdf>, retrieved 2.4.2015.

O'Connor, William E. (2001) *An Introduction to Airline Economics*. 6th ed. Praeger Publishers, Westport, CT.

Olson, David L. – Wu, Desheng Dash (2008) *Financial Engineering and Risk Management – Enterprise Risk Management*. World Scientific Publishing Co. Pte. Ltd., Singapore.

Pulvino, Todd c. (1998) Do Asset Fire Sales Exist? An Empirical Investigation of Commercial Aircraft Transactions. *The Journal of Finance*, Vol. 53 (3). 939–978.

Rising Oil Prices Reducing Profitability – Regional Differences Widen. IATA. <http://www.iata.org/pressroom/pr/Pages/2012-03-20-01.aspx>, retrieved 18.10.2014.

SAS Annual Report November 2013–October 2014. <http://www.sasgroup.net/en/wp-content/uploads/sites/2/2015/01/SAS-Annual-Report-2013-2014.pdf>, retrieved 27.3.2015.

Schofield, Neil C. (2007) *Commodity Derivatives: Markets and Applications*. John Wiley & Sons Ltd, West Sussex.

Schubert, Renate (2006) Analyzing and managing risks – on the importance of gender differences in risk attitudes. *Managerial Finance*, Vol. 32 (9), 707–715.

Smith, C.W., Jr. – Stultz, R.M. (1985) The Determinants of Firms' Hedging Policies. *Journal of Financial and Quantitative Analysis*, Vol. 20, 391–405.

Smith, Clifford W., Jr. – Smithson, Charles W. – Wilford, Sykes D. (2003) Managing Financial Risk. In: *The Revolution of Corporate Finance*. 4th ed., eds. Joel M. Stern – Donald H. Chew, Jr, 345–366. Blackwell Publishing Ltd, Malden, MA.

Valiante, D. (2013) *Commodities Price Formation: Financialisation and Beyond*, CEPS-ECMi Task Force Report. Center for European Policy Studies, Brussels.

Welch, Ivo (2014) *Corporate Finance*. 3rd ed. Ivo Welch, Los Angeles, Ca.

Wensween, John G. (2007) *Air Transportation: A Management Perspective*. 6th ed. Ashgate Publishing Group, Brookfield, VT.

Weselby, Simon, Fuel and Emissions Performance Manager, Airbus. *Saving Fuel* presentation. IATA Mainetenance Cost Conference, October 2012. < https://www.iata.org/whatwedo/workgroups/Documents/MCC-2012-ATL/Day1/1150-1230-airbus-saving-fuel-team-sport.pdf>, retrieved 15.12.2014.

APPENDIX 1 QUALITATIVE SOURCES

Finnair (2007) 2006 Annual Review, Finnair. < http://www.finnairgroup.com/group/group_12_2.html>, retrieved 21.3.2015.

Finnair (2007) 2006 Financial Report, Finnair. < http://www.finnairgroup.com/group/group_12_2.html>, retrieved 21.3.2015.

Finnair (2008) 2007 Annual Review, Finnair. < http://www.finnairgroup.com/group/group_12_2.html>, retrieved 21.3.2015.

Finnair (2008) 2007 Financial Report, Finnair. < http://www.finnairgroup.com/group/group_12_2.html>, retrieved 21.3.2015.

Finnair (2009) 2008 Annual Review, Finnair. < http://www.finnairgroup.com/group/group_12_2.html>, retrieved 21.3.2015.

Finnair (2009) 2008 Financial Report, Finnair. < http://www.finnairgroup.com/group/group_12_2.html>, retrieved 21.3.2015.

Finnair (2010) 2009 Annual Review, Finnair. < http://www.finnairgroup.com/group/group_12_2.html>, retrieved 21.3.2015.

Finnair (2010) 2009 Financial Report, Finnair. < http://www.finnairgroup.com/group/group_12_2.html>, retrieved 21.3.2015.

Finnair (2011) Finnair Group Financial Year 2010 Q4 presentation, Finnair. <http://www.finnairgroup.com/group/group_12_5.html>, retrieved 25.3.2015.

Finnair (2011) 2010 Annual Review, Finnair. < http://www.finnairgroup.com/group/group_12_2.html>, retrieved 21.3.2015.

Finnair (2011) 2010 Financial Report, Finnair. < http://www.finnairgroup.com/group/group_12_2.html>, retrieved 21.3.2015.

Finnair (2011) Finnair Group Financial Year 2010 Q4 Results, Finnair. <http://www.finnairgroup.com/group/group_12_5.html>, retrieved 4.4.2015.

Finnair (2012) 2011 Financial Report, Finnair. < http://www.finnairgroup.com/group/group_12_2.html>, retrieved 21.3.2015.

Finnair (2013) 2012 Financial Report, Finnair. < http://www.finnairgroup.com/group/group_12_2.html>, retrieved 21.3.2015.

Finnair (2014) Finnair Group Financial Year 2013 Q4 Results, Finnair. <http://www.finnairgroup.com/group/group_12_5.html>, retrieved 4.4.2015.

Finnair (2014) 2013 Annual Report, Finnair. < http://www.finnairgroup.com/group/group_12_2.html>, retrieved 21.3.2015.

Finnair (2015) FInnair Group Financial Year 2010 Q4 Results, Finnair <http://www.finnairgroup.com/group/group_12_5.html>, retrieved 4.4.2015.

Finnair (2015) 2014 Annual Report, Finnair. < http://www.finnairgroup.com/group/group_12_2.html>, retrieved 21.3.2015.

Finnair (2015) 2014 Financial Statements, Finnair. < http://www.finnairgroup.com/group/group_12_2.html>, retrieved 21.3.2015.

Icelandair Group (2007) Icelandair Group Annual Rerport 2006, Icelandair Group. < http://www.Icelandair Groupgroup.com/investors/reports-and-presentations/annual-reports/>, retrieved 02.04.2015.

Icelandair Group (2008) Icelandair Group Annual Report 2007, Icelandair Group. < http://www.Icelandair Groupgroup.com/investors/reports-and-presentations/annual-reports/>, retrieved 25.03.2015.

Icelandair Group (2009) Icelandair Group Annual Report 2008, Icelandair Group. < http://www.Icelandair Groupgroup.com/investors/reports-and-presentations/annual-reports/>, retrieved 25.3.2015.

Icelandair Group (2010) Icelandair Group Annual Report 2009, Icelandair Group. < http://www.Icelandair Groupgroup.com/investors/reports-and-presentations/annual-reports/>, retrieved 25.3.2015.

Icelandair Group (2011) Icelandair Group Annual Report 2010, Icelandair Group. < http://www.Icelandair Groupgroup.com/investors/reports-and-presentations/annual-reports/>, retrieved 25.3.205.

Icelandair Group (2012) Icelandair Group Annual Report 2011, Icelandair Group. < http://www.Icelandair Groupgroup.com/investors/reports-and-presentations/annual-reports/>, retrieved 25.3.2015.

Icelandair Group (2012) Icelandair Group Q4 Report 2011, Icelandair Group. < http://www.Icelandair Groupgroup.com/investors/reports-and-presentations/>, retrieved 25.03.2015.

Icelandair Group (2013) Icelandair Group Annual Report 2012, Icelandair Group. < http://www.Icelandair Groupgroup.com/investors/reports-and-presentations/annual-reports/>, retrieved 25.03.2015.

Icelandair Group (2013) Icelandair Group Q4 Report 2012, Icelandair Group. < http://www.Icelandair Groupgroup.com/investors/reports-and-presentations>, retrieved 25.03.2015.

Icelandair Group (2014) Icelandair Group Annual report 2013, Icelandair Group. < http://www.Icelandair Groupgroup.com/investors/reports-and-presentations/annual-reports/>, retrieved 25.03.2015.

Icelandair Group (2015) Icelandair Group Annual Report 2015, Icelandair Group. http://www.Icelandair Groupgroup.com/investors/reports-and-presentations/annual-reports/>, retrieced 25.04.2015.

Icelandair Group (2015) Icelandair Group Q4 Report 2014, Icelandair Group. < http://www.Icelandair Groupgroup.com/investors/reports-and-presentations>, retrieved 25.03.2015.

Norwegian Air Shuttle (2007) Norwegian Air Shuttle Annual Report 2006, Norwegian Air Shuttle. <https://www.norwegian.com/uk/about-norwegian/investor-relations/reports--presentations/annual-reports/>, retrieved 24.3. 2015.

Norwegian Air Shuttle (2008) Norwegian Air Shuttle Annual Report 2007, Norwegian Air Shuttle. <https://www.norwegian.com/uk/about-norwegian/investor-relations/reports--presentations/annual-reports/>, retrieved 24.3. 2015.

Norwegian Air Shuttle (2009) Norwegian Air Shuttle Annual Report 2008, Norwegian Air Shuttle. <https://www.norwegian.com/uk/about-norwegian/investor-relations/reports--presentations/annual-reports/>, retrieved 24.3. 2015.

Norwegian Air Shuttle (2009) Norwegian Air Shuttle Interim Report Q4 2008, Norwegian Air Shuttle. <https://www.norwegian.com/uk/about-norwegian/investor-relations/reports--presentations/interim-reports-and-presentations/2008/>, retrieved 24.03.2015.

Norwegian Air Shuttle (2010) Norwegian Air Shuttle Annual Report 2009, Norwegian Air Shuttle. <https://www.norwegian.com/uk/about-norwegian/investor-relations/reports--presentations/annual-reports/>, retrieved 24.3. 2015.

Norwegian Air Shuttle (2010) Norwegian Air Shuttle Interim Report Q4 2009, Norwegian Air Shuttle. <https://www.norwegian.com/uk/about-norwegian/investor-relations/reports--presentations/interim-reports-and-presentations/2009/>, retrieved 24.03.2015.

Norwegian Air Shuttle (2011) Norwegian Air Shuttle Annual Report 2010, Norwegian Air Shuttle. <https://www.norwegian.com/uk/about-norwegian/investor-relations/reports--presentations/annual-reports/>, retrieved 24.3. 2015.

Norwegian Air Shuttle (2011) Norwegian Ari Shuttle Interim Report Q4 2010, Norwegian Air Shuttle. <https://www.norwegian.com/uk/about-norwegian/investor-relations/reports--presentations/interim-reports-and-presentations/2010/>, retrieved 24.03.2015.

Norwegian Air Shuttle (2012) Norwegian Air Shuttle Annual Report 2011, Norwegian Air Shuttle. <https://www.norwegian.com/uk/about-norwegian/investor-relations/reports--presentations/annual-reports/>, retrieved 24.3. 2015.

Norwegian Air Shuttle (2012) Norwegian Air Shuttle Interim Report Q4 2011, Norwegian Air Shuttle. <https://www.norwegian.com/uk/about-norwegian/investor-relations/reports--presentations/interim-reports-and-presentations/2011/>, retrieved 24.03.2015.

Norwegian Air Shuttle (2013) Norwegian Air Shuttle Annual Report 2012, Norwegian Air Shuttle. <https://www.norwegian.com/uk/about-norwegian/investor-relations/reports--presentations/annual-reports/>, retrieved 24.3. 2015.

Norwegian Air Shuttle (2013) Norwegian Air Shuttle Interim Report Q4 2012, Norwegian Air Shuttle. <https://www.norwegian.com/uk/about-norwegian/investor-relations/reports--presentations/interim-reports-and-presentations/2012/>, retrieved 24.03.2015.

Norwegian Air Shuttle (2014) Norwegian Air Shuttle Annual Report 2013, Norwegian Air Shuttle. <https://www.norwegian.com/uk/about-norwegian/investor-relations/reports--presentations/annual-reports/>, retrieved 24.3. 2015.

Norwegian Air Shuttle (2014) Norwegian Air Shuttle Interim Report Q4 2013, Norwegian Air Shuttle. <https://www.norwegian.com/uk/about-norwegian/investor-relations/reports--presentations/interim-reports-and-presentations/2013/>, retrieved 24.03.2015.

Norwegian Air Shuttle (2015) Norwegian Air Shuttle Annual Report 2014, Norwegian Air Shuttle. <https://www.norwegian.com/uk/about-norwegian/investor-relations/reports--presentations/annual-reports/>, retrieved 24.3. 2015.

Norwegian Air Shuttle (2015) Norwegian Air Shuttle Interim Report Q4 2014, Norwegian Air Shuttle. <https://www.norwegian.com/uk/about-norwegian/investor-relations/reports--presentations/interim-reports-and-presentations/2014/>, retrieved 24.3.2015.

Scandinavian Airlines (2007) SAS Group Annual Report & Sustainability Report 2006, Scandinavian Airlines. <http://www.sasgroup.net/en/category/investor-relations/financial-reports/>, retrieved 26.4.2015.

Scandinavian Airlines (2007) Interim Report Q4 2006, Scandinavian Airlines. <http://www.sasgroup.net/en/category/investor-relations/financial-presentations/?y=2007>, retrieved 26.4.2015.

Scandinavian Airlines (2007) Year-end Report 2006, Scandinavian Airlines. < http://www.sasgroup.net/en/category/investor-relations/financial-reports/interim-reports/?y=2007>, retrieved 26.4.2015.

Scandinavian Airlines (2008) SAS Group Annual Report & Sustainability Report 2007, Scandinavian Airlines. < http://www.sasgroup.net/en/category/investor-relations/financial-reports/>, retrieved 26.4.2015.

Scandinavian Airlines (2008) Year-end Report 2007, Scandinavian Airlines. < http://www.sasgroup.net/en/category/investor-relations/financial-reports/interim-reports/?y=2008>, retrieved 26.4.2015.

Scandinavian Airlines (2009) SAS Group Annual Report & Sustainability Report 2008, Scandinavian Airlines. < http://www.sasgroup.net/en/category/investor-relations/financial-reports/>, retrieved 26.4.2015.

Scandinavian Airlines (2009) Interim Report Q4 2008, Scandinavian Airlines. <http://www.sasgroup.net/en/category/investor-relations/financial-presentations/?y=2009>, retrieved 26.4.2015.

Scandinavian Airlines (2009) Year-end Report 2008, Scandinavian Airlines. < http://www.sasgroup.net/en/category/investor-relations/financial-reports/interim-reports/?y=2009>, retrieved 26.4.2015.

Scandinavian Airlines (2010) SAS Group Annual Report & Sustainability Report 2009, Scandinavian Airlines. < http://www.sasgroup.net/en/category/investor-relations/financial-reports/>, retrieved 26.4.2015.

Scandinavian Airlines (2010) Year-end Report 2009, Scandinavian Airlines. < http://www.sasgroup.net/en/category/investor-relations/financial-reports/interim-reports/?y=2010>, retrieved 26.4.2015.

Scandinavian Airlines (2011) SAS Group Annual Report & Sustainability Report 2010, Scandinavian Airlines. < http://www.sasgroup.net/en/category/investor-relations/financial-reports/>, retrieved 26.4.2015.

Scandinavian Airlines (2011) Year-end Report 2010, Scandinavian Airlines. < http://www.sasgroup.net/en/category/investor-relations/financial-reports/interim-reports/?y=2011>, retrieved 26.4.2015.

Scandinavian Airlines (2012) SAS Group Annual Report with Sustainability Overview 2011, Scandinavian Airlines. < http://www.sasgroup.net/en/category/investor-relations/financial-reports/>, retrieved 26.4.2015.

Scandinavian Airlines (2012) Interim Report Q4 2011, Scandinavian Airlines. <http://www.sasgroup.net/en/category/investor-relations/financial-presentations/?y=2012>, retrieved 26.4.2015.

Scandinavian Airlines (2012) Year-end Report 2011, Scandinavian Airlines. < http://www.sasgroup.net/en/category/investor-relations/financial-reports/interim-reports/?y=2012>, retrieved 26.4.2015.

Scandinavian Airlines (2013) SAS Group Annual Report with Sustainability Overview 2012, Scandinavian Airlines. < http://www.sasgroup.net/en/category/investor-relations/financial-reports/>, retrieved 26.4.2015.

Scandinavian Airlines (2014) SAS Group Annual Report with Sustainability Overview 2013, Scandinavian Airlines. < http://www.sasgroup.net/en/category/investor-relations/financial-reports/>, retrieved 26.4.2015.

Scandinavian Airlines (2015) SAS Group Annual Report with Sustainability Review 2013–2014, Scandinavian Airlines. < http://www.sasgroup.net/en/category/investor-relations/financial-reports/>, retrieved 26.4.2015.

Scandinavian Airlines (2015) Interim Report Q4 2013–2014, Scandinavian Airlines. <http://www.sasgroup.net/en/category/investor-relations/financial-presentations/?y=2014>, retrieved 26.4.2015.

APPENDIX 2 INTERVIEW

- Could you tell about your position and job description at Finnair?
- Do you engage in dialogue with specific personnel or departments with regards to hedging decision?
- How would you describe the development of the airline industry over the past decade? Has there been any concrete developments or changes related to it?
- How has the price of oil affected your operations over the past decade? Has the oil price volatility had any immediate effects on your operational activities and has it somehow been reflected on the risk management of jet fuel price risk?
- What kind of framework and strategy does Finnair have in fuel price risk management? Could you describe it and the limits it sets to jet fuel hedging?
- What do strive to achieving by managing jet fuel price risk? Do you consider jet fuel price risk management as an important function in airline business?
- What derivatives instruments do you employ in jet fuel hedging and what are the underlying assets?
- On what basis do you choose the underlying instrument and how do you take into consideration the potential basis risk in cross-hedging? Do you somehow manage the basis risk?
- Do you employ option structures in jet fuel hedging? If so, why are these very structures preferred in hedging and what do you seek for with them instead of simple call options?
- Are the derivatives instruments employed in hedging listed, over-the-counter or both?
- What kind of counterparties does Finnair have in hedging? How do you take into consideration the counterparty risk in OTC contracts?
- Does the relative small size of Finnair have any implications on hedging activities and the derivatives used in jet fuel hedging? Do you perceive that the small size of the airline introduces any challenges and, if so, could you describe them?
- Do you analyse the price formation of fuel and oil into the future and do you let analyst forecasts to have any implications on hedging?
- What operational measures does Finnair employ in mitigating jet fuel exposure? To what extent are these operational measures actively developed?
- How do you perceive the alternative and unconventional fuels in replacing crude oil as the main source for jet fuel? Do you aim at utilising biofuels and would you consider them as a relevant alternative in the future?