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Risk Management for commodity consumers

-A study of the Airline industry-

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Purpose:	The aim of this study is two folded. We wish to investigate if there is a value premium from hedging jet fuel exposure for American and European airlines. We also seek to answer if airlines can affect their probability to default by using Risk Management.
Methodology:	A quantitative approach using regression analysis has been used.
Theoretical perspectives:	The theoretical perspective can be derived from classical Risk Management theory and credit evaluation using a Merton approach. By combining the two value creation can be quantified.
Empirical Foundation:	The Airline industry during 2003-2006 has empirically been studied to obtain the data needed.
Conclusions:	During the period 2003 – 2006 there existed a value premium for airlines that hedged their expected future consumption of jet fuel. This premium has, over the 4 year period, on average been 17 percent. There is no support for the theory stating that the value creation form derivative hedging comes from a decrease in the expected cost of default. The value creation is derived from the classification of jet fuel as a non-core risk.

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1 Introduction

In this introductory chapter choice and motives behind the research topic are presented and this leads up to the purpose of the thesis. The chapter is ended by delimitations and a disposition of the thesis.

1.1 Background

At 8:46 a.m. the morning of September11, 2001 American Airlines flight 11 crashed into the north tower of the World Trade Center in New York City, USA. 17 minutes later United Airlines flight 175 crashed into the south twin tower. In the aftermath of these terrorist attacks were an international decrease in demand for air travelling and an airline industry in deep crisis. The airlines did not just have to struggle with a decrease in demand, but also increased costs, mainly due to higher security demands and highly volatile costs for flight fuel. Price for crude oil, which ultimately determines the price for flight kerosene, was further increased due to uncertainty in the Middle East, following in the footsteps of Americas “War On Terror”. Later in time the oil price suffered other shocks in respond to natural catastrophes, like for example the hurricane Katrina, which severely damaged the United States’ oil industry. On September 15, 2005 both Delta Airlines and Northwest Airlines filed for bankruptcy and by doing so four out of the seven largest airlines in the US were under Chapter 11 protection. Both companies stated that a major reason behind the filings were the impact of raising fuel prices. (Airfinance Journal, Oct 2005)

1.2 Problem discussion

Miller and Modigliani (1961) stated that Risk Management by a company is irrelevant for firm value, since shareholders can create the same diversification themselves. Since then Miller and Modigliani’s propositions regarding capital structure and Risk Management have been debated, mainly due to their failure to be applicable in a non perfect world where taxes, transaction costs and information asymmetry exists. Trough the years several explanations to why companies manage risks have been brought forward. Examples of these arguments include the decrease of variability in cash flows, management compensation schemes, decrease in expected bankruptcy cost and benefits from a convex tax schedule. (See e.g. Froot et al. 1993, Stulz, 1984 and Stulz and Smith, 1985)

To add to this theoretical framework above there have been some studies that tries to empirically measure the impact in value creation of Risk Management. Allayannis and Weston (2001) showed that use of foreign exchange derivatives was positively related to firm value in an investigated sample of 720 non-financial firms. Tufano (1996) examined the gold mining industry and found little empirical support that Risk Management maximizes shareholder value. Callahan (2002) found a negative relationship between the use of gold derivatives and stock performance in the American gold mining industry, hence conclude that value maximizing managers should not engage in hedging activities. Jin and Jorion (2006) investigated the oil and gas industry and did not find any relationship between use of commodity derivatives and the market value.

Schrand and Unal (1998) divides the risk carried by firms into two types, core-business risk and homogenous risk based on if a firm has a comparative information advantage concerning the risk or not. Companies are compensated for carrying core-business risk in which they have a comparative advantage, but they are not compensated for carrying homogenous (non-core) risk. Therefore, they conclude that a company should manage and eliminate homogenous risk, something that is supported by Merton (2005).

Much of the empirical research has, as the studies above, been concentrated on either the effect of derivative usage to manage foreign exchange risks or interest risks. When investigating commodity exposure, mainly producers have been studied. For a producer of a commodity it is not obvious that the risk is a non-core risk, since the company has some inside information about the market it is present on. Therefore a commodity producer can have a comparative advantage in forecasting fluctuations in the commodity prices. If the risk is judged to be a core business risk then the risk is value adding and the company should therefore not take part in any actions to manage it. We therefore argue that it is of less interest to study producers of a commodity. Instead it is of greater importance to study consumers of commodities.

One reason why most studies have concerned producers of commodities instead of consumers, as argued in several of the papers mentioned, is that the price of the commodity has such a large and visible impact on a producer. For consumers the commodity is probably only one of several inputs that affect the cash flows of a firm. Therefore it is more difficult to spot the influence of the variation in price. However, one industry has shown to be significantly exposed to commodity risk, the airline industry. Louder (2004) showed that airlines are exposed to jet fuel price risk while they at the same time do not show a significant exposure to interest and currency risk. A further confirmation of the influence from jet fuel prices on the financial performance of an airline comes from airlines´ annual reports. All investigated airlines acknowledge fuel price as a major operating risk that can have a serious impact on their ability to generate profit. Consequently it is something they need to closely monitor and/or manage.

Previous studies concerning hedging in the airline industry was performed by Carter et al. (2006) and Lauder (2004). Carter et al. (2006) study the American airline industry during 1992-2003 and conclude that there is a positive relationship between hedging and firm value. This stock price premium according to them could be as large as 10 percent. By studying airlines from Australia and New Zeeland, Louder (2004) concludes that airlines have a significant exposure to oil prices and that it, as a result, should be large potential gains from hedging jet fuel exposure.

To our knowledge, no studies investigating the effects of hedging on European airlines have so far been conducted. We therefore argue that it is of interest to find out if the positive relationship between hedging and firm value found on the American market is also present in Europe. In their study Carter et al. (2006) discover that the hedging premium was the highest in the two last years of the study which coincides with a period of high prices and high volatility. They therefore suggest that investors might put a higher value on hedging when prices are high and relatively more volatile. These years the average prices of jet fuel were 71 and 85 cents per gallon. Since then the prices have increased even more, rising above 200 cents per gallon for the first time in October 2005 (Exhibit 1). During the years of their study fuel cost constituted an average of 13,75 percent of operating cost for the airlines a number that 2005 had increased to 23,63 percent (Table 4.1, p. 32). With higher and still volatile prices representing an even larger percentage of operating costs it is of interest to investigate if investors put an even higher value on hedging today. To be able to make this comparison it is a must to also investigate the American airlines which was the base behind the Carter et al. (2006) study.

As mentioned earlier several airlines have had problems resulting in appliances for bankruptcy protection. For that reason we would want to investigate if hedging could be a way for the airline industry to reduce the risk of default. By using a credit risk measure developed by Merton (1974) we hope to find that Risk Management does indeed influence the probability of default. If hedging can reduce the probability of default it is possible for companies to increase their leverage and by doing that increase the firm value through the increased tax shield.

1.3 Purpose

The aim of this study is two folded. We wish to investigate if there is a value premium from hedging jet fuel exposure for American and European airlines. We also seek to answer if airlines can affect their probability to default by using Risk Management.

1.4 Delimitations

Our study does not try to investigate managerial motives to hedging. Furthermore, we are not interested in any potential income from derivatives. Therefore we make the assumption that the expected return for a hedging portfolio over time is zero.

A third delimitation made is to exclude airlines under bankruptcy. Hedging in close to bankruptcy states is a different research field where different parameters are of importance. Both from a legal and banking perspective Chapter 11 firms are limited to what kind of derivative hedging positions they are allowed to take. The purpose of the thesis is not to find optimal hedging strategies for companies under default.

1.5 Thesis outline

Chapter 2 gives an overview of the, for the thesis, relevant theoretical framework with the focus on hedging as value enhancing and on the Merton credit valuation model. In the third chapter data collection, methodology and methodological problems are presented and evaluated. A shorter description of the empirical findings from the study can be found in chapter 4 along with a correlation matrix of used variables. Chapter 5 contain the results and analysis from the performed regressions. The thesis ends with chapter 6 where the conclusion of the study is presented. Here the authors also give some suggestions for future research within related areas.

2 Theory

This second chapter presents the theoretical context, which is twofold. Firstly, the research involving motives for Risk Management as a value creating activity is scrutinized and secondly the Merton credit valuation model is examined.

2.1 Motives for Risk Management

Modigliani and Miller (1958) conclude that in a market without contracting costs and taxes, corporate financial policy is irrelevant. In perfect capital markets individual investors can hedge, or offset any hedge taken by the corporation, using the financial markets. Hence hedging should be left to the stakeholders in the Modigliani and Miller world (Modigliani and Miller, 1961). However, in the real world we see lots of examples of successful Risk Management, with theoretical support from references below. The theories regarding Risk Management can be divided into two groups. The first cluster being shareholder value maximization and the second utility maximization for managers. Focus of this thesis is on Risk Management as shareholder value maximizing, with managerial incentives briefly discussed in order for the reader to obtain the full picture.

2.1.1 Financial distress costs

A long standing argument for Risk Management has been to reduce the expected cost of financial distress. This was first argued by Smith and Stulz (1985) and Myers and Smith (1982), both stating that hedging reduce the volatility of the firm and therefore make financial distress less likely.

Financial distress cost can be derived from three different sources. The main source is loss of competitiveness, deriving from lack of internal financing for profitable projects, fire sale of valuable assets and financial squeeze from competitors. The second motive for financial distress costs is concessions to stakeholders, in order to compensate them for the additional risk of doing business with an entity under bankruptcy threat. Thirdly is the loss of the interest tax shield. (Opler and Titman, 1994)

Expected financial distress costs can be decomposed into two parts; cost in case of default and likelihood to default. It is primarily the second part of the equation, probability to default, that is affected by hedging. Before the start of use of derivatives by corporations a common method to decrease cash flow volatility was via diversification, or conglomerate building. The diversification allowed the combined entities to take up more debt than the separate divisions could. (Lewellen, 1971) A problem with this strategy is that the core competence of the management team may very well be limited to highly correlated business areas, making the combined entity inefficient (Berger and Ofek, 1995, Servaes, 1995 and Lang and Stulz, 1994). With the introduction of derivatives hedging firms could allow the parent company to gain the same predictability of cash flows, without having to add on non-core business divisions (Ross, 1996).

2.1.2 Tax incentive

Mainly two arguments have been brought forward to why tax can impel firms to employ Risk Management programs. Smith and Stulz (1985) show that if hedging reduces the variability of pre-tax firm value in a convex tax environment, then expected corporate tax is reduced as long as the cost of the hedge do not exceed the tax savings.

A for this paper more interesting tax argument is brought forward by Leland (1998). He discusses the possibility for less volatile cash flows to increase the debt capacity of a firm and thus enable an increase in the value of the tax shield from debt. The tax advantage of greater leverage, allowed by risk reduction, will more than offset the value transfer from equity holders to bondholders. This is true in a market with agency costs as well as in a market without agency costs. (Leland, 1998) The theoretical finding of Leland lies in the very heart of this thesis, where empirical arguments for value enhancing risk reduction, closely related to the tax shield, will be investigated.

2.1.3 Underinvestment problem

Myers (1977) showed that a firm could sustain deadweight cost when it has a high default risk, due to profitable investment opportunities being turned down. The reason is that that the project, if undertaken, is financed by equity while the majority of the value creation, due to their prioritized status in case of a bankruptcy, would belong to the bondholders. Even if the project has a positive net present value per se, it may therefore be turned down, due to the managers acting in the interest of the shareholders. (Myers, 1977)

Bessembinder (1991) claim that the underinvestment problem, also called debt overhang problem, can, due to two reasons, be solved using derivative hedging. Firstly, hedging decreases the sensitivity of the senior claim, allowing the equity holders to capture a larger part of the value creation. Secondly, hedging signal commitment to the bondholders allowing the firm to repay the bond in states of nature where it otherwise would not be able to do so. Most notably none of the benefits achieved above can be replicated by the investor herself; hence Bessembinder here opposes Modigliani and Miller (1961). Empirical evidence suggests that value creation from hedging partly can be explained by the underinvestment problem (Gay and Nam, 1998 and Carter et al, 2006).

2.1.4 Costly external financing

Motivating the use of Risk Management as a way to cope with costly external financing was first brought forward by Froot et al. (1993) and is strongly connected to agency problems and the pecking order theory (Myers and Majluf, 1984). The logic is that if the market has difficulties in evaluating the management, due to economic “noise” in the earnings and cash flows, investors will require a premium for investing in the firm. If Risk Management is used, the company is less likely to have insufficient internal funds to finance projects with positive net present value and therefore will not have to issue debt at a discount to obtain financing. A counterargument made is that if future positive net present value project is large, hedging can eliminate any possibility of avoiding external financing, due to upside limitations in positive state of nature (Ross, 1996).

2.1.5 Managerial reasons for Risk Management

Shareholder value maximization focuses on increasing market value by reducing the cost of financial distress, lowering tax and solving the underinvestment problem. The second group of Risk Management theories, focusing on utility maximization for managers and other non-diversified stakeholders, talk about reducing the risk for risk adverse managers. This at the expense of well diversified shareholders (Smith and Stulz, 1985). For variations of this also see Myers and Smith (1990). Smith and Stulz (1985) also acknowledge that by reducing the risk of promising projects managers can justify investments. Hence Risk Management from a managerial risk reduction perspective can be value enhancing for shareholders as well. The incentive for management to engage in Risk Management can be derived from their compensation package. Smith and Stulz (1985) claim that managers that are paid with company stock, due to the linear payoff of stocks, are more likely to engage in hedging than managers that are being rewarded with stock options. Tufano (1995) finds strong empirical evidence for managerial tenure and stock ownership as motives for hedging.

The reader is encouraged to keep managerial reasons for hedging in mind, in order to be better able to evaluate the arguments and insights later brought forward.

2.1.6 Separating core risks from non-core risks

Historically, risks have been defined as cash flow volatility. In order for a firm to maximize shareholder value the cash flow volatility should be reduced. (Froot et al., 1993) A path break to this notion was made by Stulz (1996), when he was the first to go beyond the simple idea of minimizing variance and instead conclude that some risks can add value to a firm while others do not. The way of selecting which risk that was adding value was by determining if the management had a comparative advantage in estimating future prices. Risks, for which no comparative advantage exists, should be hedged (Stulz, 1996).

Schrand and Unal (1998) further develop the separation of risk argument posed by Stulz (1996). Schrand and Unal (1998) are also the first to discriminate between core and non-core risks. With the definition of core risk being; *"…firms earn rents or economic profits for bearing risk related to activities in which the firm has a comparative information advantage"* (Schrand and Unal, 1998). To the contrary non-core risks are described as risks where the firm can earn zero economic rent in efficient markets for bearing the risk. Example of non-core risks given are; interest rate, exchange rates and commodity price risks. The conclusion is that a firm should minimize the cash flow variance due to non-core risks and focus the risk taking on risks that produce economic rent. A problem identified by the two authors is that core and non-core risks are closely related to the specific firm strategy. What is a core risk for one firm could be a non-core risk for a competitor.

The separation between core and non-core risks is of great importance to this thesis. It is not in the authors' opinion that the general risk level in firms should be reduced, but management must assess which risks the firm have a comparative advantage in. In other words; from which risks the firm can earn economic rent.

2.2 Default risk from a Merton perspective

The credit risk framework used in this thesis can be derived from the Merton (1974) approach to value a particular corporate debt. Merton in turn bases his paper on the seminal work of Black and Scholes (1973), presenting a complete general equilibrium theory of option pricing. Merton (1974) start off with acknowledging the three components determining the value of corporate debt: (1) required rate of return on the risk free debt (risk free in terms of default); (2) various provisions and restrictions contained in the indenture; (3) the probability that the firm will default and hence not be able to meet some or all of its obligations. In this thesis, as well as in the Merton (1974) article, especially the effects from changes in the probability of default are of interest.

A particular strength in the Merton (1974) approach is that the method is based on solid economic theories e.g. the Black and Scholes (1973) option pricing theory, the Modigliani and Miller (1958) theorem with the required rate of return on debt as a function of the debt equity ratio and the Fama (1970) Efficient Market Hypothesis, as well as the fact that all the required inputs are easily observable.

2.2.1 The KMV™ model[1]

The Merton (1974) framework has been successfully commercialized by KMV™, later bought by Moody's. Since the KMV™ methodology has become the practical application of the Merton model, this thesis will utilize the fine tunings and language the market recognize in relation to KMV™. KMV™ recognizes that three components are needed to find the probability to default:

1. Market value of assets – Defined as the expected future cash flow produced by the firm's assets discounted back at an appropriate rate. The measure incorporates all available information about the firms industry, as well as the state of the general economy.

2. Asset Risk – Defined as the uncertainty, risk, of the asset value. The value of the firm's assets is an estimate and is therefore per definition exposed to risks. The risks should be assessed in the context of the firm's business or asset risk.

3. Leverage – Defined as the contractual liabilities. For liabilities it is the book value that is of interest, since that is the nominal amount that actually has to be repaid. Closely related to leverage is the default point. The long term nature of some liabilities create a breathing space for corporations resulting in that a firm can survive for shorter periods if the Market Value of Assets is lower than book value of liabilities.

[1] 2.2.1 The KMV™ model, is partly a summary of a paper prepared by Moody´s called: "*Modelling default risk 2003*"

The final model is therefore:

$$\textit{Distance-to-Default} = \frac{MarketValueofAssets - DefaultPo\,\text{int}}{AssetValueVolatility}$$

Where *Distance-to-default* is assumed to be normally distributed[2].

In accordance with Merton (1974), KMV™ sees equity as a call option on the assets of the leveraged firm with the strike price equal to the face value of debt. Equivalently, risky debt can be seen as a risk free bond plus a short put option. From the put-call-parity, based on the law of one price, and using the option pricing formula both Market Value of Asset as well as Asset Volatility can be derived.

The KMV™ model has stood the test of time and several articles have shown the reliability of the model. Among them Kanak and Pondromos (2006) tests it on real-estate companies in the UK. Densler et al (2006) and Berndt et al (2004) uses the KMV framework to find the credit spread respectively the risk premium of bonds. Syversten (2004) demonstrate that KMV™ works fairly well on the Norwegian market, hence can be applied in an European institutional context. Especially the Densler et al (2006) is of importance for this thesis since it is of importance that a fixed probability of default will lead to a fixed credit spread, as well as a fixed perceived riskiness of the debt issued. The fact that the KMV™ model is continuous, as oppose to discrete ratings, enables better quantifications of any effects found.

[2] In KMV™ the normality assumption has been replaced by a large database of how actual defaults are complying with different Distance-to-Default. However, since this thesis does not aim to measure the default probability in percentage, no assumptions about the distribution have to be made.

3 Methodology and data collection

In this chapter we give a description of the methodology used in order to perform our proposed research. We here describe how data for the study was collected and which problems we had to resolve for the study to be reliable and valid.

3.1 Research approach

Our aim with this thesis is to empirically test some of the theoretical explanations behind the use of hedging within companies; hence we use a deductive approach (Patel and Davidson, 1994). In particular we investigate if firm value is enhanced for companies that hedge their non-core risks and whether or not Risk Management can reduce a firm’s probability of default. This is done by performing a quantitative study on the American and European airline industry during 2003-2006. The thesis is in some aspects based on a previous study performed by Carter et al. (2006) concerning the American airline industry.

3.2 Data collection

Due to the large geographical spread on our investigated companies any primary data have not been feasible to collect, instead we have been forced to rely on secondary data reported by the companies.

3.2.1 Sample

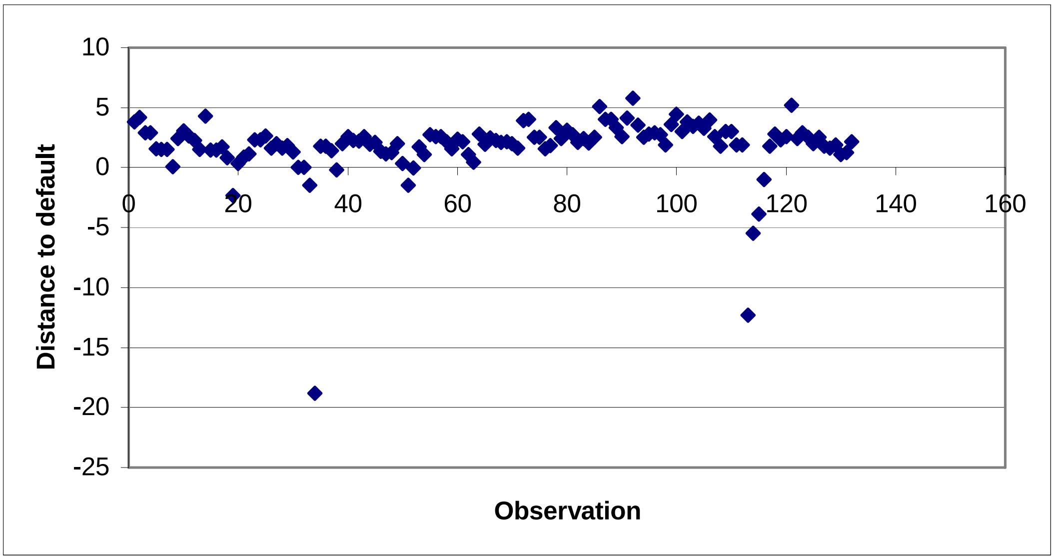
To find the sample companies the Morgan Stanley Company Index (MSCI) for Transportation, sub-category Airlines, was used. The American list of companies was double checked against the sample used by Carter et al. in 2006. Out of their 28 Airlines 10 where found to have merged or defaulted. Several other airlines, included in MSCI, had to be excluded, due to either a lack of available information, either annual reports or stock price observations, or a lack of similarity in operations with the other airlines. This left us with 19 American airlines with a total of 71 observations regarding hedging. Among European airlines a similar approach was taken, resulting in 18 airlines and 61 yearly observations. Totally 37 airlines and 132 observations were obtained.

3.2.2 Excluded observations

After a quick analysis of the collected data it was clear that some observations had to be excluded before the regression analysis, otherwise these would distort the findings. Three measures were used in order to exclude outliers, but it is important to notice that most of these observations were outliners according to several other measures as well. First observations that showed a negative value for Distance-to-Default was excluded, the rationale behind this is twofold. Negative Distance-to-Default means that the company should already have defaulted on its loans. In fact, companies such as Delta Airlines and Northwest Airlines were both under Chapter 11 in 2006 when they had a negative calculated Distance-to-Default. Secondly, companies that are in financial problems, which a negative Distance-to-Default implies, will have problems to act on the financial market in order to hedge. Observations that were excluded due to negative Distance-to-Default were Delta Airlines 2006, Great Lakes Aviation 2003 – 2004, Hawaiian Airlines 2003, Northwest Airlines 2005 – 2006 and Dart Group 2003-2006 (Diagram 3.1). All companies excluded due to negative Distance-to-Default where either under Chapter 11, defaulted during the year or made a sizable SPO.

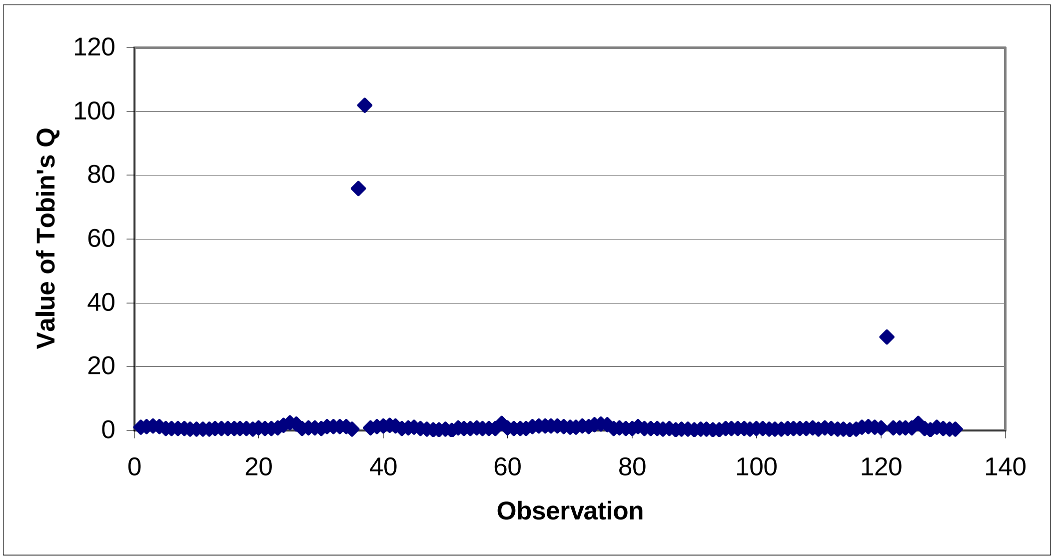
The exclusion of defaulted companies will inevitably lead to a survivorship bias, however since it is not the aim of this thesis to find hedging strategies for companies under default, this is deemed not to be a problem. To include the defaulting companies would lead to a bias much more severe, a bias that would make generalization of the results to times with less defaulting companies and to other industries impossible.

Diagram 3.1 Distance-to-Default



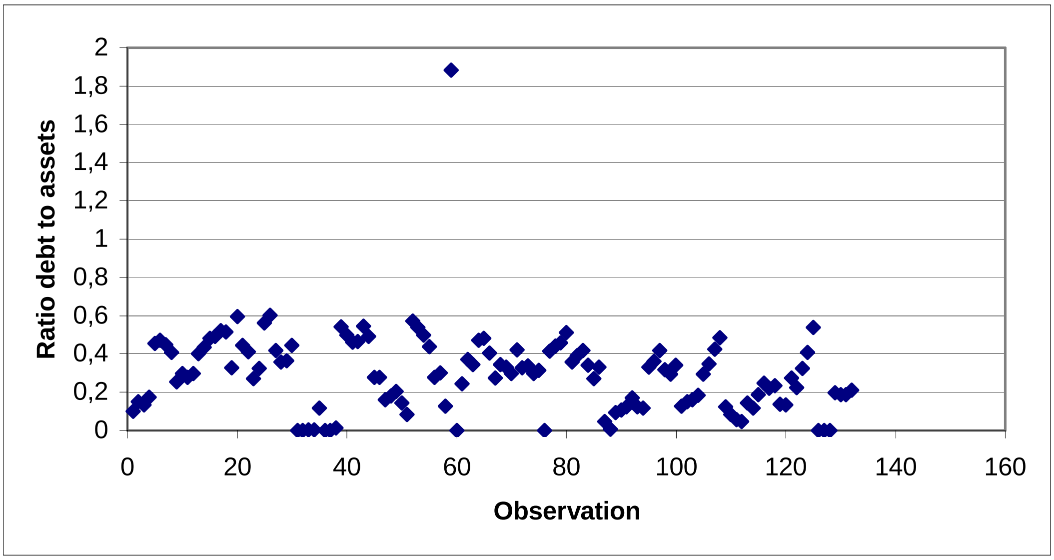
A second measure used to exclude outliers were the calculated values for Tobin's Q where three observations, Hawaiian Airlines 2004, 2005 and Aviangro 2006, had values that by far exceeded all other observations. (Diagram 3.2)

Diagram 3.2 Tobin's Q



Lastly the only obtained observation for United Airways had to be excluded due to its unnatural high Long Term Debt-to-Assets ratio (1,88). (Diagram 3.3)

Diagram 3.3 Long Term Debt-to-Assets



After the elimination of these outliers the dataset consisted of 118 observations divided in 56 observations from 17 European airlines and 62 observations from 18 American airlines.

3.2.3 Hedging data

Data regarding the jet fuel hedging by the airlines were obtained from the companies' annual reports or 10-K filings. The interest was of how much of the expected fuel consumption for the following year that was hedged at the end of the year. Often this was directly stated in the annual report or, when annual reports were not available, in the 10-K filing. However, some airlines have chosen to state how much of each quarter's expected consumption that is hedged. When this was the case the quarterly data was used to calculate a yearly average.

3.2.4 Other company specific data

Company specific data, such as information regarding debt and book value of assets, was collected using Datastream, a financial database from Thomson Financial Limited. From this source data regarding interest rates and currency exchange rates was also retrieved. Exchange rates were used in order to recalculate all companies balance sheet into dollars, thus better enabling comparisons between firms from different countries. The exchange rates used was the spot rates at the end of the year; this method is compliant with Reuters' approach to convert Balance Sheet data into different currencies.

3.3 Calculating distance to default

The basis for calculating probability of default is as mentioned earlier the KMV™ framework, which in turn is based on Merton's findings (Merton, 1974). In practice, this measure is derived from Distance-to-Default, which in turn is calculated from a firm's market value of assets, default point and the volatility of its assets according to the following formula;

$$\textit{Distance-to-Default} = \frac{MarketValueofAssets - DefaultPo\text{int}}{AssetValueVolatility}$$

Since both market value of assets and their volatility are unknown variables they had to be calculated. This was done using Black & Scholes (1974) option pricing formula and the put call parity. More explicitly the following two formulas were used.

1. Black & Scholes (1974) option pricing formula applied to a Merton/ KMV™ framework:

$$V_E = V_A \times N(d_1) - e^{r \times T} \times X \times N(d_2)$$

Where:
V_E = value of the firm's equity
V_A = value of the firm's assets
X = repayable debt at time T
T = maturity of the debt
r = risk free interest rate
N(.) = cumulative Normal distribution function

$$d_1 = \frac{\ln(\frac{V_A}{X}) + (r + \frac{\sigma_A}{2}) \times T}{\sigma_A \times \sqrt{T}}$$

$$d_2 = d_1 - \sigma_A \times \sqrt{T}$$

3. . Volatility function:

$$\sigma_E = \frac{N(d_1) \times \sigma_A \times V_A}{V_E}$$

Except for the two unknown variables Market Value of Assets and Asset Volatility all other inputs in these formulas can be obtained from easily available data. Needed input variables were the following;

- Market value of equity
- Equity volatility
- Book liabilities
- Default point
- Risk free interest rate

3.3.1 Calculating input variables

To calculate the equity volatility the daily closing price for the firms' stocks were obtained from Datastream. From this data the daily volatility was calculated and later recalculated into yearly volatility by multiplying with the square root of number of trading days.

$$\sigma_{Yearly} = \sigma_{Daily} \times \sqrt{tradingdays}$$

Closing stock price in each year was multiplied with the number of publicly traded stocks in order to get the market value of equity.

Liabilities were retrieved directly from annual reports and were adopted without adjustments.

To calculate a default point one major assumption had to be made. We are measuring the probability for a company to default on their payments within the following 12 months. By accounting definition long term liabilities will not have to be repaid within this period which poses the question whether or not these should be included in the calculations. We have chosen to include half of the long term liabilities in solving the equation system. This is a commonly used method and in our study it seems to have resulted in an accurate calculation of Distance-to-Default. During the year a company show a negative Distance-to-Default they either filed for Chapter 11 protection went into bankruptcy or made a sizable SPO.

Risk free interest used in the calculations was the one year US T-bill rate. Even though the airlines are located in different countries, we argue that since all company data is denoted in US dollar only the American interest rate is needed. This is based on an assumption that the International Fischer Parity holds.

3.3.2 Calculating unknown variables

As mentioned above, to calculate the unknown variables Market Value of Assets and Asset Volatility the Black & Scholes option pricing formula was used. A complication in solving these variables is that they are interdependent and therefore have to be solved for simultaneously. In order to accomplish this, an Excel sheet was constructed and then the solver function in Excel, which used iterations to find the Market Value of Assets and Asset Volatility, was used.

Next step would be to calculate the probability of default which can be done in two ways. Either historical data of Distance-to-default and actual default rates are used or an assumption of the distribution is made. Since we do not have access to the default database used by KMV^{TM}, we have chosen not to calculate the probability of default. By being forced to assume a statistical distribution we would have decreased our reliability without adding any extra value. For our purposes it is just as useful to investigate the Distance-to-Default. The obtained results can later be used by the reader to calculate probability of default, based on her available data or preferred distribution assumption.

A summary of the variables used in the calculations of Distance-to-Default and how they were found can be seen in the table below.

Table 3.1 Summary of variables in Distance-to-Default

Variables needed in the analysis	**Notes**
Market value of Equity	Number of shares * Price per share
Equity volatility	From market prices
Book liabilities	Balance Sheet
Default point	Short term liabilities + 0,5 * long term liabilities
Risk free interest rate	American one year T-bill rate was used
Market value of Assets	From the option pricing formula
Asset volatility	From the option pricing formula

3.4 Regression Analysis

In quantitative studies a common tool is to use regression analysis in order to draw statistically certain conclusions. When working with regression analysis several important choices have to be made.

3.4.1 Choice of regression model

Since the data sample spans both a time-series and a cross-sectional dimension the choice of regression analysis is not entirely simple. A first alternative is to treat the data as panel data, which would be natural considering the nature of the sample. Baltagi (1995) lists several benefits of using panel data analysis, such as the ability to control for heterogeneity and to identify and measure effects that are undetectable in cross-sections and time-series analysis. However, panel data also have its limitations and a major one as listed by Baltagi (1995) is the short time-series dimension. Since the sample only consists of a maximum of 4 yearly observations, for some airlines there are even only a single observation, this limitation would be extra severe in this study. Due to this using panel data was unfeasible and instead a cross-sectional approach was use. If panel data were to be used, regressions with fixed effects estimations would have to be used. This would eliminate a large part of the degrees of freedom. Therefore, the result from such a regression would say very little of the true relationships within the model and consequently to draw any conclusions out of the estimated model would be difficult. In order to perform a panel data regression with fixed effects more time-series data would have to be collected, i.e. more yearly observations for each airline. This is not possible due to the low availability of data reaching further back than 2003, especially concerning European companies.

However, if we were to pool the data and run ordinary least squares (OLS) regressions on the entire sample we would have enough degrees of freedom, but instead run into other severe problems. Since we have several observations from the same airlines we would suffer from high degrees of serial correlation within the sample. Therefore it is not suitable to work with the entire sample in a cross-sectional approach either.

Instead we were forced, due to type and availability of data, to perform cross-sectional analysis for every observed year separately. This was done using OLS analysis in the econometrics software package EViews. Both ordinary and standardized coefficients were obtained. Standardized coefficients are used to determine economical significance. OLS is based on several underlying assumptions that has to hold for the result to be BLUE (Best Linear Unbiased Estimate), for example the residuals has to be normally distributed. This could pose a problem in our estimations since we have between 27 and 33 observations for each year while at the same time using up to 5 independent variables. Therefore to validate our findings from OLS we also performed a non-parametric regression. Non-parametric regressions do not assume any distribution of the parameters a priori which makes them more robust, but instead they have less explanatory power.

3.4.2 Dependent variables

In our study we have two main dependent variables, Tobin's Q and Distance-to-Default. How we derived and calculated Distance-to-Default, our measure of probability of default, can be read above. Tobin's Q is the used proxy for firm value creation and is further explained below. To enable easily understood and interpreted results the natural logarithm of these variables were used.

The variable Q was introduced by James Tobin in order to evaluate valuation of physical assets in relation to their replacement cost. This was mainly done in order to explain effects of shocks in monetary theory (Tobin, 1969 and Brainard and Tobin, 1968). Later the ratio has been used as a proxy for a firm's value and value creation by measuring the ratio between the market value of the firm and the replacement costs of its assets. A theoretical sound, but computational complicated, way of calculating Q was developed by for example Lindenberg and Ross (1981). In response to this, Chung and Pruitt (1994) tried to develop an easily computed approximation of Tobin's Q that is based on easily available accounting information. They found that their simplification was highly correlated with the more theoretical correct Q values calculated with the Lindenberg and Ross (1981) approach. Considering the high difference in computational cost, availability of data and the high correlation between measures, the Chung and Pruitt simplification of Tobin's Q was used in the study. Tobin's Q has been calculated as follows:

$$Tobin's Q = \frac{MVofEquity + preferredStock + BVliabilities - currentassets + BVinventory}{BVTotalAssets}$$

Source: Chung and Pruitt, 1994

3.4.3 Independent variables

The most important independent variable used in all regressions is Hedging, measured as percentage of next year's expected fuel consumption that was hedged in December 31st. Hedging is expected to have a positive influence on Tobin's Q as well as a positive effect on Distance-to-Default, cetris paribus. To not get spurious results in the regressions, several control variables were also included.

When investigating value creating by hedging 6 independent variables were used. Distance-to-Default was used in order to see if potential value creation can be derived from a decrease in expected cost of default. According to theory this is one of the benefits from hedging and therefore Distance-to-Default was expected to be positively related to firm value. A dummy variable for other hedging strategies, such as fuel pass trough agreements, was included. Since it is a type of hedging it was expected to carry a positive sign. A second dummy for American firms was used to see whether American and European companies materially differ. Considering the many problems within the American airline industry it was, on forehand, believed that American airlines would show a lower value. Lastly, to control for leverage and firm size the variables Long Term Debt-to-Assets and the logarithm of Total Assets were included. Leverage was expected to have a positive influence due to e.g. benefits from a tax shield. As regards to Size a positive sign was expected, due to potential economies of scale.

In the regression to test the impact of hedging on Distance-to-Default the same explaining variables as above was used. The dummy variable for American companies was expected to be negative and the dummy for other hedging strategies positive, with the same motivations as above. Leverage should be negatively related to Distance-to-Default, this comes naturally since adding more debt will by definition decrease a firm's Distance-to-Default. Size ought to be positive related to this measure as it should be less likely that a large firm goes bankrupt than a smaller firm. Below the used variables and expected signs are summarized in a table.

Table 3.2 Expected sign in the regressions run

Dependent variable: Tobin's Q			**Dependent variable: Distance-to-Default**	
Independent variables:	**Expected Sign**		**Independent variables:**	**Expected Sign**
Hedge	+		Hedge	+
Distance-to-Default	+		Ln Assets	+
Ln Assets	+		LT Debt-to-Assets	-
LT Debt-to-Assets	+		Dummy American firm	-
Dummy American firm	-		Other Hedges	+
Other Hedges	+			

3.6 Methodological Problems

We have chosen just to investigate the hedging activities of airline companies between the years 2003 and 2006. If we would have chosen to go further back in time we would have come across two major problems. First it is difficult to access older annual reports than this; it has proven rather difficult to find enough information for even the chosen period. In Europe, over the last couple of years, the introduction of IFRS accounting standards has significantly improved the given information. In North America the needed information for a prolonged period should be able to obtain. However, if we would have investigated the American airline industry in 2001 and 2002 we would have been looking at an industry in severe crisis due to the aftermath of the September 11 terrorist attacks in New York 2001. This would be a clear situation were another input would be the most important, leaving hedging to only be considered by a fraction of the investors.

3.6.1 Validity

For a study to have high validity it should measure what it sets out to measure. In other words, can the conclusions drawn from the study actually be made based on it? (Bryman and Bell, 2003)

To proper assess the validity of this study it has to be divided into two parts where the first part answers if hedging is value creating for airlines. The chosen method for this is in many aspects similar to previous studies regarding the value creation of hedging. Tobin's Q is the general choice of proxy for firm value and the used control variables are in large parts the same. Therefore, the chosen method is judged to be valid.

Our investigation into the effect of hedging on a firm's probability of default uses a technique that, to our knowledge, has not been used in a similar manner before. To calculate Distance-to-Default some assumptions had to be made, but as much as possible these assumptions were based on standards previously used. In spite of this the method used to calculate a firm's risk of default is theoretically sound and empirically well tested. Thus, even though the Merton/KMV^{TM} framework has never been used as regards to hedging before, the chosen method is believed to be valid.

Even though the method as a whole is deemed as valid it is perhaps important to reflect a bit over one important component. Is hedging positions in place at the last of December a good proxy for a firm’s hedging behaviour in the upcoming year? We argue that this is the best available measure for an outside researcher. To properly benefit from hedging the contracts has to be in place over a relative long period of time. A firm that only hedges the next three months consumption does not utilize the full benefits from hedging, but instead only delay the variations somewhat. We therefore believe that our estimate of hedging is the best measure for a company’s true risk reducing hedge position.

3.6.2 Reliability

Except for having high validity it is of importance that a study generates trustworthy and reliable results. A research paper is deemed to have a high degree of reliability if it were to generate the same result if performed again. (Bryman and Bell, 2003). In order to assess the reliability of this study two main areas have to be scrutinized; the reliability of the collected data and of the methods used.

Data was collected from annual reports and from the databases Reuters and Datastream. Information gathered from these databases is judged to be reliable. However, to double check a few observations were cross referenced between the sources and found to be correct. Both Reuters and Datastream gets their firm specific information from companies’ external reporting. External reporting from firms is deemed to be reliable, or at worst the best proxy of information available to external investors. A further support to this is that only companies that are forced to file their annual reports according to the IFRS or US GAAP regulative framework were included in the study.

All primary regressions were run using OLS in the econometrics software EViews and SPSS, a well used tool within statistical research. For OLS to present a correct result certain assumptions has to be fulfilled. To control for these conditions a number of residual tests has been performed. Except for the regression with Tobin's Q as the dependent variable in 2005, all residual tests have resulted in acceptable values which enable us to trust the results. The main problem in 2005 is a lack of normally distributed residuals. If the sample is large enough a lack of normality does not pose a problem (Brooks, 2005). However, it is questionable if this study contains a large enough sample to enable disregarding of normality. Since outliers have already been excluded, and several of the variables have been transformed into logarithmic values, to reach normality more observations would have to be added. This is not possible since all listed and comparable airlines in Europe and America is already included in the study. To go outside of these regions would impose the problem that these airlines are not subjected to the strict accounting standards regarding hedging which exists in US GAAP and IFRS. This also limits the ability to go further back in time to enable a pooled analysis using panel data. Too few observations make us question the reliability of the results in 2005, while the robustness of the residual tests in other years implies that these results are reliable.

4 Empirical findings

This chapter will present the empirical findings from the conducted study. Included airlines and selective statistic regarding them is presented in Table 4.1. A correlation matrix between variables is also provided.

4.1 Hedging

As regards to hedging one important distinction within the sample has to be made. Some companies that state they do not have any derivative hedging contracts in place instead have the ability to pass through all fuel costs to their customers. This is for example possible for fright airlines and for connection carriers, which operates under contracts with the major airlines. Since these companies are not exposed to fuel prices they can be said to be totally hedged, they are therefore separated from the others and not included in calculations of e.g. averages (See Table 4.1, p. 32).

Use of hedging varies considerable within the investigated sample both between airlines and between years. Out of the sample of 35 airlines there are 12 airlines that in one or more years did not hedge any of its expected fuel consumption for the next year. However, very few companies have chosen never to hedge. Out of the airlines, were data for all four years are available, only Turkish Airline does not hedge any year. On the other side of the scale there are companies such as Southwest, Ryanair and British Airways that in all four years have hedged more than 70 percent of their expected fuel consumption. Overall, airlines hedges 34 percent of their air fuel, but there are significant differences between American and European airlines. Hedging seems to be more attractive for the European airlines since they hedge on average 45 percent of their fuel needed, when American airlines only hedge 23 percent (See Table 4.1, p. 32).

4.2 Tobin's Q

As a proxy for company value a simplified version of Tobin's Q have been used. The calculations of the Q values gives that the average value is 0,80 with American firms somewhat higher valued with a mean of 0,87, compared to the European mean of 0,73 (See Table 4.1, p. 32). Considering the deep crisis in many American airlines it is perhaps a surprising result that investors value American airlines higher than European. Possible explanation for this could be the survivorship bias, due to exclusion of defaulted airlines, mainly domiciled in the US.

4.3 Leverage

Leverage was measured in two ways, Debt to Equity (total liabilities/market value of equity) and Long Term Debt-to-Assets. The two measures give a ambiguous answer to whether or not airlines are highly leveraged. As measured through Debt-to-Equity, airlines are extremely highly leveraged with a total mean value of 4,5, with American firms having a mean of 5,7 and Europeans 3,1. Mean values in this case is though somewhat misguiding, due to some extreme values following the bad stock performance for companies such as Delta, that filed for Chapter 11 during the period. Looking at the median values the picture is more in line with expectations, but still shows a very high leverage. Median values for Debt-to-Equity are for the total sample 2,6, for American firms 2,3 and for European airlines 2,6. Long Term Debt-to-Assets also shows that American airlines have a more offensive capital structure than their European counterparties. 35 percent of the assets in airlines in North America are financed with long term debt, while only 24 percent in Europe, resulting in a total mean of 30 percent. It is though important to notice that we have chosen to disregard from any use of operational leasing of airlines, which is a common practise in the industry. Omitting potential operating leases most likely leads to an underestimation of the true leverage. Based on results above, it is concluded that the airline industry is a highly leveraged industry.

Table 4.1 Final Sample

American airlines:	Years	Fuel as % of operating cost	Average hedged	Other hedge	LT Debt-to-Assets	Tobin's Q
Air Tran Airways	2003-2006	32,9	31	0	0,350	1,161
Alaska Air	2003-2006	24	41	0	0,282	0,461
AMR	2003-2006	27	16	0	0,445	0,606
Continental	2003-2006	21,7	6	0	0,502	0,644
Delta Airlines	2003-2005	16	24	0	0,484	0,654
Express jet hold	2003-2006	15	0	1	0,441	1,705
Frontier Airlines	2003-2006	31,3	13	0	0,396	0,765
Great Lake Aviation	2005-2006	23,2	0	0	0,001	1,269
Hawaiian Ailines	2006	25,2	30	0	0,116	0,358
Jetblue Airways	2003-2006	29,5	34	0	0,492	1,346
Mesa Air Group	2003-2006	30,2	0	1	0,397	0,726
Midwest Airlines	2003-2006	30	11	0	0,172	0,375
Northwest Airlines	2003-2004	28,6	22	0	0,537	0,652
Skywest	2003-2006	32,9	0	1	0,286	0,689
Southwest	2003-2006	19,8	80	0	0,139	1,245
US Airways	2005-2006	20	33	0	0,418	0,656
Westjet	2003-2006	26,5	5	0	0,408	1,312
World Airways	2003-2006	23,1	0	1	0,241	0,638
American Averages	*N.A*	*25,4*	*23,1*	*N.A*	*0,350*	*0,871*
European airlines:						
AerLingus	2006	17	0	0	0,329	0,506
Aeroflot	2003-2006	32,3	5	0	0,181	1,007
Air Berlin	2006	22	80	0	0,359	1,136
Air France – KLM	2005-2006	17,5	77	0	0,318	0,509
Alitalia	2003-2006	20	40	0	0,355	0,533
Austrian Airlines	2003-2006	19,3	8	0	0,457	0,68
British Airways	2003-2006	21	75	0	0,388	0,619
Cyprus Airways	2003-2006	16	16	0	0,196	0,621
Easyjet	2003-2006	23	63	0	0,077	0,668
Finnair	2003-2006	16,8	35	0	0,156	0,513
Iberia	2003-2006	18	59	0	0,065	0,335
Lufthansa	2003-2006	14	73	0	0,134	0,314
Norwegian Air	2004-2006	25,5	15	0	0,000	0,972
Ryanair	2003-2006	35	78	0	0,320	1,584
SAS	2003-2006	14	47	0	0,358	0,616
SkyEuro	2006	29	90	0	0,000	1,721
Turkish Airline	2003-2006	29,8	0	0	0,374	0,808
European Averages	*N.A*	*21,8*	*44,8*	*N.A*	*0,240*	*0,732*
Total Averages	***N.A***	***23,64***	***34,65****	***N.A***	***0,298***	***0,802***

This table summarizes the Final sample and observations used in the paper.
* When calculating the average amount of fuel hedged the companies engaged in other hedging strategies was excluded.

4.3 Correlation

Table 4.2 Correlation matrix comprised of variables used in regressions

	Hedge (%)	Tobin's Q	Distance-to-Default	LT Debt-to-Assets	Ln Assets	Dummy American firm	Other Hedges	Equity Volatility
Hedge (%)	1							
Tobin's Q	-0,003	1						
Distance-to-Default	0,449	-0,046	1					
LT Debt to Assets	-0,263	0,163	-0,170	1				
Ln Assets	0,459	-0,269	0,336	0,349	1			
Dummy American firm	-0,390	0,177	-0,446	0,337	-0,152	1		
Other Hedges	-0,401	0,129	-0,107	0,107	-0,350	0,376	1	
Equity Volatility	-0,338	0,017	-0,874	0,016	-0,332	0,404	0,059	1

This table reports the correlation between the variables, both dependent and independent, later used in regressions. The correlations are calculated over the entire period.

In order to find any multi-collinearity problems a correlation matrix was produced. Table 4.2 shows that the correlations between the variables are well below any levels that would indicate multi-collinearity problems. The only exception is between Distance-to-Default and Equity Volatility, hence the two of them will never be included in the same regression.

In Exhibit 2 the annual values are displayed. There are no major differences between the pooled matrix and each year separately. One observation worth mentioning is that Distance-to-Default and Hedge have a correlation of 0,718 in 2005, much above the average 0,449. The 0,718 correlation is judged to not pose any multi-collinearity problem.

5 Analysis

In chapter 5 the results from the performed regressions are presented and analysed. The first regression shows the effect of hedging on firm value creation and later hedging influence on Distance-to-Default is scrutinized.

5.1 Effect of hedging on firm value

Table 5.1 Estimates of the relation between value creation and hedging behaviour

Variable	2003		2004		2005		2006		Average
Constant	3,723	**	1,116		0,551		2,583	***	1,993
P-value	(0,029)		(0,460)		(0,668)		(0,016)		
Hedge	0,788	**	0,734	**	0,088		0,408	*	0,505
Stand. Coef.	0,451		0,495		0,119		0,358		0,356
P-value	(0,024)		(0,030)		(0,557)		(0,082)		
Distance-to-Default	0,063		0,246		-0,062		-0,054		0,048
Stand. Coef.	0,249		0,149		-0,192		-0,041		0,041
P-value	(0,595)		(0,341)		(0,557)		(0,617)		
LN(Assets)	-0,232	***	-0,118		-0,055		-0,215	***	-0,155
Stand. Coef.	-0,693		-0,453		-0,347		-0,742		-0,559
P-value	(0,006)		(0,108)		(0,400)		(0,002)		
LT Debt-to-Assets	1,534	**	1,860	**	1,092		1,084		1,393
Stand. Coef.	0,579		0,676		0,407		0,391		0,513
P-value	(0,015)		(0,023)		(0,164)		(0,155)		
Dummy American firm	0,204		0,226		0,069		-0,056		0,111
Stand. Coef.	0,233		0,188		0,182		-0,015		0,147
P-value	(0,409)		(0,341)		(0,811)		(0,823)		
Other hedges	-0,285		-0,076		-0,049		-0,111		-0,130
Stand. Coef.	-0,233		-0,036		-0,124		-0,011		-0,101
P-value	(0,200)		(0,781)		(0,875)		(0,688)		
R2-Adj	0,376		0,256		0,026		0,165		
Prob(F-stat)	0,0136	**	0,052	*	0,403		0,094	*	
# Observations	27		28		30		33		

This table reports the result of the regressions of firm value creation, measured as Tobin's Q, on hedging behaviour and other firm characteristics. One regression is run for each year of the sample period. Coefficients, Standardized Coefficients and P-values, calculated using Whites heteroskedasticity corrected standard errors, are presented. Statistical significance at the 10%, 5% and 1% levels is indicated by *, ** and ***, respectively.

As can be seen in Table 5.1 the independent variables are fairly stable, both in size and especially in terms of sign, over the period. This implies that the relationship holds, even if the degrees of freedom in the regression are low. The full model is significant in three out of the four years contained in the sample, however the amount of the variation explained vary considerably from 38 percent in 2003 to only 3 percent in 2005.

The most important result is that the Hedge variable is both statistically and economically significant for three of the four years, meaning that hedging of jet fuel is value creating for airlines. Coefficients for the hedging variable suggest that the value premium from hedging is as high as 50 percent (Table 5.1). This means that, during the investigated period, a company that hedge 100 percent would have had 50 percent higher value relative to a company that did not hedge any of its exposure. However, as can be seen above, the premium varies over the years from the statistical significant premiums of above 70 percent in both 2003 and 2004 to as low as 9 percent in 2005. On average, risk managing airlines hedges 34 percent (Table 4.1, p. 32) of their fuel consumption, which results in an average value premium for hedging firms in excess of 17 percent. The found hedging premium is significantly higher than the approximately 5 percent premium for currency hedging found by Allayannis and Weston (2001) for 720 non-financial firms in the US. It is also higher than the average 10 percent hedging premium for American airlines found by Carter et al. (2006). An explanation behind the increase in value premium, compared to the Carter et al. study, is that fuel prices today constitute a larger part of the airlines operating expenses. In the previous study 13,75 percent of the firm’s operating expenses came from jet fuel expenses while in this study this has increased to 23,63 percent (Table 4.1, p. 32), a significant increase. If investors, as first found by Carter et al. (2006), assigns a premium to airlines that manages their exposure to fuel prices it is to be expected that this premium should increase as the impact of fluctuations becomes more severe to the company.

That the hedging premium varies between years is in line with the findings of both Allayannis and Weston (2001) and Carter et al. (2006). Allayannis and

Weston found that the premium was higher in the years when the dollar was appreciating, hence when the exporting firms analysed profited the most from hedging. Carter et al. (2006) argues that the variation could be a result from investors valuing hedging higher in years with high and more volatile fuel prices. They base this suggestion on their findings of higher and more significant coefficients in their last two investigated years, which they characterize as years with high prices and high volatility. Our results support this hypothesis in 2003 and 2004, which compared to the previous study also showed high prices and high volatility. However, as prices continue to rise, with high volatility in 2005, the hedging premium seems to disappear only to return in 2006 (see Table 5.3, for basic statistic for jet fuel commodity prices). The reduction in premium in 2005 – 2006 contradicts the Allayannis and Weston (2001) findings, saying that the premium should continue to be high as the price keep increasing.

Table 5.3 Basic statistic for jet fuel commodity prices

	2003	2004	2005	2006
Mean	85,63	120,71	172,23	196,30
Median	83,72	118,49	169,87	192,77
Std ev(Daily)	2,8%	2,8%	2,8%	2,2%
Std ev(Yearly)	44,1%	44,1%	44,6%	34,0%

Presented in the table are the average spot prices for jet fuel, in cents per gallon, from trading hubs in Rotterdam, Los Angeles, New York and the US Gold Coast.
Source: Energy Information Administration (EIA)

The high and persistent significance of hedging to value creation in the airline industry confirm that jet fuel should be seen as a non-core risk, defined by Schrand and Unal (1998), as a risk that do not add value when carried by the airlines. Since the risk does not add value companies should eliminate it and, as can be seen in the study, those who do are awarded a premium.

According to theory one of the major reasons for derivative hedging to create value is by reducing the expected cost of default. However, the probability of default, measured as Distance-to-Default, is not significant for any of the years and, even worse, change sign. This is a conforming result to Carter et al. (2006), who measure default probability with Altman's Z score (Altman, 1968) and as S&P credit rating. None of the variables are significant in the Carter et al. (2006)

analysis. Comparing to Opler and Titman (1994) the insignificance is a contrasting outcome. In an industry with a high level of default Opler and Titman would argue that a lowering of expected default costs should award a premium due to the three reasons; loss of competitiveness, financial distress concessions and loss of tax shield. The intriguing result will be further investigated, concerning how the comprising parts of Distance-to-Default is effected by hedging.

Among the firm specific factors the results are mixed compared to what was expected. The Size variable, measured as the natural logarithm of Total Assets, is negative and statistically significant in two out of four years (See Table 5.1, p. 34). The negative and economically important sign contradict what was expected. Even if there exist benefit of scale within the industry, which would result in a positive relationship between value and size, this might be outweighed by the lack of flexibility present in large firms. In worrying times the higher flexibility in small firms would then explain the negative relationship found. This could be further supported by the bankruptcies of large American airlines such as; Delta Airlines, Northwest Airlines and US Airways.

A higher Long Term Debt-to-Asset is positively correlated with value creation. The standardized coefficient, with an average of -0,559, confirms the economical significance of leverage, as regards to value creation. Both arguments for the utilization of the tax shield (See Deen and Doron, 2002 and Kang, 1995) as well as theories regarding Information Asymmetry and Agency costs (see Farma and Jensen, 1983 and Jensen, 1986), solid and long lasting Finance theories, can be used to explain why high leverage in general add value. The enablement of debt as value creating activity is nevertheless an important finding considering the focus taken in the paper, towards corporation default and tax shield utilization.

For the two dummy variables included no significance can be found. Hence, it is not possible to conclude that any major structural difference between European and American airlines in terms of value creation exists. That “Other hedging”-arrangements, such as pass-through agreements and guarantied caps, are not statistically significant implies that these agreements do not create value to the same extent as derivative hedging do.

In order to validate the results the same data were run using Non-Parametric regressions. As can be seen in Exhibit 3, no material differences are present, in terms of sign and size of the coefficients. The significance however, is to some extent lower, which is in line with expectations since the assumption are less restricted.

Summarizing the findings regarding value creation in the airline industry, the most value adding activities are derivative hedging and leverage. There is no proof of value creation from reduced bankruptcy risk and no structural differences between American and European firms can be found.

5.2 Effect of hedging on Distance-to-Default

To investigate how hedging creates value the focus is turned towards the Distance-to-Default variable. As have been discussed above, Distance-to-Default did not show any significant effect on value creation, measured as Tobins Q. Theoretically derivative hedging has long been supported by the notion that reducing the expected bankruptcy costs is a major source of value creation from hedging. We offer three possible explanations to why we do not find any support for these theories within the airline industry. First, it is possible that hedging actually does not have any significant and measurable effect on a firm’s Distance-to-Default. A second explanation could be that risk managing firm’s use their more stabile cash flows to enable an increase in leverage. This would result in value creation from an increased tax shield while at the same time Distance-to-Default remains at the same level as if they did not hedge. A third alternative is that investors do not identify or value a reduction in probability of default. To answer which explanation holds true in the airline industry we first investigate whether or not hedging reduces the probability of default. Based on Smith and Stulz (1985) and Myers (1983) derivative hedging should decrease the probability of default, hence increase Distance-to-Default. The results from the performed regression are presented in Table 5.3 below.

Table 5.3 Estimates of the relation between Distance-to-Default and hedging behaviour

Variable	2003		2004		2005		2006		Average
Constant	5,137		0,319		-3,805		-3,411		-0,440
P-value	(0,266)		(0,786)		(0,132)		(0,115)		
Hedge	0,867		0,439	***	0,101		0,455		0,466
Stand. Coef.	0,158		0,424		0,618		0,178		0,345
P-value	(0,183)		(0,010)		(0,925)		(0,205)		
LT Debt-to-Assets	-0,358		-0,277		0,381		-0,718		-0,243
Stand. Coef.	-0,131		-0,100		0,025		-0,127		-0,083
P-value	(0,684)		(0,413)		(0,865)		(0,518)		
LN(Assets)	-0,205		0,021		0,218		0,186	**	0,055
Stand. Coef.	-0,173		0,137		0,248		0,492		0,176
P-value	(-0,35)		(0,708)		(0,104)		(0,038)		
Dummy American firm	-0,815	**	-0,117		-0,784		-0,606	*	-0,581
Stand. Coef.	-0,539		-0,218		-0,252		-0,394		-0,351
P-value	(0,044)		(0,337)		(0,117)		(0,076)		
Other hedges	-0,187		0,049		0,843		0,758	*	0,366
Stand. Coef.	-0,048		0,211		0,290		0,346		0,200
P-value	(0,735)		(0,809)		(0,104)		(0,057)		
R^2-Adj	0,167		0,167		0,197		0,309		
Prob(F-stat)	0,114		0,107		0,065	*	0,009	***	
# Observations	27		28		30		33		

This table reports the result of the regressions of firm Bankruptcy risk, measured as Distance-to-Default, on hedging behaviour and other firm characteristics. One regression is run for each year of the sample period. Coefficients, Standardized Coefficients and P-values, calculated using Whites heteroskedasticity corrected standard errors, are presented. Statistical significance at the 10%, 5% and 1% levels is indicated by *, ** and ***, respectively.

The regressions above give no conclusive evidence in support of theories linking derivative hedging to a reduction in default probability, however there are some tendencies in the material. Coefficients for hedging are positive, average of 0,466, and of economically significant size with an average for the standardized coefficients of 0,345. This indicates that hedging do have an effect on a firm's Distance-to.-Default, though to give more certain results of the importance, this relationship has to be further investigated.

Results from the regression show signs of an economically significant structural difference between Europe and the US in terms of default probability, with the

European firms being less risky from a bankruptcy perspective. The existence of a structural difference is further supported by the non-parametric regression which shows statistical significance in three of the four years. (See Exhibit 3) That a difference exists indicates that investors do not value a reduction in a firm's default probability. If they would have, the difference in default probability should have been reflected in a structurally higher value for European airlines. As can be seen in Table 5.1 (p.34), this difference in value creation between American and European airlines does not exist.

Other control variables display no obvious pattern and are statistically insignificant. An explanation behind the dummy variable Other hedges showing inconclusive results could be that there are too few firm's in the sample with this kind of strategy to be able to draw any conclusions. Some explanatory power exists in the model and both R^2-Adjusted and the F-test value are significant and increase over the sample period.

To further investigate the effect of hedging on a firm's Distance-to-Default it is a must to analyse the components of the measure. Recalling the Distance-to-Default formula, displayed below, the measurement rely on three inputs; assets, leverage and volatility. It is not likely that the size of the assets in any way is affected by hedging behaviour. However, intuitively both leverage and volatility should be affected by the more stable and predictable cash flows received through derivative hedging. One likely scenario is that hedging enables the liabilities to increase and the volatility to decrease (see Leland, 1998 and Stulz, 1996). This would make the net effect on Distance-to-Default close to zero and thus explain why the study does not find as strong relationship as expected. Both Leverage and Volatility must therefore be regressed to hedging behaviour in order to further deepen the analysis.

$$\textit{Distance-to-Default} = \frac{\textit{MarketValueofAssets} - \textit{DefaultPo}\,\mathrm{int}}{\textit{AssetValueVolatility}}$$

Table 5.4 Estimates of the relation between leverage and hedging behaviour

Variable	2003	2004	2005	2006	Average
Constant	0,899 *	0,384	1,637 **	1,843 ***	1,191
P-value	(0,090)	(0,312)	(0,013)	(0,001)	
Hedge	-0,007	-0,120	-0,031	-0,114 **	-0,068
Stand. Coef.	-0,288	-0,477	-0,544	-0,394	-0,426
P-value	(0,955)	(0,283)	(0,768)	(0,039)	
LN(Assets)	-0,022	0,004	-0,053 *	-0,060 **	-0,033
Stand. Coef.	-0,395	0,631	-0,729	-0,606	0,028
P-value	(0,383)	(0,838)	(0,072)	(0,013)	
Dummy American firm	0,018	-0,025	0,035	0,015	0,011
Stand. Coef.	0,328	0,237	0,243	0,141	0,237
P-value	(0,698)	(0,565)	(0,589)	(0,787)	
Other Hedges	0,063	0,168	-0,107	-0,137 *	-0,003
Stand. Coef.	0,016	0,183	-0,009	-0,023	0,042
P-value	(0,675)	(0,241)	(0,356)	(0,053)	
R2-Adj	-0,011	0,112	0,148	0,358	
P-value F-stat	0,466	0,154	0,091 *	0,002 ***	
# Observations	27	28	30	33	

This table reports the result of the regressions of firm Leverage, measured as Long Term Debt-to-Assets, on hedging behaviour and other firm characteristics. One regression is run for each year of the sample period. Coefficients, Standardized Coefficients and P-values, calculated using Whites heteroskedasticity corrected standard errors, are presented. Statistical significance at the 10%, 5% and 1% levels is indicated by *, ** and ***, respectively.

Using Table 5.4 the Leland argument from 1998 of an increase in long term debt by hedging firms can be forcefully rejected in the airline industry during the start of the millennium. There is clearly not any evidence of the tax shield from interest payments being the driver of value creation due to derivative hedging. Even if only significant for 2006 the coefficient for Hedging is actually negative for all years. Standardized coefficients for Hedging are large, with an average of -0,426. This implies an economically significant relationship, provided that the statistically significance was higher. The negative coefficients would suggest a prudent verses risky firm behaviour. On one side there are firms that both hedge and have a limited leverage and on the other side firms that accumulate risk, both in terms of operational exposure regarding jet fuel and in term of financial exposure due to leverage. An evidence of this is that of the 9 firms that hedges more than half of their exposure, on average 7 has lower leverage than the median airline. (See Exhibit 4) The firm specific variables all display statistically or economically insignificant results.

When looking at the volatility side of the equation, Equity Volatility have been chosen as the variable to investigate. To understand why Asset Volatility is not chosen, recall that leverage was included in the formula to derive Asset Volatility. Equity Volatility is therefore considered to be a more pure measurement of volatility.

Table 5.5 Estimates of the relation between volatility and hedging behaviour

Variable	2003		2004		2005		2006		Average
Constant	-0,020		0,778	*	1,887	***	1,807	***	1,113
P-value	(0,987)		(0,096)		(0,008)		(0,002)		
Hedge	-0,195		-0,149	**	0,020		-0,050		-0,094
Stand. Coef.	-0,251		-0,303		0,397		-0,116		-0,054
P-value	(0,229)		(0,046)		(0,922)		(0,429)		
LN(Assets)	0,023		-0,014		-0,072	**	-0,066	**	-0,032
Stand. Coef.	0,156		-0,160		-0,359		-0,539		-0,180
P-value	(0,685)		(0,521)		(0,023)		(0,011)		
Dummy American firm	0,291	**	0,047		0,203	*	0,171	**	0,178
Stand. Coef.	0,533		0,180		0,300		0,430		0,289
P-value	(0,013)		(0,323)		(0,053)		(0,010)		
Other Hedges	0,022		-0,012		-0,218	**	-0,222	***	-0,108
Stand. Coef.	0,045		-0,124		-0,393		-0,405		-0,175
P-value	(0,915)		(0,894)		(0,039)		(0,008)		
R2-Adj	0,188		0,237		0,413		0,534		
P-value F-stat	0,072	*	0,166		0,008	***	0,000	***	
# Observations	27		28		30		33		

This table reports the result of the regressions of firm Volatility, measured as annual Equity Volatility, on hedging behaviour and other firm characteristics. One regression is run for each year of the sample period. Coefficients, Standardized Coefficients and P-values, calculated using Whites heteroskedasticity corrected standard errors, are presented. Statistical significance at the 10%, 5% and 1% levels is indicated by *, ** and ***, respectively.

Regarding Volatility and hedging behaviour no major relationship can be found and once again the analysis has to be based on the sign and size of the coefficients. That there should be a negative relationship between hedging and Equity volatility was indicated when the correlation between the two variables was calculated. These calculations showed a negative correlation in every year with an average correlation for all years of -34 percent. (See Table 4.2 p. 33 and Exhibit 2) The regression analysis supports this by showing coefficient that are negative and of economically significant size for all years except for 2005. A result which implies that the stock market do take hedging into account and perceive hedging firms as less risky compared to non hedging firms. On average a firm that goes from 0 to 100 percent hedging will reduce the volatility in the equity with almost 10 percentages. Considering that the average Equity Volatility in the sample over the period was found to be 47 percent, a 10 percentage decrease is material. DaDalt et al. (2002) suggests and proves that hedging firms are more able to meet analysts' earnings forecast. More predictable cash flows should lead to a perceived lower firm risk, which can explain a reduction in volatility from hedging.

Control variables used in the regression presents a pattern that was to be expected. The variable Other Hedges is negative and approximately of the same size as for Hedging. This indicates that, as regards to reduction of Equity Volatility, the stock market appreciates other hedging arrangements equally to futures and forward derivative hedging. American airlines have a higher volatility in the stock market, which most likely can be derived from the, previously mentioned, turbulent industry environment in recent years. Lastly, size also shows to be negatively related to hedging which coincides with a belief that larger firms have a higher degree of diversification within their operations which should lead to more stabile cash flows.

To summarize the findings regarding Distance-to-Default and derivative hedging; measurable effects on the default risk of the firm can be found due to hedging behaviour. This can primarily be derived from a decrease in equity volatility. On the other hand no sign of tax shield utilization, due to increased leverage, can be found. These findings make it possible to state that the reason for why a decrease in probability of default does not add value comes from investors not recognising or perceive it as valuable. Finally, some indications are found that the airline industry can be divided into Prudent and Risky firms.

6 Conclusion

In this final chapter we present our conclusions from the performed study. We also offer suggestions how the findings can be applicable to other industries. Finally we give suggestions to further research within the area.

The purpose of the thesis was to find out whether or not derivative hedging of jet fuel exposure is value creating for airlines and if hedging can affect the probability of default.

During the period 2003 – 2006 there existed a value premium for airlines that hedged their expected future consumption of jet fuel. This premium has, over the 4 year period, on average been 17 percent. The 17 percent should be compared to the estimated 10 percent premium in the American airline industry during 1993 – 2003, presented by Carter et al. (2006). Since our study includes European firms a potential explanation behind the increased premium could be the inclusion of European airlines. However, the study finds no support for any significant differences between American and European firms, regarding value creation. The explanation offered to the increased value premium is derived form a substantial increase of jet fuel costs, measured as percentage of total operating cost.

There is no support for the theory stating that the value creation from derivative hedging comes from a decrease in the expected cost of default. Probability of default, measured as Distance-to-Default, is found to be affected by the hedging behaviour, but the market does not seem to value this effect.

Leverage, on the other hand, is deemed to be value enhancing, but is not positively related to hedging. In the material we have found indications of a prudent firm behaviour. Of the 9 firms that hedges more than half of their exposure, on average 7 have lower leverage than the median airline. The intriguing result of firms pursuing a low risk strategy could be an effect of the turbulent industry environment after the September 11 attacks. The outcome, with both high hedging and low leverage, opposes prior, both theoretical and empirical, research. When generalizing such a result, which might be affected by industry and time specific factors, a high degree of cautiousness has to be taken into consideration.

The performed study has shown that hedging of jet fuel is value creating for airlines; however it has not shown the source behind the value creation. It is not possible to find support for explanations such as a reduction of expected bankruptcy cost or an increased tax shield from interest payments. To explain the value premium from hedging the authors instead believe that focus should be directed towards the classification of risk.

Airlines' exposure to jet fuel has been classified as a non-core risk, meaning a risk where the firms have no comparative advantage as regards to information. According to theory a firm should manage its exposure to such a risk, since it does not add value. Consequently an airline that eliminates its exposure to jet fuel price risk should be valued higher by investors, since it generates the same expected return with a lower risk. Since the value premium can not be attributed to other known factors we believe that a majority of it can be derived from the risk reduction. Value from hedging comes therefore not from the direct benefits of hedging, but from investors' attitude towards risk taking.

The airline industry provides an extraordinary research opportunity, since almost 30 percent of the total cost base constitute of one commodity exposure. However, the result can intuitively be transferred to other producers, of either products or services, exposed to commodity price risk. It ought to be almost impossible for a consumer of a standardized commodity to be able to gain a comparative advantage when it comes to future price movements. As have been proven in the study investors acknowledge the risk reduction of non returning risks and award the risk managing company a premium. The larger the exposure the larger the premium, hence there is no excuse for management to accumulate non performing risks.

6.1 Future Research

As regards to future research Risk Management is an area of great importance. When it comes to non-core and core risks researchers have just scratched the surface. In this paper we have managed to show a significant risk premium rewarded to companies acknowledging a non-core risk and managing it in a proper way. Other interesting non-core risks, yet waiting to be researched on, could be property exposure, via real estate assets, or market exposure, through pension holdings.

A second path for the eager minds of tomorrow is to look deeper into the Prudent Firm Theory, implied in the airline industry. The question in focus would be how Risk Management and capital structure are integrated in times when an industry is under external pressure. According to the Prudent Firm Theory a polarization will take place, forcing companies to choose either a Prudent or a Risky strategy, in terms of both an operational and financial perspective.

7 References

Articles:

Allayannis G. and Weston J.P., (2001), *"The Use of Foreign Currency Derivatives and Firm Market Value"*, The Review of Financial Studies, Vol. 14, No. 1, pp. 243-276

Altman E., (1968), *"The Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy"*, Journal of Finance, Vol. 23, No.4, pp. 589-609

Berger P. and Ofek E., (1995), "*Diversification's effect on firm value*", Journal of Financial Economics, Vol. 37, No. 1, pp. 39-66

Berndt A., Rohan D., Duffie D., Ferguson M. and Schranz D., (2004), *"Measuring Default Risk Premia"*, Working Paper, Second Edition.

Bessembinder H., (1991), "*Forward Contracts and Firm Value: Investment Incentive and Contracting Effects*", Journal of Financial Quantitative Analysis, Vol. 26, No. 4, pp. 519-532

Brainard W.C., Tobin J., (1968), *"Pitfalls in Financial Model Building"*, The American Economic Review, Vol. 58, No. 2, pp. 99-122

Callahan M., (2002), *"To Hedge or Not to Hedge…That Is the Question: Empirical Evidence from the North American Gold Mining Industry 1996-2000"*, Financial Markets, Institutions & Instruments, Vol. 11, No. 4

Carter D.A., Rogers D.A., Simkins B.J., (2006), *"Does Heding Affect Firm Value? Evidence from the US Airline Industry"*, Financial Management, Vol. 35, No. 1, pp 53-86

Chung K.H., Pruitt S.W., (1994), *"A simple approximation of Tobin's q"*, Financial Management, Vol. 23, No. 3, pp. 70-74

Deen K., Doron N., (2002), "*Valuation of the Debt Tax Shield"*, Journal of Finance, Vol. 57, No. 5, pp. 2045-2073

Densler et al (2006), "*From default probabilities to credit spreads: Credit risk models do explain market prices*", Finance Research Letters, Vol. 3, No. 2. pp. 79-95

Euromoney Institutional Investor PLC, (2005), "*Reigning in Chapter 11*", Airfinance Journal, Oct. 2005, p. 1

Fama E., (1970), "Efficient *Capital Markets: Review of Theory and Empirical Work*", Journal of Finance, Vol. 25, No. 2, pp. 383-417

Fama E. and Jensen M., (1983), "*Separation of Ownership and Control*", Journal of Law and Economics, Vol. 26, No. 2, pp. 301-325

Froot K.A., Scharfstein D.S., Stein J.C., (1993), *"Risk Management: Coordinating Corporate Incvestment and Financing Policies"*, The Journal of Finance, Vol. 48, No. 5. pp. 1629-1658

Gay G. and Nam J., (1998), "*The underinvestment problem and corporate derivatives use*", Financial Management, Vol. 27, No. 4, pp. 53-69

Jensen M., (1986), "*Agancy Costs of Free Cash Flow, Corporate Finance, and Takeovers*", The American Economic Review, Vol. 76, No. 2, pp. 323-329

Jin Y. and Jorion P., (2006), *"Firm Value and Hedging: Evidence from U.S. Oil and Gas Producers"*, The Journal of Finance, Vol. 61, No.2, pp 893-919

Kanak P. and Pondromos V., (2006) *"An Empirical Estimation of Default Risk of the UK Real Estate Companies"*, The Journal of Real Estate and Financial Economics, Vol. 32, No1, pp. 21-40

Kang J., (1995), *"The conditional relationship between financial leverage and corporate investment: Further clarification"*, Journal of Business Finance and Accounting, Vol. 22, No. 8, 1211-1220

Lang L., Paulsen A. and Stulz R., (1995), *"Asset sales, firm performance, and the agency costs of managerial discretion"*, Journal of Financial Economic, Vol. 27, No. 1, pp. 3-37

Leland H., (1998), *"Agency Costs, Risk Management, and Capital Structure"*, Journal of Finance, Vol. 53, No. 4, pp. 1213-1243

Lewellen W., (1971), *"A Pure Financial Rationale for the Conglomerate Merger"*, Journal of Finance, Vol. 26, No. 2, pp. 521-537

Lindenberg E.B. and Ross S.A, (1981), *"Tobin's q Ratio and Industrial Organization"*, The Journal of Business, Vol. 54, No 1, pp.1-32

Louder G.F., (2004) *"Financial Risk Exposure in the Airline Industry: Evidence from Australia and New Zeeland"*, Australian Journal of Management, Vol. 29, No. 2, pp 295-316

Merton R.C. (1974), *"On the Pricing of Corporate Debt: The Risk Structure of Interest Rates"*, The Journal of Finance, Vol. 29, No. 2, pp. 449-470

Merton R.C., (2005), *"You Have More Capital Than You Think"*, Harvard Business Review, Vol. 83, No. 11, pp. 84-94

Miller M.H and Modigliani F., (1958), *"The Cost of Capital, Corporation Finance and the Theory of Investment"*, The American Economic Review, Vol. 48, No. 3, pp. 261-297

Miller M.H and Modigliani F., (1961), *"Dividend Policy, Growth and the Valuation of Shares"*, The Journal of Business, Vol. 34, No. 4, pp. 411-433
Myers S., (1977), *"Determinants of Corporate Borrowing"*, Journal of Financial Economics, Vol. 5, No. 2, pp. 147-175

Myers S.C. and Majluf N.S, (1984), *"Corporate financing and investment decisions when firms have information that investors do not have"*, Journal of Financial Economics, Vol. 13, No. 2, pp. 187-221

Myers D. and Smith C., (1982), *"On the Corporate Demand for Insurance: Evidence from the Reinsurance Market*", Journal of Business, Vol. 55, No. 2, pp. 281-296

Myers D. and Smith C., (1990), *"On the Corporate Demand for Insurance: Evidence from the Reinsurance Market*", Journal of Business, Vol. 63, No. 1, pp. 19-41

Opler T.C. and Titman S., (1994), *"Financial Distress and Corporate Performance"*, Journal of Finance, Vol. 1949, No. 3, pp. 1015-1040

Ross M.P., (1996), *"Corporate Hedging: What, Why and How?"*, Working paper, University of California, Berkeley

Schrand C. and Unal H., (1998), *"Hedging and Coordinated Risk Management: Evidence from Thrift Conversions"*, The Journal of Finance, Vol. 53, No. 3, pp. 979-1013

Servaes H., (1995) "*The Value of Diversification During the Conglomerate Merger Wave*", Journal of Finance, Vol. 51, No. 4, pp. 1201-1225

Smith C.W. and Stulz R.M., (1985), *“The Determinants of Firms’ Hedging Policies”*, The Journal of Financial and Quantitative Analysis, Vol. 20, No. 4, pp. 391-405.

Stulz R.M., (1984), “*Optimal Heding Policies”*, The Journal of Financial and Quantitative Analysis, Vol. 19, No. 2, pp. 127-140

Stulz R., (1996), *“Rethinking risk management”*, Journal of Applied Corporate Finance, Vol. 9, pp. 8-24

Syversten B. D., (2004), “*How accurate are credit risk models in their predictions concerning Norwegian enterprises?*”, Norges Bank, Economic Bulletin, Vol. 75, No. 4, pp. 150-156

Tobin J., (1969), *“A General Equilibrium Approach to Monetary Theory”*, Journal of Money, Credit and Banking, Vol. 1, No. 1, pp. 15-29

Tufano P., (1996), *“The Determinants of Stock Price Exposure: Financial Engineering and the Gold Mining Industry”*, The Journal of Finance, Vol. 53, No. 3, pp. 1015-1052.

Books

Baltagi, B H., (1995), *”Econometric Analysis of Panel Data”*, John Wiley & Sons, Chichester, 1995

Brooks, C., (2005), “Introductory econometrics for finance”, Cambridge University Press, Cambridge

Bryman A., Bell E., (2003), *“Business Research Methods”*, Oxford University Press, Oxford

Patel, R. and Davidson, B. *”Forskningsmetodikens grunder – Att planera, genomföra och rapportera en undersökning”*, Studentlitteratur, Lund

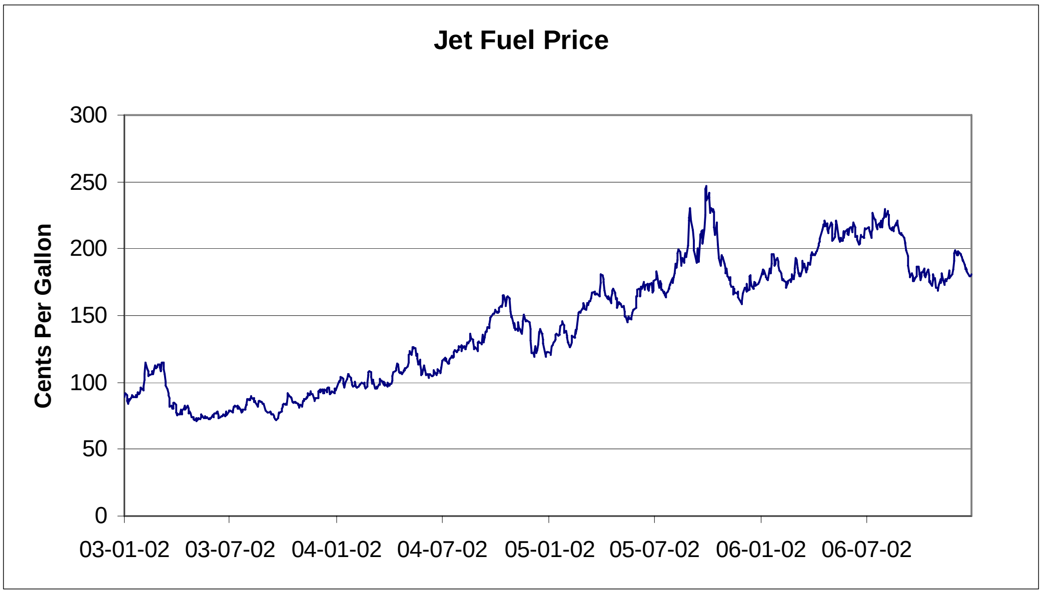
Databases:

Reuters 3000Xtra, Reuters

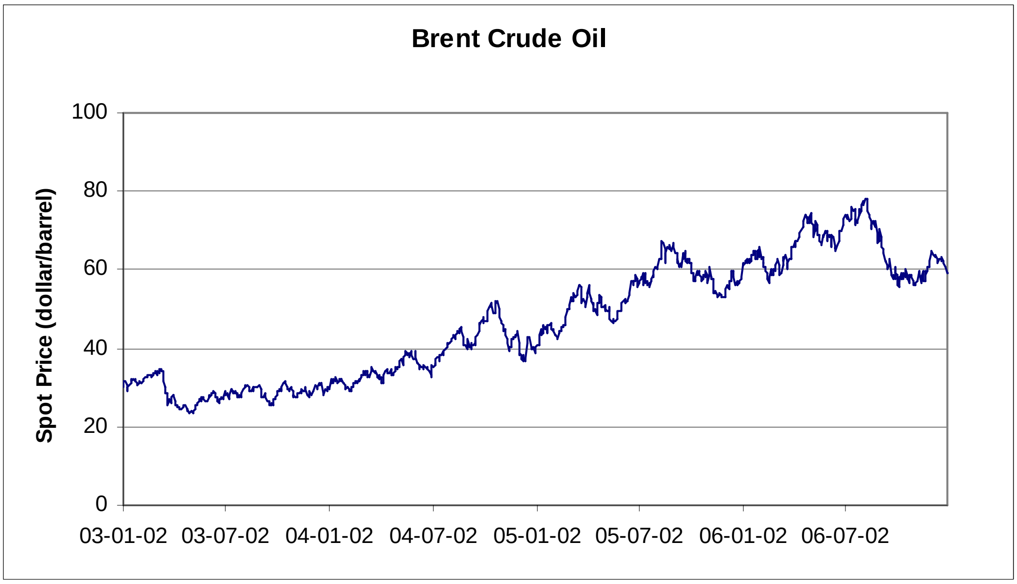
Datastream Advance 4.0, Thomson Financial Limited

Energy Information Administration (EIA), http://www.eia.doe.gov/

Exhibit 1 Development of the jet fuel and oil price over the period



Presented in the graph is the average spot price for jet fuel over the period, in cents per gallon, from trading hubs in Rotterdam, Los Angeles, New York and the US Gold Coast.
Source: Energy Information Administration (EIA)



Presented in the graph is the spot price for Brent Crude Oil FOB over the period, in dollar per barrel.
Source: Energy Information Administration (EIA)

Exhibit 2 Correlation matrices for variables in each year

2006	Hedge (%)	Tobin's Q	Distance-to-Default	LT Debt-to-Assets	Dummy American firm	Other Hedges	Equity Volatility
Hedge (%)	1						
Tobin's Q	0,031	1					
Distance-to-Default	0,397	-0,235	1				
LT Debt to Assets	-0,261	-0,049	-0,022	1			
Dummy American firm	-0,384	0,019	-0,447	0,271	1		
Other Hedges	-0,142	0,039	0,003	0,107	0,383	1	
Equity Volatility	-0,331	0,245	-0,852	-0,207	0,401	-0,077	1

2005	Hedge (%)	Tobin's Q	Distance-to-Default	LT Debt-to-Assets	Dummy American firm	Other Hedges	Equity Volatility
Hedge (%)	1						
Tobin's Q	-0,303	1					
Distance-to-Default	0,718	-0,180	1				
LT Debt to Assets	-0,359	0,308	-0,226	1			
Dummy American firm	-0,473	0,309	-0,495	0,374	1		
Other Hedges	-0,381	0,110	-0,090	0,059	0,349	1	
Equity Volatility	-0,520	0,149	-0,879	0,108	0,430	-0,050	1

2004	Hedge (%)	Tobin's Q	Distance-to-Default	LT Debt-to-Assets	Dummy American firm	Other Hedges	Equity Volatility
Hedge (%)	1						
Tobin's Q	0,057	1					
Distance-to-Default	0,531	0,065	1				
LT Debt to Assets	-0,336	0,415	-0,257	1			
Dummy American firm	-0,371	0,294	-0,349	0,443	1		
Other Hedges	-0,335	0,232	-0,087	0,180	0,380	1	
Equity Volatility	-0,402	-0,111	-0,944	0,119	0,255	0,110	1

2003	Hedge (%)	Tobin's Q	Distance-to-Default	LT Debt-to-Assets	Dummy American firm	Other Hedges	Equity Volatility
Hedge (%)	1						
Tobin's Q	-0,059	1					
Distance-to-Default	0,168	-0,034	1				
LT Debt to Assets	-0,063	0,448	-0,321	1			
Dummy American firm	-0,187	0,309	-0,587	0,289	1		
Other Hedges	-0,483	0,150	-0,245	0,047	0,373	1	
Equity Volatility	-0,219	-0,044	-0,925	0,167	0,529	0,196	1

These tables report the correlation between the variables, both dependent and independent, used in regressions. The correlations are calculated for each year.

Exhibit 3 Results from non-parametric regressions

Dependent variable: Tobin's Q

Variable	2003		2004		2005		2006		Average
Constant	2,590		1,232		1,087		3,742	**	2,163
P-value	(0,191)		(0,508)		(0,306)		(0,013)		
Hedge	0,543		0,633		0,185		0,389		0,438
P-value	(0,269)		0,130)		(0,575)		(0,211)		
Distance-to-Default	0,093		0,339		0,014		0,060		0,127
P-value	(0,469)		(0,386)		(0,802)		(0,664)		
LN(Assets)	-0,189	*	-0,131		0,088		-0,202	***	-0,109
P-value	(0,054)		(0,161)		(0,121)		(0,008)		
LT Debt-to-Assets	1,954	**	2,072	**	1,285	**	1,031		1,586
P-value	(0,004)		(0,027)		(0,029)		(0,132)		
Dummy American firm	0,205		0,304		0,012		-0,003		0,130
P-value	(0,375)		(0,249)		(0,934)		(0,990)		
Other hedges	0,099		-0,154		-0,160		-0,146		-0,090
P-value	(0,748)		(0,682)		(0,424)		(0,630)		
R2-Adj	0,45		0,381		0,361		0,306		
Prob(F-stat)	0,042	**	0,089	*	0,072	*	0,117		
# Observations	27		28		30		33		

Dependent variable: Distance-to-Default

Variable	2003		2004		2005		2006		Average
Constant	2,993		0,063		-0,319		-1,666	*	1,528
P-value	(0,130)		(0,949)		(0,833)		(0,059)		
Hedge	0,308		0,323		1,024	**	0,259		0,479
P-value	(0,535)		(0,110)		(0,025)		(0,184)		
LN(Assets)	-0,097		0,040		0,046		0,120	***	0,027
P-value	(0,313)		(0,415)		(0,565)		(0,009)		
LT Debt-to-Assets	-0,469		-0,371		0,275		-0,278		-0,211
P-value	(0,481)		(0,430)		(0,729)		(0,514)		
Dummy American firm	-0,506	**	-0,132		-0,375	*	-0,282	**	-0,324
P-value	(0,027)		(0,337)		(0,064)		(0,033)		
Other hedges	-0,038		0,117		0,478	*	0,446	**	0,251
P-value	(0,908)		(0,561)		(0,083)		(0,020)		
R2-Adj	0,345		0,321		0,519		0,487		
Prob(F-stat)	0,092	*	0,087	*	0,002	***	0,002	***	
# Observations	27		28		30		33		

The tables above report the result of the non-parametric regressions on the effect of hedging on Tobin's Q and Distance-to-Default respectively. One regression is run for each year of the sample period. Coefficients and P-values are presented and statistical significance at the 10%, 5% and 1% levels is indicated by *, ** and ***, respectively.
Regressions run on the following webpage: http://www.stat.wmich.edu/slab/RGLM/

Exhibit 4 Prudent firms

Firm	Average hedged	LT Debt-to-Assets
SkyEuro	**90**	**0,00**
Southwest	**80**	**0,14**
Air Berlin	80	0,36
Ryanair	**78**	**0,32**
Air France - KLM	**77**	**0,32**
British Airways	75	0,39
Lufthansa	**73**	**0,13**
Easyjet	**63**	**0,08**
Iberia	**59**	**0,06**
Median (all firms):	**31**	**0,33**

The table shows the average hedge and leverage of the 9 firms that hedges the most. Highlighted are those firms that have a lower leverage than the median value within the industry.