St. Petersburg University

Graduate School of Management

[Master in Corporate Finance]

INFLUENCE OF HEDGING ON FIRM VALUE: US AIRLINES EXPERIENCE

Master’s Thesis by the 2nd year student

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St. Petersburg

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 (Подпись студента)

30/05/2017 (Дата)

# Abstract

|  |  |
| --- | --- |
| Master Student's Name  | Georgiy Tautiev |
| Master Thesis Title  | Influence of hedging on firm value: US airlines experience |
| Faculty  | Graduate School of Management |
| Main field of study  | Corporate Finance |
| Year  | 2016 |
| Academic Advisor's Name  | Bukhvalov A. V. |
| Description of the goal, tasks and main results  | The main purpose of this work is to determine the relationship between hedging and the value of the company. To achieve this goal, the author has studied the work in this area, examined the main methods of research, as well as the theoretical basis of risk management. For the empirical study, the author reviewed the experience of US airlines, in particular the activities of the country's 10 largest air carriers for 16 years between 2000 and 2015. The results of the empirical study confirmed the existence of a positive link between the hedge and the value of the company. Moreover, regression analysis has revealed a strong relationship between hedging and the credit rating of companies. |
| Keywords | Hedging activity, Firm Value, Risk-Management, Airlines.  |

Аннотация

|  |  |
| --- | --- |
| Автор  | Георгий Таутиев |
| Название магистерской диссертации  | Влияние хеджирования на ценность компании: опыт авиалиний США |
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| Научный руководитель  | Бухвалов А. В. |
| Описание цели, задач и основных результатов  | Основной целью данной работы является определение взаимосвязи между хеджированием и ценностью компании. Для достижения данной цели, автором были изучены работы в данной области, рассмотрены основные методы исследований, а также теоретические основы риск-менеджмента. Для эмпирического исследования автором был рассмотрен опыт авиалиний США, в частности деятельность 10 крупнейших авиаперевозчиков страны на протяжении 16 лет в период с 2000 года по 2015 год. Результаты эмпирического исследования подтвердили наличие положительной связи между хеджированием и ценностью компании. Более того, регрессионный анализ позволил выявить сильную взаимосвязь между хеджированием и кредитным рейтингом компаний. |
| Ключевые слова  | Хеджирование, ценность компании, риск-менеджмент, авиалинии. |

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# **Introduction**

Risk management in operating and financial activities of a company – is a very important part of corporate finance. The most important decisions are taken with taking into account possible risks, that’s why almost all companies try to manage and hedge risks. In risk management companies may rely on some laws, or just intuition of company’s management, or logic. Anyway, the main question in sphere of managing risks is how such activity affects company’s value.

First of all, when we talk about influence of managing risks on firm value, we need some criteria in order to highlight companies who intentionally manage risks.

That’s why we have to pay attention to such way of managing risks as hedging. Usually, hedging means use of financial instruments connected with taking some liabilities in future. Not every company will dare to use derivatives, and if it declares that it hedges risks, then it really evaluated all connected risks and consequences. In this case we can say, that company intentionally uses hedging instruments.

From the researcher’s side, interest in hedging is explained by several key points. Firstly, hedging risks can decrease not only specific, but also market risks. Secondly, theoretically, hedging can decrease risk till zero. It allows to hope, that effect of hedging can be easily seen. Thirdly, contemporary financial market allows to use different hedging instruments in order to hedging almost all the risks. Finally, the biggest joint-stock companies have to disclose all the risk management measures applied.

Recent literature in corporate finance has fostered an improved understanding of why nonfinancial firms may hedge.' However, very little research has focused on whether hedging achieves reasonable economic objectives. In particular, many researchers are interested in whether hedging increases firm value. Allayannis and Weston (2001) examine the relation between foreign currency hedging and Tobin's Q. They conclude that hedging is associated with higher firm value. On the other hand, Jin and Jorion (2004) find no relation between hedging and firm value for oil and gas producers. Previous research in this field implies that hedging in positively associated with firm value in the US airline industry (Carter et al., 2005).

This masterwork contributes to the body of corporate risk management research in two important ways. First, given the conflicting results on the relation between hedging and firm value, we provide additional evidence regarding this question by studying the hedging of jet fuel price risk exposure by US airlines. The airline industry offers a unique perspective from which to analyze the value of firms' hedging activities because the industry is largely homogeneous and competitive. Further, we focus on the hedging of a single, homogeneous and volatile input commodity, jet fuel. Second, and perhaps more important, we will compare our results with analysis provided by previous research and will try to better understand what changed and whether there is still the source of potential value from hedging by airlines. Compared to previous research done in this sphere, we will consider most recent period, from 2000 till 2015 inclusively, which will include 2001 year, which was very hard for US airline carriers, and financial crisis.

Airlines face significant distress costs. Pulvino (1998,1999) finds that distressed airlines are forced to sell their aircraft at price below the market. Froot et al. (1993) suggest that firms facing significant expected distress costs will choose to inderinvest. The underinvestment cost is an indirect cost of financial distress (e.g., Stulz, 1996). They show that hedging is a mechanism to alleviate this underinvestment incentive. In their model, hedging is more valuable when investment opportunities display lower correlations with cash flows from hedgeable risks. The airline industry is an excellent example because its environment conforms well to this theory of hedging.

Thus, the purpose of this paper is to explore new evidences about relation between hedging activity and firm value and compare them with results of previous research done in this sphere. The primary subject of the master thesis is jet fuel hedging activity of US airlines.

The research goal of this paper is to examine influence of hedging activity of company on its firm value.

In order to achieve goal of this master work, we set the following objectives:

* To analyze hedging instruments
* To determine motivation of management for using hedging instruments
* To define variables which influence on company’s ability to hedge its risks
* Conduct empirical study for determining influence of hedging on firm value

This masterwork is an empirical research: we conduct econometric analysis for achieving set goal with the help of Stata software.

The main sources of information for this master thesis include: academic articles devoted to hedging activities, its influence on firm value in different industries, determinants of firm value; professional periodical literature (Journal of Finance, Financial Management, Small Business Economics, The Accounting Review and others); reports of global financial companies (e.g. Deloitte).

In addition to Thomson Reuters DataStream, we used reports published on Security Excange Commission (form 10-K and 10-Q). For the regression analysis we also used annual reports published on web-sites of companies.

In order to achieve defined goal we use the following structure of this master thesis. The first chapter is devoted to US Airline industry, its key figures important for our analysis, industry-specific risk management practices and motivation of hedging. In this chapter we will provide information about hedging instruments, their implementation and impact to firm value. Moreover, we will briefly discuss previously done researches and their results and develop research hypotheses.

The second chapter will be devoted to empirical research on influence of hedging on firm value. In this part we will describe methodology applied, process of sample selection, descriptive statistics of the sample. Furthermore, we will discuss results of statistics analysis and, based on them, develop managerial implications.

# **Chapter 1. Risk Management in US airlines industry**

## **US Airline Industry Environment**

The US airline industry offers an excellent setting for examining the effect of hedging on firm value. First, airlines are exposed to substantial, but hedgeable, risk exposures. One particularly notable risk facing airlines is their exposure to rising jet fuel prices. Second, the investment and financing environment in the industry demonstrates similarities to the setting posed by Froot et al. (1993) in motivating the benefits of hedging. We will discuss these two points futher in this section.

Before moving further, we would like to focus on specifics of US Airline industry for better understanding or area of research. In this part we will observe the US airlines industry, define its key statistics, which are important for this particular master thesis and discuss industry-specific risk-management specifics. Going deeper, we will describe common hedging tools used in this industry and motives of use, discuss results of former research.

The US contributed more than 28% of the global airline industry revenues in 2015, having grown steadily in volume and value during the preceding five years. Similar growth is expected towards 2020. However, stronger growth in the Asia- Pacific region means that the US will be contributing just under 25% of global revenues at that stage.

The US airlines industry had total revenues of $166,276.7m in 2015, representing a compound annual growth rate (CAGR) of 5.4% between 2011 and 2015. In comparison, the European and Asia-Pacific industries grew with CAGRs of 5.3% and 9.6% respectively, over the same period, to reach respective values of $129,695.4m and $196,038.7m in 2015.

*Figure 1. US Airlines industry value: $ billion, 2011-2015*

The industry value has been growing during 2011-2015 period, compound annual growth rate equal to 5,4%. If in 2015 value was $166,3 billion, in 2020 it is forecasted $215 billion with CAGR 5,3% (MarketLine 2016).

Since object of this research is US airlines industry, we should mention key players. In the following table we present major airlines of the US transportation market.

*Table 2. Major US airlines by number of passengers, 2016*

|  |  |  |
| --- | --- | --- |
| 1 | American Airlines | 198,714575 |
| 2 | Delta Air Lines | 183,741787 |
| 3 | Southwest Airlines | 151,740357 |
| 4 | United Airlines | 143,177 |
| 5 | Alaska Airlines | 41,945 |
| 6 | JetBlue Airways | 38,263104 |
| 7 | Spirit Airlines | 21,618039 |
| 8 | Frontier Airlines | 14,8 |
| 9 | Hawaiian Airlines | 11,050911 |
| 10 | Allegiant Air | 11,003864 |

As we previously mentioned, US airlines industry offers an excellent setting for examining the effect of hedging on firm value, because they are exposed to substantial, but hedgeable, risk exposures. On of the biggest types of costs of airlines is jet fuel. Jet fuel is a commodity which can be hedged. The most difficult issue here is that prices on fuel are very volatile. If we provide correlational analysis between oil prices and jet fuel prices, we will see that they are very correlated (0,99).

*Figure 2. Average monthly jet fuel prices, 2000-2015*

*Figure 3. Jet fuel consumption in US, 2004-2016*



Overall, airline disclosures suggest fuel price risk is of significant importance. Fuel price risk is ubiquitous across all airlines, as opposed to foreign currency price risk that applies only to relatively small set of airlines that operate in foreign markets.

## **Hedging and its impact**

Many of the participants in the futures markets are hedgers. They use futures markets to reduce their risk. This risk may be due to changes in oil prices, exchange rates, stock market conditions or other indicators. The ideal hedging completely eliminates the risk. In practice, such contracts are rare. Most futures hedging research boils down to attempts to develop hedging conditions that most closely match its ideal case.

Choosing futures markets to hedge risk, investors and companies usually seek to take a position that maximizes risk neutralization. There are 2 types of hedging positions: short and long.

A short position is convenient when the hedger already owns the asset and is going to sell it in the future. Long positions are used by companies that intend to acquire an asset and wish to fix its price.

Arguments in favour of hedging are obvious. Most companies are engaged in manufacturing, retail, wholesale, or the provision of services. They have no experience of predicting market indicators, such as interest rates, exchange rates or commodity prices. Therefore, for them, hedging the risks associated with these factors is appropriate. Such companies can focus on their core business. Hedging, they avoid unpleasant surprises, such as a sharp increase in the prices of goods. In practice, many risks can not be hedged.

Sometimes, as one of the arguments indicate that shareholders, if they want, can themselves hedge. However, this claim is controversial. It assumes that shareholders know about the risks inherent in the company's activities as much as its management. In many situations this is far from the case. In addition, this argument ignores the impact of commissions and the cost of other transactions. In the case of large transactions, the cost per hedged dollar is lower than when performing small transactions. Consequently, hedging by companies is cheaper than hedging by small shareholders.

Most of the theoretical research in corporate risk management argues that firms can increase value by hedging. In a seminal article, Smith and Stulz (1985) argue that by reducing probability of bankruptcy, hedging can increase firm value and this effect is larger for firms with higher costs of financial distress. In the same article, they propose that firms facing an income tax liability function that is convex in taxable income can reduce expected tax payments by hedging taxable income.

Most scientists hold the view that "financial risk management is an effective way to add value to a company", however, there is no complete clarity as to what are the benefits of risk management. Practice, when answering the question about the benefits of risk management, first of all note "improvement of the quality of decisions made throughout the company". Further, in importance, they consider it important to "preserve the reputation of the company" and only then point to "reducing the volatility of profits", "stabilizing cash flows", "reducing the costs of financial difficulties" [Servaes, Tamayo, Tufano, 2009].

Regarding methods and tools for risk management, managers generally point to the use of insurance policies by companies and hedging of risks using currency and interest derivatives. Further on the degree of use are financial guarantees, loans in foreign currency and fixed-term contracts for commodities (goods) [Servaes, Tamayo, Tufano, 2009].

Most researchers agree with the view that "derivatives help companies manage their risks more effectively" [A Survey of Finance Professors' Views on Derivatives, 2004]. However, at the present time, there is no universal theory or model that would confirm that a hedge is itself capable of creating value. Postulate Modigliani-Miller says that no financial decision in an efficient market can increase the value of the company (see, eg: [Brealey, Myers, 2007]). Therefore, researchers propose models in which various imperfections of financial markets and the peculiarities of the economic environment in which companies operate are the source of value in hedging.

A brief analysis of the main hypotheses regarding the possible benefits of hedging is given in the review (Bukhvalov, 2010). The first hypothesis is that hedging leads to a reduction in the costs of financial difficulties: a decrease in the likelihood of financial difficulties in the future has a positive impact on the company's confidence in investors, consumers, suppliers, employees and, therefore, increases its profits and its value (Smith, Stulz , 1985).

The second hypothesis refers to the fact that hedging avoids the problem of underinvestment - the rejection of investment projects due to difficulties in financing them due to the onset of risk events. This problem is exacerbated if, for some reason, access to the capital markets for the company is temporarily limited (Froot, Sharfstein, Stein, 1993).

The third hypothesis is that hedging creates the possibility of increasing the share of debt financing: high profit volatility forces the company to lower the level of debt burden below the optimal level (because of fears of growth in the cost of borrowed capital in the case of forced additional loans). Reducing the volatility due to risk management makes it possible to increase the debt burden to the optimal level and use the tax shield more effectively [Leland, 1998].

The fourth hypothesis is that hedging provides an opportunity to decrease tax costs, for example, in the case of progressive taxation of corporate profits or when the law allows for the transfer of losses to future years (Smith, Stulz, 1985; Graham, Smith, 1999).

Finally, the fifth hypothesis: the fact that hedging programs exist in the company is often viewed by investors as a signal about the ability of the company's management to control the situation, which has a positive impact on investors' confidence. However, there is an agent problem that managers who own shares in a company may prefer hedging to protect the stability of their wealth, while managers who are eligible for option programs may not be able to hedge risks (DeMarzo , Duffie, 1991; Tufano, 1998).

There is a little empirical evidence whether hedging assists in value creation. Three recent studies have been made to address this shortcoming. The first one by Allayannis and Weston (2001) examine effect of currency derivatives usage on relative market value (Tobin’s Q ratio). The results of their research shows positive relation between hedging and Q ratio and thus it proves relation between hedging and firm value. On the other side, Jin and Jorion (2004) examined relation between hedging and firm value (also Q ratio) in Oil & Gas Industry, but results showed no relation between hedging and Q ratio. Authors of this article argued, that the positive effect of hedging shown by Allayannis and Weston (2001) might be hard to interpret because of issues that are difficult to adequately control.

Derivative instruments represent rights or obligations that meet the definitions of assets or liabilities and should be reported in financial statements.

Fair value is the most relevant measure for financial instruments and the only relevant measure for derivative instruments. Derivative instruments should be measured at fair value, and adjustments to the carrying amount of hedged items should reflect changes in their fair value (that is, gains or losses) that are attributable to the risk being hedged and that arise while the hedge is in effect.

Only items that are assets or liabilities should be reported as such in financial statements. Derivative instruments are classified as assets or liabilities. However, the gains or losses that result from changes in the fair values of derivative instruments are not separate assets or liabilities and therefore should not be reported as such in the statement of financial position.

 Special accounting for items that are designated as being hedged should be provided only for qualifying items. One aspect of qualification should be an assessment of the expectation of effectively offsetting changes in fair values or cash flows for the risk being hedged during the hedge period. Entities are therefore required to assess whether the hedging instrument is highly effective in offsetting changes in the fair value or cash flows of the hedged item that are attributable to the hedged risk.

Entities must recognize derivative instruments as assets or liabilities in the statement of financial position and subsequently measure them at fair value unless any of the explicit scope exceptions are met. If a derivative instrument meets certain hedge accounting criteria, an entity may designate the instrument as one of the following hedges:

* Fair value hedge: A hedge of the exposure to changes (that are attributable to a particular risk) in the fair value of (1) a recognized asset or liability or (2) an unrecognized firm commitment.
* Cash flow hedge: A hedge of the exposure to variability (that is attributable to a particular risk) in the cash flows of (1) a recognized asset or liability or (2) a forecasted transaction.
* Foreign currency hedge: A hedge of the foreign currency exposure of (1) an unrecognized firm commitment, (2) a recognized asset or liability, (3) a forecasted transaction, or (4) a net investment in a foreign operation.

The relationships between the hedged items and the hedging instruments are typically referred to as hedging activities or hedging transactions and are subject to the specific hedge accounting criteria outlined in the guidance. For transactions that qualify for hedge accounting, the guidance requires that the timing of the effective portion of the gain or loss recognition on a hedging instrument match the timing and recognition in earnings of (1) the changes in the fair value of the hedged asset, liability, or firm commitment that are attributable to the hedged risk or (2) the effect of the exposure to the variability of cash flows from the hedged asset, liability, or forecasted transaction (that is attributable to a particular risk).

For many entities, the breadth and complexity of accounting for derivatives and hedging activities have created significant challenges. The time and energy required have prompted some entities to use the assistance of third parties. Today, many years after the initial implementation of the current guidance that applies to derivatives and hedging activities, entities continue to face challenges associated with the ongoing application of that guidance. Several of these key challenges are highlighted below.

Accounting for derivatives and hedging activities involves the application of a number of requirements that an entity must fulfil to qualify for hedge accounting. However, before entities can begin to assess whether those requirements have been met, they must understand fully the purpose of the derivative transactions, as well as the risks that are being hedged and how effective the hedge is at mitigating those risks. Entities should also understand the economics of transactions from a risk management perspective and the accounting impact of transactions from a financial reporting perspective. Achieving this understanding has proved difficult for some accounting and financial reporting departments, which may not have extensive knowledge of or work experience with derivative instruments and related risk management activities.

The application of hedge accounting requires extensive documentation. To qualify for hedge accounting, an entity must clearly document at the inception of a hedging relationship its risk management objective and strategy for entering into the derivative transaction. An entity must also perform a hedge effectiveness assessment (and document that analysis) both at the outset of the hedge transaction and on an ongoing basis (at least quarterly). The assessment must include an evaluation of whether the relationship between the hedging instrument and the hedged item is considered highly effective. Given the nature of the hedge accounting criteria, it should be presumed that, absent contemporaneous, formal, and complete documentation, a hedging instrument does not qualify for hedge accounting.

Hedge accounting should not be considered as an accounting policy election but, rather, a privilege. If the conditions for hedge accounting are met, the application of hedge accounting is appropriate. If any of the conditions for hedge accounting are not met, the application of hedge accounting is inappropriate. The approach to the shortcut method is equally binary: inappropriate application of the shortcut method— a method permitted per an exception in the guidance with respect to the effectiveness assessment requirements—is perhaps the most common error associated with the application of hedge accounting. Use of the shortcut method is appropriate only if all the conditions associated with its application are precisely met—an assertion that many entities have found difficult to make with sufficient precision. If an entity fails to meet all the conditions required for applying the shortcut method, use of that method will result in an accounting error. Since the application of the shortcut method, much like the application of hedge accounting, is an election and not a requirement, many entities have reduced or eliminated their use of the shortcut method to mitigate the risk of misapplication.

## **Value-Based Management**

Before investing money into some company and even think about it, we need to understand the main purpose of each company. However, it is not so easy to formulate this aim precisely. Nowadays, there are two main theories.

* *Shareholders theory*. According to Jensen (Jensen, 2001), main purpose of each company is to increase its value for shareholders. In this theory, author means also creditors, and by increasing its welfare, society receives positive impact.
* *Stakeholders theory*. Second important theory is presented by Wallace (Wallace, 2003) and implicates not only shareholders and creditors, but all people somehow involved in company’s operations and functioning. This theory present function of the company as multi-factor.

Determining and finding this firm’s value is the main purpose of Value-Based Management (VBM). For successful achievement of this aim, we need to clearly understand, what is included is VBM and what steps we need to undertake for goal reaching. Understanding of this mechanism help us in in determining crucial valuation points. Pursuant to Copeland (Copeland, Koller, Murrin, 1995), structure of VBM can be drawn as next:



Figure 1.1 Structure of VBM

 As we can see from the picture, effective increasing and value determining is not possible without clear and effective management. More clear definition of difference between “governance” and “management” is given by one of professors from Graduate School of Management (Bukhvalov, 2005). We will not stop on governance and management and will go more into valuation part.

 In this masterwork, VBM was described as a necessary introduction for valuation-strategy for company. According to Volkov (2006), Value-Based Management consists of four main modules: valuation, strategy, finance and corporate governance.

* *Valuation module*. This module presumes choosing of appropriate valuation model and all necessary assumptions and procedures for determining company’s value. In addition, it implements monitoring system and crucial drivers for new value creation.
* *Strategy module*. Determines precise link between company’s value and its business-strategies.
* *Finance module*. Describes company’s financial policies, which directed to value creating.
* *Corporate Governance module*. Aimed on negotiations of shareholders’ and managers’ interests.

In this masterwork we consider influence of hedging on firm value, where market value is objective of research.

* *Market Value.* This is indicator of what investors are willing to pay for company’s assets. This indicator could differ significantly for book value and depends more on investor’s expectations. Defining the market value of private companies is quite difficult task, because they are not publically traded. Many adjustments need to be done or many peers need to be taken to define this market value precisely. Recent study (Destri, Picone, Mina, 2012) offers implementation of new technologies for determining market value. We will not stop on them, because the only thing we are interested in this masterwork about market value – determining, is our target firm overvalued or undervalued.

In this master thesis we also examine firm value as Tobin’s Q ratio. When Tobin (1969) first introduced the concept of *q* (defined as the ratio of the market value to replacement values of a firm’s assets), his intent was to capture a firm’s propensity to invest. Since that time, *q* has evolved to the point where it has become a veritable Swiss army knife for financial economics researchers*.* As such, it is used in the literature as a proxy for a varied set of unobservable firm characteristics*,* including the quality of a firm’s investment opportunity set (Lang, Poulsen, and Stulz 1995), the extent of agency problems (Opler and Titman 1993), and the overall quality of the firm’s management team (Lang, Stulz, and Walkling 1989).

Tobin’s *q* is typically estimated using one of two competing approaches. The first, referred to as the computationally costly approach, uses an extensive set of financial statement information as a starting point for estimating both market and replacement values. These data are then adjusted for factors that are likely to cause systematic divergences between market and accounting values. In contrast, the second approach, referred to as the simple approach, uses a comparatively small set of financial statement data with minimal adjustments.

Previous research (Chung and Pruitt 1994) finds estimates of *q* from the two approaches to be both close in level and highly correlated over large samples. However, no study examines whether the competing *q* estimates diverge in ways that are systematically related to variations in other common firm financial characteristics. For example, the estimates produced by the simple method may be very close to those derived from the computationally costly method for low-leverage firms but significantly higher for high-leverage firms.

In our case, we take consumers of oil, airlines, where investors would not speculate on oil prices. We also test relation between hedging activity of company and its firm value. As measurements of hedging we will take jet fuel hedging. As we previously mentioned, we take jet fuel hedging because it is applicable to every airline, in contrast with other types of hedging, such as hedging foreign currency price risk.

Based on previous research in this sphere, we can develop several hypotheses:

H1. There is influence between hedging activity of a company and firm value

H2. Hedging activity of a company is dependent on credit rating of a company.

H3. Cash liquidity affects hedging activity of a company.

# **Chaper 2. Empirical research on influence of hedging on firm value**

## **Methodology**

We will use two main methods in our research: statistical and regression analysis.

*Statistical*

It is important to notice, that US airline industry faced difficulties after September 11, 2001, which resulted in series of downgrading credit ratings of companies. This led to many bankruptcy filings for Chapter 11. We took 10 biggest companies of the US and variables for 15 years. The question here is whether hedging somehow associated with firm value. For this purpose we use mean-comparison test in order to understand whether the difference significant or not.

*Regression analysis*

Two main regression models are built in this master thesis. The first one is aimed to find determinants of jet fuel hedging. The purpose of the second is to find relation between hedging activity and firm value of the company.

*1st regression model*

Firstly, we have to understand determinants of jet fuel hedging in order to understand, which parameters lead company for hedging. For this purpose, we construct linear multivariate regression model. The basic model is following:

*hedged fuel* = β1\*Xit +…+ βk\*Xkt + αi + eit, where:

* X – vector of variables, which reflect the company characteristics;
* β1, βk – vectors of unknown coefficients
* eit – random variable

The dependent variable – is percentage of hedged fuel requirements for next year. This data is obtained from annual reports of the company and 10-K report to Security and Exchange Commission. According to the US law, public joint stock companies have to disclose information about market risk and hedging policy.

For the independent variables we chose variables based on companies’ performance and access to financial markets.

Following variables were taken:

1. Capital expenditures to sales
2. Tobin’s Q
3. LT debt to assets
4. Ln assets
5. Cash flow to sales
6. Cash to sales
7. Credit rating

The first four independent variables have implications for financial constraint hypotheses. The capital expenditures-to-sales ratio and Tobin’s Q are used to proxy for the amount and productivity of investment opportunities, respectively. In the underinvestment costs framework, both of these variables should be positively related to hedging. The debt ratio serves as a standard measure of financial constraints, and is generally predicted to show a positive relation with hedging if firms facing higher probabilities of distress hedge more. Finally, firm size, measured as natural logarithm of total assets, potentially serves as an inverse measure of bankruptcy costs. If so, firm size should be negatively related to hedging (Nance et al. 1993).

The next three variables shown, cash flow-to-sales ratio, cash-to-sales ratio, and credit rating, also might proxy for financial constraints. Airlines that generate greater cash flow should have less binding financial constraints, so they might have fewer incentives to hedge. Alternatively, better-performing firms may want to hedge to lock in the effects of their higher profitability as in Breeden and Viswanathan (1998).

*2nd regression model: relation between hedging and firm value*

In order to examine existence of relation between hedging activity of a company and its value, we constructed second regression model, which also is a linear regression:

*firm value (q ratio)* = β1\*Xit +…+ βk\*Xkt + αi + eit, where:

* X – vector of variables, which reflect the company characteristics;
* β1, βk – vectors of unknown coefficients
* eit – random variable

The dependent variable here is firm value, which is accounted as a Tobin’s Q ratio. Wу measure firm value using the simple approximation of Tobin’s Q, developed by Chung and Pruitt (1994).19 This method offers several advantages: first, the computational cost is low relative to other more complex methods of calculating Tobin’s Q. The data was obtained by calculating simple Tobin’s Q formula, which is accounted as market value divided by total assets value. Finally, Chung and Pruitt (1994) and Perfect and Wiles (1994) find a high degree of correlation between the simple approximation and more rigorous constructions of Q.20 DaDalt, Donaldson, and Garner (2003) note these three advantages of utilizing a simple construction of Q, and conclude that the simple Q calculation is preferable in most empirical applications. Given the proportion of smaller firms in our sample, the availability of data is an especially important issue.

 For this model we took same independent variables with addition of percentage of fuel hedged for next year and advertising-to-sales ratio.

## **Sample selection**

My sample was constructed by searching all airlines which fulfil the following conditions:

* Operated at least 10 years during the period 2000-2015
* Disclose information on market risk exposure in accordance with SEC requirements
* Operates in US and thus has the same fuel costs

With this condition I took 10 biggest US airline companies, which operated during mentioned period, disclose information, has the biggest shares on the market.

In the Table 2 you can find required data and its source.

*Table 2. Data and source of information*

|  |  |  |
| --- | --- | --- |
| № | Data | Source of Information |
| 1 | Assets | Annual report of a company |
| 2 | Market Value | Thomson Reuters DataStream |
| 3 | Capital expenditures | Annual report of a company |
| 4 | Sales | Annual report of a company |
| 5 | Long-term debt | Annual report of a company |
| 6 | Credit Rating | Bloomberg |
| 7 | Cash Flow | Annual report of a company |
| 8 | Percentage of fuel hedged for the next year | SEC (Report 10-K) |

We ended up having 10 companies, but since not every company was operating full 15 years, we have 126 firm-years.

## **Descriptive statistics of variables**

Further, in Table 3, we provide descriptive statistics of acquired data.

*Table 3. Descriptive statistics*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Variable** | **Observations** | **Mean** | **St.Dev** | **Min** | **Max** |
| Assets | 126 | 12936,23 | 13184,95 | 0,9 | 54121 |
| Market Value | 126 | 4521,982 | 6365,524 | 22,73 | 38349,86 |
| Capital expenditures | 126 | 803,8817 | 804,7135 | 2,6 | 4060 |
| Sales | 126 | 9983,008 | 9719,863 | 157,1 | 40704 |
| Long-term debt | 126 | 4320,336 | 5331,861 | 0 | 36416 |
| Credit Rating | 107 | BB-  | -  | Bankrupt | A  |
| Cash Flow | 126 | 771,4462 | 1250,04 | -1707 | 7927 |
| % of fuel hedged for the next year | 126 | 0,265338 | 0,230437 | 0 | 0,95 |
| Tobin’s Q | 126 | 0,601128 | 2,456359 | 0,0283 | 2,661413 |
| Cash Flow to Sales | 126 | 0,1020588 | 0,0949915 | -0,2418842 | 0,3408375 |
| Cash to Sales | 126 | 0,1302991 | 0,112091 | 0 | 0,5716146 |
| LT Debt to Assets | 126 | 0,301736 | 0,208753 | 0 | 1,882742 |
| Capital expenditures to sales | 126 | 0,1228171 | 0,1427853 | 0,0086802 | 1,029597 |

*Tobin’s Q*. In this master thesis Tobin’s Q is taken as a variable, which describes firm value of a company and is calculated as market value of a company divided by total assets value. Sometimes this ratio is taken for understanding whether company is overvalued or undervalued. Usually, if Q ratio is smaller than 1, company is undervalued and overvalued if this ratio is greater than 1. Relying on this interpretation of Tobin’s Q, we can conclude that average company is undervalued by 17%. The maximum value in our sample is 2,66 in 2014 for Spirit Airlines. The lowest value was in 2001 for United Airlines, whose aircraft was used in terrorist attack on September 11.

*Percentage of fuel hedged for the next year.* For managing risks connected with fuel prices volatility, companies hedge using derivatives. The share of aircraft fuel costs takes up to 40% of all costs, so companies have to control situation and make decision regarding risk management. The maximum amount of fuel hedged was recorded in 2006, when Southwest Airlines hedged 95% of its projected fuel requirements. In 2006 jet fuel price was climbing constantly. As we can see from the table above, in average firms hedge 26,5% percent of its fuel requirements.

*Cash to Sales ratio*. Generally, it is seen as comparison of cash balance at the end of a period (usually expressed in number of weeks or months) to the sales revenue in that period. It indicates the effectiveness of the firm's credit and collection policies, and the amount of cash required as buffer for unexpected delays in cash collection. In this work it is also taken for analysis of financial constraints.

*Cash flow to sales ratio*. This ratio shows financial strength of the company, how much cash from the sales revenue they can turn into cash flow. In this masterwork it is also seen for analysis of company’s strengths and its possible financial constraints for pursuing risk management policy.

For cash to sales and cash flow to sales ratios the minimum amount was recorder in 2003, when Hawaiian Airlines filed for bankruptcy and thus had to pay to debtors everything, so company ended having no cash and with ceased operations.

*Long-term debt to assets ratio*. This ratio shows, what proportion of company’s assets are financed with debt. It provides information about ability of company to meets its financial obligations. The higher this ratio – the more risks company bears. In our sample the highest value (1,88) was recorded in 2005 for United Airlines, which was under Chapter 11 (bankrupt) at that moment.

*Capital expenditures to sales.* This ratio is used for understanding how frequently company reinvests its revenue to assets. In other words, it is a proxy for measuring amount of investing opportunities. In airlines industry it is very important measure, because companies have to buy aircrafts.

*Credit Rating*. From theme of our topic, it is one of the most important factors. It shows creditworthiness of a company. Since airlines use derivatives for hedging their risks, they have to get access for financial instruments, but with low credit rating, they get constrains. In our sample the lowest credit rating is “D” in Standard & Poor’s scale, which means that company is a bankrupt. In United States many airline companies filed for bankruptcy. Thus, in sample there are 6 companies, which filed for bankruptcy in period from 2000 to 2015. Some companies, like AMR Corporation didn’t emerge from bankruptcy and were acquired by their competitors. The highest rating in our sample was “A” in Standard & Poor’s scale for company Southwest Airlines since 2000 till financial crisis in 2008.

## **Statistical analysis**

*Results of statistical analysis*

As it was previously mentioned, we will start from statistical analysis. For conducting this part, we divided sample in two groups. We will compare companies which didn’t file for bankruptcy (Chapter 11) with those which did. We got 6 companies which were under Chapter 11 for any time in period from 2000 till 2015. Results of statistical analysis are presented in Table 4.

*Table 4. Statistical analysis (part 1).*

|  |  |  |
| --- | --- | --- |
|  | **Companies filed for Chapter 11** | **Companies didn’t file for Chapter 11** |
| **Variable** | **Mean** | **Mean** |
| Credit Rating | B | BB+ |
| % of fuel hedged for the next year | 16,95% | 36,71% |
| Tobin’s Q | 0,4783 | 0,7429 |
| Cash Flow to Sales | 0,0849 | 0,1498 |
| Cash to Sales | 0,1318 | 0,1426 |
| LT Debt to Assets | 0,2958 | 0,2415 |
| Capital expenditures to sales | 0,0791 | 0,1865 |

The first thing we can observe is that companies which didn’t file for bankruptcy during taken period tend to hedge twice more. There is a possibility for several reasons. First of all, credit rating of this companies is higher, which gives broader access to financial markets and thus, they can use more hedging instruments. The next point is long-term debt to assets. Companies from second subsample have lower proportion of long-term debt and thus their risks are lower and it affects their credit rating.

The next thing we can observe is that Tobin’s Q is much higher, which means that problem of undervaluation for this firms is slightly lower which also can affect ability of attracting investments.

From the point of ability to extract more cash from revenue, we can see that companies in the second subsample seem to be more successful in this issue. In average, they get almost twice more cash flow from sales than companies in the first subsample.

Nevertheless, cash to sales ratio is almost equal, which means that companies have store realitively equal proportion of cash for such issues like unexpected delay in cash collection.

Finally, we can conclude, that companies which didn’t file for bankruptcy during taken period, tend to invest almost three times more than other companies.

Apart from dividing companies by bankruptcy factor, we divided data by periods: from 2000 till 2007 and from 2008 till 2015. By doing so, we hope to find evidence on changes in hedging behavior and changes in key financial factors after financial crisis. In Table 5 you can find comparison of the key financial factors of two subsamples.

*Table 5. Statistical analysis (part 2).*

|  |  |  |
| --- | --- | --- |
|  | **Period 2000-2007** | **Period 2008-2015** |
| **Variable** | **Mean** | **Mean** |
| Credit Rating | B+ | B+ |
| % of fuel hedged for the next year | 29,45% | 23,08% |
| Tobin’s Q | 0,6158 | 0,4825 |
| Cash Flow to Sales | 0,0927 | 0,1085 |
| Cash to Sales | 0,1412 | 0,1091 |
| LT Debt to Assets | 0,3724 | 0,2836 |
| Capital expenditures to sales | 0,1442 | 0,0951 |

Regarding our main factor, we can see that hedging behavior has changed and mean amount of fuel hedged decreased by 6%. There are several possible reasons. One of them is price for the jet fuel. If we will compare jet fuel prices, we can see that in the beginning of 2008 price achieved its maximum and after that period it decreased significantly till second quarter 2009 and for the past 2 years jet fuel price decreased to its 10-year minimum.

The next important thing here is that our proxy for firm value, Tobin’s Q is lower for the second period. Possible explanation is that financial crisis was quite stressful for airlines, which resulted in lower investment activities of companies (capital expenditures to sales ratio), lower effectiveness in cash collection policies (cash to sales ratio) and this all resulted in lower market value to assets ratio.

From such perspective it also seems that hedging activity is associated with firm value of a company.

## **Econometric analysis**

*Results of regression analysis*

In this section we will start with results for first regression: determinants of jet fuel hedging.

Let us remind you that with first regression we intend to define determinant of jet fuel hedging in order to understand which characteristics of company influence company’s behavior. Also, we would like to remind that one of our hypotheses is that credit rating is strongly associated with hedging activity of a company. Table 6 represents obtained results.

*Table 6*. *Jet fuel hedging determinants*

|  |  |
| --- | --- |
| **Variable** | **Coefficient** |
| Credit Rating | 0,0187389\*\*\* |
| Tobin’s Q | 0,1412\*\* |
| Cash Flow to Sales | -0,5305204 |
| Cash to Sales | 0,42695\* |
| LT Debt to Assets | -0,692618 |
| Capital expenditures to sales | 0,2846935 |
| Constant | 0,5139464 |
| R-squared | 0,2804 |
| Prob > F | 0,0002 |

Note: the symbols \*, \*\* and \*\*\* sign the variables significant at the 10%, 5% and 1% levels respectively.

From the table above, we can conclude, that our hypothesis about role of credit rating in hedging activity was correct. Moreover, we can see that our analysis supports model of Froot et al. (1993). This set of results could be argued to imply that hedging is conducted by airlines with fewer financial constraints. This argument is true if all airlines face similar costs of distress (if distress occurs). However, if airlines with greater distress costs optimally choose lower debt ratios and are assigned higher credit ratings, then the observed results appear more consistent. Recall that underinvestment costs are a subset of total distress costs. Firms with greater productivities and amounts of investment opportunities stand to lose more value if distress occurs. Thus, the leverage and credit rating results are complementary to the Q and capital expenditures results discussed above. Firm size shows a positive relation with jet fuel hedging. If smaller firms face larger proportional distress costs, then this result is inconsistent with a distress argument. The hedging versus size result also suggests that larger airlines do not subscribe to a “too big to fail” hypothesis in setting risk management policies. Rather, the positive relation is consistent with an argument that economies of scale and/or scope might apply to hedging future jet fuel purchases.

For further analysis we test whether hedging activity is associated with firm value. We investigate whether airlines’ jet fuel hedging activities affect firm value by estimating the empirical relationships between Tobin’s Q (our proxy for firm value) and jet fuel hedging. We construct our models to resemble those used by Allayannis and Weston (2001). Finally, we include a liquidity measure, the ratio of cash to sales, in the regressions. Carter and Simkins (2004) find that airlines with greater liquidity demonstrate less sensitivity to the market price effect of the 9/ 11 attacks.

We measure firm value using the simple approximation of Tobin’s Q, developed by Chung and Pruitt (1994). This method offers several advantages: first, the computational cost is low relative to other more complex methods of calculating Tobin’s Q. Second, the data are readily available using Thomson Reuters Datastream for small, as well as large, firms. Finally, Chung and Pruitt (1994) and Perfect and Wiles (1994) find a high degree of correlation between the simple approximation and more rigorous constructions of Q. DaDalt, Donaldson, and Garner (2003) note these three advantages of utilizing a simple construction of Q, and conclude that the simple Q calculation is preferable in most empirical applications. Given the proportion of smaller firms in our sample, the availability of data is an especially important issue.

Our sample consists of 10 airlines over a maximum period of 2000-2015 with a total of 126 firm-year observations of Tobin’s Q. Table 7 presents results for the effects of jet fuel hedging on airline firm value.

*Table 7. Estimates of the relation between firm value and hedging behavior*

|  |  |
| --- | --- |
| **Variable** | **Coefficient** |
| ln (Assets) | -1,681725\*\*\* |
| LT Debt to Assets | -2,252802 |
| Cash Flow to Sales | -8,114087\*\*\* |
| Cash to Sales | -2,9652 |
| Credit Rating | 0,0068309 |
| % of Next year's fuel requirements hedged | 2,716094 |
| Capital expenditures to sales | 1,985518\*\* |
| Constant | 21,02852 |
| Adj. R-squared |   |
| Prob > F |   |
| Wald | 587,65\*\*\* |
| Prob > chi2 | 0,0000 |

Regression model of Table 7 demonstrates that the magnitude of the hedging premium associated with the continuous hedging variable is robust to differing econometric specifications. In these specifications, we estimate the regressions using time-series feasible generalized least squares (FGLS). The coefficient on the hedged percentage of fuel requirements variable is about 2.72 and the coefficient is statistically significant at 1% level in the FGLS specification.

**Summary**

In this part we are going to summarize all the main findings of econometric and statistical analysis and compare them with results of prior research on influence of hedging on firm value.

Results of econometric analysis show that hedging activity of a company is influenced by its credit rating. It can be explained by the fact that company’s ability to operate with financial markets is dependent on credit rating. It shows possibility of bankruptcy and represents financial constraints. Thus, we can accept H2. Moreover, while conducting research for defining determinants of hedging, we found that cash to sales, which represents airline’s liquidity associated with fuel hedging and is significant at 10% level.

Finally, we done research for defining influence of hedging activity on firm value. Let us remind, that we used Tobin’s Q as proxy for firm value. Our results suggest that jet fuel hedging is associated with firm value and thus we can accept H1. Furthermore, we defined that firm value is associated by cash flow to sales ratio, which shows financial strength of the company, how much cash from the sales revenue they can turn into cash flow, and capital expenditures to sales which is used for understanding how frequently company reinvests its revenue to assets. In other words, it is a proxy for measuring amount of investing opportunities.

Based on the research findings, we can develop a set of managerial implications:

* Hedging cannot be seen as an instrument for increasing firm value, but it can be used for managing essential risks and thus can act proactively towards possible distresses.
* Since we found that investors value hedging of companies, we can conclude, that hedging reduces underinvestment costs.
* Credit rating is an important tool which not only shows to investors that management of the company, but also is associated with company’s hedging ability.

# **CONCLUSION**

The US airline industry offers a unique sample allowing for a more direct test of the value implications of hedging predicted by Froot et al. (1993). High jet fuel prices coincide with low industry cash flows, and industry investment is positively related to the level of jet fuel costs. Because jet fuel constitutes a large percentage of airline operating costs and jet fuel prices are highly volatile, airlines face an incentive to hedge fuel price risk. Such hedging provides firms with the opportunity to buy underpriced assets from distressed airlines during periods of high jet fuel prices and/or protects the ability to meet previously contracted purchase commitments.

We find that airlines employing jet fuel hedging trade at a premium, after controlling for other factors impacting value. This result provides evidence in support of Allayannis and Weston’s (2001) findings that hedging adds value, and suggests that the results of Jin and Jorion (2004) might be a consequence of their sample choice. While Guay and Kothari (2003) question the validity of the Allayannis and Weston results, we argue that our results offer clearer evidence that hedging adds value because reduction of jet fuel price risk exposure is clearly economically significant.

Furthermore, our sample choice allows us to form a more educated opinion as to the source of value gain from hedging. Large airlines are typically in the best position to buy assets of distressed airlines at discounted prices. Hedging future jet fuel purchases allows these firms a means to manage a significant source of variation in cash flows. Given that jet fuel price increases often coincide with distress in the airline industry, hedging provides an additional source of cash for making acquisitions during these periods. Our results show that the value increase from hedging increases with capital investment, and that this interaction provides the vast majority of the hedging premium. This result implies that investors value hedging more in airlines where they expect hedging to protect the ability to invest in bad times.

One caveat of our analysis is necessary. While we find that firm value is positively associated with the amount of hedging, we do not claim that airlines can magically increase value by increasing the amount of fuel hedged. If airlines optimally choose an appropriate hedge ratio based on the benefits achievable from hedging, then firm value should reflect this optimal hedging percentage. Rather, the hedging premium reflects that those firms with greater ability to take advantage of the benefits associated with hedging, such as enhanced ability to invest in economically profitable projects, have higher optimal valuations if their hedging policy is chosen optimally. For example, the Froot et al. (1993) framework implies that an airline possessing valuable investment opportunities if fuel prices increase should choose to hedge until it is ensured of enough cash flow to fund all of these investments. For another airline evaluating the same set of investment opportunities, if none are valuable then this airline has no incentive to hedge future jet fuel purchases.

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