DOES RISK MANAGEMENT INCREASES THE FIRM VALUE?

EVIDENCE FROM THE JET FUEL HEDGING IN THE AIRLINE INDUSTRY

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Abstract

This thesis examines the use of financial instruments to hedge jet fuel risk in the airline industry during 2000-2014. The main goals are to understand if changes in the hedging policy increases the airline firm's value, measure by the Tobin's Q and if the use of different financial tools also has an impact in the airline company's value. The results show that all the values are statistically insignificant. This leads to the conclusion that the model used may not be the right one. Further research is needed in the area and maybe the best approach is the one followed by Viessmann (2010).

Résumé

Ce mémoire de recherche analyse l'utilisation des instruments financiers pour couvrir le risque de carburéacteur dans l'industrie des transports aérien entre 2000 et 2014. Les principaux objectifs sont comprendre si les changements dans la politique de couverture augmentent la valeur des entreprises de transport aérien mais aussi, tester, à l'aide du Q de Tobin, si l'utilisation de différents outils financiers a un impact sur la valeur de la compagnie aérienne. Les résultats montrent que toutes les valeurs sont statistiquement insignifiantes. Par conséquent, cela veut dire que le modèle utilisé peut ne pas être le bon. On peut donc penser que peut-être la meilleure approche est celle suivie par Viessmann (2010), et que de la recherche supplémentaire est nécessaire.

Abstrato

Esta tese examina a utilização de instrumentos financeiros para cobrir o risco do jet fuel na indústria da aviação comercial durante o período de 2000 a 2014. Os principais objetivos são entender se as mudanças na política de gestão de risco aumenta o valor da empresa de aviação, medida pelo Tobin's Q, e se o uso de diferentes instrumentos financeiras também tem um impacto no valor da companhia aérea. Os resultados mostram que todos os valores são estatisticamente insignificantes. Isto leva à conclusão de que o modelo usado pode não ser o mais adequado para este estudo. É necessária mais investigação na área e, talvez, a melhor abordagem seria a seguida pela Viessmann (2010).

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1. Introduction

1.1 Aim of the paper

"Our operations and financial results are significantly affected by the availability and price of jet fuel. Based on our 2014 forecasted mainline and regional fuel consumption, we estimate that as of December 31, 2013, a $1 per barrel increase in the price of crude oil would increase our 2014 annual fuel expense by $104 million (excluding the effect of our hedges), and by $87 million (taking into account such hedges)."

Source: American Airlines Group Inc. (2014)

As stated by American Airlines Group, the largest airline in the world so far, in terms of clients served, jet fuel strongly affects the performance of the firm and its volatility is a source of heavy costs to the airline industry.

The airline industry is splint between air freight and passenger air transportation. This work will focus on the passenger air transportation business since the cost structure and market dependence is different.

The aim of this paper is to understand if hedging jet fuel increases the shareholders value in the US airline industry. It is also a goal to realize if changes in the hedging policy of the firms lead to higher shareholders value/returns.

The paper will be focused in the airline industry since they have an exposure to a commodity (jet fuel) with a highly volatile price (when compared to other commodities), it being one of the main components of its operating costs. This industry also presents a homogeneous risk exposures and hedging strategies across firms.

1.1 Structure of the thesis

The airline industry will be presented at first, with some facts and figures relevant to the study. Subsequently the markets and financial instruments to hedge the risk exposure are presented. Afterwards, the paper will focus on previous literature review on the topic of hedging commodities price and the possible reasons that hedging adds value to firms. Following it, the data and methodology will be present. Then the use of derivatives and firm value will be exposed, with the analysis of the multivariate tests performed. Finally, the conclusions will be presented.

1.2 List of Abbreviations

SEC U.S. Securities and Exchange Commission

IATA International Air Transportation Association

SIC Standard Industry Classification

2. Industry Overview

2.1 Industry Background

1 January 1914—A Benoist flying boat takes off from St. Petersburg, Florida, and crosses the bay to Tampa. On board with pilot Tony Jannus is Abram C. Pheil, the world's first scheduled commercial air passenger. This historic flight marked the dawn of the commercial air transport age."

Source: IATA (1) (2014), page 11

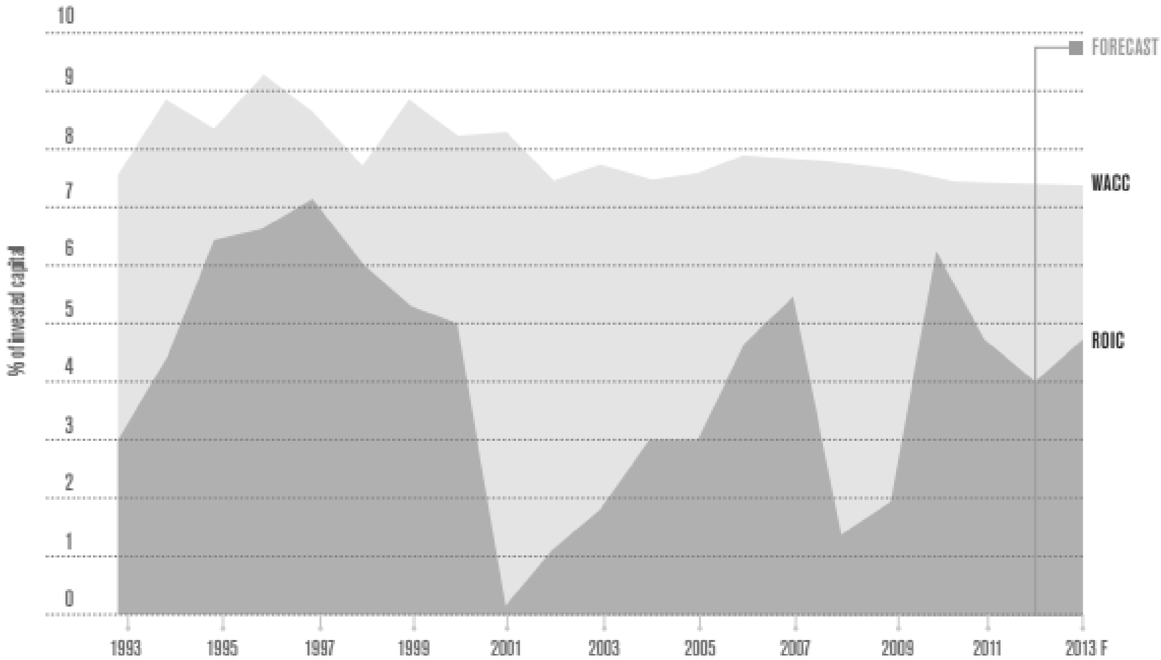
For an industry born in 1914, after 101 years it is still facing challenges.

This industry is split between passengers and cargo air transportation. Due to its world wide range, the airline industry is sensitive to economic growth, political events, international trade and terrorism. According with IATA (1) (2014), in 2015, the industry will safely transport 3,3 billion passengers and 50 million metric tons of cargo across a network of almost 50000 routes. In 2014 the business activity generated $2.4 trillion, however profitability doesn't keep up with this values. Figure 1 shows' the profitability measured as return on invested capital. As we can see the industry, until 2013, can't generate enough profit to compensate the cost of operations (WACC).

In the past, the governments were the owners of most of the airline companies. Nowadays some are still state owned, such as the Portuguese government owned, TAP. Starting in North America, the market was open to new private airlines which lead to new entries such as low cost air carriers, creating a more competitive market. Most air carrier companies had to merge, be acquired or went bankrupt to match the current competition. An example of this is the merger that created the America Airlines Group the biggest airline company according to revenue, passengers carried, passenger-kilometers flown and fleet size.

Since the beginning of the century the airline industry has faced the most turbulent periods in its history. September 11 2001 and 2008 economic crisis and oil shocks were some of the worst times this industry faced.

Figure 1 - Return on invested capital in airlines and their WACC



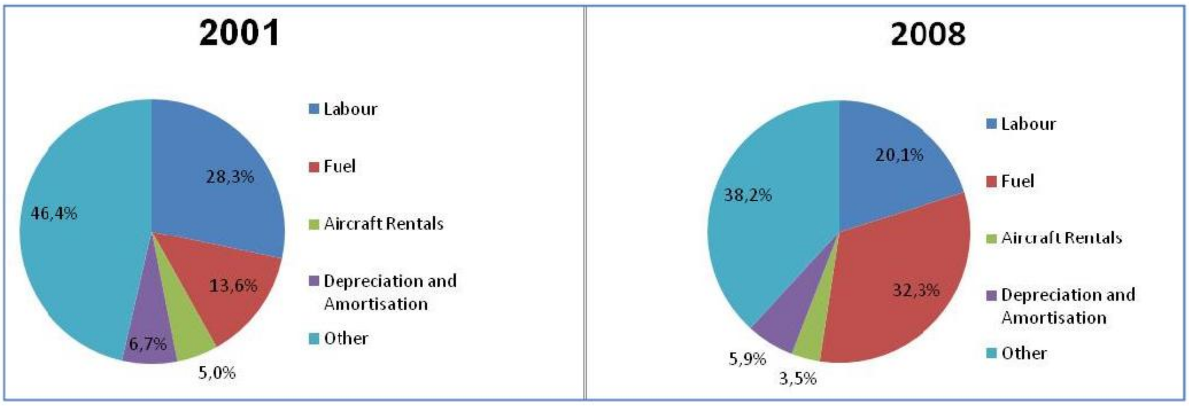
Source: McKinsey and company for IATA (2013). On the left side the percentage of invested capital is presented

2.2 Cost Structure of the industry

As figures 2 and 3 shows, the Labor cost has been loosing importance over time, while Fuel cost increased importance from 2001 to 2008, from 13,6% to 32,3%, decreasing in value to 29% in 2014.

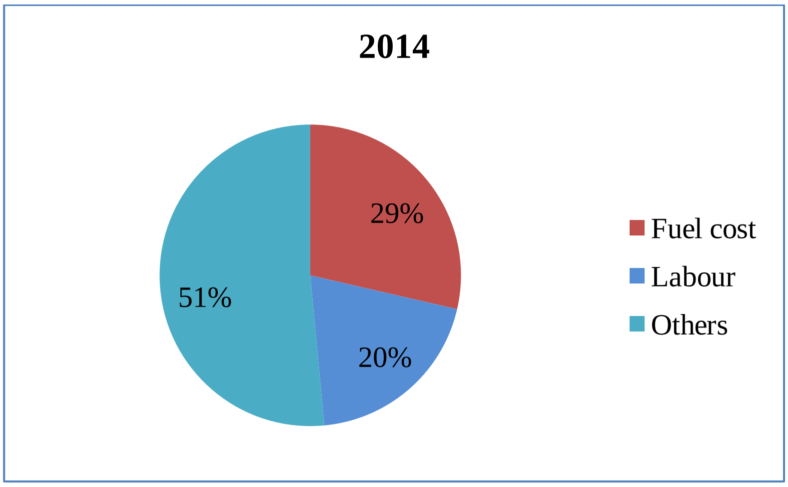
Most of the airlines' operating costs are fixed, while the margins on sales are small. This makes the airline industry highly sensitive to changes in costs and demand (Morell, 2007). Also, according with the Blanco et all (2003), one issue in the demand side is the price sensitivity of costumers, mainly the holiday sector. Their empirical study shows that if flight prices increase by 1%, flight demand would decrease in the same proportion. It is difficult for airlines to pass through an increase in their costs to the consumers by increasing ticket prices.

Figure 2: Percentage of airline operating costs in 2001 and 2008 to the members of IATA organization.



Source: Viessmann (2010)

Figure 3: Percentage of airline operating costs in 2014 to the members of IATA organization



Source: IATA (1), (2010), own illustration

Since most of the costs are fixed, they are difficult to dispose when demand decreases. Employee contracts are expensive and difficult to break and aircrafts are difficult to sell (Morell, 2007). Airline employees hold large bargaining power since the level of skills, activities and responsibility in the operations is one of the highest, comparing with other industries (Thoren, 2002). The consequences of strikes are enormous to the airline companies. In the most recent example the Portuguese airline company employee's, TAP, made a 10 days strike making the company lose 30 million Euros. (Sol, 2015).

2.1 Risk Exposures of the Airlines

According with Zea (2002), through a study made by Mercer Management Consulting, there are four major categories of risks that the airlines face.

2.1.1 Strategic Risk

It is related with the business design choices and how linked is it to the external environment. One example of this is the choice of an airline to be a low-cost company.

2.1.2 Hazard Risk

It is related with events of greater force, such as terrorism, war, airplane crashes and environment catastrophes.

2.1.3 Operational Risk

It is related with all the aspects of the operation, such as employee strikes, crew scheduling and logistics, among others.

2.1.4 Financial Risk

It is related to the financial choices of the airlines. The three most common hedged risks in the airline industry are: (1) currency risk exposure, (2) interest rate exposure and (3) jet fuel price risk exposure (Loudon, 2004). The focus of this thesis will be the jet fuel risk exposure.

2.1.4.1 Currency Risk Exposure

This exposure results directly from the international operation business model of the airlines, where tickets and capital expenditures occur in different currencies and countries and indirectly from tourisms demand (Morell, 2007).

2.1.4.2 Interest Rate Exposure

Since airlines have usually a high leverage capital structure, interest rates is a big issue, being gearing costs directly related with it (Morell, 2007). It is normal for airline companies, in years of distress, to not generate enough operating profit to cover the interest rates.

2.1.4.3 Jet fuel price risk exposure

Figure 2, in the year of 2008, and figure 3, show how heavy to the cost structure is the jet fuel price. Moreover, short-term cash flows are directly related with changes in jet fuel prices (Loudon, 2007).

The volatility of the jet fuel prices depends of two factors: (1) the volatility of crude oil, since jet fuel is refined from crude oil and (2) the crack spread, the difference between the price of crude oil and a refined product, that is relatively stable (Snyder, 2008).

To manage this risk airlines can follow three approaches, according with Morell (2007). They can increase the jet fuel efficiency of their operations, pass the change in price to the costumer or hedge the jet fuel exposure using financial instruments. The first two options are difficult to implement, being the third option the easiest to implement and manage.

3. Markets and financial instruments to hedge jet fuel price

3.1 Available Markets

To hedge jet fuel price, the airline companies should purchase them on the exchange traded market or over-the-counter market. Both of them have special characteristics in terms of risks and advantages.

3.1.1 Exchange Markets

A derivative exchange market is an organized exchange where individuals trade standardized contracts that have been defined by the exchange (Hull, 2011). The exchange acts as an intermediate, called cleaning house, to all the transactions, taking an initial margin from the buyer and seller of the financial assets as a security deposit. It is the cleaning house who also calculates the net position of each side of the contract, buyer and seller, by monitoring all the transactions. In the end of the day, in this market, if the trader suffers a loss above the margin account threshold requirement, he has to close the position and take the loss, or add more money until it reaches the amount of the initial margin. This mechanism ensures that there is no counterparty risk. While counterparty risk is eliminated in the exchange markets, liquidity risk is added. If the price of fuel, for example, decreases a lot, at the end of the day, the exchange triggers the margin calls and the airline companies need to add more cash to the margin account, making it extremely difficult to manage the treasury needs.

3.1.2 Over-The-Counter Markets

According with Hull (2011), the over-the-count market is an alternative to the exchanges, with a much larger size. The over-the-counter market is defined as a network of deals that interact among them through a telephone-linked and computer-linked network. This network helps the airlines and other companies to find counterparties for their specific contract needs. For Cobbs et all (2004), airline companies, such as Southwest airlines, prefer over-the-counter derivatives to exchange traded futures because they are more customizable. Derivatives, in this market, are traded directly between the airlines and investment banks, that most of the times are market makers (Hull, 2011). Most airlines prefer to trade with three or four different banks to diversify credit risk and also to get the best pricing possible. The ability to customize these contracts facilitates the implementation of a dynamic hedging strategy from the firms. Dynamic hedging strategy is defined by Hull (2011) as adjusting a hedging strategy according with the underlying movements. A disadvantage of the over-the-counter market derivatives on jet fuel, according with Cobbs et all (2004), is the illiquidity of this type of derivatives, since demand is higher than the supply. This fact makes the over-the-counter contracts of jet fuel expensive and not available in enough quantities to hedge all the exposure of the industry on jet fuel price risk.

3.1.3 Available markets to hedge jet fuel price

According Cobbs et all (2004), there are no exchange traded markets available in Europe or the United States of America for jet fuel. Airlines can then trade jet fuel on the over-the-counter market or use cross-hedging, defined as contracts on commodities that have a high correlation with jet fuel, such as crude or heating oil. To Hull (2011), the use of cross-hedging creates a new risk, the basis risk. Basis risk arises from the correlation between the commodity to be hedge and the commodity used to replicate it. The difference between the price of the commodity used (example of heating oil) to hedge and the price of jet fuel, in the case of the airline industry, is the basis risk. There are three origins of basis risk, according with Hull (2011). Basis risk arises from the difference between the delivery of the contract asset and consumption data (calendar basis risk), the delivery location of the contract asset and the place where the commodity will be consumed (location basis risk) and the underlying commodity hedged in the derivative contract and the commodity to be consumed (product basis risk). To reduce basis risk, when hedging using the exchange traded market, the airline companies shall analyze the correlation between the two commodities that will be used, picking a commodity as correlated as possible with jet fuel, choose a contract with a physical delivery as close as the place where the commodity will be consumed and with a delivery data as similar as the physical consumption data.

3.2 Financial instruments to hedge jet fuel exposure

Airline companies can choose among different kinds of financial instruments to hedge its fuel risk. They can use options (mainly call options, spreads and zero-cost collars), swaps, futures and forwards. This study will focus on the ones reported by the airline industries in the 10-K annual reports, mainly futures and forwards, swaps, pass-through agreements, call options and collars.

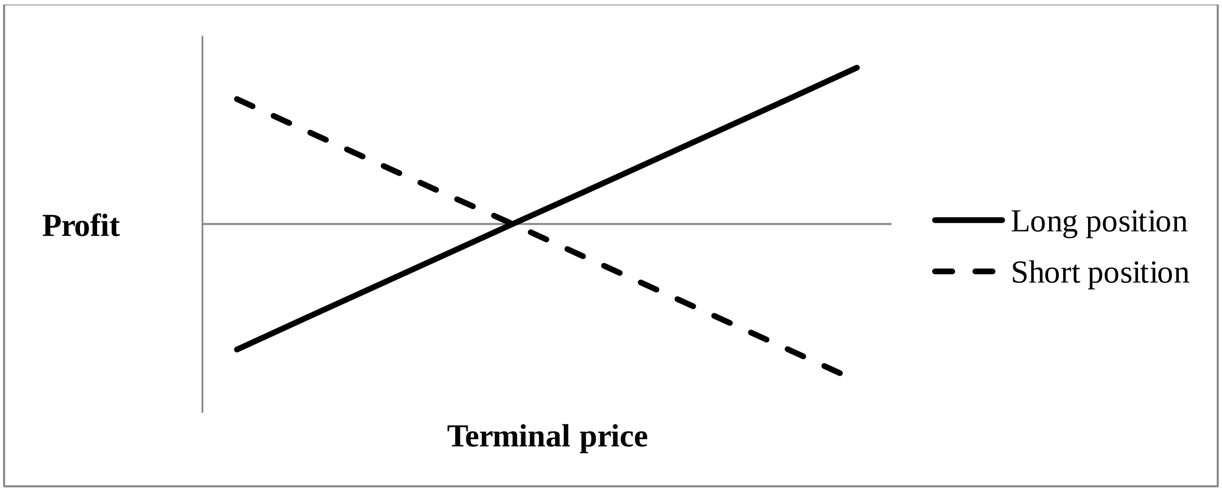
3.2.1 Future and Forwards contracts

According with Carter et all (2004), futures and forwards contracts are agreements to buy or sell a specific quantity and quality commodity, for a certain price, at a designated time in the future. The buyer agrees to purchase the commodity, having a long position and profits when the underlying price rises. The seller agrees to sell the commodity, having a short position, and benefiting from a decrease in the price of the commodity. Airlines enter in future and forward contracts as a buyer, so that they can compensate their physical short exposure to jet fuel.

Future contracts are traded on exchanges, are marked to market daily through the cleaning house, and are mostly use to speculate, since most of the times the times the physical deliver does not occur. Forwards are traded in the over-the-counter market, are settle at maturity only and usually the contract is settled through delivery.

The profit and loss from a future contract can be seen in figure 4. The dashed line presents the profit from the short position while the solid line presents the profit from the long position in a future contract or forward, since both presents the same profit and loss.

Figure 4: Profit and loss from a future contract.



Source: Hull (2011), own illustration

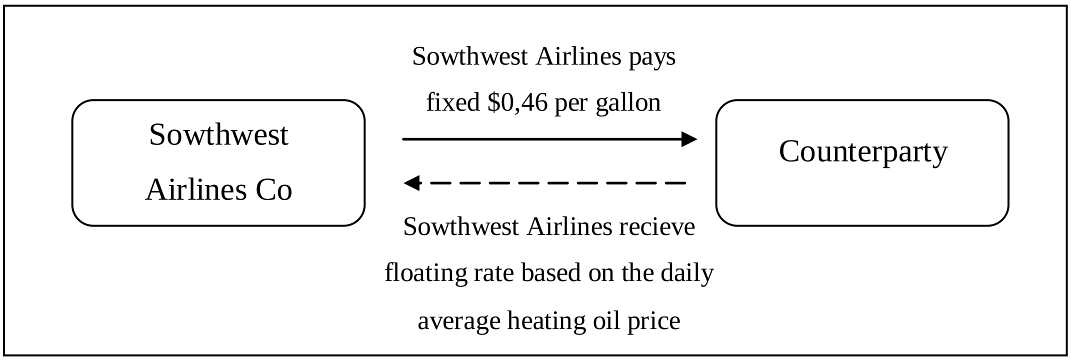
This future contracts and forwards are used by the airline companies since they do not require an upfront cost and the price of its jet fuel purchases is fixed, being easier to manage the monetary resources needed. The protection against increases in jet fuel price is then guarantee. However, the company loses the capacity of benefit from decrease in the jet fuel value, loosing competitive advantage against not hedger or hedger with other financial instruments, such as calls or collars. Also, since forwards are traded in the over-the-counter market, it is easier to settle the amount of gallons hedge and define jet fuel as the underlying asset of the contract, instead of relying in an underlying with a high degree of correlation, such as heating oil. As an additional disadvantage the forwards have in relation to futures contracts, is that credit risk, bankruptcy of the counterparty, is present.

3.2.2 Swaps

According with Hull (2011), the Swap contracts appeared in 1980s and have grown since then. This financial instrument is mainly present in the over-the-counter market. Hull (2011) defines Swaps as an agreement between two counterparties to exchange cash flows in the future. One of the counterparties pays a fixed price, while the other pays a floating price. The dates where the cash flows shall be paid and the way to calculate it are predetermined in the contract. There is no physical transaction of the underlying (jet fuel). Since the swap contract is an exchange of cash-flows, the airline purchases the jet fuel in the market, being the difference between the market price and the fixed rate offset by the swap agreement (Carter et all, 2004). Figure 5 shows an example of a swap contract taken from Southwest

Airlines Co (1996), where "(...) the Company pays or receives the difference between the daily average heating oil price and a fixed price of $0,46 per gallon".

Figure 5: Fuel hedging dynamics using a real example swap contract.



Source: Southwest Airlines Co (1996), own illustration

Since forwards and futures can be seen as simple example of a swap, being an exchange of cash flows made only in one date in the future, while a swap involves exchange of cash flows made in several dates, this financial instrument as the same advantages and disadvantages of futures, if traded in exchanges, or forwards, if traded in the over-the-counter market.

3.2.3 Pass-through Agreements

According with Carter et all (2004), within the industry, some airlines use additional ways to protect themselves from rising fuel prices. One of those ways is the one used by some smaller carriers, where the firm contracts with major airlines to provide service to smaller communities near the major airlines hub. One of the services the major airlines provide is the fuel pass-through agreements, where the major carrier absorbs the risk of fluctuating fuel prices. In this way the small carriers pay a constant fix price, eliminating the risk.

A disadvantage these agreements have is the loss of competitive advantage in case the fuel price decreases and credit risk, since if the major airline that the agreement was made declare bankruptcy, the agreement will not be fulfilled.

3.2.4 Options - Calls, Spreads and Zero-Cost Collars

In the eighteenth century, in both Europe and United States, the first trading of put and call options started (Hull, 2011).

According with Hull (2011), an option is a financial instrument that gives the right to do something to the holder of the option. The owner does not have to exercise this right. The options can be European, where the holder exercise the right only at maturity, or American, the exercise of the right is made at any time during the life of the option. A physical deliver can happen if the option traded is in a commodity and the holder of the option exercises it.

The options have an upfront cost, the payment is made in the beginning of the contract life, and a credit risk, if traded in the over-the counter market. If traded in an option exchange, the company will also face margin requirements.

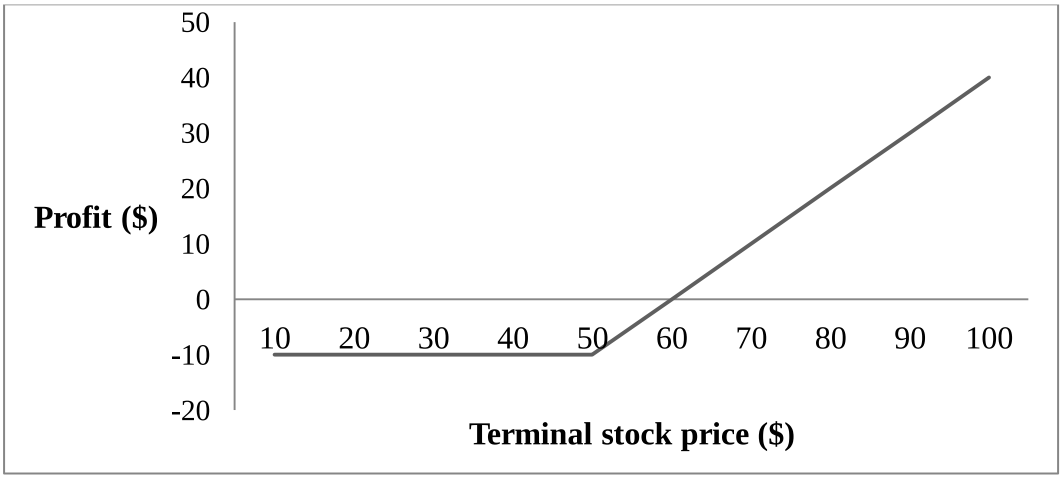
There are several types of options and strategies. The ones more used from the airline industry are call options and the collar strategy to hedge the jet fuel price.

3.2.4.1 Call Options

A call option is defined by Hull (2011) as a contract that gives the holder of the option the right to buy an asset by a certain date for a certain price (strike price). In the case of the airline industry, the companies use the option to have the right to buy fuel.

When using a call option, the airline companies are protected from the increase and decrease of the fuel price. If the price in the market (spot price) increases, the company exercises the option and pays the strike price from the fuel. If the spot prices decrease, the firm does not exercise the right, having a loss equal to the price of the option. Due to this characteristic the price paid from the option is usually seen as an insurance premium. These options have a higher premium due to the high volatility of energy commodities, such as fuel. The figure 6 gives an example of the payoff that a European call option has. The option is in one share of stock, the option price is $10 and the strike price is $50. The example was taken from Hull (2011).

Figure 6: Payment from an European call option



Source: Hull (2011), own illustration

Due to the high upfront cost, airline companies choose to hedge its jet fuel risk using zero-cost collar structure or spread structures.

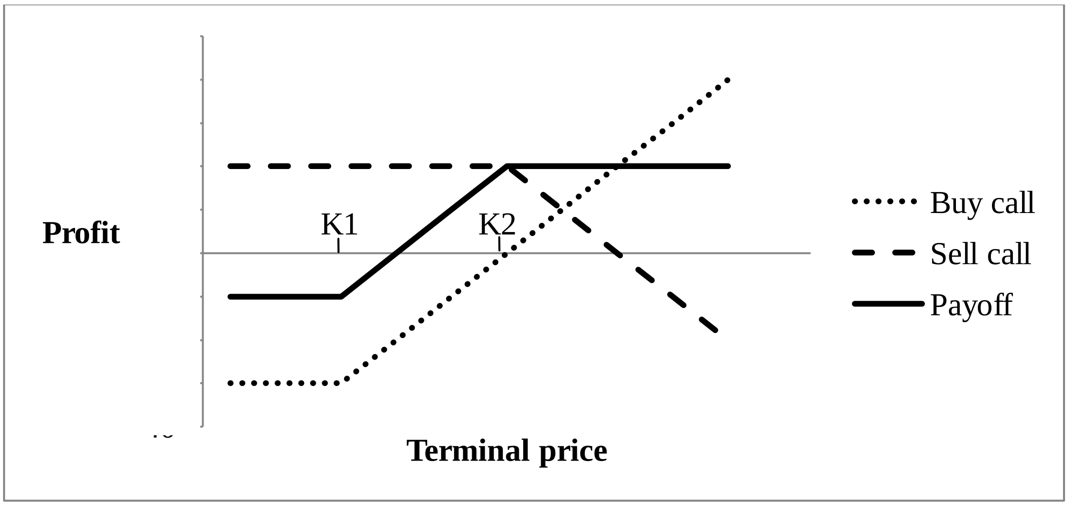
3.2.4.2 Spread structures - Bull spreads and zero-cost Collars

A spread trading strategy, according with Hull (2011), involves taking a position in two or more options of the same type. The spread strategy can be a bull spread, if it is used a long call option on the fuel commodity with a certain strike price, and selling a call option on the same commodity with a higher strike price. Both the options have the same expiration date. It is required an initial investment if constructed with calls. If constructed with puts, it involves an upfront positive cash flow to the investor.

The strategy limits the upside risk of the investor, making the airline companies protected from a big increase in the fuel price. However the strategy locks the possibility of benefiting from the decrease in the fuel price.

The strategy payoff using calls is illustrated in figure 7. The profits from the two option positions taken separately are shown by the dashed lines. The profit from the strategy is shown by the solid line and is the sum of the profits given by the dashed lines. The strike price from the long call is K1. The strike price from the short call is K2.

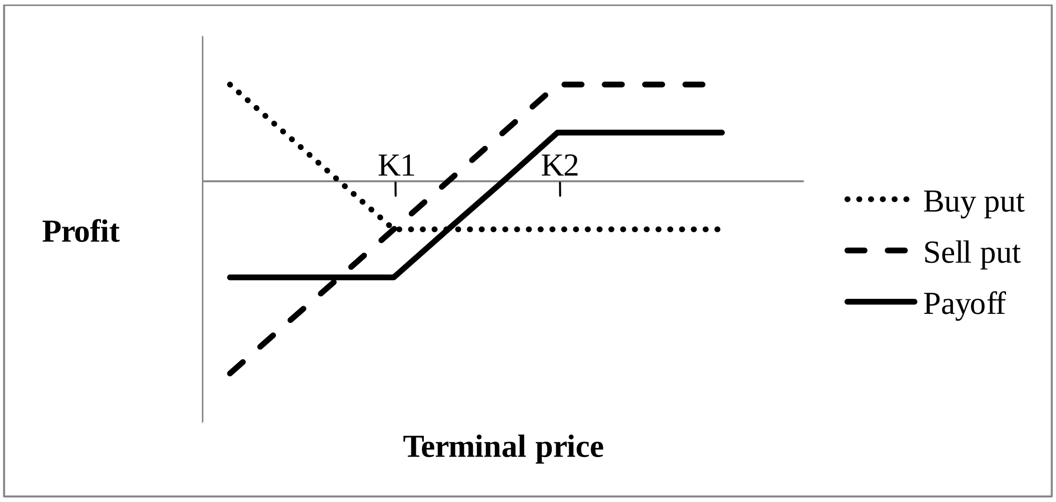
Figure 7: Profit from bull spread created using call options



Source: Hull (2011), own illustration

The strategy payoff using puts is illustrated in figure 8. The profits from the two option positions taken separately are shown by the dashed lines. The profit from the strategy is shown by the solid line and is the sum of the profits given by the dashed lines. The strike price from the long put is K1. The strike price from the short put is K2.

Figure 8: Profit from bull spread created using put options

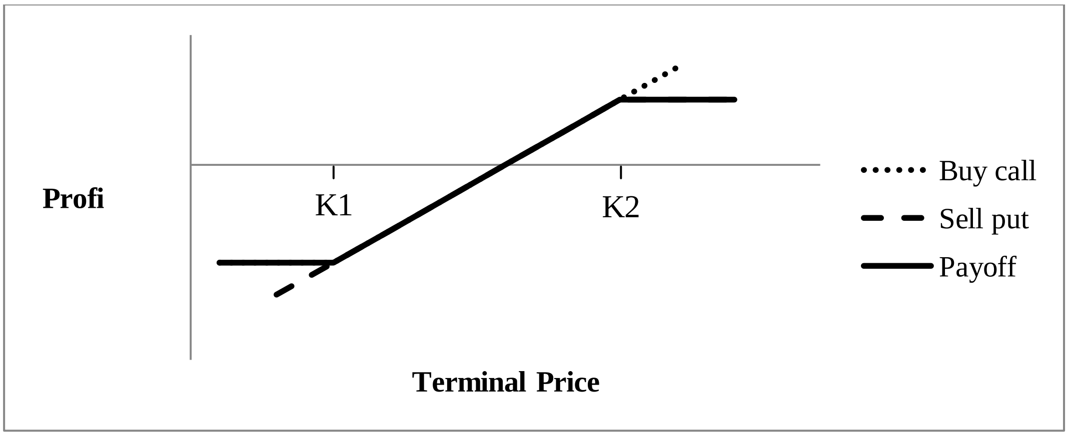


Source: Hull (2011), own illustration

A zero-cost collar structure is a spread structure that involves the purchase of fuel call options with the simultaneous sale of fuel put options with identical expiration dates (United Airlines, Inc., 2009). The proceeds from selling the put option are used to offset the cost of buying the call option. A put option is defined by Hull (2011) as the right to sell an asset, by a certain date, for a certain price.

The strategy payoff is illustrated in figure 9. The profits from the two option positions taken separately are shown by the dashed lines. The profit from the strategy is shown by the solid line and is the sum of the profits given by the dashed lines. The strike price from the long call is K1. The strike price from the short put is K2. The payoff overlaps the separated positions in the hedges.

Figure 9: Profit from the zero-cost collar structure.



Source: Viessmann (2010), own illustration

4. Literature Review

Trying to understand if hedging commodities price risk increases firm value is the goal of several researchers. The impact of commodity price risk hedging has been split in the literature between the producers and users of commodities hedging policies. Also, the literature also found possible reasons for hedging increase the firms' value.

4.1 Hedging commodities price by producers of commodities

For producers of commodities firms, the use of risk management to manage commodity price risk to increase the shareholders value has contradictory results presented by the academic world. On one side, Adam et all (2004) state that, for the gold mining industry, using quarterly data from an analyst at Scotia McLeod, the corporate derivatives use can be intrinsically valuable. This intrinsic value arises from the positive derivatives cash flows, which are, on average, significantly positive, which appear to translate in an increase in the shareholders value. However, Callahan (2002), with a yearly sample of gold mining producer firms, states that market, in terms of volatility, sees the gold mining industry as options, meaning, if the firm reduces volatility with hedging policies it also reduces the shareholders value. The paper also concludes that the more the firms in this industry hedge gold price risk, the worse it is for the return of their firm's stock performance. Also, in the oil and gas industry, according with Lookman (2004), when the commodity price hedged is a primary risk, the firms have a lower firm value. This author also states that if a firm hedges a secondary risk, such as the case of hedging jet fuel price in the airline industry, it adds value to the firm. In the oil and gas industry as well, Jim et all (2005) concluded that risk management is not related to firm value measured by the Tobin's Q.

4.2 Hedging commodities price by consumers of commodities

If we take the commodity users hedging policies, were the airline industry is present, the majority of the literature states there is an increase in firm value if hedging policies are used. More specifically in the airline industry, Cartes et all (2003) confirm airlines face negative exposure to jet fuel prices. Also, on average, Airline companies stocks returns are negatively correlated with jet fuel rice changes. They also found evidence that, on average, airlines increase shareholders value by hedging against the change in jet fuel prices. Viessmann (2010) also concludes that hedging the jet fuel in the airline industry, creates value, but does not stop the increase in the prices.

4.3 Effects of Hedging

There are several effects of hedging to a firm. Most of them are beneficial for the firms and can help to explain why hedging may increase the firms' value.

Nance et all (1993) tried to understand the Fortune 500 firms' use of derivatives using survey data. The paper found that firms that hedge have a more convex tax function, have less coverage of fixed claims, are larger and have more growth opportunities. Froot et all (1993) concludes that hedging reduces underinvestment problems and the cost of financial distress. Tufano (1996) studied the hedging activities in the gold-mining industry and found that the use of options are positively related to the value of stock and negatively related to the number of options held by managers and directors. This evidence is consistent with theories of management risk aversion, such as the ones defended by Stulz (1984). Smith et all (1985) found that firms hedge for three reasons: tax purposes, costs of financial distress and managerial risk aversion. Finnaly, Mian (1996) found strong evidence of economies of scale in hedging when investigating all the three types of hedging activities described in Smith et all (1985).

5. Research Questions

From the Literature Review presented before, two questions emerged:

1. Does the use of jet fuel derivatives to hedge in the airline industry increases the firms' value in the 21th century?
2. Does the market perceive the use of different financial instruments as more or less valuable?

The first question appeared since the only study in the hedging behavior of the airline industry, that didn't use OLS, in the 21th century, was Viessmann (2010). Also the instability in the airline industry in all the first decade of the 21th century, with the years 2001, 2005, 2008 and more recently 2014, the jet fuel price was one of the main causes, and hedging the salvation or destruction of the companies. This was particularly visible in the 2008 crisis, where fuel was one of the important drivers and jet fuel hedging strategies were questioned. Nowadays, starting in July 2014, the price decreased, making the firms hedging strategy questioned again and if hedge firms will lose competitive advantage, as in 2008. Will the losses with hedging change the conclusions of Cartes et all (2003)?

The second question comes from the fact that only Viessmann (2010) tried to understand if different financial instruments adds value to the firms. In the paper the analysis was only made to futures and options. In this paper the goal is to analyze the behavior of all financial instruments stated by the airline companies as used to hedge.

6. Data and Methodology

6.1 Methodology

The methodology used is similar to both Allayannis et all (2001) and Carter et all (2004).

The sample consists of all airline industry firms, with the SIC codes 4512 and 4513, that are publicly traded and are in COMPUSTAT database. The number of firms reaches 32, between 2000 and 2014.

According with Allayannis et all (2001), SFAS 105 required all the firms to report information about financial instruments with off-balance sheet risk (future, forwards, options and swaps). Later, SEC (1998) requires companies to disclose quantitative information about their market risk exposure resulting from derivatives and underlying non derivative items, from 15 June 1998 onwards. In this category it is included future, forwards, options and swaps. It is due to this release that the companies included the airline firms, start reporting the total percentage fuel hedged from these financial instruments, as well as the instruments used. Since the firms report the total percentage fuel to be hedged in the future, the observations will start in 1999.

For the firms in the sample, the fuel hedge percentage of the total consumption and the financial instruments used, were taken from the 10-K annual reports, present in the SEC website. If a firm reports that it uses fuel hedge, but not state the financial instruments used, it is also included in the sample. The reverse is also accepted in the sample. Since the firms do not report these values, they are considered as blank. The firm can still apply hedging instruments or fuel hedge, even if they not state so.

The different financial instruments considered in the sample - future, forwards, pass-through agreements, options, such as call option, zero-collar structures and spread structures, and swaps - are considered in the model as dummy variables. If the firm states clearly in the 10-K report that it uses one of them, they will enter the model with the value of 1. If it is clearly stated that the firm does not use them, then it is given the value of 0 to the variable. For the pass-through agreements, if a firm states clearly that it has a pass-through agreement with another airline, and if the total amount of fuel percentage is not reported, then the amount hedged, considered the amount covered by the agreement, is considered to be 100%.

Tobin's Q is used as a proxy for the firm's market value. Tobin's Q is defined by Allayannis et all (2001) as the ratio of the market value of the firm to replacement cost of assets, evaluated at the end of the fiscal year for each firm. In this study it is assumed that the replacement cost of assets is equal to the book value of the assets, measured by the Total Assets of the firm. Assuming the market value of the Debt is equal to the book value of the debt, the Tobin's Q formula will then be:

$$\text{Tobin's Q} = \frac{\text{Total Assets} - \text{Equity(Book Value)} + \text{Equity(Market Value)}}{\text{Total Assets}}$$

To calculate the Equity at Market Values, the COMPUSTAT was used to find the price per share and the shares outstanding of each firm, that multiplied give the Assets at Market Value. Then it reduced the Debt at Book Values to calculate the Equity at Market Values. The final value is the multiplication of these two variables. To the Total Assets and Equity at Book Values, the COMPUSTAT was also used.

6.2 Data

Table 1: Summary Statistics

	No. Obs	Mean	Std. Dev.	Skewness	Kurtosis
Sample description					
Total Assets	293	7830,97	10912,36	1,90	3,39
Total Sales	292	6479,10	8802,48	1,93	3,66
Book Value of Equity	295	-23,14	4442,63	2,80	15,58
Market Value of Assets	295	2321,86	4881,47	4,54	26,20
Financial Instruments					
Collars	262	0,43	0,50	0,30	-1,94
Calls	262	0,41	0,49	0,38	-1,88
Spreads	262	0,06	0,24	3,82	12,88
Swaps	262	0,51	0,50	-0,04	-2,02
Futures	262	0,07	0,26	3,31	9,21
Forwards	262	0,16	0,37	1,91	1,70
Pass-through	262	0,36	0,48	0,60	-1,67
Tobin's Q	293	1,00	0,55	1,70	3,46
% Hedge	284	0,33	0,33	0,86	-0,46
Control Variables					
Dividends	295	0,23	0,42	1,31	-0,29
Leverage	293	0,29	0,18	0,20	-0,37
Profitability	293	-0,01	0,07	-6,57	50,16
Investment Oportunities	291	0,10	0,11	2,94	12,75

The table presents the summary statistics for the sample. The sample contains all the airline industry companies, with the SIC codes 4512 and 4513, presented in an exchange and operating in the United States in the years 2000 until 2014. The variables Total Assets, Total Sales, Market Value of Equity and Market Value of Assets are in million dollars. The dummy variable Zero-Collar dummy equals 1 if the airline company reports the use of zero-collar structures to hedge its exposure to jet fuel risk. The dummy variable Call dummy equals 1 if the airline company reports the use of call options to hedge its exposure to jet fuel risk. The dummy variable Spread dummy equals 1 if the airline company reports the use of spread structures to hedge its exposure to jet fuel risk. The dummy variable Swap dummy equals 1 if the airline company reports the use of swap contracts to hedge its exposure to jet fuel risk. The dummy variable Future dummy equals 1 if the airline company reports the use of future contracts to hedge its exposure to jet fuel risk. The dummy variable Forward dummy equals 1 if the airline company reports the use of forward contracts to hedge its exposure to jet fuel risk. The dummy variable Pass-Through dummy equals 1 if the airline company reports the use of pass-through agreements to hedge its exposure to jet fuel risk. The variable % Hedge represents the amount the airline company hedge in the year. The dummy variable Dividend dummy equals 1 if the airline company reports the payment of a cash dividend in the year and 0 otherwise. The Leverage variable is calculated using the debt-to-assets ratio. The Profitability variable is calculating using the return on assets formula - net income divided by total assets. The Investment Opportunities variable is calculated using the capital expeditors over sales ratio.

As the table 1 shows, the sample is mostly composed from firms with a lower total asset of 7830,97$ millions, negative market value of equity and market value of the assets lower than 2321,86$ millions and the book value of assets. Even if profitability is negative, the concentration of firms is in the positive side, having values higher than -0,01$ millions. In terms of dividends and leverage, the observations have a similar behavior, according with kurtosis.

6.3 Control Variables

To understand if fuel hedge increases the firm value of airline industries, the effect of other variables that have an impact in the measure of value used (Tobin's Q) shall be excluded. Various control variables, based in Carter et all (2004), are described below, as well as the theoretical reason behind them.

Size: To control the effect of size, it will be used the log of Total Assets. According Allayannis et all (2001), large firms are more likely to use financial instruments to hedge risk since, for example, hedging has a large fixed start-up cost.

Dividends: Dividends are used as proxy to the firm's ability to access the financial markets. If a firm paid a common dividend during the year in analysis, it is included in a dummy variable as 1. As Allayannis et all (2001) stated, this variable is important to measure the Tobin's Q since if firms cannot obtain the necessary financing, they will only take positive net present value (NPV) projects, inflating its Q ratio. If a firm pays a dividend during the year, it is less likely to have capital constraints. As Carter et all (2004) also stated, the payment of a dividend may be seen as a positive signaling from management. Also, the increase, reduction or elimination on the dividend paid is also seen as positive or negative signaling by the market.

Leverage: As Carter et all (2004), a variable to control the changes in the capital structure will be used. It will be defined as the ratio between the Long Term Debt and the Total Assets. In Allayannis et all (2001) Leverage had an ambiguous effect in firm value.

Profitability: A variable measuring the profitability will be added. In it profitability is defined as the Return on Assets or the ratio between Net Income and Total Assets. This variable is needed since a profitable firm is more likely traded at premium than a less profitable one. Allayannis et all (2001) found a positive relation beween the Return on Assets and the firm value, measured by the Tobin's Q.

Investment Opportunities: The market tends to give a higher value to firms with greater investment opportunities. The ration of Capital Expenditures to Sales will then be used as proxy to investment opportunities. Froot et all (1993) and Géezy et all (1997) defend that firms that hedge are more likely to have more investment opportunities. . Allayannis et all (2001), however, found week evidence from a positive relation between Investment Opportunities and firm value.

Time effect: A year dummy variable is used to control the systemic time effects on airline company value. The results of this dummy will not be reported.

7. The use of Financial Instruments and Firm Value

7.1 Firm's hedging profile over time

Being the aim of this study to: (1) understand the impact of changes in hedging policy in the airline industry company's value and (2), understand the impact of different financial instruments in the airline industry firm's value, the analysis of the use of different financial instruments over time for the firms present in the sample is presented in table 2.

As the table 2 presents, the airline industry seems to adjust the hedging behavior to the jet fuel price increase and decrease. In 1999 64% of the sample, hedged. The number of firms hedging kept increasing to 90% in 2003, 2 years after the 9/11, in 2001. After this peak, the number of airlines hedging was reduced to 68% in 2004, increasing again until 2007. In the years 2008 and 2009, due to the big changes in the fuel price, the airlines decrease and increase the amount hedged. In the year 2010 they reduced the hedging policy, again, to increase it in 2011 to 80% of the airlines hedging their jet fuel exposure. Since 2011 until 2014, the number of companies hedging decrease to values close to 2000 (69% in 2014 to 64% in the year 2000).

Table 2: Profile of firm's hedging over time

	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14
Number of firms hedging jet fuel price															
	14	14	14	19	15	16	15	16	16	17	12	12	12	11	9
Percentage of sample															
(%)	64	74	74	90	68	76	75	80	76	89	75	80	75	73	69
Number of firms using zero-collar structures															
	1	0	1	2	3	6	7	7	6	5	3	3	6	4	3
(%)	5	0	5	10	14	29	35	35	29	26	19	20	38	27	23
Number of firms using call options															
	2	3	1	2	2	2	2	2	4	7	6	6	6	4	3
(%)	9	16	5	10	9	10	10	10	19	37	38	40	38	27	23
Number of firms using spread structures															
	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1
(%)	0	0	0	0	0	0	0	0	0	5	6	0	6	7	8
Number of firms using swap contracts															
	6	5	5	7	6	5	5	5	3	4	4	5	5	5	3
(%)	27	26	26	33	27	24	25	25	14	21	25	33	31	33	23
Number of firms using future contracts															
	0	0	0	0	0	0	0	0	1	1	1	0	1	1	0
(%)	0	0	0	0	0	0	0	0	5	5	6	0	6	7	0
Number of firms using forward contracts															
	2	1	1	1	0	1	2	2	1	1	0	0	0	0	0
(%)	9	5	5	5	0	5	10	10	5	5	0	0	0	0	0
Number of firms using pass-through agreements															
	3	3	3	5	5	4	3	2	4	3	2	1	1	1	1
(%)	14	16	16	24	23	19	15	10	19	16	13	7	6	7	8

This table presents a summary of the firms' use of financial instruments to hedge jet fuel price over time. A company is a user of a financial instrument, for example a call option, if it is clearly stated in the 10-K annual report that they used it. The first row represents the last two digits of the year in observation.

In terms of financial instruments hedged, it is visible some trends. Spread structures and future contracts start being used since 2009 and 2008, respectively. Since 2009 the airline companies do not report the use of forwards. The firms that used forwards before may have started using future contracts, or may have get out of the market. Zero-collar structures, swap contracts and call options are used since 2000. From 2002 until 2007 zero-collar structures grew, from 5% to 35%. When the 2008 crisis hit and the fuel price increased to historical maximums, decreasing a few months later, making the airline companies understand that the disadvantages of this financial instrument may be too big to ignore. After that, the number of airline firms using zero-collar structures decreased over time, only surpassing the 35% visible in 2007 in 2012, with 38% of the sample. For the companies using the call option to hedge its jet fuel exposure, the behavior was the opposite. With between 9% and 10% of the firms using this financial instrument to hedge between 2000 and 2007, the number increased until 2011 to 40%, reducing since then to 23% in 2014. The swap contracts users, until 2007, where more or less constant, ranging from 24% until 32% of the sample. In 2008 it was seen a decrease to 14%, increasing again the number of firms using this financial instrument until 2013, ranging the values between 21% and 33%. The number of firms using pass-through agreements increased from 2000, with 14% of the sample, until 2003, with 24% of the firms. The number then decreased until 2007, reaching 10% of the sample, increasing again in 2008 to 19%. Since 2008, the number of firms using pass-through agreements decreased from 19% to 8% in 2014.

7.2 Multivariate tests

The paper test two main hypothesis: (1) airline companies that hedge are rewarded by investors with a higher value and (2), airline companies that hedge with different financial instruments are rewarded with a higher value. This tests will be performed using a pooled OLS estimation to compare the value the companies have (Tobin's Q) with the use of different financial instruments. Control variables that could have an impact on Tobin's Q will be added. The control variables are Size, using the Log of Total Assets as proxy, Access to Financial Markets, using a dummy variable that equals 1 if the airline company reports the payment of a cash dividend in the year and 0 otherwise, Leverage, using the debt-to-assets ratio, Profitability, using the return on assets as proxy and Investment Opportunities, calculated using the capital expeditors over sales ratio as proxy.

Table 3: Estimates of the relationship between Farm Value and Hedging behavior - Models 1 to 5

	OLS Models				
	1	2	3	4	5
Number of observations	262	262	262	262	262
R^2	0,053	0,032	0,027	0,033	0,026
F statistic	1,059	0,209	1,192	1,458	1,155
Constant	-0,002	0,002	-0,004	-0,008	-0,002
	(-0,150)	(0,197)	(-0,380)	(-0,666)	(-0,197)
Size	-0,039	-0,041	-0,040	-0,039	-0,040
	(-1,061)	(-1,137)	(-1,114)	(-1,075)	(-1,105)
Dividend dummy	0,016	0,007	0,008	0,010	0,006
	(0,777)	(0,337)	(0,377)	(0,516)	(0,323)
Leverage	0,000	0,000	-0,001	0,000	0,000
	(-0,806)	(-0,877)	(-1,005)	(-0,892)	(-0,972)
Profitability	0,001	0,001	0,001	0,001	0,001
	(1,048)	(1,151)	(1,1445)	(1,135)	(1,209)
Investment opportunities	-0,006	-0,005	-0,005	-0,005	-0,005
	(-1,626)	(-1,484)	(-1,484)	(-1,551)	(-1,438)
% Hedged	-0,004	-0,003			
	(-1,468)	(-1,327)			
Zero-Collar dummy	0,004		0,014		
	(0,148)		(0,672)		
Call dummy	0,022			0,031	
	(0,857)			(1,417)	
Spread dummy	0,010				0,038
	(0,126)				(0,486)
Swap dummy	0,009				
	(0,438)				
Future dummy	-0,001				
	(-0,010)				
Forward dummy	0,019				
	(0,493)				
Pass-Through dummy	-0,035				
	(-1,410)				

None of the values are statistically significant at the 1%, 5% and 10% level.

The table presents the results of the pooled OLS regressions of the use of derivatives in the company value. The sample contains all the airline industry companies, with the SIC codes 4512 and 4513, presented in an exchange and operating in the United States in the years 2000 until 2014. The dependent variable is the Log of

Tobin's Q. The Size variable is calculated using the Log of Total Assets. The dummy variable Dividend dummy equals 1 if the airline company reports the payment of a cash dividend in the year and 0 otherwise. The Leverage variable is calculated using the debt-to-assets ratio. The Profitability variable is calculating using the return on assets formula - net income divided by total assets. The Investment Opportunities variable is calculated using the capital expeditors over sales ratio. The dummy variable Zero-Collar dummy equals 1 if the airline company reports the use of zero-collar structures to hedge its exposure to jet fuel risk. The dummy variable Call dummy equals 1 if the airline company reports the use of call options to hedge its exposure to jet fuel risk. The dummy variable Spread dummy equals 1 if the airline company reports the use of spread structures to hedge its exposure to jet fuel risk. The dummy variable Swap dummy equals 1 if the airline company reports the use of swap contracts to hedge its exposure to jet fuel risk. The dummy variable Future dummy equals 1 if the airline company reports the use of future contracts to hedge its exposure to jet fuel risk. The dummy variable Forward dummy equals 1 if the airline company reports the use of forward contracts to hedge its exposure to jet fuel risk. The dummy variable Pass-Through dummy equals 1 if the airline company reports the use of pass-through agreements to hedge its exposure to jet fuel risk. The standard errors are shown beneath the prentices estimation.

Table 3 and 4 presents the OLS models, from 1 to 5 in the first table, and from 6 to 10 in the second one. The first model measured the impact of all the variables together. Models 2 to 10 measures the impact of the percentage hedged by the firm and the dummy variables representing the financial instruments used to hedge on a standalone basis. Model 6 represents all the financial instruments that are options and its impact in the firm value.

In all the models, the explaining power is low. The values range between 5,3%, in the model one, to 2,6% in models 5 and 8. These values are much lower than the regressions made by Allayannis et all (2001), that achieved an R^2 equal to 22%, with the fixed effect models, or Carter et all (2003), who achieved R^2 equal to 25%, approximately.

None of the values are statistically significant so no conclusions can be presented.

Table 4: Estimates of the relationship between Farm Value and Hedging behavior - Models 6 to 10

	OLS Models				
	6	7	8	9	10
Number of observations	262	262	262	262	262
R^2	0,043	0,029	0,026	0,027	0,038
F statistic	0,187	1,285	1,130	1,165	1,700
Constant	-0,001	-0,008	-0,002	-0,003	0,005
	(-0,075)	(-0,643)	(-0,175)	(-0,264)	(0,419)
Size	-0,040	-0,041	-0,040	-0,037	-0,042
	(-1,127)	(-1,129)	(-1,115)	(-1,015)	(-1,167)
Dividend dummy	0,011	0,011	0,006	0,007	0,008
	(0,564)	(0,556)	(0,301)	(0,363)	(0,400)
Leverage	0,000	0,000	0,000	0,000	-0,001
	(-0,964)	(-0,937)	(-0,973)	(-0,959)	(-1,044)
Profitability	0,001	0,001	0,001	0,001	0,001
	(1,146)	(1,081)	(1,199)	(1,215)	(1,184)
Investment opportunities	-0,005	-0,005	-0,005	-0,005	-0,005
	(-1,565)	(-1,430)	(-1,447)	(-1,476)	(-1,497)
% Hedged					
Zero-Collar dummy	-0,038				
	(-1,610)				
Call dummy	0,023				
	(1,025)				
Spread dummy	0,014				
	(0,171)				
Swap dummy		0,019			
		(0,997)			
Future dummy			0,016		
			(0,298)		
Forward dummy				0,020	
				(0,540)	
Pass-Through dummy					-0,043
					(-1,850)

None of the values are statistically significant at the 1%, 5% and 10% level.

The table presents the results of the pooled OLS regressions of the use of derivatives in the company value. The sample contains all the airline industry companies, with the SIC codes 4512 and 4513, presented in an exchange and operating in the United States in the years 2000 until 2014. The dependent variable is the Log of

Tobin's Q. The Size variable is calculated using the Log of Total Assets. The dummy variable Dividend dummy equals 1 if the airline company reports the payment of a cash dividend in the year and 0 otherwise. The Leverage variable is calculated using the debt-to-assets ratio. The Profitability variable is calculating using the return on assets formula - net income divided by total assets. The Investment Opportunities variable is calculated using the capital expeditors over sales ratio. The dummy variable Zero-Collar dummy equals 1 if the airline company reports the use of zero-collar structures to hedge its exposure to jet fuel risk. The dummy variable Call dummy equals 1 if the airline company reports the use of call options to hedge its exposure to jet fuel risk. The dummy variable Spread dummy equals 1 if the airline company reports the use of spread structures to hedge its exposure to jet fuel risk. The dummy variable Swap dummy equals 1 if the airline company reports the use of swap contracts to hedge its exposure to jet fuel risk. The dummy variable Future dummy equals 1 if the airline company reports the use of future contracts to hedge its exposure to jet fuel risk. The dummy variable Forward dummy equals 1 if the airline company reports the use of forward contracts to hedge its exposure to jet fuel risk. The dummy variable Pass-Through dummy equals 1 if the airline company reports the use of pass-through agreements to hedge its exposure to jet fuel risk. The standard errors are shown beneath the prentices estimation.

8. Conclusion

This thesis analyzes the use of different financial instruments to hedge jet fuel exposure and the percentage hedged by the companies, in a sample of 32 airline transportation companies in the United States. The goal was to understand if hedged percentage increased the firm value and the use of different financial tools had a different impact in the firm value.

Using as proxy of the airline companies' market value, Tobin's Q, the study shows that all the values do not have statistical significance. This leads to the conclusion that the model used may not be the right one. Further research is needed in the area and maybe the best approach is the one followed by Viessmann (2010).

The main conclusion this study takes, according with the percentage of firms that hedge, is that the airline industry may have a hedging behavior that tries to time the market, instead of a neutral approach. The decrease in the number of airline companies that hedged recently prove that. When the market signals the airline industries that the price of jet fuel will decrease, the firms stop hedging. When the market signals that the price is going to increase, the airlines start to hedge again. In cases similar to the 2008 crisis, where the hedging behavior was countercyclical with market, the airlines suffer huge losses that may lead to this result.

In a time that the price per barrel of crude oil WTI decreased from 100$ to 53$, between June 2014 until January 2015, airline companies are again embraced with a big decrease in the price of jet fuel. The choices they made picking the financial instruments to hedge this exposure are now crucial to face a competitive advantage of non hedger's airlines. According with this thesis, the airlines understand it and reduced their jet fuel hedging policies, being the percentage of airlines with an hedging behavior declining since 2011, with 80% of the sample engaging in hedging, to a percentage of 69% in 2014, a value similar to the values seen 10 years ago, in 2004 (68%). A risky move that may have paid off in 2014 and until now since the price of 6 months contracts at 11/05/2015 was at 59,6$ per barrel of crude oil traded in the WTI, recovering from 48$ per barrel in March 2015.

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Appendix

Appendix 1: Examples from Great Lakes Aviation, a airline company that does not hedge, taken from the 10-K annual report

"Fuel Costs:

Fuel is a major component of the Company's operating expenses. **The Company does not hedge its fuel purchasing costs.** The Company's cost of fuel varies directly with market conditions, and the Company has no guaranteed long-term sources of supply. Generally, the Company intends to follow industry trends by raising fares in response to significant fuel price increases. However, the Company's ability to pass on increased fuel costs through fare increases may be limited by economic and competitive conditions. Accordingly, a reduction in the availability of, or an increase in, the price of fuel could have a material adverse effect on both the Company's cash flow from operations and the Company's profitability. In fiscal year ending December 31, 2004, the Company's average price per gallon of fuel consumed increased to an average of $1.54 per gallon compared to the average price per gallon of $1.23 for the fiscal year ending December 31, 2003. The Company estimates that every $.01 increase in the price of fuel per gallon equates to an annualized increase in fuel expense of approximately $92,000. As of February 28, 2005, the Company's cost for fuel was $1.76 per gallon, a 14% increase from the $1.54 per gallon average for the year ending December 31, 2004."

Appendix 2: Examples from Southwest Airlines, a airline company that does hedge and uses several financial instruments, taken from the 10-K annual report

"As detailed in Note 10 to the Consolidated Financial Statements, **the Company has hedges in place for approximately 85 percent of its anticipated fuel consumption in 2005** with a combination of derivative instruments that effectively cap prices at a crude oil equivalent price of approximately $26 per barrel. Considering current market prices and the continued effectiveness of the Company's fuel hedges, the Company is forecasting first quarter 2005 average fuel cost per gallon, net of expected hedging gains, to exceed fourth quarter 2004's average price per gallon of 89.1 cents. **The majority of the Company's near term hedge positions are in the form of option contracts**, which protect the Company in the event of rising jet fuel prices and allow the Company to benefit in the event of declining prices."

Appendix 3: Examples from Skywest Inc, a airline company that does pass-through agreements, taken from the 10-K annual report

"In the past, the Company has not experienced difficulties with fuel availability and currently expects to be able to obtain fuel at prevailing prices in quantities sufficient to meet its future needs. Pursuant to the Company's contract flying arrangements, United will bear the economic risk of fuel price fluctuations on the Company's United Express flights**. On the Company's Delta Connection regional jet flights, Delta will bear the economic risk of fuel price fluctuations.** On the majority of the Company's Delta Connection routes flown by EMB120s, as well as all existing Continental Connection routes, the Company will bear the economic risk of fuel fluctuations. At present, the Company believes that its results from operations will not be materially and adversely affected by fuel price volatility."