# CAPITAL STRUCTURE IN THE AIRLINE INDUSTRY
## - An Empirical Study of Determinants of Capital Structure

**Emil K Bratlie**

**Andreas Jøtne**

**Supervisor: Gunnar Stensland**

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## Norwegian School of Economics

**Abstract**

This thesis analyse which company specific factors that affect the capital structure in the airline industry. Our sample consists of 39 airlines from different parts of the world, and data is collected from the last decade. We will use previous empirical studies of capital structure as a reference when interpreting the results from our sample.

In the first section of this paper, we will present the airline industry and the main capital structure theories.

We are going to use an econometric approach when analysing our data sample. Our dependent variables are the book or the market debt ratio in the two different models. The independent variables consist of company specific factors as: size, profit, growth, tangibility of assets, leasing, financial strength, strategy, ownership situation and transparency. Some interesting findings are that the market model explains 31.1% of the variation in capital structure of airline companies, and that six out of seven independent variables are significant. The book model does only explain 18.5%, and have only one significant variable. This may be explained by the argumentation that the market model are more forward looking than the book model which imply that stakeholders base their decision on the future expectations rather than historical values.

Generally, there are many theories that deal with capital structure issues, and we are going to test whether some of them are superior for our sample. Our findings show that none of the mentioned models are able to fully explain the obtained results, which is in line with the common consensus.

**Preface**

This paper is part of our master degree at Norwegian School of Economics. We have a specialization in financial economics supplied with subjects from economic analysis and business analysis and performance management.

This master thesis has been the most challenging and rewarding part of our study at Norwegian School of Economics. When writing this paper we were able to apply knowledge obtained from different courses.

By working together we had the benefit of discussing and use each other's knowledge, which we felt had a positive effect on our thesis.

We find both capital structure and the airline industry as interesting, and we have by working on this paper acquired knowledge that could be of use in future work related situations.

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# 1. Industry

## 1.1 Motivation for the selection of topic

After four and half years as a student of subjects concerning economics and business administration we have gotten many different interesting topics to choose from when preparing our master thesis. Since we both have specialization in financial economics, this was set as a base when choosing the topic. We have also studied subjects from econometrics and business analysis and performance that we wanted to include in our thesis. Capital structure in an energy intensive industry was both a relevant and interesting topic. After some back and forth we ended up choosing the airline industry as a representative of an energy intensive industry.

We found the airline industry interesting because of its' importance in economy and world globalization. It provides services everywhere in the world and give people the opportunity to visit places that formally would be thought of as almost impossible. Few other industries get that much attention from the government, media and the public. One explanation concerning this extra attention may be the airline industry's importance in linking the world together. The airline industry has been a popular topic in Norway because of the rivalry in the Norwegian market, Norwegian Airlines large order of new aircrafts and the high rate of employee vs. company disagreements.

We found no previous studies about capital structure in the airline industry, and thought it would be interesting to test if the airline industry has the same influencing factors as previous studies in general. The airline industry is highly energy intensive because of the large fuel consumption. The volatility in fuel prices, adds to the normal operational risk and we wanted to see if it influenced the capital structure choices. The airline industry is also capital intensive because of the need for large investments in planes and other fixed assets. The management have to choose from different financial sources when raising capital for these large investments. Hence, we got the possibility to test which factors, if any, which influence capital structure behaviour in a capital and energy intensive industry.

## 1.2 Problems we want to address

We will in this thesis address the capital structure behaviour of airline companies. In order to do this, we have to investigate which company specific factors (if any) that have a significant relationship with the companies' capital structure. We are also going to investigate whether there are some of the classical capital structure theories that can explain our findings. Furthermore we are going to examine whether our results correspond well with other capital structure analysis, and if there are airline industry specific deviations.

**The problems to be addressed:**
***What are the determinants of capital structure in the airline industry? Do our obtained results correspond well with other studies and capital structure theories?***

## 1.3 Scope and limitations

Before going any further, it will be appropriate to address some limitations concerning our paper. We are going to use a selection of recent studies and analysis when writing this paper. This is not because we are going to question their findings, but rather because we want to compare their result with ours. By doing this we want to produce a higher degree of understanding concerning capital structure issues. Hence, this is not a critic or review of other studies.

The term capital structure refers to the mixture of debt and equity that fund a company's assets. Although many previous studies have analysed the composition and design of different types of debt and equity, this will not be deliberated in our thesis.

The theories included have been chosen on the basis of what we regard as the most relevant for capital structure. They are highly recognised and often used as a basis in capital structure research. Generally, the theories included have proven to be the ones most recognized when explaining capital structure.

## 1.4 Outline

We will begin this thesis with a short presentation of the airline industry characteristics and history because we want the reader to get a picture of the airline industry before we start our analysis.

Then we will present theory in order to predict and explain capital structure determinants. Next we will present and give motivation for variables that we believe to be relevant for firm's debt ratio. We would also present previous empirical findings regarding the variables, which we would use to compare and analyse our findings.

In the next section we will describe our data sample and discuss its limitations. Further we will present the econometric method, which we would later use in our analysis.

In the analysis and result section we would first present the descriptive statistics from our sample. Then we present our first statistical testing using the pooled OLS regression. Lastly we will present our FE results and how the predictions of the presented capital structure theories is in line with our obtained results.

Lastly we would give a concluding remark on the obtained results in our thesis, and give suggestions to future research.

## 1.5 Industry definition

**Airline/Aviation industry,** the business of transporting paying passengers and freight by air along regularly scheduled routes, typically by airplanes but also by helicopter. (Freedictionary.) We limit our sample by leaving out the helicopter part of the industry. Hence, when we mention airline/aviation industry, helicopters are not included.

## 1.6 Industry characteristics

The largest income in the airline industry comes from passenger services. We have also chosen to focus on airlines that are mainly normal passenger services and not air cargo firms (even though some of the firms have smaller cargo services, it is hard to

separate the different costs from annual report. Also many of the airlines are controlled by a parent company and include different subsidiaries.)

Since the largest part of the revenue comes from passenger service the airlines are dependent on consumer and business confidence. A family will go on vacation when they feel they have good enough economy to treat themselves with something extra. Hence flying, which is often included in a vacation, could be seen as luxury good for leisure travellers. When the consumer confidence drops, you would expect lower demand for leisure travels. Consumer confidence is measured by "an unique indicator formed from survey results of more than 5,000 households and designed to gauge the relative financial health, spending power and confidence of the average consumer" (Investopedia, Consumer Confidence).

An important aspect of passenger service is the business traveller, since they are more likely to fly more frequently than for example the vacation (leisure) passenger. Airlines try to the get the loyalty of business passengers by using for example frequent flyer programs. One example is Qantas Frequent flyer program where you can earn points by flying with Qantas, use Direct Earn credit or charge card or shop with their partners. The points can be used to fly, priority check-in and a Qantas Club membership (Qantas). By earning more points the benefits become larger and gives the customer more incentive to fly with Qantas once more. Business travellers are also more likely to purchase the upgraded services that would give the airline higher margin on their service. They are also not that price sensitive, which is the degree to what the price of a product affects consumers purchasing behaviours (Investopedia, Price-sensitivity), and the demand would not fall that much in an economic downturn.

Fuel has, in the last couple of years, become the largest single cost for the airlines. Globally, the airline industry has a bill of US$ 178 billion in 2011, which accounts for 30 per cent of operating expenses (IATA, Airline Industry Fuel Consumption, 2011). Fuel consumption efficiency is important and has acquired an increasing attention from airline manufacturers. Therefore, new airplanes have become more fuel-efficient. This has severe consequences for airlines with older fleets because airlines like Ryan Air, with its new airline fleet, have a lower jet fuel cost per kilometre. Routes over longer distances will also have lower average jet fuel cost, since take-off and landing use much more jet fuel than in the air cruise.

**Table 1: Fuel prices and operating costs**

| Year | % of Operating Costs | Average Price per Barrel of Crude | Break-even Price per Barrel | Total Fuel Cost |
|---|---|---|---|---|
| 2003 | 14% | $28.8 | $23.4 | $44 billion |
| 2004 | 17% | $38.3 | $34.5 | $65 billion |
| 2005 | 22% | $54.5 | $51.8 | $91 billion |
| 2006 | 26% | $65.1 | $68.3 | $117 billion |
| 2007 | 28% | $73.0 | $82.2 | $135 billion |
| 2008 | 33% | $99.0 | $88.9 | $189 billion |
| 2009 | 26% | $62.0 | $55.4 | $125 billion |
| 2010 | 26% | $79.4 | $91.0 | $139 billion |
| 2011F | 30% | $112.0 | $116.3 | $178 billion |
| 2012F | 32% | $99.0 | $101.1 | $198 billion |

Source: (IATA, Airline Industry Fuel Consumption, 2011)

As shown in table 1, fuel expenses (crude oil) went from 14 per cent to an expected 32 per cent of operating costs in less than ten years. This is partially caused by the rise in average price of crude oil, but also that airlines have been making cost reductions in other operational expenses like wages. Figure 1 shows how the rise in crude oil price affected the net profits of the airline industry. Another interesting finding in this figure is that the net profits of 2001 to 2004 are negative, but the negative profits decrease even though crude oil prices have been rising. One interpretation of this is that airlines have been making cost efficiency efforts to handle soaring crude oil prices, and declining demand after the 9/11 terror attack. Since 2010 the airlines have had a positive net profit even though crude oil prices have been at all time high.
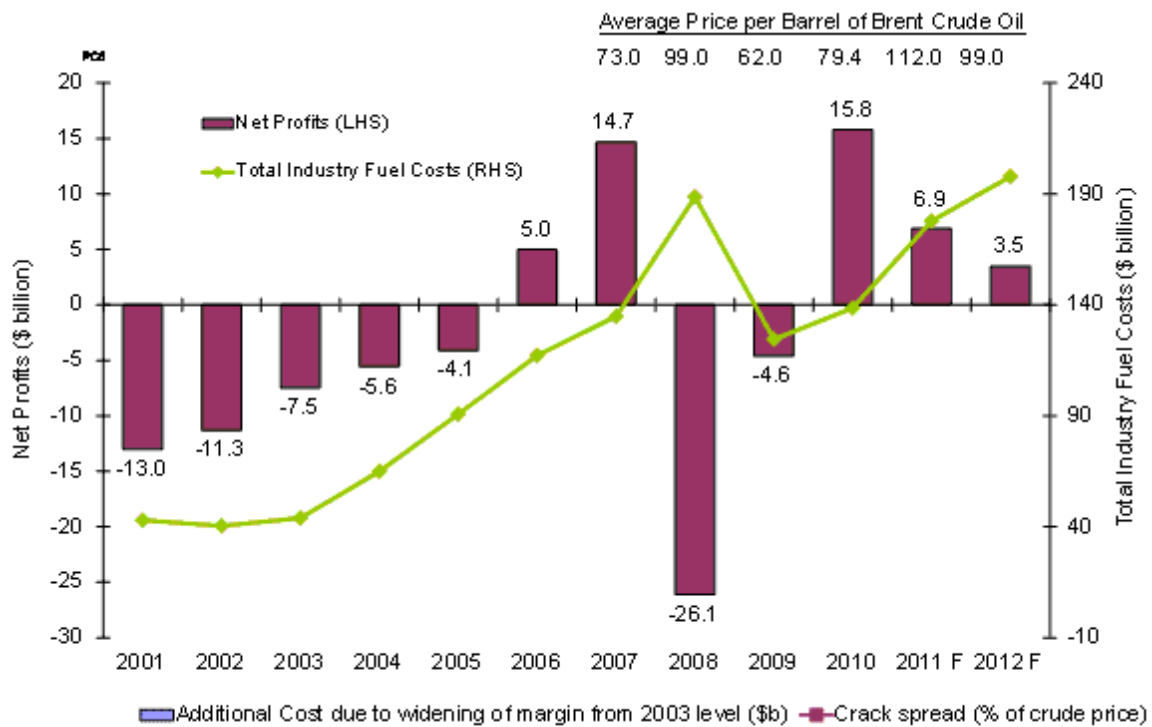
*Source:* (IATA, Industry Stats, 2011)

It is normal to hedge the fuel costs. Fuel hedging is "the practice of making advance purchases of fuel at a fixed price for future delivery to protect against shock of anticipated rises in price" (Travel-Industry-Dictionary). The major airlines have been hedging since the 1980s, but as the financial difficulties starting in 2001 developed, some of them no longer have cash available to invest in the oil-futures market. One challenge that all firms have is to maintain energy cost control when crude oil price are volatile. Andy Harrison, chief executive of Easy Jet, pronounce the importance of crude oil for the airline industry: "Oil remains the biggest challenge and uncertainty" (Daily Mail, 2008).

## 1.7 Industry history

Since the airlines introduction to commercial use in the 1950, there has been a change on a technical level and in industry factors. One important industrial factor is the deregulation, which started in the United States in 1978, later followed into Europe and which is happening now in Asia. The deregulation or "liberalization" affected the competitive environment in the different regions. It lowered the entry barriers and the competition in the deregulated regions accelerated. This introduced the need of cost

efficiency and operating profitability management, and could be seen as the start of low-cost-carriers.

The airline industry depends on good economic conditions both regional and worldwide to produce years with high growth and profitability. The deregulation has increased the competition and affected growth and profitability. This could be seen in figure 2 where the net profit has been very volatile since the 1990s. The airlines dependence of the world's stability and economy can be seen in the period 1990 to 1993 when the Gulf War hit the economy. After that the airline industry made record profitability for some years, before it once again was hit by a downturn in the economy. The financial crisis, which started in 2007, ended up forcing record losses for the airline industry. In this period the 9/11-terror attack also had a negative impact on profitability. This is not only caused by the public becoming more afraid to use air transportation, but also that new safety actions led to a much higher hassle factor of flying (MIT Global Airline Industry Program).
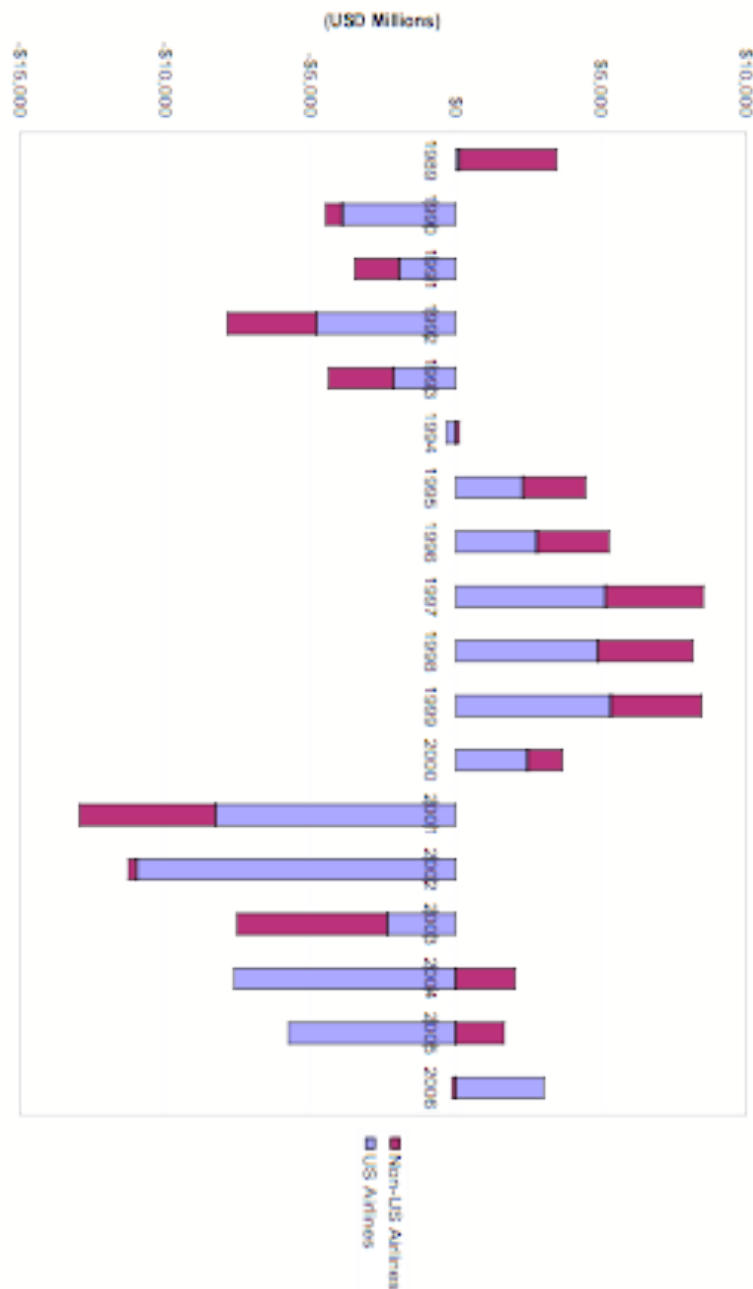
*Source*: (MIT Global Airline Industry Program)

The increasing competition forced airlines to seek lower costs and higher productivity. This caused a high number of mergers, acquisitions and internal growth to take advantage of economies of scale. Economies of scale are "the increase in efficiency of production as the number of goods being produced increases. Typically, a company that achieves economies of scale lowers the average cost per unit through increased production since fixed costs are shared over an increased number of goods" (Investopedia, Economies Of Scale).

The governments became concerned about the industry's consolidation and declining competition. Naturally, mergers are likely to face opposition from the government. As a consequence of this, airlines started to go into partnerships and "global strategic alliances" to acquire economies of scale. A strategic alliance is an arrangement between two companies that have decided to share resources to undertake a specific, mutually beneficial project. This alliance is less involved and less permanent than a joint venture, in which two companies typically pool resources to create a separate business entity (Investopedia, Strategic Alliance).

Since 2000 we have seen a growth in low-fare airlines, which could better satisfy the new demand for low cost travel. In this period we have also seen that operating costs as fuel have been increasing. The economic downturn and higher operating costs lead to massive layoffs and cutbacks in the industry. It became clear that most of the legacy airlines (legacy airlines meaning full-service carriers) had to high operational costs and to low productivity compared to the low-fare airlines. These challenges led many large airlines (US Airways, United, Delta and Northwest among others) into Chapter 11 bankruptcy in the period 2001 to 2005. Under the bankruptcy protection these airlines started re-structuring with lay-offs and cutting operational costs, closing in on the advantage of low-fare airlines as shown in figure 3.

**Figure 3: ($/ASM) Labour cost and available seat miles. (ASM is equal to number of available seats times the number of miles flown, and is used to measure seat supply among airlines)**
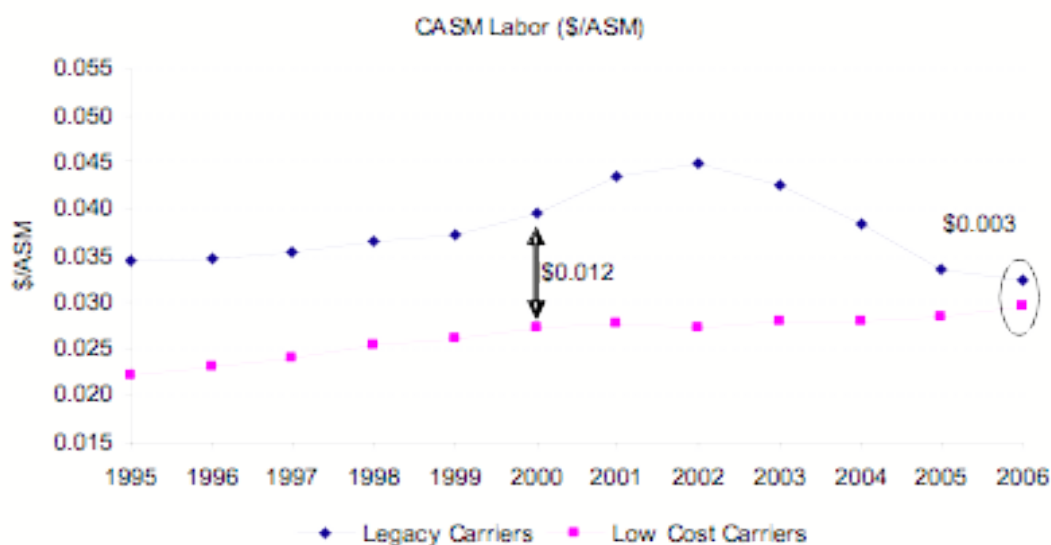


*Source:* (MIT Global Airline Industry Program)

In 2010 the airline industry had revenue of 547 billion US Dollars and 2681 million scheduled passengers. The operating profit was 21.7 billion US Dollars and a profit margin of 4 per cent, which gave a net profit of 15.8 billion US Dollars and for the first time positive in the last three years. IATA forecasts an average of 4.6 per cent yearly growth into 2015. Historically the average growth has been 5 per cent the last 30 years.  But the future is not only bright after a little boost in 2010. "2011 will certainly be more challenging. Rising oils prices and new taxes are already increasing cost. The currency crisis continues to hold back Europe's recovery". Giovanni Bisignani, Director and CEO of IATA (IATA, Industry Stats, 2011).

## 2. Theoretical framework concerning capital structure

Capital structure of companies is a widely studied subject. Since Modigliani and Miller's (M&M) article about the irrelevancy of capital structure in 1958, the capital structure problematic have evolved and become a popular subject of empirical testing. Several new theories have accrued, but none of them have been able to fully explain all capital structure decisions. We are in this part of the thesis going to briefly mention some different models concerning capital structure determination.

### 2.1 Capital Structure irrelevance: The Modigliani-Miller (M&M) Model

M&M were the first to introduce a formal analysis of the capital structure irrelevance theorem in the famous study "The cost of capital, Corporation Finance, and the theory of investment" (Miller, Modigliani & Merton, 1958). M&M showed that leverage would not affect the total value of the firm in a perfect capital market. A perfect capital is recognized by:

1. "Investors and firms can trade the same set of securities at competitive market prices equal to the present value of their future cash flows.
2. There are no taxes, transaction costs, or issuance costs associated with security trading.
3. A firm financing decision do not change the cash flows generated by its investments, nor do they reveal new information about them. Hence there is no information asymmetry and the expectations of risk and return are the same for everyone." (Berk & DeMarzo, 2007 s. 455)

**M&M Proposition I**: "In a perfect capital market, the total value of a firm is equal to the market value of the total cash flows generated by its assets and is not affected by its choice of capital structure." (Berk & DeMarzo, 2007, s. 455)

Modigliani and Miller established their argument by the **Law of One Price, Arbitrage Possibilities and Homemade Leverage.**

**Law of One Price:** In a perfect capital market the total cash flow paid out to all of the firm's security holders is equal to the total cash flow generated by the firm's assets. Thus as long as the choice of securities does not change the cash flow generated by

the assets, the value of the firm is given by the cash flows of the assets and not the choice of securities. The consequence of this claim is that decisions about financing and investments become independent.

**Arbitrage possibilities**. Modigliani and Miller (1958) used the proof of contradiction in Proposition I. If Proposition I does not hold investors could exploit arbitrage opportunities, by short selling overpriced stock and buying under-priced stock with identical income streams. Since there are no transaction costs and the stocks are the same except for price, the investor would instantaneous increase their wealth. (Baker & Martin, 2011)

**Homemade leverage.** If investors prefer an alternative capital structure to the one that the firm has chosen, he could borrow and lend on his own to achieve the preferable leverage level. This is possible because as long as investors can borrow or lend at the same rate as the firm and there is no transaction cost, which are two of the stated assumptions. Then homemade leverage becomes a perfect substitute for the use of leverage for the firm.

**MM Proposition II**: "The cost of capital of levered equity increases with the firm's market value debt-equity ratio." (Berk & DeMarzo, 2007, s. 461)

Proposition II is an implication of M&M theory and proposition I. It states that the expected rate of return on the common stock of a levered firm increases in proportion to the debt-equity ratio, expressed in market values. Debt issues have an explicit and implicit cost. The explicit cost is the rate of interest charged on the firm's debt. The implicit cost is that it increases the firm's financial risk and therefore causes shareholders to demand a higher return on their investment. The implicit and explicit cost together makes that debt is no cheaper than equity, and the return that the investors require on their investment is unaffected by the firms capital structure. (Brealy, Myers, & Marcus, 2007)

Equation 1: Cost of capital

$$R_E = R_A + \left(\frac{D}{E}\right) * (R_A - R_d)$$

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*Where*;

$R_e = $ *expected rate of return on equity*

$R_d = $ *expected return on debt*

$R_A = $ *expected return on asset*

$D = $ *market value of debt*

$E = $ *market value of equity*

Equation 1 reveals the effect of leverage on the return of the levered equity. The levered equity return equals unlevered return, plus some additional caused by leverage.

The insight from M&M can be used to understand the firm's cost of capital on new investments when they are levered. A levered firm is financed with both equity and debt; the risk of the underlying assets will match the risk of a portfolio of its equity and debt. Therefore the appropriate cost capital of this portfolio is the appropriate cost of capital for the firm's assets. This gives us the weighted average of the firm's equity and debt cost of capital.

**Equation 2: Unlevered cost of capital (pre-tax WACC)**

$$R_A = \frac{E}{D+E} * R_e + \frac{D}{D+E} * R_d$$

*Where*;

$R_e = $ *expected rate of return on equity*

$R_d = $ *expected return on debt*

$R_A = $ *expected return on asset*

$D = $ *market value of debt*

$E = $ *market value of equity*

**Figure 4: Cost of capital**
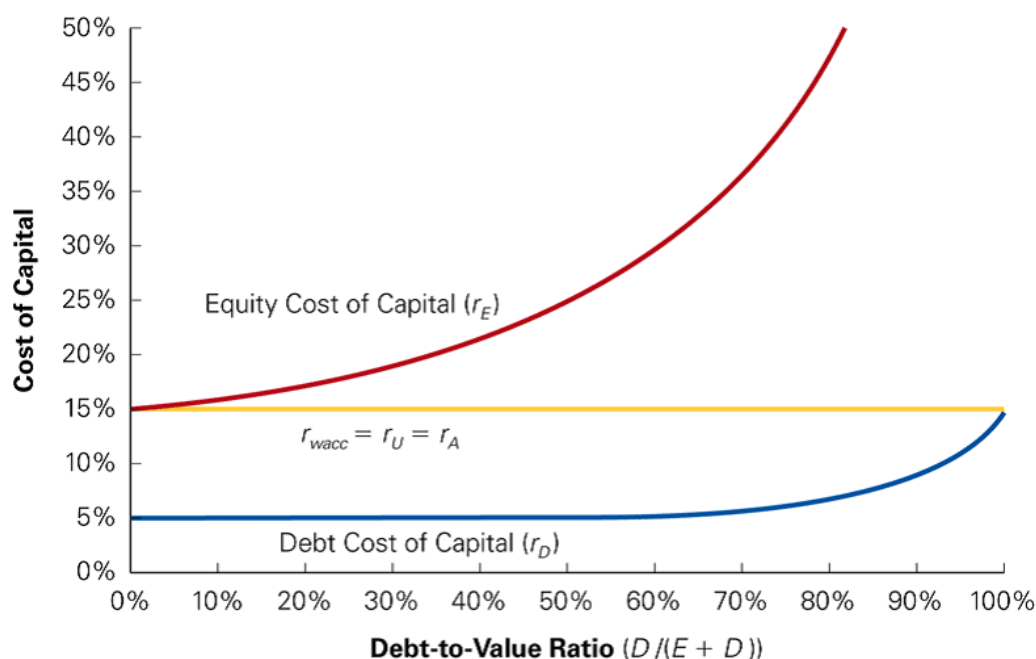


(Source: (Berk & DeMarzo, 2007))

## 2.2 Agency costs theories

The agency cost theory view on capital structure decisions has its origin from the principal-agent theories. Shareholders are defined as the principal, which because of time limitations etc. need to hire an agent (the managers of the company) to govern the company in their best interest. Hence, maximize shareholder value. In a non-perfect world, there exist information asymmetries, which imply that the principal cannot control all the decisions made by the management. The main idea behind this capital structure theory is that the shareholders choose a level of leverage in order to discipline the company management (Jensen 1986), and by doing this, save a lot of time consuming efforts and monitoring costs. By using debt as a disciplinary factor, stakeholders may also have better control on the strategy, which the company management choose to follow. For example, by choosing a high level of leverage (high dividend pay out ratio, debt level etc.) shareholders decrease the probability of agents investing in unprofitable diversification projects just for personal reasons like status etc. Kaplan and Weisbach (1992) find that diversified firms carry relatively more debt than non-diversified firms. This finding may be explained with the agency cost theory. The theory suggests that shareholders do not want more diversification and therefore increase their company's debt level. Hence, they decrease the FCFF

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available to self-interested managers (Jensen 1986) to invest in the (potentially) unprofitable diversification projects.

## 2.3 Trade-off theory

In most countries interest cost, in contrast to dividends, is deducted from the companies' taxable income. Hence, given that there are no cost related to high debt levels and borrowing rates are constant, it would increase company value when debt levels increase. Miller (1988) exclaims, " The optimal capital structure might be all debt!" The trade-off theory includes the cost financial distress, and argues that debt levels are given by a trade-off between the present value of tax shield implied by debt financing and the its bankruptcy costs.

Bankruptcy costs are either direct or indirect. Jensen and Meckling (1976) provide a further analysis of these costs. Direct costs consist of legal, consulting and restructuring expenses when a company experience financial distress. The indirect costs are argued to include; lost sales and profits, broken contracts, poor credit terms, increased costs of issuing debt to refinance current obligations and employee turnover.

The trade-off theory may be expressed analytically through the following model. Lets assume that a company generate a cash flow R that is uniformly distributed between 0 and R\*. D illustrates the company's interest costs and T is the corresponding tax rate (assumed to be constant). If the companies generate R<D there is a deadweight loss of k\*R that is used up in the process. (k is a constant)

If R>D equity holders receive (R-D)(1-T), while if R<D they receive 0. The market value of debt equals $\frac{\bar{R}-D}{\bar{R}}D + \frac{D}{\bar{R}}\frac{D(1-k)}{2}$ where $\frac{\bar{R}-D}{\bar{R}}$ is the probability that R>D and $\frac{D}{\bar{R}}$ is the probability of default. The market value of equity is given as $\frac{\bar{R}-D}{\bar{R}}(\frac{\bar{R}+D}{2} - D)(1-T)$. The firms value, given by $V_E + V_D$ equals:

Equation 3: Firm value given by the sum of V(E) and V(D)

$$= \frac{\bar{R}-D}{\bar{R}}\left(\frac{\bar{R}+D}{2} - D\right)(1-T) + \frac{\bar{R}-D}{\bar{R}}D + \frac{D}{\bar{R}}\frac{D(1-k)}{2}$$

The model assume that the choice of leverage is determined by which D that maximize the company value. When deriving Eq.3 with respect on D, we get the following first order condition (FOB) (Faulkender & Petersen, 2006) (Lemmon & Zender, 2010):

$$\frac{\partial V}{\partial D} = 0 \rightarrow D = \frac{T\bar{R}}{T + 1 - k}$$

The model is illustrated in Figure 5.

**Figure 5: Trade-off theory**
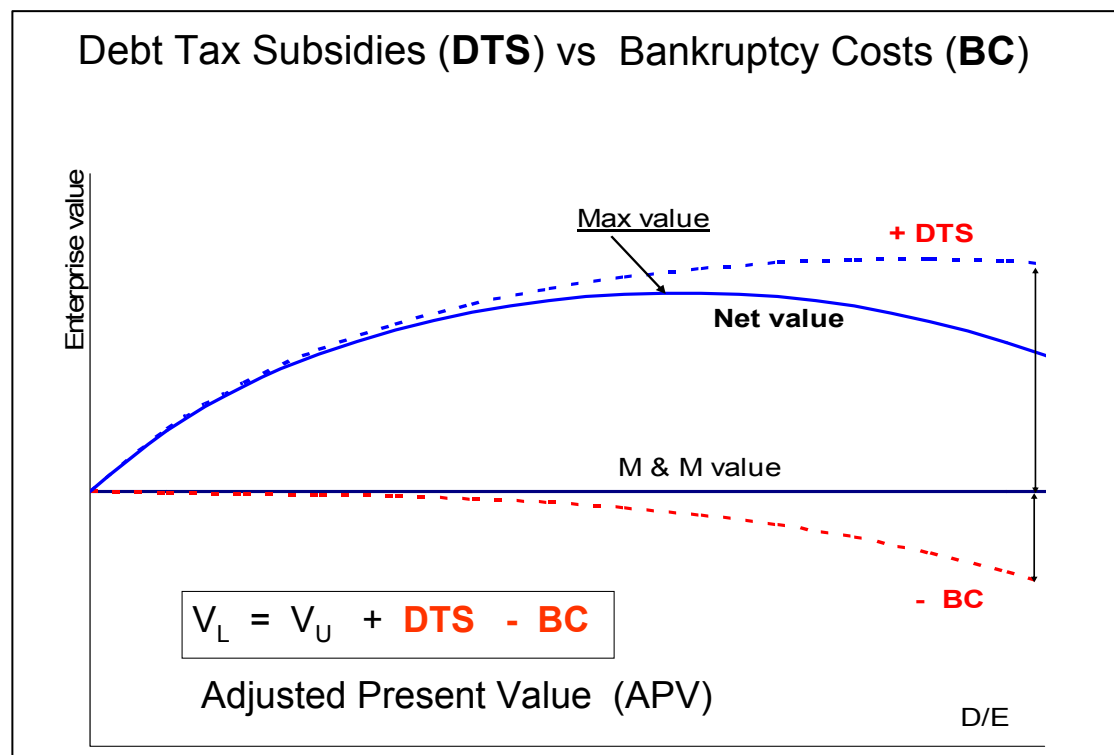


(Source: Johnsen 2010)

The model imply that companies operating in industries or countries with high tax rates will have, ceteris paribus, a greater optimal leverage than equal companies operating with lower tax rates.

When k increases, which implies lower expected bankruptcy costs, the optimal debt level decreases. This imply that it would be optimal for companies with a high portion

tangible assets which may easy be sold in the second hand market, to hold more debt than companies holding lots of intangible assets.

As given by the FOC, the model also implies that there is a positive relationship between average free cash flow (profitability) and leverage. Hence, expected bankruptcy costs are lower (since the buffer kR is larger) and interest tax shields are more valuable for profitable companies.

## 2.4 Pecking Order

Pecking order don't give us a well-defined target debt-to-value ratio but ranks the different financing options, and could therefore been seen as a contrast to the trade-off theory. Myers (1984) main points are that firms prefer internal finance. If internal funding is not enough, the firm will issue the safest security first. They will start with debt, then hybrid securities and equity as a last resort. Hybrid security could be for example convertible bonds.

In the pecking order, there is no well-defined target debt-equity mix, because there are two kinds of equity, internal and external, one at the top of the pecking order and one at the bottom. Each firms observed debt ratio reflects its cumulative requirements for external finance.

Myers argued that the pecking order theory was description of typical behaviour by looking at the aggregates from non-financial corporations over the decade 1973-1982. This showed that 62 per cent of the capital expenditure was financed with internally generated cash. The bulk of external financing came from borrowing and while net new stock issues only stand for 6 per cent.

Myers (1984) set up an example with asymmetric information. A firm needs to raise N dollars to be able to invest in a potentially valuable investment opportunity. The net present value of this opportunity is y and x is the value of the firm without the investment.

The manager of the firm knows what y and x is, but the investors in the capital market do not. Investors only see a joint distribution of possible values (x, y~). So there is

asymmetry in information between the manager and investors. Information asymmetry is a situation in which one party in a transaction has more or superior information compared to another. There is also a possible cost since the firm may have to sell securities for less than they are really worth. Myers supposes that issues stock with the aggregate value N when issued. But if investors would acquire manager's information the value would be $N_1$.

Myers builds on that a manager's objective is to maximize the intrinsic value of the firms existing shares, which would say the value of the old shareholders stakes in the firm. Possible new investors knows this and would therefore assume that the managers are not on their side, and will rationally adjust what they are willing to pay for the shares.

Further Myers defines $\Delta N$ ($\Delta N = N_1 - N$) as the amount that the share is over- or undervalued. Then the manager will issue and invest when $y > \Delta N$. This could lead to underinvestment as the firm could pass on a positive net present value opportunity since the share is undervalued.

If the shares is overvalued managers would issue, even if is to only put the money in the bank. The problem with this is that the investors know this and would therefore only buy equity if the firm has already exhausted its debt capacity. This way investors force the managers to follow the pecking order. But as Myers later point out that this to extreme and the model is used to predict managers financing decision when there is asymmetric information.

When the management acts this way its signals news to both old and new shareholders by their choice of financing. Myers list two key points from the assumptions and implications of the model above.

1. The cost of relying on external financing. Asymmetric information creates a possibility that the firm would choose not to issue and therefore lose positive net present value investment. This underinvestment could be avoided if the firm has enough internal generated cash.

2. The advantages of debt over equity issues. If the firm needs external funds, it is better of issuing debt than equity securities. This gives the general rule "Issue safe securities before risky ones".

It is worth mentioning that if the firm could issue default-risk free debt it would be as good as internally generated cash. Then ΔN is zero and the firm would never pass on a positive net present value investment opportunity.

## 2.5 Determinants of capital structure

Table 2: Summary of predicted signs according to capital structure theories.

| | Theories | | |
|---|---|---|---|
| Factor | Trade-off | Pecking order | Agency cost |
| *Firm Size* | + | - | |
| *CVA* | + | - | |
| *Profitability* | + | - | + |
| *Earnings volatility (risk)* | - | - | +/- |
| *Growth Opportunities* | - | +/- | - |
| *Energy Intensity* | - | - | - |
| *Ownership-structure* | + | | |
| *Rated vs. Non-rated* | + | +/- | |
| *Low-cost vs. Service* | +/- | - | - |
| *Leasing* | + | | |

### 2.5.1 Firm size
The effect of firm size is one of the most recognized determinants in studies of capital structure behaviour. Titman and Wessel (1988) claim that firm size functions as a natural diversification mechanism of company earnings, hence reducing the probability of default. Large companies should therefore bear more debt (and pay less to debt holders) than for example smaller firms. Trade-off theory argues that there exist a positive relationship between probability of default and leverage.

Firm size may also function as proxy of transparency (asymmetric information). When you assume that large companies are subject of analysis by potential and existing investors more often than smaller companies. Hence, large firms are more

able to issue information sensitive equity than small firms. This implies that we could expect a negative relationship between firm size and debt according to pecking order, since larger firm exhibits increasing preference for equity relative to debt (Frank and Goyal 2009).

*Previous Empirical findings:*

Rajan and Zingales (1995) investigated capital structure variables in G-7 countries. (G-7 is France, Germany, Italy, Japan, United Kingdom and United States). They used book leverage as dependent variable. In their sample size is positively correlated with leverage in all countries except Germany, where it is negative. They believe that the negative relationship is caused by German bankruptcy laws that offer better protection to creditors than the rest of the world, and not by asymmetric information.

Mjos (2007) studied Norwegian companies in the period 1992-2005 and used several different measurements of leverage; the one we will focus on is interest bearing debt too total assets. In the variable for size, measured by ln total assets, they found a significant positive relationship.

Titman and Wessel (1988) studied capital structure over the period 1974 to 1982. They found that size is negatively related to long-term debt divided by book value of assets but not long-term debt divided by market value of equity.

Psillaki and Daskalakis (2009) investigated the capital structure determinants for small and medium size firms in Greek, France, Italy and Portugal. When computing leverage (dependent variable) they does not differentiate between long-term and short-term debt, where we only use long-term debt. They computed firm size by the logarithm of sales and found a positive significant relationship between size and leverage.

Gaud, Hoesli, and Bender (2005) investigated the capital structure in 106 Swiss companies that are listed in the Swiss stock exchange in the period 1991 to 2000. In their sample they found a positive correlation between size and leverage, when they computed size as the natural logarithm of sales. They concluded that this positive correlation is because size acts as an inverse proxy for the probability of bankruptcy, which is consistent with the trade-off theory. They rejected that size acts as an inverse

proxy for informational asymmetries that are suggested from pecking order theory.

Frank and Goyal (2007) studied the variation in market leverage across firms using a sample of publicly traded US firms from 1950 to 2003. They found what they call six core factors that account for more than 27 % of the variation in leverage. They found that large firms in terms of assets tend to have higher leverage.

### 2.5.2 Tangibility of assets

Tangible assets are that have a physical form (airplanes, buildings etc.). We have chosen to measure the factor by taking fixed assets-to-total assets. Tangible assets can be seen as the most secure assets that creditors can accept as security for the issued debt. It is the collateral the firm can offer to its debtors. Debtors are given the security since they can liquidate the assets in a case of bankruptcy. Tangible assets are easiest to value and liquidate compared to for example intangibles, since there are less asymmetric information and more a common revision standards for tangible assets.

A high ratio of fixed-to-total assets leaves large collateral for the debtors and should therefore indicate lower risky debt and lower interest payments. But the influence of assets-to-total assets is not unambiguous.

Jensen and Meckling (1976) argue for a positive relationship between a high-ratio of fixed-to-total assets and leverage. They use the classical shareholder versus bondholder conflict, where the stockholders are prone to overinvest. However, since tangible assets can be secured against the debt, the creditors have a higher probability to recover their debt payments. This leads to lower agency costs and lower expected costs of distress (trade-off theory). This gives an expected positive relationship between size of tangible assets and debt.

On the other side, Grossman and Hart (1982) argue for a negative relationship between tangibility of assets and leverage using agency costs and pecking order theory. Firms with lower levels of collateral (tangible assets) have higher agency costs for managers consuming excessive perquisites than firms with higher levels of collaterals. Firms with high levels of debt will be more closely monitored, and this reduces the excessive use of perquisites from managers. Since the monitoring costs in

general are higher for firms with less collateral, they might decide to have a higher level of debt for reducing the consumption of perquisites. The pecking order implies therefore a negative relationship between tangibility of assets and leverage.

***Previous empirical findings:***

Rajan and Zingales (1995) found that with cross-sectional relationship from international data that tangibility is positively correlated with leverage. But the relationship is not significant and is highly autocorrelated.

Gaud, Hoesli, and Bender (2005) measured this variable as the sum of tangible assets and inventories divided by total assets. They explained the found positive relationship between leverage and tangibility, with firms use tangible assets as collateral when issuing debt.

Frank and Goyal (2007) found that firms with more tangible assets tend to have higher leverage. This is further supported by Mjos (2007) study of Norwegian companies tangibility had a positive significant relationship with leverage.

On the other side Daskalakis and Psillaki (2008) measured asset tangibility as tangible assets divided by total assets. In their sample asset tangibility is negatively significant with leverage in all countries except Portugal.

### 2.5.3 Profitability

Profitability is a recognised determinant of capital structure decisions in firms and is essential in many of the different theories. From the trade-off theory, high profitability reduces probability of financial distress (or bankruptcy costs) and induces firms to increase debt levels because the tax-deductibility of interest payments. Hence; trade-off theory implies that there exist a positive relationship between leverage and profitability (Frank and Goyal, 2009) Agency theories expect the same positive relationship between profitability and size. Intuitively, high profitability increases the amount of funds available for managers to invest in new potential unprofitable investments. High leverage will discipline managers by forcing them to pay out more of the company's excess cash (Jensen, 1986).

Pecking order theories imply in contrast to the theories mentioned above a negative relationship between profitability and leverage. Since retained cash is the cheapest way of raising funds for new investments because of information asymmetries, high profitability increases this amount and decreases the need of issuing debt (Myers, 1984).

***Previous empirical findings:***

In Titman and Wessels (1988) empirical findings profitability are negatively related to debt for both market and book values. But they are only significant for market values and not book values of debt ratios. They suggest that increase in market value because of increasing operating income, is not completely offset by increasing debt borrowing. This is consistent with Myers pecking order theory, that firms prefer internal to external financing.

Rajan and Zingales (1995) found that profitability is negatively correlated in all countries except Germany. This is supported by Mjos (2007) that found that there is a significant negative relationship between rentability and leverage.

Daskalakis and Psillaki (2008) researched profitability by taking operating surplus and divide with total assets. Their sample shows that profitability is negatively correlated to leverage. Frank and Goyal (2007) also concluded that firms with higher profits tend to have lower leverage.

Gaud, Hoesli, and Bender (2005) also found a negative relationship between debt and profitability, where profitability was measured by the return on total assets (the ratio of EBIT to total assets). They concluded as evidence for the pecking order theory and the trade-off theory in the short run.

### 2.5.4 Risk

High uncertainty of future cash flows increase the probability of financial distress, and make potential tax savings from using debt less predicable. The need of disciplinary actions towards the firm´s managers is also unsecure because of the unknown amount of retained earnings available for unprofitable investments. Hence, trade-off theory and agency theory draw towards a negative relationship between the

level of earnings volatility and leverage. (Frank and Goyal, 2009) On the other side firms with high business risk may have lower agency cost of debt, and therefore could borrow more. Hence, we can use the agency theory to explain both positive and negative signs.

Earnings volatility can be argued to have the same negative relationship when following the pecking order theory. Intuitively, a reputation of highly volatile earnings may induce lenders to demand an additional risk premium on debt (higher cost of debt), which reduces the motivation of choosing debt when raising new capital (Baker & Martin, 2011).

***Previous empirical findings:***

Daskalakis and Psillaki (2008) computed risk as the squared deviation of each year's earnings before tax. They found that leverage is negatively correlated with risk. This is equal to the relationship found in Frank & Goyal (2007).

On the other side Kim and Sorensen (1986) used variation in EBIT as a proxy for business risk, and found it to be positive and significant. They concluded that it supported the argument that operating variance may reduce the agency cost of debt, rather than increase it.

### 2.5.5 Growth opportunities

Growth opportunities can be measured using the market-to-book ratio (M/B), the change in logarithm of total assets or the ratio of capital expenditures to assets and the percentage change in total sales. We have chosen the percentage change in total sales as a proxy of growth opportunities in our regression model since this avoids us having market value stated in both the independent and dependent variable. We will include the M/B ratio in our descriptive statics because it is intuitively easy to interpret and compare.

The pecking order in its simplest form predicts a positive relationship between growth opportunities and leverage. Since firms need to take up debt when investments exceeds retained earnings. Therefore leverage would increase when investments

exceeds retained earnings and decrease when investments is less than retained earnings.

However, using the pecking order theory with taken the future of the firm more in account. Managers would look into the future and keep a low level of debt, since they will avoid using new equity offerings to finance new investments. Equity offerings are lowest in the pecking order and could signal that the stock is overpriced. This leads to a negative relationship between growth opportunities and leverage. (Frank and Goyal, 2009)

"The trade-off theory predicts that firms predicts firms with more investments opportunities have less leverage because they have stronger incentives to avoid underinvestment and asset substitution that can arise from stockholder-bondholder agency conflicts" (Frank and Goyal, 2011, page 25). This is supported by Myers (1977) and Jensen and Meckling (1976), which argue that managers of highly levered firms have stronger incentives to engage in underinvestment and asset substitution.

***Previous empirical findings:***

Rajan and Zingales (1995) measured growth with market to book, which enters with a negative coefficient in all countries except Italy, and has a high degree of autocorrelation.

Gaud, Hoesli, and Bender (2005) found that growth firms are less levered than the non-growth firms, which they conclude is caused by that growth firms prefer equity to debt to avoid bankruptcy in accordance with pecking order theory. Gaud measured growth as the market-to-book value. Also Frank and Goyal (2007) measured growth by taking market-to-book assets ratio, where they found a negative relationship between growth and leverage.

### 2.5.6 Energy intensity

High levels of energy related cost compared other costs may increase the probability of becoming insolvent; hence, cost of debt will increase (Shivdasani & Zenner, 2005). Energy prices (here, fuel prices) have become more expensive and volatile during the period 2000-2010. This increases the importance of hedging and more fuel-efficient

airplanes. Volatile fuel costs that is a major part of the companies overall costs imply a lower degree of leverage when using the trade-off theory. This negative relationship is caused by increased probability of default and a more uncertain potential tax saving. Agency theory will induce the same relationship. Higher uncertainty of future fuel costs decreases the need of disciplinary actions because the amount of retained earnings available for unprofitable investments is unknown.

High degree of fuel costs may increase company risk, and therefore result in that debtors will demand an additional risk premium when lending funds to the company. Hence, debt becomes more expensive and managers get incentives to reduce the probability of needing to lend money. Pecking order theory argues that we would expect a negative relationship between energy intensity and leverage.

### 2.5.7 Ownership structure

Ownership structure states whether the company is a public or state owned firm. There are studies that indicate that there is a relationship between ownership concentration and capital structure. Diffield, Mahambare and Pal (2007) find a positive relationship between ownership concentration and leverage in Indonesian and Korean firms. One may intuitively argue that high ownership concentration (especially if the major owner is the government) firms are perceived to be more robust (lower probability of financial distress), and that they therefor get a lower premium when borrowing funds. There are also found a positive relationship between financial performance and ownership concentration (Gedajlovic & Shapiro, 2002), which again imply that these firms, from the trade-off theory, may have a higher potential tax benefit from increasing their debt levels. Pecking order theory would imply a lower degree of leverage because of the high level of retained earnings. (NB! High concentration ownership is not equivalent with governmentally owned companies, but do we find the same relationship?)

### 2.5.8 Debt rating

The pecking order theory predicts that firms with credit rating will use less debt and more equity, hence a negative relationship between leverage and credit rating. On the other side firms with credit rating would face a lower degree of information asymmetry and therefore use more equity and less debt. Because you will expect

firms with credit rating have easier access to the debt market and hence a higher leverage on the side. This is suggested and researched by Faulkender and Petersen (2006) and Lemmon and Zender (2010).

To support debt rating as a determining factor for leverage Kisgen (2009) have documented that firms issue significantly less debt when they are close to rating changes.

### 2.5.9 Capital structure and degree of competition

Degree of competition is one of the industry specific factors mentioned in the section above. There are conducted several tests on whether and how increasing competition affect the firms choice of capital structure. Opler and Titman (1994) suggest that highly levered firms lose market share to their less levered rivals during industry downturns for several reasons. First, distressed firms that face underinvestment problems (debt overhang) are forced to sell off assets and reduce their selling efforts. Second, highly levered firms have difficulty retaining and attracting customers who are concerned abut long-term viability and product quality of product. Third, rival competitors can consider highly levered firms as a vulnerable competitor and seize the opportunity to steal customers.

Low-levered firms, assumed to have deep pockets, can engage in predatory practices especially in a highly competitive environment designed to financially exhaust highly levered rivals and drive them out of the market. A highly levered firm might be vulnerable to predation from low-levered competitors because low-levered competitors can purposefully reduce their prices and keep this strategy for a long time to drive the highly levered firm out of business. The highly levered firm may not survive this kind of competitive behaviour if it can no longer secure financing for its operating or investment costs. (Baker & Martin, 2011)

High level of competition can replace debt as a managerial disciplinary mechanism, thereby inducing more efficient behaviour.

The airline industry has internationally experienced a shift in the degree of competition. From being an initially regulated industry, it as now become deregulated

and much more competitive. The deregulation has introduced new low-cost players into the market. We expect that low-cost firms (which compete on prices) bear less debt than airline companies that follow the full-service business model.


### 2.5.10 Leasing

"A lease is a contract that allows the lessor to retain ownership of an asset and that the lessee to enjoy the services of the asset over a stipulated time period in return for stipulated rental payments to the lessor" (Baker and Martin, 2011 page 387).

In a lease the lessor takes the risks and returns from the ownership of the asset while the lessee takes the risks and returns from the use of the asset. The primary element of risk in ownership comes from the risk of default by the lessee, and the liquidation value plays an important role if default. These are two of the main elements in the cost of leasing.

Financial Accounting Standards Board distinguishes between two type of leases based on the lease terms and the classification determines the accounting treatment of the lease:

- *Operational lease*: The entire lease payments are reported as operating expense, but are not reported as asset or the lease payments as liability in the balance sheet.
- *Capital lease*: Listed as acquired asset and the future lease payments as liability on the balance sheet. The interest payments are deducted as an interest expense.

The different accounting type of lease will affect the firm's balance sheet as well as the debt-equity ratio.

PV (Lease payments) = Purchase Price – PV (Residual Value)

In a perfect market, the cost of leasing is equivalent to the cost of purchasing and reselling the asset. Residual value is the assets market value at the end of the lease.

Assuming that the loan is fairly priced, the loan payments would be
PV (loan Payments) = Purchase Price

Considering residual value, the Law of One Price and the total cost of purchasing either the loan or the lease is the same we get

PV (Lease Payments) + PV (Residual Value) = PV (Loan Payments)

In a perfect market the cost of leasing and then purchasing the asset is equivalent to the cost of borrowing to purchase the asset. Leasing is just another zero-NPV financing alternative for firms in a perfect capital market.

To compare the decision to lease versus borrowing, you must determine the amount of loan that leads to same level of fixed obligations that the firm would have with the lease. This is called the lease-equivalent loan. The lease-equivalent loan is the loan that is required on the purchased asset that leaves the purchaser with the same obligations, as the lessee would have. Then you are avoiding too ignore the important point that the lease obligation could trigger financial distress. Hence the firm is effectively adding leverage to its capital structure, even though it is not stated on the balance sheet (operational lease). (Berk & DeMarzo 2007)

### *Previous empirical findings:*

Gavazza (2011) examined the commercial aircraft leasing market with the intuition that more liquid assets decrease the cost of external financing, this making leasing more attractive. This is caused by that more liquid assets are more redeploy able and less specific, which you find in aircrafts. Since more than half of the commercial aircrafts are leased and there exists an active secondary market, which as mentioned makes aircrafts liquid assets. One of Gavazza's findings was that more liquid the aircraft was the more likely to be leased, and to be an operational lease.

The second market plays an allocative role since airlines trade aircrafts to adjust their productive capacity. When there is a positive demand shock affecting profitability airlines expand and acquire aircrafts, and conversely negative shock they sell aircrafts. This way leasing helps to efficiently locate the capital goods. Leasing allows also carriers to transfer some risk to the operating lessors. The lessors are assumed to take the aircraft ownership risk through their economies of scale, knowledge, diversification of aircrafts and geographic regions.

Gavazza (2010) found that high-volatility airlines lease and low-volatility airlines own aircrafts. This is caused by high-volatility airlines expect to adjust their capacity more frequently and therefore value leasing more than low-volatility airlines. His

empirical analysis shows that leased aircrafts are parked inactive less frequently than owned aircrafts, and when under the condition of being used leased aircrafts have a higher capacity utilization than the owned aircrafts.


### 2.5.11 Capital structure and industry effects

Firm specific and industry characteristics are thought to have important implications on the choice of capital structure. Industry characteristics may consist of for example the competitive nature of the industry, level of technology and need of continuing innovation (tech industries), barriers of entry, excess to close substitutes, regulations etc. Industry characteristics are tested in several different empirical studies. Sanyal and Mann (2010) find that the financial structure of non-high-tech and high-tech start up companies differ significantly. Rotemberg and Scharfstein (1990) show how companies alter their capital structure in order to gain a better competitive position in the product market. Since the airline industry has strong characteristics, and these characteristics are shown to have significantly effects on capital structure. We expect to find our estimated coefficients to differ from the ones obtained in similar empirical tests conducted on other industries.

**Table 3: Summary of previous empirical finding**

| Factor | Previuos empirical studies | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *Rajan and Zingales* | *Mjos* | *Titman and Wessel* | *Psillaki and Daskalakis* | *Gaud, Hoesli, and Bender* | *Frank and Goyal* | *Oftedal and Sorhus* | *Kim and Sorensen* |
| *Firm Size* | + | + | - | + | + | + | + | |
| *CVA* | + | + | | - | + | + | + | |
| *Profitability* | - | | - | - | - | - | - | |
| *Financial Stregth (Risk)* | | | | - | | - | - | |
| *Growth Opportunities* | - | | | - | - | - | - | + |

# 3. Methodology and empirical data

## 3.1 Data sample

The collected data sample is the foundation of our study and we have therefore assigned a brief discussion about how we found the data and how we choose which companies to include.

To collect data for this thesis we have used the companies' annual reports, the three major rating agency's web pages and the database Datastream. We have chosen Datastream since it consists of comprehensive time series data that have both the depth and range to give us all the information needed to perform our planned analysis. Datastream could give us data from a span of 50 years from 175 countries and 60 global markets. The school have this program installed on some of their computers and we used the excel application to create a spreadsheet for later input in STATA.

Financial information as EBIT, Sales, etc. was found searching the companies' annual reports. These reports are found online, either as a link in the companies' official web page, or in sites that are specialized in publishing annual reports. Market values of equity are collected using the Datastream application, while credit ratings are found by searching in the three major rating agencies' web pages. Information about ownership structure and strategy (low-cost vs. service) are found in the annual reports.

Our sample's company information is collected for the time span 2000 to 2010. For different reasons we have not been able to fully gather all company information in this time period. Possible explanations may be the presence of bankruptcies, mergers etc. happening between 2000 and 2010. This thesis is about which (if any) of our chosen explanatory variables that can be proven significantly to affect airline companies leverage. We believe that a ten-year period gives us a large enough span to produce an acceptable picture of our chosen companies' economic fluctuations. Over the ten-year periods both the economy and the airline industry have had their ups- and downturns. Examples of downturns are the 11.09 happening, the SARS virus (BBC News, 2003) and the economic crisis. An up turn may be the pre-financial crisis years.

We have included all medium to large airline companies (mainly those that are a part of one of the large alliances) that have had their financial reports available online. There are large companies that could not be included, because of the lack of information (Examples are Qatar airways and other airlines from the middle east). Very small companies are not included since we mainly focus on companies that are traded in an exchange. Some airlines are governmentally owned and there are no available data on their market value. This would especially affect the leverage to market model (Model 2), since market values are a part of the dependent variables.

### 3.1.1 Criticism of data sample

Our sample size of 39 airlines could be argued to be small, especially with the lack of some variables for some airlines. This could make the result of our analysis less robust and we will therefore be careful when concluding. Hence, demanding a high level of significance, at least 5 per cent, when testing our estimated coefficients.

The sample consists of airlines from 25 different countries, where US is most frequently represented with nine different airlines. The different countries and time period of ten years could create an accounting problem, since accounting practice and standards may be different from year to year and between countries. This can be a potential problem when conducting the analysis, because we may experience using variables that do not contain the same information. We have tried to normalize the data by looking in the notes of the annual reports and then put data together into our chosen variables, thereby making them contain equal information. One variable that are more subjective and would need an extra explanation and discussion is interest-bearing debt. We have chosen to use interest bearing long-term debt, short-term part of long-term interest bearing debt, short-term financial leases and long-term financial leases. By doing these correcting measures, we believe to minimize the potential negative effects of difference in accounting etc.

We have tried to focus on airlines that could give us data from the whole period 2000 to 2010. This could result in a survival bias, since airlines that went bankrupt, merged or was acquisitioned would be avoided. The airline industry has frequently been a subject of mergers and acquisitions during the last decade, and we cannot leave out all the affected companies. Companies that have gone bankrupt have not been included.

Since we have not included airlines that have gone bankrupt over the period it is possible that we have an underestimation of the debt ratio in our dataset. Assumed that the companies that have gone bankrupt would in average have a higher debt ratio than the survivors. This problem is not easy to solve. On possibility is to include the companies that have been delisted because of bankruptcy. These companies may be difficult to include because of the lack of information. Their balance sheets may be private, and we would have to reconstruct the data from old financial statements. By doing this we may raise the possibility of diminishing the reliability of our research because of potential faults in the data. As a consequence, we choose not to include these "problem" companies in our sample.

Airlines with a negative book value of equity have been changed to zero. Their negative book value of equity indicates that the airline is kept in business from extraneous reasons, like for example bankruptcy protection.

The conclusion is that there will be some problems with our data sample that we are unable to handle. We will therefore have this in mind when performing our analysis.

## 3.2 Econometric analysis theory

Econometrics is based upon the development of statistical methods for estimating economic relationships, testing economic theories, and evaluating and implementing government and business policies (Wooldridge, 2009). We will use econometrics to analyse our data. Before conducting the analysis we want to present a rough summary of the econometric methods that we are planning to use, their limitations, and their critical assumptions.

### 3.2.1 Regular Ordinary Least Squared (OLS)

A common way of conducting econometric analysis is by using the OLS method. The method estimates model coefficients that minimize the squared sum of residuals (the error term). In order for the OLS estimates to be BLUE (best linear unbiased estimator) the Gauss Markov assumptions (1-5) has to be valid. Assumption 6 is very strong, and we may still use the information from the regression even if the normality assumption is invalid. Given a large sample size, the assumptions 1-5 will produce

asymptotic results. The Gauss Markov assumptions and normality assumption are stated briefly beneath:

*ASSUMPTIONS:*

1) Linear in parameters:

2) Random sampling

3) No perfect collinearity

4) Zero conditional mean

5) Homoscedasticity

6) Normality

Further information etc. about the diff. assumptions is found in the attachments 7.1.

### 3.2.1.1 Dummy-variables

In order to control for different qualitative information we introduce dummy variables. Dummy variables are given either the value 1 or 0 depending the chosen definition. By using dummy variables we are able to study how qualitative data affect the model interception or the estimated coefficients.

### 3.2.2 Panel Data

When conducting an econometric analysis on panel data we measure the same units in at least two periods. Hence, we are able to study the sample in two diff. dimensions:

- A cross sectional dimension N
- A time – series dimension T

The advantages by using panel data are that we are able to increase our sample size, reduce potential multicollinearity problems, build dynamic models, and control for unobservable effects better than when using cross section or time series individually. The reduction of multicollinearity is a potential result from that there are variation between cross-sections and time, which then imply that that the eventual high degree of correlation between two or more independent variables in a cross sectional model is decreasing when using panel data.

A panel data OLS regression model is given by: $y_{it} = \beta_0 + \beta_{1it}x_{1it} + \cdots + \beta_{itk}x_{itk} + v_{it}, with\ v_{it} = (a_i + u_{it})$ where $v_{it}$ is called the composite error and contain a factor $a_i$which pick up all unobserved individual specific effects that are constant over time, and the regular residuals $u_{it}$ which now vary through time.

When using panel data there are, as with regular cross sectional data analysis, some assumptions that must be valid for the estimated coefficients to be of any interest. In our analysis we focus on two diff. methods. The assumptions of each method are mentioned in the attachments (7.2 or 7.3)

When using fixed effects (FE), the goal is to eliminate the unobservable factor $a_i$ because it is perceived correlated with one or more of $x_{itj}$. If $Cov(x_{it}, a_i) > 0$, pooled OLS (i.e. ignoring the specific term) will provide a biased estimates of $\beta_{itj}$. Hence, the results are not BLUE and have no/little explanatory power. Lets assume that $a_i$ is in fact uncorrelated with each explanatory variable in each period. Then, using transformation to eliminate $a_i$ results in inefficient estimators since we loose a lot of information when removing $a_i$. When $Corr(a_i, x_{itj}) = 0$ and all the methods assumptions hold, it is more efficient to use the random effects (RE) analysis.

**FE or RE?**
Because FE allow $Cov(x_{it}, a_i) > 0$, while RE need $Cov(x_{it}, a_i) = 0$, FE is widely thought to be a more convincing tool for estimation of ceteris paribus effects. If key explanatory variables are constant through time (like for example dummy variables), we cannot use FE to estimate this effect. If key explanatory variables are non-constant, we still prefer to us RE as long as $Cov(x_{it}, a_i) = 0$.

Overall we can conclude that if:
- $a_i = 0 \rightarrow$ OLS is perfered
- $a_i \neq 0\ and\ Cov(a_i, x_{itj}) = 0 \rightarrow$ RE is preferred
- $a_i \neq 0\ and\ Cov(a_i, x_{itj}) \neq 0 \rightarrow$ FE is preferred

We will conduct both FE and RE in our underlying econometric analysis. We will then conduct a Hausman test in order to choose which of the methods to favour when presenting our results. The basic idea behind the Hausman test is to use RE estimates

unless the test reject $H_0$. We will fail to reject when RE estimated $\approx$ FE estimates, or if $\sigma_u^2$ is large.

## 3.3 The regression model

We are mainly using three different regression methods. As mentioned above, OLS is the preferred test to perform regression model when the corresponding assumptions are valid, hence, the coefficients are BLUE and consistent. The model can be written as:

**Equation 5: The regression model**

$$y_{ti} = \beta_0 + \beta_{size}size_{ti} + \beta_{profit}profit_{ti} + \beta_{growth}growth_{ti} + \beta_{cva}cva_{ti} + \beta_{fuel}fuel_{ti} + \beta_{lease}leaseing_{ti} + \beta_{financial\ strength}financial\ strength_{ti} + \delta_{lowcost}lowcost_{ti} + \delta_{private}private_{ti} + \beta_{rated}rated_{ti} + u$$

$$where\ y = marketleverage\ or\ bookleverage, i = company, t = year$$

If the OLS assumptions four and five are non-valid, we would choose to use a FE or RE regression method depending on the Hausman test and whether the assumptions mentioned in attachment 7.2 and 7.3 are valid.

We are going to operate with two different models. Model 1 is given by the usage of a dependent variable of book-leverage, while Model 2 uses market-leverage as dependent variable. The two models have different benefits. Model 1 is based on accounting-based historic values, while Model 2's explanatory variable is based on the expectations of future cash flows. In other words we can argue that Model 1 is backward looking, while Model 2 is forward looking. We cannot say that one of the explanatory variables is better than the other, and both have been used in empirical studies concerning the "what determines a company´s capital structure" problematic. Since we believe that there may be obtained interesting findings by using both models, this thesis will contain both of them.

## 3.4 Definition of variables

We are in this part of the assignment going to clearly define the variables that we are going to use in our econometric analysis.

### 3.4.1 Dependent variables

**Book-leverage**

This variable is defined as:

$$bookleverage_t = \left( Int.\,bear.\,debt_t \middle/ Int.\,bear.\,debt_t + BVeq_t \right)$$

The variable $Interest\ bearing\ debt_t$ is equal to the one argued for in the paragraph above. It may be important to mention that we have defined long-term financial leases and short-term part of financial leases as interest bearing. Hence, they are included in the independent variable in both Model 1 and 2. $BVeq_t$ represents the value of equity found from the representative company's accounting.

**Market-leverage**

This variable is defined as:

$$marketleverage_t = \left( Int.\,bear.\,debt_t \middle/ Int.\,bear.\,debt_t + MVeq_t \right)$$

The variable $Interest\ bearing\ debt_t$ is given by finding total liabilities for the representative company and subtracting the corresponding accounts payables, accounts receivables and other non-interest bearing debt. The reason behind removing these non-interest bearing accounting records is that they no longer may disrupt the "real" financial leverage, which is in line with the argumentation found in Rajan & Zingales (1995). $MVeq_t$ represent the market value of the company's equity.

### 3.4.2 Independent variables

**Profit**

This variable is defined as:

$$profit_t = EBIT_t \middle/ Total\ Sales_t$$

The profit variable is meant to measure the overall profitability of the given company. From different studies we find that there are many different methods to calculate this variable. We have chosen to define this variable as (earnings before interest and taxes) EBIT's part of total sales, which is equal to what is done in for example Frank and Goyal (2009).

**Collateralize value of assets (CVA)**

This variable is defined as:

$$cva_t = {PPE_t}/{Total\ Assets_t}$$

CVA (a proxy of the firm's tangibility of assets) is meant to measure the availability of the company's assets. This variable is motivated by the argument that a company's composition of assets may affect the financial leverage. It is important to mention that we use net values of property plant and equipment (PPE) where accumulated depreciation is subtracted from the acquisition value. Equal variable definition is found in Rajan et.al (1995), Frank et.al (2009). Titman and Wessels (1988) focus on the size of intangible assets compared to total assets, which is the opposite of what we are doing.

**Size**

This variable is defined as:

$$Size_t = Ln(Total\ Sales_t)$$

Size is meant to illustrate the magnitude of the representative company's operations. This method of using ln of sales when calculating size is used in several other studies Frank et.al (2009), Rajan et al. (1995) and Titman & Wessels (1988).

**Growth**

This variable is defined as:

$$growth_t = \left( {Total\ Sales_t} \big/ {Total\ Sales_{t-1}} \right) - 1$$

The growth variable is found by calculating the percentage change in the company's total sales. This way of defining growth can also be found in Frydenberg (2004). Another popular method to define this variable is to use the market-to-book relationship (also known as Tobin's Q). We chose not to use Tobin's Q as proxy of growth because we are uncertain which possible effects it will have on our regression to have the same data as a part of both an dependent variable and independent variable. We will use Tobin's Q in the descriptive statistic analysis because it is easier to interpret and compare.

**Fuel**

This variable is defined as:

$$fuel_t = {Jetfuel_t} \big/ {Total\ Sales_t}$$

The fuel variable is meant to be a proxy of energy intensity. The jet fuel cost is found either in the general income statement or in the notes of operational expense. A possible pit fall with this variable definition is that successful hedging (and/or speculation) etc. may reduce the jet fuel cost and give us a more frail picture of the companies actual jet fuel consumption. On the other hand, we assume that none of the companies are better to hedge/speculate in price shifts and that the variable on average produces a good proxy of the companies' energy demand. There are no studies as we know of that have used this variable definition.

**Leasing**

This variable is defined as:

$$leasing_t = {Operational\ Leasing\ Expence_t} \big/ {Total\ sales_t}$$

Leasing is meant to give us a picture of the representative company's leasing policies. We focus on operational leasing costs because this is a way of leveraging the company without stating it in the accounted liabilities. There are no studies as we know of that have used this variable definition.

**Financial Strength**

This variable is defined as:

$$financial\ strength_{it} = \left(Return_{ti} - \frac{\sum_{t=1}^{T} Return_{\bar{t}}}{n}\right)^2 \left(* (-1)\ if\ \left(Return_t - \frac{\sum_{t=1}^{T} Return_{\bar{t}}}{n}\right) < 0\right),$$

$$Where\ Return_t = \frac{EBIT_t}{Total\ Assets_t}$$

The financial strength variable is meant to be a proxy of risk and is calculated by taking the square of the return of the company when the average return obtained by the whole sample for the studied time period is subtracted. This is also controlled for negative values. Its purpose is to represent the risk accompanying to the company's earnings and the company's bankruptcy costs. When a company produces a return below the average return, obtained from all companies during the whole sample period, we perceive it to be more risky than companies with positive financial strength variables. The variable uses EBIT/Total sales as a measure of obtained return. Similar variable definitions is also use by Booth et al. (2001) and Frydenberg (2004)

**Low-cost**

This dummy variable is defined as:

$$lowcost_t = 1\ if\ lowcost\ strategy, else\ lowcost_t = 0$$

We have added this binary variable in order to get qualitative information on whether there is a difference in the capital structure of companies that follow a low-cost or service business strategy. We found information on the companies strategy in their annual reports.

**Rated**

This dummy variable is defined as:

$$rated_t = 1 \ if \ the \ company \ is \ rated, else \ rated_t = 0$$

The binary variable Rated was created in order to acquire qualitative information on whether there is a difference in the capital structure of companies that are rated or non-rated by one of the three major rating agencies. This variable is meant to be a proxy of the company's transparency.

**Private**

This variable is defined as:

$$private_t = 1 \ if \ more \ than \ 50\% \ of \ the \ company \ is \ owner \ by \ non$$
$$- \ governmental \ institutions \ (or \ people), else \ private_t = 0$$

This binary variable was made in order to be able to test whether there are differences between highly governmental owned and private companies when looking at their capital structure.

## 3.5 Hypothesis

Based on the theories mentioned in part 2 of our assignment and their implications on company´s financial leverage, we formulate three different hypotheses for the airline companies in our sample. The first hypothesis is formulated for the trade-off theory. The second hypothesis is for pecking order theory, while hypothesis three is for the agency theory. We will use the hypothesis to test whether one of the different theories are more relevant for the airline industry than the others. $H_i$ is the alternative hypothesis while $H_0$ is the null hypothesis. We will reject $H_0$ based on the estimated coefficients' 95 per cent confidence interval.

**Hypothesis 1 – Trade-Off Theory**

*H1.1 - CVA*

　　*$H_i$: There is a positive relationship between leverage and CVA*

*H₀: There is a negative/no relationship between leverage and CVA*

*H1.2 - Size*

    *H$_i$: There is a positive relationship between leverage and size*

    *H$_0$: There is a negative/no relationship between leverage and size*

*H1.3 - Profit*

    *H$_i$: There is a positive relationship between leverage and profit*

    *H$_0$: There is a negative/no relationship between leverage and profit*

*H1.4 – Financial strength*

    *H$_i$: There is a negative relationship between leverage and the risk proxy*

    *H$_0$: There is a positive/no relationship between leverage and the risk proxy*

*H1.5 - Growth*

    *H$_i$: There is a negative relationship between leverage and growth*

    *H$_0$: There is a positive/no relationship between leverage and growth*

**Hypothesis 2 – Pecking Order Theory**

*H2.1 - CVA*

    *H$_i$: There is a negative relationship between leverage and CVA*

    *H$_0$: There is a positive/no relationship between leverage and CVA*

*H2.2 - Size*

    *H$_i$: There is a negative relationship between leverage and size*

    *H$_0$: There is a positive/no relationship between leverage and size*

*H2.3 - Profitability*

    *H$_i$: There is a negative relationship between leverage and profitability*

    *H$_0$: There is a positive/no relationship between leverage and profitability*

*H2.4 – Financial strength*

    *H$_i$: There is a negative relationship between leverage and the risk proxy*

    *H$_0$: There is a positive/no relationship between leverage and the risk proxy*

*H2.5 - Growth*

    *H$_i$: There is a relationship between leverage and growth*

    *H$_0$: There is no relationship between leverage and growth*

**Hypothesis 3 – Agency Theory**

*H3.1 - Profitability*

    *H$_i$: There is a positive relationship between leverage and profitability*

    *H$_0$: There is a negative/no relationship between leverage and profitability*

*H3.2 – Financial strength*

   *H$_i$: There is a relationship between leverage and the risk proxy*

   *H$_0$: There is no relationship between leverage and the risk proxy*

*H3.3 - Growth*

   *H$_i$: There is a negative relationship between leverage and growth*

   *H$_0$: There is a positive/no relationship between leverage and growth*

**Table 4: Summary of alternative hypothesis**

|  | Theories | | |
|---|---|---|---|
| **Factor** | **Trade-off** | **Pecking order** | **Agency cost** |
| *Firm Size* | + | - | |
| *CVA* | + | - | |
| *Profitability* | + | - | + |
| *Financial Strength (risk proxy)* | - | - | +/- |
| *Growth Opportunities* | - | +/- | - |

# 4. Analysis and results

This section first describes the statistics concerning our data sample and later shows the analytical results from our econometric testing.

## 4.1 Descriptive statistics

Our data sample consists of 39 airline companies from different parts of the world. Annual report information is collected for the time period 1999(2000)-2010. The following table 4 demonstrates a summary of the descriptive statistics for variables and important factors in our analysis. Table 4 include variable mean, standard deviation and minimum/maximum values.

**Table 5: Descriptive statistics**

| Variable | Mean | Std. Dev. | Min | Max | # Observations |
|---|---|---|---|---|---|
| bookleverage | .548453 | .2421684 | 0 | 1 | 336 |
| marketleverage | .4816494 | .2418083 | 0 | .9696208 | 281 |
| debt | 2942.253 | 3413.325 | 0 | 17198 | 336 |
| profit | .0538167 | .128189 | -.4949507 | .952381 | 358 |
| cva | .5706763 | .1671552 | .0546149 | .9074107 | 341 |
| size | 8.03139 | 1.385772 | 3.091043 | 10.5007 | 358 |
| market-to-book | 1.792615 | 3.34475 | -39.05 | 19.94416 | 318 |
| fuel | .2273109 | .0857857 | .0174567 | .4868652 | 328 |
| leasing | .0666439 | .0519218 | 0 | .3301663 | 339 |
| totalassets | 8263.035 | 9238.904 | 6 | 45114.3 | 349 |
| private1govern0 | .4977169 | .5005665 | 0 | 1 | 438 |
| lowcost1service0 | .537037 | .6406159 | 0 | 2 | 324 |
| rated1non-rated | .3114754 | .4636398 | 0 | 1 | 427 |
| risk | .0137014 | .1989898 | -.2777906 | 3.495543 | 349 |

### 4.1.1 Book-leverage

Our sample has a book-leverage mean of 0.548, which imply that the average airline company's total assets are financed by 54.8 per cent debt. The high standard deviation and gap between minimum and maximum values indicate large variations. Frank and Goyal (2009) got average long-term debt to total assets of 20%, which indicates that companies in our sample on average use significantly more leverage than the average US non-financial company in the period 1950 – 2003.

### 4.1.2 Market-leverage

Market-leverage is our forward-looking dependent variable for Model 2. In our sample the average market-leverage is 0,482, which imply that the average airline debt is 48.2% of their market value. With standard deviation of 0.24 and maximum 0.97 and minimum of 0, indicates large variations in our sample. In comparison Frank and Goyal (2009) got an average market-leverage of 0.2 that is considerably lower.

### 4.1.3 Profit

The profit airline industry mean of 5.38% is high compared to the one´s found by Frank and Goyal (2009) (2%, but they use EBITDA/Sales) and Oftedal and Sorhus (2011) (-1%). The negative value obtained from Oftedal and Sorhus`s (2011) reference sample is argued in their thesis to be explained by the negative effects of the financial crisis. Hence, this may imply that the average airline company handled the negative effects of the financial crisis better than the general company.

Another factor that may explain the difference between the profit ratios obtained in our sample and the one found by Oftedal and Sorhus (2011) is that we have chosen large well-known companies while their reference sample consist of large, medium and small companies. They mention that many of the small companies had large negative EBIT values during the period 2008-2009, while our sample may be affected by a degree of survival bias. This draws us to the possibility that our estimated profitability is artificially high.

### 4.1.4 CVA

CVA ranges form zero to one and our sample produce a value of 0.57, which indicates that on average 57 per cent of the airline´s assets are tangible. Compared to Frank and Goyal (2009) sample of US listed non-financial firms from the period 1950-2003, which produce a ratio of 0.34 our result support the statement that the airline industry is generally more capital-intensive than the average company. Oftedal and Sorhus (2011) got a value of 0.513 on their reference sample (including listed companies from several different countries in the period 2006-2009), which also supports the statement of high capital intensity in the airline industry.

### 4.1.5 Size

Size is constructed as the logarithm of sales, hence the mean, maximum and minimum have little to none economical interpretation. A standard deviation of 1.386 and a maximum of 10.5 and minimum of 3.09 indicate large differences in size between the airlines in our samples.

### 4.1.6 Fuel

The fuel variable ranges from zero to one and produce a mean of 0.223 that indicates that fuel on average occupy 22.3% of the company´s total sales. Our variable ranges from 2% to 49% and have a standard deviation on approximately 9%. This illustrates the importance of fuel hedging and low-fuel consuming aircrafts etc. since fuel-price fluctuations may produce strong competitive disadvantages/advantages.

### 4.1.7 Growth

We choose to use Tobin's Q when doing the descriptive analysis of our samples growth prospects because it is easier to compare with other studies. Our sample

produced an average market-to-book ration of 1.8, which indicates that the market expects future growth in the industry despite the increasing difficulties that the industry has experienced in the last ten years. Frank and Goyal (2009) and Oftedal and Sorhus (2011) got similar values (1.78 and 1.59) in their US- and reference sample. This indicates that the airline industry on average is given the same growth prospects from the market as the general company.

### 4.1.8 Leasing
The leasing variable has a mean of 0.067 and is computed by dividing leasing costs by sales. This indicates that 6.7% of the average airline sales go to paying for leasing. The variable ranges from max 0.33 and 0 at the lowest. This is natural because some airlines own all their tangible assets, while others depend on leasing aircrafts and etc.

### 4.1.9 Financial Strength (risk proxy)
The risk proxy variable has a mean of 1.37 % with a standard deviation of 19.89%. The max and min values are 350 % and -30 %. Since the standard deviation is relatively small compared to the max and min levels, this may indicate that there are some extreme observations in our sample that influence the estimated econometric results.

### 4.1.10 Collinearity matrix
Multicollinearity refers to the state where there is positive/negative correlation between independent variables in a multiple regression model. (Wooldridge, 2009) When variables are highly correlated they express basically the same information. Statistically we do not want multicollinearity because if it exist, then independent variables are unnecessary and do not add any predictive value over each other. Generally, it is difficult to find variables that are not correlated with each other and as we can see from table 5 correlations between explanatory variables is also present in our sample. The highest correlation in our data sample is between risk and profit (0.6761). We will not omit any variable because of collinearity. For further information about effects etc. of presence of multicollinearity and is possible effect on our analysis, see attachment 7.4.1.

**Table 6: Collinearity matrix**

| | Correlation matrix | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| size | 1.0000 | | | | | | | | | | |
| profit | -0.2423 | 1.0000 | | | | | | | | | |
| growth | -0.2148 | 0.2744 | 1.0000 | | | | | | | | |
| cva | 0.1561 | 0.1495 | -0.1130 | 1.0000 | | | | | | | |
| fuel | -0.1046 | -0.1702 | 0.1172 | 0.0879 | 1.0000 | | | | | | |
| leasing | -0.3818 | -0.3083 | 0.0436 | -0.2733 | 0.1517 | 1.0000 | | | | | |
| stockreturn | -0.0427 | 0.0002 | 0.1649 | -0.0225 | 0.0315 | 0.0221 | 1.0000 | | | | |
| private1gov | -0.0587 | 0.2832 | 0.0491 | -0.0443 | -0.1743 | -0.2586 | -0.0131 | 1.0000 | | | |
| lowcost1se | 0.1065 | 0.1730 | 0.0678 | 0.0030 | -0.0370 | -0.3442 | 0.0421 | 0.4479 | 1.0000 | | |
| rated1nonr | 0.2176 | -0.1836 | -0.2352 | -0.0031 | -0.0822 | -0.0444 | -0.0474 | -0.0002 | -0.0366 | 1.0000 | |
| Financal Strength | -0.1258 | 0.6761 | 0.1444 | 0.0544 | -0.2097 | -0.2651 | -0.0166 | 0.2375 | 0.1394 | -0.1086 | 1.0000 |

## 4.2 Analysis

### 4.2.1 Pooled OLS

To test our hypothesis we started by conducting a pooled OLS regression. The estimated results obtained from the different models are cited in the table 7 below. We have applied robust standard errors to avoid a potential problem of biased t-statistics and p-values (homoscedasticity), which may be the case with regular OLS standard errors. We have applied this feature in all the forthcoming regressions.

| | Pooled OLS | |
|---|---|---|
| **Variables** | **Model 1 (Book)** | **Model 2 (Market)** |
| *growth* | 0.0660 | 0.0303 |
| | (1.93) | (1.10) |
| *profit* | -0.362 | -0.886* |
| | (-1.40) | (-2.42) |
| *cva* | 0.537*** | 0.469*** |
| | (5.85) | (4.35) |
| *size* | 0.0343** | 0.0208 |
| | (2.98) | (1.46) |
| *fuel* | 0.0110 | -0.285 |
| | (0.06) | (-1.56) |
| *leasing* | 1.458*** | 1.103* |
| | (3.56) | (2.23) |
| *privat* | 0.0409 | 0.0245 |
| | (1.52) | (0.74) |
| *lowcost* | -0.0597 | -0.0744 |
| | (-1.91) | (-1.75) |
| *rated* | -0.00779 | -0.00210 |
| | (-0.26) | (-0.07) |
| *financial strength* | 1.291 | 2.327 |
| | (1.00) | (0.64) |
| *Constant* | -0.133 | 0.0958 |
| | (-1.01) | (0.59) |
| *Observations* | 282 | 240 |
| *R-squared* | 0.182 | 0.216 |
| *Adjusted R-squared* | 0.152 | 0.181 |
| *F* | 9.711 | 9.562 |
| * p<0.05, ** p<0.01, *** p<0.001 | | |

R-squared represents the proportion of the total sample variation on the dependent variable that us explained by the independent variables (Wooldridge, 2009). R-squared ranges from 0 to 1 where 1 are obtained if the model explains 100% of the sample variation. Hence, it is preferable that the model obtain a high R-squared. Adjusted R-squared control for the number of explanatory variables. As we can see, from table 6, book-leverage and market-leverage model have adjusted R-squared on respectively 15.2 % and 18.1 % .The models produce F-values of 9.711 and 9.562 which imply that the overall model is satisfied (significant explanatory power).

### 4.2.2 Discussion of results

Difference between Model 1 (book) and Model 2 (market): the magnitude of the coefficients in Model 2 is often smaller than the ones obtained from Model 1. A possible explanation may be that for example an increasing profitability will increase market value more than it affects the book value of equity, and therefore the effect on leverage becomes smaller in the situation where market value of equity is in the denominator. All coefficient interpretation is ceteris paribus (all other variables are kept constant).

#### 4.2.2.1 Profit

*Model 1: Book-leverage*

We obtained a negative relationship between profit and book-leverage. When the EBIT-sales ratio increases with 1 percentage point, book-leverage decreases by approx. 0.36 percentage points. The coefficient has a t-value of -1.40 and is not significantly different from zero on a 5, 1 or 0.1 % level.

*Model 2: Market-leverage*

We obtained a negative relationship between profit and market-leverage. When the EBIT-sales ratio increases with 1 percentage point, market-leverage decreases by approx. 0.886 percentage points. Economically this strong positive relationship is supported by the pecking order theory. Pecking order theory argues that increasing profitability increases the retained earnings available for investments. Since retained earnings are the cheapest way of funding new investments, high profitability implies less need of debt and lower degree of leverage. The coefficient has a t-value of -2.42 and is significantly different from zero on a 5 % level.

#### 4.2.2.2 Size

*Model 1: Book-leverage*

We obtained a positive relationship between size and book-leverage. When size increases with 1 per cent, book-leverage increases by approx. 0.0003 percentage points. Economically this positive relationship is supported by the trade-off theory. Trade-off theory argues that increasing firm size will decrease the risk of default. This will induce firms to increase their debt tax shields because of the low bankruptcy costs. The coefficient has a t-value of 2.98 and is significantly different from zero on a 1 % level.

*Model 2: Market-leverage*

We obtained a positive relationship between size and market-leverage. When size increases with 1 per cent, book-leverage increases by approx. 0.0002 percentage points. The coefficient has a t-value of 1.46 and is not significantly different from zero on a 5, 1 or 0.1 % level.

### 4.2.2.3 CVA
*Model 1: Book-leverage*

We obtained a positive relationship between CVA and book-leverage. When the tangible to total assets ratio increases with 1 percentage point, book-leverage increases by approx. 0.54 percentage points. Economically this strong positive relationship is supported by both the agency and trade-off theory. Trade-off theory argues that increasing CVA decreases the risk of default because of the high degree of collateral obtained from having a lot of fixed assets. This induces firms to increase their debt tax shields. The coefficient has a t-value of 5.85 and is significantly different from zero on a 0.1 % level.

*Model 2: Market-leverage*

We obtained a positive relationship between CVA and market-leverage. When the tangible to total assets ratio increases with 1 percentage point, market-leverage increases by approx. 0.47 percentage points. Economically this strong positive relationship is, as mentioned above, supported by both the agency and trade-off theory. The coefficient has a t-value of 4.35 and is significantly different from zero on a 0.1 % level.

### 4.2.2.4 Growth
*Model 1: Book-leverage*

We obtained a positive relationship between growth and book-leverage. When the growth rate of total sales increases with 1 percentage point, book-leverage increases by approx. 0.07 percentage points. The coefficient has a t-value of 1.93 and is not significantly different from zero on a 5% level.

*Model 2: Market-leverage*

We obtained a positive relationship between growth and market-leverage. When the growth rate increases with 1 percentage point, market-leverage increases by approx. 0.03 percentage points. The coefficient has a t-value of 1.1 and is not significantly different from zero.

### 4.2.2.5 Fuel
*Model 1: Book-leverage*

We obtained a positive relationship between fuel and book-leverage. When the fuel to sales ratio increases with 1 percentage point, book-leverage increases by approx. 0.0110 percentage points. Economically this positive relationship is not supported by any of the mentioned theories. One possible explanation may be that some airline companies have to take up debt in order to be able to pay for the future contracts of fuel. Another explanation may be that there is a positive link between fleet age and debt, and that old aircraft use more fuel than new. An econometric explanation may be that the coefficient is a victim of endogenity; hence, the coefficient has no explanatory power. The coefficient has a t-value of 0.06 and is as expected not significantly different from zero.

*Model 2: Market-leverage*

We obtained a negative relationship between fuel and market-leverage. When the fuel to sales ratio increases with 1 percentage point, market-leverage decreases by approx. 0.285 percentage points. The coefficient has a t-value of -1.56 and is not significantly different from zero.

### 4.2.2.6 Leasing
*Model 1: Book-leverage*

We obtained a strong positive relationship between leasing and book-leverage. When the operational leasing cost to sales ratio increases with 1 percentage point, book-leverage increases by approx. 1.458 percentage points. Economically this strong positive relationship is contradicting our expectations of a negative relationship. Since a leased obligation is effectively adding leverage to the capital structure even though it is not stated on the balance sheet. Hence a leased obligation could trigger higher

financial distress and therefore lower leverage. The coefficient has a t-value of 3.56 and is significantly different from zero on a 0.1 % level. A possible explanation may be that the leasing variable is a victim of endogenity, which implies that we cannot trust the obtained results.

*Model 2: Market-leverage*

We obtained a positive relationship between leasing and market-leverage. When the leasing cost to sales ratio increases with 1 percentage point, market-leverage increases by approx. 1.1 percentage points. Economically this strong positive relationship is, as mentioned above, not supported by the mentioned theories. The coefficient has a t-value of 2.23 and is significantly different from zero on a 5 % level.

### 4.2.2.7 Private
*Model 1: Book-leverage*

We obtained a positive relationship between the private dummy and book-leverage. When the private people own the more than 50% of the company shares, book-leverage increases by approx. 0.041 percentage points. Economically this positive relationship is not supported by any of the mentioned theories that state that there should be a negative relationship between being privately owned and leverage. The coefficient has a t-value of 1.52 and is, as expected, not significantly different from zero.

*Model 2: Market-leverage*

We obtained a positive relationship between the private dummy and market-leverage. The coefficient has a t-value of 0.74 and is not significantly different from zero.

### 4.2.2.8 Low-cost
*Model 1: Book-leverage*

We obtained a negative relationship between the low-cost dummy and book-leverage. When the company follows a low cost strategy book-leverage decreases by approx. 0.06 percentage points. Economically this negative relationship is supported by the mentioned theories. One explanation is that low-levered firms, assumed to have deep pockets, can engage in predatory practices especially in a highly competitive environment designed to financially exhaust highly levered rivals and drive them out

of the market. Hence, low-cost firms tend to have lower leverage than service airlines in order to have the possibility of predatory pricing. The coefficient has a t-value of -1.91 and is not significantly different from zero.

*Model 2: Market-leverage*

We obtained a positive relationship between the low-cost dummy and market-leverage. When the company follows a low-cost strategy market-leverage decreases by approx. 0.074 percentage points. Our theoretical framework supports this negative relationship. The coefficient has a t-value of -1.75 and is not significantly different from zero.

### 4.2.2.9 Rated
*Model 1: Book-leverage*

We obtained a negative relationship between the rated dummy and book-leverage. When the company is rated by one of S&P, Moody's and Fitch book-leverage decreases by approx. 0.008 percentage points. Economically this negative relationship is supported by the pecking order and agency theory. The negative relationship could be explained by a lower degree information asymmetry; hence, less cost when issuing equity. Another possible explanation is that when a firm is rated, this functions as a disciplinary effect towards the managers. Hence, there is less need of debt to discipline managers. This is supported by Kisgen´s (2008) findings, which state that firms issue less debt when they are close to rating changes.
The coefficient has a t-value of -0.26 and is not significantly different from zero.

*Model 2: Market-leverage*

We obtained a negative relationship between the rated dummy and market-leverage. When the company follows a low-cost strategy market-leverage decreases by approx. 0.002 percentage points. Our theoretical framework supports this negative relationship. The coefficient has a t-value of -0.5 and is not significantly different from zero.

### 4.2.2.10 Financial Strength
*Model 1: Book-leverage*

We obtained a positive relationship between the risk proxy and book-leverage. The coefficient has a t-value of 1.0 and is not significantly different from zero.

*Model 2: Market-leverage*

We obtained a positive relationship between financial strength and market-leverage. A possible economical explanation is mentioned above. The coefficient has a t-value of 0.64 and is not significantly different from zero.

### 4.2.3 Summary Pooled OLS results

We obtain positive significant estimates for CVA and leasing for both models. We were surprised by the significant positive estimates to the leasing variables, which were the opposite of our expectations. Size was the only estimate other than CVA and leasing that had significant estimates in the book model. We obtained significant estimates for profit in the market model. It was surprising to find that growth produced no significant estimates, while profit and size only was significant for one of the models. We suspect that the pooled OLS regression may contain endogenous variables, unobservable constant effects and etc. that may affect our results.

### 4.2.4 Alternative method to analyse the data

Because of the potential complications and pitfalls caused by conducting a pooled OLS we chose to apply alternative models in order to be able to more robustly explain how the different determinants affect capital structure. As mentioned in part 3.3.2 we can choose between either the FE or RE model. Which one we choose depends on the outcome of a Hausman test.

**Table 8: Hausman test; Book-leverage model**

| HAUSMAN TEST Model 1 (book) | | | |
|---|---|---|---|
| --Coefficients-- | | | |
| (b) Fixed1_1 | 8B) Rel1_1 | (b-B) Difference | sqrt(diag(v_b-V_B)) |
| size | .0263543 | .0294046 | -.0030504 | .0184725 |
| profit | -.455991 | -.430086 | -.025905 | .0812441 |
| cva | .7221116 | .6752073 | .0469043 | .0537808 |
| fuel | -.0897121 | -.0708331 | -.018879 | .0817971 |
| marketbook | -.0187855 | -.0046906 | -.0140949 | .0043077 |
| leasing | -.269046 | .2656113 | -.5346573 | .2455438 |
| risk | 1.642183 | 1.528878 | .1133051 | .2504927 |

| b = consistent under Ho and Ha; obtained from xtreg |
|---|
| B = inconsistent under Ha, efficient under Ho; obtained from xtreg |
| Test:  Ho:  difference in coefficients not systematic |
| chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B) |
| =      79.27 |
| Prob>chi2 =      0.0000 |
| (V_b-V_B is not positive definite) |

The Hausman test of the book model given by table 8 produced a Prob > chi2 of 0.000 which imply that we can reject H0: FE and RE OK when testing against Hi: FE OK and RE not OK. Since there is explanatory power in the unobservable factor that can be used in the RE regression + that we are able to use time constant dummy variables we prefer to use RE instead of FE when H0 cannot be rejected. Since H0 was rejected, we have to eliminate all of the unobservable fixed effect. Hence, we use FE regressions when testing Model 1 (book). This also implies that there exist a zero conditional mean problem in our pooled regression (hence, assumption 4 is invalid), and the obtained pooled OLS results have no explanatory power.

**Table 9: Hausman test; Market model**

| HAUSMAN TEST Model 2 (market) | | | |
|---|---|---|---|
| --Coefficients-- | | | |
| (b) Fixed1_1 | 8B) Rel1_1 | (b-B) Difference | sqrt(diag(v_b-V_B)) |
| size | .1338596 | .0800429 | .0538167 | .0190621 |
| profit | -1.124053 | -.9596024 | -.1644507 | .061222 |
| cva | .5285894 | .5729657 | -.0443763 | .0500923 |
| fuel | -.5847307 | -.3751881 | -.2095425 | .0726358 |
| marketbook | -.0778349 | -.0548665 | -.0229685 | . |
| leasing | -.0499921 | .6293005 | -.6792926 | .270575 |
| risk | 4.766876 | 4.120449 | .6464275 | . |

| b = consistent under Ho and Ha; obtained from xtreg |
|---|
| B = inconsistent under Ha, efficient under Ho; obtained from xtreg |
| Test:  Ho:  difference in coefficients not systematic |
| chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B) |
| =      20.24 |
| Prob>chi2 =      0.0051 |
| (V_b-V_B is not positive definite) |

When we performed the Hausman test for the market model given in table 9 we could reject H0 on a five per cent level. Prob > chi2 was 0.005. We choose to use the FE model for model 2 (market). As with model 1, this implies that OLS assumption 4 is invalid.

**Table 10: FE regression; Book-leverage and Market model**

| FE regression | | |
|---|---|---|
| | **Model 1 (Book)** | **Model 2 (Market)** |
| *size* | 0.0264 | 0.134** |
| | (0.59) | (3.61) |
| *profit* | -0.456 | -1.124*** |
| | (-1.51) | (-3.94) |
| *cva* | 0.722*** | 0.529* |
| | (4.22) | (2.43) |
| *fuel* | -0.0897 | -0.585** |
| | (-0.25) | (-3.45) |
| *marketbook* | -0.0188 | -0.0778*** |
| | (-0.83) | (-3.83) |
| *leasing* | -0.269 | -0.0500 |
| | (-0.51) | (-0.05) |
| *risk* | 1.642 | 4.767* |
| | (1.50) | (2.11) |
| *Constant* | -0.0305 | -0.730* |
| | (-0.09) | (-2.09) |
| *Observations* | 282 | 240 |
| *R-squared* | 0.205 | 0.331 |
| *Adjusted R-squared* | 0.185 | 0.311 |
| *F* | 6.608 | 9.857 |
| * p<0.05, ** p<0.01, *** p<0.001 | | |

## 4.2.5 Discussion of results

We are in this part of the thesis going systematically go through the results obtained from the FE regression. All interpretations are ceteris paribus (all other variables are held constant).

### 4.2.5.1 Profit

*Model 1: Book-leverage*

We obtained a negative relationship between profit and book-leverage. When the EBIT-sales ratio increases with 1 percentage point, book-leverage decreases by approx. 0.456 percentage points. The coefficient has a t-value of -1.51 and is not significantly different from zero.

*Model 2: Market-leverage*

We obtained a negative relationship between profit and market-leverage. When the EBIT-sales ratio increases with 1 percentage point, market-leverage decreases by approx. 1.124 percentage points. Economically this strong negative relationship is supported by the pecking order theory. Since retained earnings are the cheapest way raising funds for new investments (because of information asymmetry) the company will use earnings instead of debt. Low profitable firms have less retained earnings to use for new investments; hence, they take on more debt. The coefficient has a t-value of -3.94 and is significantly different from zero on a 0.01 % level.

*Previous studies:* Rajan et.al (1995), Titman et.al (1988), Psillaki et.al (2009), (Gaud et.al (2005)*,* Frank et.al (2007) and Oftedal & Sorhus (2011) also find a negative relationship between debt ratio and profitabiliy. Hence, our findings are in line with previous studies.

### 4.2.5.2 Size
*Model 1: Book-leverage*

We obtained a positive relationship between size and book-leverage. When size increases with 1 per cent, book-leverage increases by approx. 0.00026 percentage points. The coefficient has a t-value of 0.59 and is not significantly different from zero.

*Model 2: Market-leverage*

We obtained a positive relationship between size and market-leverage. When size increases with 1 per cent, book-leverage increases by approx. 0.0013 percentage points. Economically, as mentioned in 4.2.2.2, this positive relationship is supported by the trade-off theory. The coefficient has a t-value of 3.61 and is significantly different from zero on a 1% level.

*Previous studies:* Rajan et.al (1995), Psillaki et.al (2009), (Gaud et.al (2005)*,* Frank et.al (2007) and Oftedal & Sorhus (2011) also find a positive relationship between debt ratio and size. Hence, our findings are in line with most previous studies.

### 4.2.5.3 CVA
*Model 1: Book-leverage*

We obtained a positive relationship between CVA and book-leverage. When the tangible to total assets ratio increases with 1 percentage point, book-leverage

increases by approx. 0.722 percentage points. Economically this strong positive relationship is supported by both the agency and trade-off theory as mentioned in 4.2.2.3. The coefficient has a t-value of 4.22 and is significantly different from zero on a 0.1 % level.

*Model 2: Market-leverage*

We obtained a positive relationship between CVA and market-leverage. When CVA increases with 1 percentage point, market-leverage increases by approx. 0.529 percentage points. The coefficient has a t-value of 2.43 and is significantly different from zero on a 5 % level.

*Previous studies:* Rajan et.al (1995), (Gaud et.al (2005), Frank et.al (2007) and Oftedal & Sorhus (2011) also find a positive relationship between debt ratio and CVA. Hence, our findings are in line with most previous studies.

### 4.2.5.4 Growth
*Model 1: Book-leverage*

We obtained a negative relationship between growth and book-leverage. When growth rate in total sales increases with 1 percentage point book-leverage decreases by approx. 0.066 percentage points. The coefficient has a t-value of -0.83 and is not significantly different from zero on a 5 % level.

*Model 2: Market-leverage*

We obtained a negative relationship between growth and market-leverage. When growth rate increases with 1 per cent market-leverage decreases by approx. 0.078 percentage points. . Economically this negative relationship could be explained by the all the mentioned theories. The trade-off theory explains this negative relationship by using the following argumentation: Firms with more investment opportunities will have incentives to use less leverage in order to avoid possible underinvestment problems/costs. The negative relationship could also be explained by the pecking order theory. When looking into the future of the firm, managers would like to keep a low degree of debt in order to avoid new equity offerings when needing capital to potential investments. The coefficient has a t-value of -3.83 and is significantly different from zero on a 0.1 per cent level.

*Previous studies:* Rajan et.al (1995), (Gaud et.al (2005)*,* Frank et.al (2007) and Oftedal & Sorhus (2011) also find a negative relationship between debt ratio and growth prospects. Hence, our findings are in line with previous studies.

### 4.2.5.5 Fuel
*Model 1: Book-leverage*

We obtained a negative relationship between fuel and book-leverage. When the fuel to sales ratio increases with 1 percentage point, book-leverage decreases by approx. 0.09 percentage points. The coefficient has a t-value of -0.25 and is not significantly different from zero.

*Model 2: Market-leverage*

We obtained a negative relationship between fuel and market-leverage. When the fuel to sales ratio increases with 1 percentage point, market-leverage decreases by approx. 0.585 percentage points. Economically this negative relationship is supported by the trade-off theory, agency cost theory and pecking-order theory. The negative relationship is in the agency theory explained by that energy-price volatility and high degrees of fuel consumption functions as a natural disciplinary factor on the managers of the company. According to the trade-off theory high fuel-to-sales ratio and volatile fuel prices increases the risk of becoming insolvent; hence, increasing bankruptcy costs which makes it optimal for the company to reduce their leverage. The coefficient has a t-value of -3.83 and is significantly different from zero on a 1 % level.

### 4.2.5.6 Leasing
*Model 1: Book-leverage*

We obtained a negative relationship between leasing and book-leverage. When the operational leasing cost to sales ratio decrease with 1 percentage point, book-leverage decreases by approx. 0.27 percentage points. Economically this negative relationship is in line with our expectations. A leased obligation is effectively adding leverage to the capital structure even though it is not stated on the balance sheet. Hence a leased obligation could trigger higher financial distress and therefore lower leverage. The coefficient has a t-value of -0.51 and is not significantly different from zero on a 5 % level.

*Model 2: Market-leverage*

We obtained a negative relationship between leasing and market-leverage. When the leasing cost to sales ratio increases with 1 percentage point, market-leverage decreases by approx. 0.05 percentage points. The coefficient has a t-value of -0.05 and is not significantly different from zero on a 5 % level.

### 4.2.5.7 Financial Strength
*Model 1: Book-leverage*

We obtained a strong positive relationship between financial strength and book-leverage. This implies that companies, which produce returns below the sample average (financial strength<0), ceteris paribus, will have less debt than those who produce returns above the sample average (financial strength>0). Hence, the lower financial strength a company have, the more risky it is. A possible explanation is that companies that produce returns below the sample average choose to reduce their leverage in order to decrease the probability of default. Companies with a financial strength factor above zero will use more debt in order to exploit the potential debt tax shield, which is in line with the trade-off theory. The coefficient has a t-value of 1.5 and is not significantly different from zero.

*Model 2: Market-leverage*

We obtained a positive relationship between the financial strength factor and market-leverage. Hence, more risky companies (financial strength < 0) use less debt. A possible economical explanation is mentioned above. The coefficient has a t-value of 2.11 and is significantly different from zero on a 5 per cent level.

*Previous studies:* Psillaki et.al (2009), Frank et.al (2007) and Oftedal & Sorhus (2011) also find a negative relationship between risk and debt ratio. Hence, our findings are in line with most previous studies.

### 4.2.6 Summary FE regression results
When conducting the FE regression model, we got an adjusted R-squared of 18.5% for the book model and 31.1% for the market model. This tells us that the market model has a better predictive value of a company's debt level than the book model. In

the market model six out of seven coefficients are significantly different from zero, while only one of the coefficients is significant in the book model. This may be explained by the argumentation that the market model is more forward looking than the book model, which implies that stakeholders base their decision on the future expectations rather than historical values. A summary of the obtained results and predicted signs are given in table 9. We have also included the pooled OLS estimates for comparison.

**Table 11: Summary of predicted and estimated signs**

| | Theories | | | Results | | | |
|---|---|---|---|---|---|---|---|
| Factor | Trade-off | Pecking order | Agency cost | Pooled OLS (book) | Pooled OLS (market) | FE (book) | FE (market) |
| *Firm Size* | + | - | | +** | + | + | +** |
| *CVA* | + | - | | +*** | +*** | +*** | +* |
| *Profitability* | + | - | + | - | -* | - | -*** |
| *Finacial Sterngth* | - | - | +/- | + | + | + | +* |
| *Growth Opportunities* | - | +/- | - | + | + | - | -*** |
| *Energy Intensity* | - | - | - | + | - | - | -** |
| *Ownership-structure* | + | | | + | + | | |
| *Rated vs. Non-rated* | + | +/- | | - | - | | |
| *Low-cost vs. Service* | +/- | - | - | - | - | | |
| *Leasing* | + | | | +*** | +* | - | - |

*\*\*\*0.001,\*\*0.01, \*0.05*

## 4.2.7 Further information concerning the empirical analysis

When testing for serial collinearity in the explanatory variables we found evidence of positive serial correlation (see attachment 7.4). As mentioned in Rajan and Zingales (1995) there may be problems with autocorrelation when conducting this kind of analysis. They found a positive relationship between leverage, asset tangibility and market-to-book, but the results was not significant and strongly autocorrelated. As a consequence we run a RE AR (1) regression for both models. This is a regression that takes into account the autocorrelation problem. The estimated coefficients were close to the ones obtained from the regular FE regressions but some of the estimates became more significant etc. We will not investigate this further since we believe this is beyond the scoop of our thesis.

**Table 12: Comparing AR(1) FE regression results with regular FE results**

|  | FE (market) | AR(1) FE (market) | FE (book) | AR(1) FE (book) |
|---|---|---|---|---|
| **growth** | -0.0778*** | -0.0828 | -0.0188 | -0.022 |
|  | (-3.83) | (-1.79) | (-0.83) | (-0.79) |
| **size** | 0.134** | 0.133*** | 0.0264 | 0.0317 |
|  | -3.61 | -4.1 | -0.59 | -1.03 |
| **profit** | -1.124*** | -0.958*** | -0.456 | -0.754*** |
|  | (-3.94) | (-3.48) | (-1.51) | (-4.07) |
| **cva** | 0.529* | 0.472** | 0.722*** | 0.527*** |
|  | -2.43 | -3 | -4.22 | -4.33 |
| **fuel** | -0.585** | -0.536** | -0.0897 | -0.182 |
|  | (-3.45) | (-2.77) | (-0.25) | (-1.12) |
| **leasing** | -0.05 | 0.913 | -0.269 | 0.0996 |
|  | (-0.05) | -1.34 | (-0.51) | -0.2 |
| **financial strength** | 4.767* | 5.276** | 1.642 | 2.300* |
|  | -2.11 | -2.88 | -1.5 | -2.51 |
| **_cons** | -0.730* | -0.764*** | -0.0305 | 0.0514 |
|  | (-2.09) | (-3.85) | (-0.09) | -0.52 |
| **N** | 240 | 207 | 282 | 245 |

## 4.3 Testing hypothesis

In this part of the assignment we are going to test which of the three mentioned theories (agency cost, trade-off and pecking-order) that is most accurate in their predictions according to our estimated coefficients. For this purpose we have chosen five of the most acknowledge variables in capital structure theory. We will use the result obtained from the FE regression.

**Hypothesis 1 Trade-off theory**

*H1.1 – CVA*

    *$H_i$: There is a positive relationship between leverage and CVA*

    *$H_0$: There is a negative relationship between leverage and CVA*

Asset tangibility has a positive relationship for both the market- and book model in our sample. In the market model we can reject $H_0$ with 5 per cent significance level. In the book model we can see from the results that we will observe a positive relation in at least 99.9 % of the time. This is in line with the trade-off theory predictions.

*H1.2 – Size*

*H$_i$: There is a positive relationship between leverage and size*

*H$_0$: There is a negative relationship between leverage and size*

Size has a positive relationship for both the market- and book-leverage model. In the market model we can reject H$_0$ with 1 per cent significance. Hence, there is a 99 % probability that H$_0$ is not satisfied. In the book model we can see from the results that we will not observe a positive relationship in at least 95 % of the time. The market model is in line with the trade-off theory, while the book model is indefinite.

*H1.3 – Profitability*

*H$_i$: There is a positive relationship between leverage and profitability*

*H$_0$: There is a negative relationship between leverage and profitability*

Profitability has a negative relationship for both the market- and book model. We cannot reject H$_0$ for either the book or market model. The market model is not in line with the trade-off theory because it is negative at least 99.9 % of the time, while the book model is indefinite.

*H1.4 – Financial strength*

*H$_i$: There is a negative relationship between leverage and the risk proxy*

*H$_0$: There is a positive/no relationship between leverage and the risk proxy*

There is a negative relationship between risk and leverage for both models. When a company produces lower returns (EBIT/Total Assets) than the average return obtained from the whole sample, we classify this company as being more risky than the general company. The intuition behind this is that companies with lower returns than average will, in the long run, have more problems operating in a market with tough competition than the most profitable companies. The book model produces indefinite results, while we can reject H$_0$ for the market model. Our results are in line with the static trade-off theory.

*H1.5 – Growth*

*H$_i$: There is a negative relationship between leverage and growth*

*H$_0$: There is a positive/no relationship between leverage and growth*

Indefinite results in the book model while there is a probability of 99.9 per cent that we obtain a negative sign on the growth variable in the market model. This is inline with the trade-off theory.

**Hypothesis 2 Pecking order theory**

*H2.1 – CVA*

    *$H_i$: There is a negative relationship between leverage and CVA*

    *$H_0$: There is a positive relationship between leverage and CVA*

Asset tangibility has a positive relationship for both the market- and book model in our sample. In the market model we cannot reject $H_0$ with 5 per cent significance. Hence, there is a 95 % probability that $H_0$ is satisfied. In the book model we can see from the results that we will observe a positive relation in at least 99.9 % of the time. This is not in line with the pecking order theory.


*H2.2 – Size*

    *$H_i$: There is a negative relationship between leverage and size*

    *$H_0$: There is a positive relationship between leverage and size*

Size has a positive relationship for both the market- and book model. In the market model we cannot reject $H_0$ with 1 per cent significance. Hence, there is a 99 % probability that $H_0$ is satisfied. In the book model we get indefinite results. The market model is not in line with the pecking order theory, while the book model is indefinite.


*H2.3 – Profitability*

    *$H_i$: There is a negative relationship between leverage and profitability*

    *$H_0$: There is a positive relationship between leverage and profitability*

Profitability has a negative relationship for both the market- and book model. In the market model we will observe a positive sign on the profitability variable at least 99.9 per cent of the time. In the book model produces indefinite results and we cannot reject either $H_0$ or $H_i$. The market model is in line with the pecking order theory, while the book model is indefinite.


*H2.4 – Financial strength*

    *$H_i$: There is a negative relationship between leverage and the risk proxy.*

    *$H_0$: There is a positive/no relationship between leverage and the risk proxy.*

There is a negative relationship between the risk proxy and leverage for both models. The book model produces indefinite results, while we can reject $H_0$ for the market model. Our results are in line with the pecking order theory.

*H2.5 – Growth*

     *$H_i$: There is a relationship between leverage and growth*

     *$H_0$: There is a no relationship between leverage and growth*

Indefinite results in the book model while there is a probability of 99.9 per cent that we obtain a negative sign on the growth variable in the market model. This is in line with the pecking-order theory since it may support both a negative and positive sign.

**Hypothesis 3 Agency cost theory**

*H3.1 – Profitability*

     *$H_i$: There is a positive relationship between leverage and profitability*

     *$H_0$: There is a negative relationship between leverage and profitability*

Profitability has a negative relationship for both the market- and book model. In the book model produces indefinite results and we cannot reject either $H_0$ or $H_i$. The market model is not in line with the agency theory, while the book model is indefinite.

*H3.2 – Financial Strength*

     *$H_i$: There is a relationship between leverage and the risk proxy*

     *$H_0$: There is a not relationship between leverage and the risk proxy*

There is a negative relationship between the risk proxy and leverage for both models. The book model produces indefinite results, while we can reject $H_0$ for the market model. Our results are in line with the agency theory since it may support both a positive and negative sign.

*H3.3 – Growth*

     *$H_i$: There is a negative relationship between leverage and growth*

     *$H_0$: There is a no/positive relationship between leverage and growth*

Indefinite results in the book model while there is a probability of 99.9 per cent that we obtain a negative sign on the growth variable in market model. This is inline with the agency cost theory.

## 4.3.1 Summary of the testing of hypothesis

**Table 13: Summary of predicted and estimated signs for the five chosen variables**

| Factor | Theories | | | Results | |
|---|---|---|---|---|---|
| | Trade-off | Pecking order | Agency cost | FE (book) | FE (market) |
| Firm Size | + | - | | + | +** |
| CVA | + | - | | +*** | +* |
| Profitability | + | - | + | - | -*** |
| Earnings volatility (risk) | - | - | +/- | + | +* |
| Growth Opportunities | - | +/- | - | - | -*** |

*\*\*\*0.001,\*\*0.01, \*0.05*

None of the mentioned models are able to explain all of our obtained results. This is in line with previous studies, which state that none of the theories are superior. Trade-off theory could explain the signs for three out of five coefficients, while pecking-order theory could explain two out of five. Agency cost could explain two out of three coefficients.

# 5. Concluding remarks

We are in this final part of the thesis going to briefly go through our most interesting findings and summarize an answer to the problems that we wanted to address.

The most interesting findings are:

- When conducting the FE regression model, we got an adjusted R-squared of 18.5% for the book model and 31.1% for the market model. This tells us that the market model has a better predictive value of a company's debt level than the book model.

- In the market model six out of seven coefficients are significantly different from zero, while only one of the coefficients is significant in the book model. This may be explained by the argumentation that the market model is more forward looking than the book model, which implies that stakeholders base their decision on the future expectations rather than historical values.

- Our significant signs from the FE regression correspond well to previous studies, and we do not observe any airline industry specific differences.

- We found a negative significant relationship between our fuel variable and debt ratio. This may imply that companies with a high energy-intensive consumption have more operational risk because of the volatile prices of energy. Hence, they have a lower optimal debt level.

- None of the mentioned models are able to explain all of our obtained results. This is in line with previous studies, which state that none of the theories are superior. Trade-off theory could explain the signs for three out of five coefficients, while pecking-order theory could explain two out of five. Agency cost could explain two out of three coefficients.

## 5.1 Suggestions to future research

It would be interesting to research whether the debt ratio of an energy intensive firm would decreases with a higher use of energy to sale. Theoretical framework argues that this would increase the operational risk and therefore decrease the optimal debt level. Is this common consensus or is our obtained result only airline industry specific?

Another further research may be to interview and/or surveys of CFOs from the sample firms regarding the variables. Are they emphasizing the same variables when they make their financial decisions? Do they have a debt ratio target that influences their financing decisions? This could lead to some interesting answers and a new angle to capital structure decisions.

# 6. Bibliography

Baker, K. H., & Martin, G. S. (2011). *Capital Structure and Corporate Financing Decisions: Theory, Evidence and Practice.* John Wiley & Sons, Inc.

Baker, K. H., & Wurgler, J. (2002). Market Timing and Capital Structure. *Journal of Finance , 57* (1), 1-32.

BBC News. (2003, 06 13). *Sars hit airlines "more than war".* Retrieved 2012 from http://news.bbc.co.uk: http://news.bbc.co.uk/2/hi/business/2986612.stm

Berk, J., & DeMarzo, P. (2007). *Corporate Finance* (second edition ed.). Pearson Education.

Booth, L., Aivazian, V., Demirguc-Kunt, A., & Maksimovic, V. (2001). Capital Structure in Developing Countries. *The Journal of Finance , LVI* (1), 87-130.

Brealy, R. A., Myers, S. C., & Allen, F. (2008). *Principals of Corporate Finance.* McGraw-Hill/Irwin.

Brealy, R. A., Myers, S. C., & Marcus, A. J. (2007). *Fundamentals of Corporate Finance.* McGraw-Hill.

Chang, X., Dasgupta, S., & Hillary, G. (2006). Analyst Coverage and Financing Decisions. *Journal of Finance , 61* (6), 3009-3048.

Daily Mail. (2008, May 7). Retrieved 2012 from www.dailymail.co.uk: http://www.dailymail.co.uk/news/article-564487/easyJet-blames-blames-soaring-fuel-prices-doubling-half-year losses.html

Diffield, N., Mahambare, V., & Pal, S. (2007). How does ownership structure affect capital structure and firm value? *Economics of Transition , 15* (3), 535-573.

Faulkender, M., & Petersen, M. A. (2006). Does the source of capital effect capital structure? *Review of Financial Studies , 19* (1), 45-79.

Frank, M., & Goyal, V. (2007). *Capital Structure Decisions: Which Factors are Reliably Important?*

Freedictionary. (n.d.). *Airline Industry Definiton.* Retrieved Feb 20, 2012 from www.thefreedictionary.com: http://encyclopedia2.thefreedictionary.com/airline+industry

Frydenberg, S. (2004). *Theory of Capital Structure.* Sør-Trøndelag University College, Department of business administration, Trondheim.

Gaud, P., Hoesli, M., & Bender, A. (2005). *Debt Equity Choice in Europe.*

Gaud, P., Hoesli, M., & Bender, A. (2005). The capital structure of swiss companies: an Empirical analysis using dynamic panel data. *Eurpoean financial management Volume 11, issue 1* , 51-69.

Gavazza, A. (2008). *Asset Liquidity and Financial Contracts: Evidence from Aircraft Leases.*

Gavazza, A. (2011). Leasing and Secondary Markets: Theory and Evidence from Commercial Aircraft. *Journal of Political Economy* , *119* (2), 325-377.

Gedajlovic, E., & Shapiro, D. (2002). Ownership and Firm Profitability in Japan. *Academy of Management Journal* , *45* (3), 575-585.

Grossman, S. J., & Hart, O. D. (1983). An Analysis Of The Principal-Agent Problem. *Econometrica* , *51* (1), 7-45.

IATA. (2011, December). *Airline Industry Fuel Consumption*. Retrieved 2012 from www.iata.org:
http://iata.org/pressroom/facts_figures/fact_sheets/Pages/fuel.aspx

IATA. (2011, December). *Industry Stats*. Retrieved March 2012 from www.iata.org:
http://www.iata.org/pressroom/facts_figures/fact_sheets/Documents/industry -stats-dec2011.pdf

Investopedia. (n.d.). *Consumer Condifence*. Retrieved 2012 from www.investopedia.com:
http://www.investopedia.com/university/releases/consumerconfidence.asp#ax zz1pvof0g6U

Investopedia. (n.d.). *Consumer Confidence*. Retrieved 2012 from www.investopedia.com:
http://www.investopedia.com/university/releases/consumerconfidence.asp#ax zz1pvof0g6U

Investopedia. (n.d.). *Economies Of Scale*. Retrieved 2012 from www.investopedia.com:
http://www.investopedia.com/terms/e/economiesofscale.asp#ixzz1pe3GnGmj

Investopedia. (n.d.). *Price-sensitivity*. Retrieved 2012 from www.investopedia.com: http://www.investopedia.com/terms/p/price-sensitivity.asp#axzz1pvof0g6U

Investopedia. (n.d.). *Strategic Alliance*. Retrieved 2012 from www.investopedia.com:
http://www.investopedia.com/terms/s/strategicalliance.asp#ixzz1tnIwbZjN

Investopedia. (n.d.). *Tobin's Q*. Retrieved April 20, 2012 from www.investopedia.com:
http://www.investopedia.com/terms/q/qratio.asp#axzz1ttC53IAv

Jensen, M. C. (1986). Agency Costs of Free Cash Flow, Corporate Finance and Takeovers. *The American Economic Review*, *76* (2), 323-329.

Jensen, M. C., & Meckling, W. H. (1976). *Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure.*

Johnsen, T. (2010). Lecure Notes: Figure: Trade-off Theory. Bergen, Bergen: Norwgian School of Economics and Business Administration.

Kaplan, N. S., & Weisbach, M. S. (1992). *The Success of Acquisitions: Evidence from Diverstitures.* NBER Working Paper NO. w3484.

Kisgen, D. J. (2008). *Do Firms Target Credit Ratings or Leverage Levels?* Boston College, Boston.

Korajczyk, R. A., Lucas, D., & McDonald, R. (1992). Equity Issues with Time-Varying Asymmetric Information. *Journal of Financial and Quantitative Analysis*, *27* (3), 297-417.

Lemmon, M. L., & Zender, J. F. (2010). Debt capacity and tests of capital structure. *Journal of Financial and Quantitative analysis, forthcoiming.*

Miller, M. (1988). The Modigliani-Miller Propositions after Thirty Years. *Journal of Economic Perspectives*, *2* (4), 449-470.

Miller, M., Modigliani, F., & Merton. (1958). The Cost of Capital, Coporation Finance, and the Theory of Investments. *American Economic Review*, *48* (3), 261-297.

MIT Global Airline Industry Program. (n.d.). Retrieved 2012 from web.mit.edu: http://web.mit.edu/airlines/index.html

Mjøs, A. (2007). *Corporate Finance: Capital Structure and Hybrid Capital.* Norwegian School of Economics and Business Administration, Department of Finance and Management Accounting, Bergen.

Myers, S. C. (1984). The Capital Structure Puzzle. *Journal of Finance*, 575-592. Nilsen, Ø. A. (2011). Lecture notes: Panel Data. Bergen, Norway: Norwegian School of Economics and Business Administration.

Oftedal, B. G., & Sorhus, J. (2011). *Capital Structure in Capital Intensive Industries - An Empirical Study of Determinants of Capital Structure with Emphasis on the Offshore Industry.* Norwegian Schoold of Economics and Business Administration, Finance, Bergen.

Opler, T., & Titman, S. (1994). Financial Distress and Corporate Performance. *Journal of Finance*, *49* (3), 1015-1040.

Psillaki, M., & Daskalakis, N. (2009). Are the determinants of capital structure country or firm specific. *Small Business Economics*, *33* (3), 319-333.

Qantas. (n.d.). *Information: Qantas*. Retrieved 2012 from www.qantas.com: http://www.qantas.com.au/fflyer/dyn/program/index

Rajan, R. G., & Zingales, L. (1995). What Do We Know about Capital Structure? Some Evidence from International Data. *The Journal of Finance , 50* (5), 1421-1460.

Rotemberg, J. J., & Scharfstein, D. S. (1990). Shareholder-Value Maximization and Product-Market Competition. *Review of Financial Studies , 3* (3), 367-391.

Sanyal, P., & Mann, C. L. (2012). *Asset Specificity, Information Asymmetry and New Firm Financing.* Brandeis University.

Shivdasani, A., & Zenner, M. (2005). How To Choose a Capital Structure: Navigating the Debt-Equity Decision. *Journal of Applied Corporate Finance , 17* (1), 26-35.

Titman, S., & Wessels, R. (1988). The Determinants of Capital Structure Choice. *The Journal of Finance , 43* (1), 1-19.

Travel-Industry-Dictionary. (n.d.). *Fuel-Hedging*. Retrieved 2012 from www.travel-industry-dictionary.com: http://www.travel-industry-dictionary.com/fuel-hedging.html

Wooldridge, J. (2008). *Introductory Econometrics: A modern Approach.* South-Western, Division of Thomson Learning.

# 7. Attachments

## 7.1 ASSUMPTIONS OLS:

*1) Linear in parameters.* This assumption states that the model can be written as

$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k + u$, where $\beta_0$, $\beta_1$, ..., $\beta_k$ are the unknown coefficients of interest and u is an unobservable random error (residuals).

*2) Random sampling.* When collecting a random sample of n observations, $(x_{i1}, x_{i2}, \ldots, x_{ik}, y_i)$ where i = 1,2,..,n the sample will give a good representation of the overall population. If this assumption is not valid, and the sample is non random, this may result in biased coefficients that have no explanatory power for the overall population.

*3) No perfect collinearity:* This assumption demand that non of the independent variables in sample $(x_{i1}, x_{i2}, \ldots, x_{ik})$ where i = 1,2,..,n are constant, and that there do not exist a perfect linear relationship between any of them. The background of this assumption is that:

- In order to find a relationship between the independent and dependent variable we need to have variation in the independent variables
- We cannot study the ceteris paribus effect of changes in one independent variable on the dependent variable if the independent variable is perfectly correlated with other independent variables.

   High degrees of collinearity between the different independent variables may result in inference "problems" and reduce the quality of the explanatory power of the calculated coefficients.

*4) Zero conditional mean.* This assumption states that the residuals u has an expected value of zero given any values of the independent variables. Mathematically this is shown as: $E(u|x_1, x_2, \ldots, x_k) = 0$.

This is a crucial assumption in order for the OLS coefficients to be unbiased. When a coefficient is unbiased then the expected value of the estimated coefficient is equal to the true population coefficient. Hence; $E(\hat{\beta}_j) = \beta_j, j = 0,1, \ldots, k$ If our estimated coefficients are biased $(E(\hat{\beta}_j) \neq \beta_j)$ our model are no longer BLUE.

*5) Homoskedasticity.* This assumption states that the variance of the residuals are the same given any values of the explanatory variables. Mathematically this assumption is written as: $Var(u|x_1,..,x_k) = \sigma^2$

This assumption is important because it implies that the standard deviation of the different unknown coefficients $\beta_0, \beta_1, ..., \beta_k$ are unbiased, which again imply that we may use inference to test whether the diff coefficients are statistically significant or not.

*6) Normality.* States that the residuals (the error term) are normally distributed. Hence: $u \sim N(0, \sigma^2)$. This assumption is not a part of the Gauss Markov assumption, but if valid, normality of residuals will imply that 4) and 5) are valid; hence: $\hat{\beta}_j \sim N\left(\beta_j, Var(\hat{\beta}_j)\right)$. This is not a crucial assumption and may be dropped if we have a reasonable large sample size.

## 7.2 ASSUMPTIONS FIRST DIFFERENCE (FD) and Fixed Effects (FE):

1) For each i, the model is: * $y_{it} = \beta_0 + \beta_{1it}x_{1it} + \cdots + \beta_{itk}x_{itk} + (a_i + u_{it}), t = 1, ..., T$

2) Random sample in the cross section

3) The independent variables cannot be constant through time ($\Delta x_{i,1,..,k} \neq 0$), and there cannot exist a (perfect) linear relationship among the different explanatory variables ($Corr(x_{itj}, x_{its}) < 1$, where $s \neq j$).

4) The independent explanatory variables are strictly exogenous conditional on the unobserved effect ($E(u_{it}|a_i, x_{itj}) = 0$). Hence, when we control for the unobserved fixed parameter a$_i$, then $Corr(x_{itj}, u_{it}) = 0$.

5) The variance of the different error, conditional on all explanatory variables is constant; $Var(\Delta u_{it}|x_{itj}) = \sigma^2, t = 2, ..., T$.

6) For all $t \neq s$, the difference in idiosyncratic errors are uncorrelated (conditional on all explanatory variables): Hence; $Cov(\Delta u_{it}, \Delta u_{is}|x_{itj}) = 0$

7) Conditional on $x_{itj}$, the $\Delta u_{it}$ are independent and identically distributed normal random variables.

If 1) → 6) hold, the estimated coefficients are BLUE and consistent.

If 7) does not hold, we can still use t- and F-distribution because we say that they are asymptotic approximations.

## 7.3 ASSUMPTIONS RANDOME EFFECTS (RE):

1) Linear in parameters: We should be able to write our model as: $y_{it} = \beta_0 + \beta_{1it}x_{1it} + \cdots + \beta_{itk}x_{itk} + (a_i + u_{it}), t = 1, \dots, T$

2) Random sampling

3) There are no perfect linear relationship between/among the explanatory variables

4) $E(u_{it}|a_i, x_{itj}) = 0$ and the expected value of $a_i$ given all explanatory variables is constant. Hence; $E(a_i|x_{itj}) = \beta_0$

5) $Var(u_{it}|a_i, x_{itj}) = Var(u_{it}) = \sigma_u^2$, for all $t = 1, \dots, T$ and the variance of $a_i$ given all explanatory variables is constant $Var(a_i|x_{itj}) = \sigma_a^2$.

6) For all $t \neq s$, the idiosyncratic errors are uncorrelated (conditional on all explanatory variables and $a_i$): Hence; $Corr(u_{it}, u_{is}|a_i, x_{itj}) = 0$

## 7.4 NOTES TO THE ECONOMETRIC ANALYSIS

We started our analysis by running the regular pooled OLS regression on the entire sample. Model 1.1 and 1.2 produced some significant values etc. but we could not rely on the result because we had not tested whether the OLS assumptions were valid. First we wanted to test whether the model was a victim of serial correlation. We tested for serial collinearity by:

1. Running the OLS regression of market-/book-leverage on all the explanatory variables and obtaining the residuals.

2. Running the regression of $\widehat{u_t}$ on $\widehat{u_{t-1}}$ for all t = 2, …, n.

We obtained a correlation of 0.81, which was significant (p-value = 0.000). We got the same result when using the method without strictly exogenous regressors. This correlation may be caused by the unobservable factor and we therefor choose not to rely on the pooled OLS results and use either RE or FE regressions instead because we assume these to produce more "safe" results.

One important OLS assumptions is the zero conditional mean assumption that states that the expected value of the error term $v_t$ is zero conditional on all the explanatory variables; hence, $E(v_t|X) = 0$. Hence, the explanatory variables are exogenous. If $v_t = a + u_t$ and $E(u_t|X) = 0$ the expected value of unobservable fixed effect (a) has to be 0 conditional to X in order for the assumption to hold. This is a strong and possible unrealistic assumption. In our sample for example efficiency, which can be a part of a, may be correlated with profits and therefor make the zero conditional mean assumption invalid. Since we suspect the unobservable factor to be present (from intuition and by the correlation between $\widehat{u_t}$ and $\widehat{u_{t-1}}$), using either RE or FE can produce more certain results that do not break the zero conditional mean assumption. A consequence of this assumption being invalid is that the estimated results are biased and useless.

**Appendix 1: Test of serial correlation with strictly exogenous regressors for the book model**

quietly reg bookleverage marketbook profit cva size fuel leasing risk
predict u_hat1_1, res
bys company: gen u_hat_lag1_1 = u_hat1_1(_n-1)

| *with strictly exogenous regressors | | | | | | |
|---|---|---|---|---|---|---|
| reg u_hat1_1 u_hat_lag1_1, robust | | | | | | |
| | | | | | | |
| Linear regression | | | | Number of obs | | 241 |
| | | | | F( 1,  234) | | 389.56 |
| | | | | Prob > F | | 0.0000 |
| | | | | R-squared | | 0.6878 |
| | | | | Root MSE | | 0.11741 |
| | | Robust\ | | | | |
| u_hat1_1 | Coef. | Std. Err. | t | P>\|t\| | [95% Conf.Interval] | |
| u_hat_lag1_1 | 0.8122066 | 0.0411507 | 19.74 | 0.000 | 0.7311423 | 0.893271 |
| _cons | -0.0003642 | 0.0075739 | -0.05 | 0.962 | -0.0152843 | 0.014556 |

**Appendix 2: Test of serial correlation without strictly exogenous regressors for the book model**

| *without strictly exogenous regressors | | | | | | |
|---|---|---|---|---|---|---|
| reg u_hat1_1 u_hat_lag1_1 marketbook size fuel leasing profit cva risk, robust | | | | | | |

| Linear regression | | | | | Number of obs | 241 |
|---|---|---|---|---|---|---|
| | | | | | F( 7, 228) | 55.40 |
| | | | | | Prob > F | 0.0000 |
| | | | | | R-squared | 0.6991 |
| | | | | | Root MSE | 0.11699 |

| u_hat1_1 | Coef. | Robust\ Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| u_hat_lag1_1 | .8222025 | .0414653 | 19.83 | 0.000 | .7405058 | .9038992 |
| marketbook | -.0063522 | .0461405 | -0.14 | 0.891 | -.0972601 | .0845557 |
| size | .0033156 | .0090515 | 0.37 | 0.714 | -.0145179 | .0211492 |
| fuel | .0944664 | .0949017 | 1.00 | 0.321 | -.092513 | .2814458 |
| leasing | -.1621853 | .2778933 | -0.58 | 0.560 | -.7097024 | .3853317 |
| profit | -.1127629 | .1432121 | -0.79 | 0.432 | -.3949254 | .1693996 |
| cva | -.0121415 | .0614265 | -0.20 | 0.843 | -.1331665 | .1088835 |
| risk | -.9613021 | 1.304001 | -0.74 | 0.462 | -3.5305 | 1.607896 |
| cons | -.0312108 | .1035667 | -0.30 | 0.763 | -.2352622 | .1728406 |

**Appendix 3: Test of serial correlation with strictly exogenous regressors for the market model**

```
quietly reg marketeleverage marketbook profit cva size fuel leasing risk
predict u_hat1_2, res
bys company: gen u_hat_lag1_2 = u_hat1_2(_n-1)
```

| *with strictly exogenous regressors | | | | | | |
|---|---|---|---|---|---|---|
| reg u_hat1_2 u_hat_lag1_2, robust | | | | | | |

| Linear regression | | | | | Number of obs | 204 |
|---|---|---|---|---|---|---|
| | | | | | F( 1, 200) | 291.14 |
| | | | | | Prob > F | 0 |
| | | | | | R-squared | 0.5645 |
| | | | | | Root MSE | 0.13947 |

| u_hat1_2 \| | Coef. | Robust\ Std. Err. | t | P>\|t\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| u_hat_lag1_2 \| | 0.7380003 | 0.0432518 | 17.06 | 0 | 0.6527174 | 0.8232831 |
| _cons \| | 0.0091836 | 0.0097996 | 0.94 | 0.35 | -0.0101391 | 0.0285063 |

**Appendix 4: Test of serial correlation without strictly exogenous regressors for the market model**

| *without strictly exogenous regressors | | | | | | | |
|---|---|---|---|---|---|---|---|
| reg u_hat1_2 u_hat_lag1_2 marketbook size fuel leasing profit cva risk, robust | | | | | | | |

| Linear regression | | | | | Number of obs | | 204 |
|---|---|---|---|---|---|---|---|
| | | | | | F( 7, 194) | | 37.99 |
| | | | | | Prob > F | | 0 |
| | | | | | R-squared | | 0.5683 |
| | | | | | Root MSE | | 0.14132 |

| u_hat1_2 \| | Coef. | Robust\ Std. Err. | t | P>\|t\| | [95% Conf. Interval] | |
|---|---|---|---|---|---|---|
| u_hat_lag1_2 \| | 0.7403102 | 0.0444351 | 16.66 | 0 | 0.6526752 | 0.8270453 |
| marketbook \| | -0.0448226 | 0.0528227 | -0.85 | 0.397 | -0.1490648 | 0.0594195 |
| size \| | -0.003352 | 0.0119076 | -0.28 | 0.779 | -0.0268363 | 0.0201322 |
| fuel \| | 0.0563482 | 0.1170574 | 0.48 | 0.631 | -0.1745129 | 0.2872093 |
| leasing \| | 0.0343042 | 0.3340136 | 0.1 | 0.918 | -0.6244389 | 0.6930471 |
| profit \| | -0.0985967 | 0.1735321 | -0.57 | 0.571 | -0.4408373 | 0.243644 |
| cva \| | -0.0224888 | 0.0814441 | -0.28 | 0.783 | -0.1831133 | 0.1381356 |
| risk | 1.391527 | 1.899106 | 0.73 | 0.465 | -2.353898 | 5.136952 |
| _cons \| | 0.0477869 | 0.131471 | 0.36 | 0.717 | -0.2115007 | 0.3070745 |

Another GM assumption that is important is the constant variance conditional on X assumption and that the variance is uncorrelated with the previous period's variance. Given that we in panel data repeatedly observe the same companies in different periods, it is typically unrealistic to assume that the error term is from diff. periods are uncorrelated. Recall that $v_t = a + u_t$ and that $a$ is constant through time. This implies that $Var(u_t + a|\text{X}) = \sigma^2$ which then imply that $corr(\sigma_t^2, \sigma_{t-1}^2) \neq 0$. Hence, OLS is inefficient compared to an estimator that exploits the possibility the correlation over time. We therefor choose to use RE or FE depending on the result of the Hausman test.

### 7.4.1 MULTICOLLINEARITY

Multicollinearity does not violate any of our assumptions as long as it is not +/- 1. The presence of multicollinearity between two variables may result in their corresponding variance estimates to be two large (Wooldridge, 2009), which again will have implications toward individual statistical inference on these variables. The other explanatory variables will not be affected by the collinearity between the mentioned variables. Omitting a variable with strong correlation toward the other variables may result in omitted variable bias, which may result in a violation of the zero conditional mean assumption.

**Appendix 5: List of companies that are present in our data sample**

| | | | |
|---|---|---|---|
| Norwegian | 1 | Malaysian Airlines | 21 |
| Southwest Airlines Co. | 2 | JetBlue Airways | 22 |
| SAS | 3 | Allegiant Air | 23 |
| Ryan Air | 4 | Republic Airways Holdings | 24 |
| Lufthansa | 5 | Pinnacle Airlines | 25 |
| Qantas | 6 | Alaska Airlines | 26 |
| Thai air | 7 | Air Berlin IPO 2006 | 27 |
| British Airways | 8 | Thomas Cook Merger 2007 | 28 |
| Chinese Southern Airlines | 9 | Czech Airlines | 29 |
| Emirates | 10 | Virgin Blue | 30 |
| Turkish airlines | 11 | New Zealand Air | 31 |
| American airlines | 12 | AirAsia | 32 |
| Delta airlines | 13 | Kenya Airlines | 33 |
| Continental Airlines | 14 | China Eastern Airlines | 34 |
| Singapore Airlines | 15 | South African Airways | 35 |
| Finnair | 16 | Dart Group | 36 |
| Air France KLM | 17 | Easy Jet | 37 |
| Air Canada | 18 | Tam Group | 38 |
| Icelandair | 19 | All Nippon Airways | 39 |
| Oman Air | 20 | | |