

Operating lease or purchase - analysis, Case: An acquisition of Airbus A330-300 for Finnair

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Abstract

Objectives of the study

The purpose of this thesis is to present different lease valuation techniques from the existing literature that can be used when assessing a financing decision of an aircraft and then test these methods in practice with the actual data provided by Finnair. The case framework used is an acquisition of a new Airbus A330-300 widebody airliner. The main question is should the aircraft be purchased or leased under an operating lease. This leads to actual hypotheses which question whether operating lease is more cost-effective than purchasing in less than 10 year period or in the long run. Eventually the analysis provides a financing decision model for Finnair.

Research method and data

The research method of this thesis is a single-company case study. My analysis will be based on cash flow-based valuation techniques such as Net Present Value (NPV) and its more advanced derivative adjusted present value (APV). The results of the model are examined with a sensitivity analysis and further enhanced with a risk analysis tool utilizing Monte Carlo simulation. There a thousand simulations are made to find the deviation of present values. The data includes current and estimated market values and lease rates of A330-300 provided by an independent valuation company.

Findings of the study

My first hypothesis, “operating lease is more cost-effective than purchasing in less than 10 years' time”, was clearly accepted as the results from both NPV and APV were indisputable. The second hypothesis, that the above holds also if the time period is extended, remains unanswered or can even be rejected. Although APV still very strongly suggests leasing over purchasing, NPV starts to draw nearer to purchasing. Still statistically leasing is the preferable choice but it is apparent that when the time period is lengthened, the purchase becomes more tempting. As a conclusion, according to my analysis in current market environment Finnair should lease the A330 under an operating lease agreement rather than buy it. This is true especially if the considered utilisation of the aircraft is rather short.

Keywords Leasing, Operating lease, Financing decision, Cash-flow based valuation, Net present value, Adjusted present value, Monte Carlo simulation, Aircraft, Finnair, Airbus, Aviation, Airlines

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Tutkimuksen tavoitteet

Tutkimuksen tavoitteena on nykyisestä kirjallisuudesta esitellä erilaisia leasingin arvostusmenetelmiä, joita voidaan käyttää lentokoneen rahoituspäätöksen arvioinnissa ja sitten kokeilla näitä menetelmiä käytännössä Finnairilta saadulla aineistolla. Tutkimus perustuu uuden Airbus A330-300 lentokoneen hankintaan. Olennaisin kysymys on pitäisikö lentokone ostaa vai liisata operatiivisella leasing-sopimuksella. Tämä johtaa varsinaisiin hypoteeseihin eli onko operatiivinen leasing kannattavampaa kuin ostaminen alle 10 vuoden tai pidemmällä aikavälillä. Tutkimuksen myötä Finnairille valmistuu malli rahoituspäätöksen analysointiin.

Tutkimusmenetelmä ja lähdeaineisto

Tutkimusmenetelmänä on yhden yrityksen case-tutkimus. Analyysini perustuu kassavirtapohjaiseen arvostusmenetelmiin kuten Nettonykyarvo-menetelmä (NPV) ja sen edistyneempi versio Oikaistu nykyarvo-menetelmä (APV). Mallin tuloksia tutkitaan herkkyyssanalyysin avulla ja parannetaan riskianalyysi-työkalulla, joka perustuu Monte Carlo-simulaatioon. Siinä simulaatio ajetaan tuhat kertaa jolloin saadaan nykyarvojen jakauma. Aineistona käytetään ulkopuolisen arviointiyrityksen tuottamia nykyarvoja ja ennusteita A330-300 markkina-arvoista ja leasing-maksuista.

Tutkimustulokset

Ensimmäinen hypoteesini ”Operatiivinen leasing on kannattavampaa kuin ostaminen alle 10 vuoden aikavälillä” hyväksyttiin selvästi tulosten ollessa kiistattomia sekä NPV että APV-menetelmillä. Toista hypoteesia, että edellinen pitää paikkansa myös pidemmällä aikavälillä, ei voitu vahvistaa. Vaikka APV -menetelmä edelleen vahvasti puoltaa leasingia, NPV-menetelmän mukaan ostaminen tulee kannattavammaksi, kun aikaväliä pidennetään. Tilastollisesti leasing silti osoittautuu kannattavammaksi. Yhteenvedona todettakoon, että mallini mukaan nykyisessä markkinatilanteessa Finnairin tulisi mieluummin liisata A330-lentokone operatiivisella leasing-sopimuksella kuin ostaa se. Tämä pätee varsinkin, jos suunniteltu käyttöaika on suhteellisen lyhyt.

Avainsanat Leasing, Operatiivinen leasing, Rahoituspäätös, Kassavirta-pohjainen arvostus, Nettonykyarvo, Oikaistu nykyarvo, Monte Carlo-simulaatio, Lentokone, Finnair, Airbus, Ilmailu, Lentoyhtiöt

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1 INTRODUCTION

1.1 Motivation and background of the study

Since the beginning of leasing related literature the burning question of to lease or purchase has confused both academic and business world. Arguments from tax benefits to off-balance sheet characteristic and from capital preserving advantages to flexibility have been expressed. Many theories have merged, some more accepted than others, but main reasoning still remains around tax and accounting benefits of leases. Also the substitutability of the lease and debt surrounds many current discussions. Present understanding is that they might not after all be perfect substitutes which would rationalise leasing and have implications on firms' optimal capital structures as well. In addition, today an ever-increasing focus is given on non-financial features that leasing provides and how they could be properly measured. Flexibility gained from leasing is one of the most commonly heard justifications in the literature but to indisputably measure it is a much more complicated story.

As a method of financing, leasing seems to be ever so popular at the moment. Especially in the airline industry leasing seems to be increasing. Gritta et al. (1994) reported that main US carriers already had 54% of their fleet leased in 1991. According to CIT (2011), 38% of the current world fleet of aircraft has been leased compared to only 3% in 1980. This percentage is now expected to rise above 50% by 2015. Gibson and Morrell (2004) find that about 25% of the aircraft are flown under an operating lease. Current economic conditions also have an effect on this but it should be stated that leasing isn't any more just a financing method for financially constrained companies as it used to be. It can be rather seen as a modern, strategic financing tool that enables very flexible fleet planning needed in this turbulent and constantly changing environment.

When considering an airline company whose balance sheet is comprised mainly of expensive aircraft the lease or purchase question becomes very valid. Minor benefits gained from the correct financing decision can make a big difference when assets are worth hundreds of millions of dollars. But what makes this complicated is first, academic literature is not omniscient and second, the industry is highly cyclical and uncertain, and thus the analysis of the financing decisions is difficult. Most often non-financial or operational reasons are used to advocate leasing over debt. But that leads to a need for valuation methods beyond financial

aspects which furthermore leads to subjective opinions and choices in valuation. So far, it might already be evident that we are on an unravelled territory.

Today, airline business is recovering from the worldwide depression and is trying to return on profit by increasing the amount of passengers while cutting the unit costs. A revival seems to be already underway and future shows glimpse of hope in this highly cyclical industry. What comes to airline financing today, naturally both debt and leasing is used but there is now ever so increasing trend of promoting particularly operating leases. They seem to offer flexibility desired by airlines in this uncertain state and perhaps assist companies with low cash reserves or uncertain future cash flows. That said, the role of the lessors in the aviation leasing business seems to be emphasized in past few years. At the same time, leasing has become a strategic source of flexibility to many of the world's major airlines.

It is clear that no one comprehensive and clear answer to this lease or purchase dilemma exists but by exploring several different perspectives and theories this thesis tries to offer better understanding of the complexity of this decision as a whole. At the same time this thesis aims to introduce some theoretical models from existing literature and compare their suitability to the case company's needs so that best of them could be used in the case company's decision making process in the future. The need for this kind of analysis seems to be apparent because finance departments of airlines do not necessarily capitalize on all useful methods available. (Gibson and Morrell, 2005)

In industries like airline business where the assets consist mostly of airplanes this kind of analysis has a great importance and creates concrete benefit. Increasing trend of operating leases and increased role of the lessors in the airline business makes this topic very current. What makes this topic also very current is that changes in IFRS account policies probably during the year of 2013 have significant effects on treatment of leases, especially operating leases which can be seen as off-balance sheet items (although they have been disclosed in the notes to the accounts). However when implemented new IASB and FASB Proposals state that all leases would need to be recorded on balance sheet as the present value of the "right-to-use" asset and a corresponding lease liability. The purpose of these changes is to make financial statements even more transparent and comparable. Companies with lots of operating lease liabilities have to be prepared. The effect of policy changes on certain key ratios and therefore on credit ratings cannot be ignored.

In their survey in 2005 Gibson and Morrell discover distinct differences in airlines' financial evaluation methods, interactions between investment and financing decisions and risk management. They find that airlines do not appear to consistently capitalize on the most advanced techniques available in the market. This may sound peculiar considering the extent of assets in airline business. However, managers are not all to blame for. This under-usage of methods may be explained by the fact that managers have not unlimited time to study all new researches. This observation raises even more the importance of this kind of comparison of the different valuation methods in airlines.

1.2 Research objectives & Hypotheses

Fortunately I was given an exceptional opportunity to implement different methods in real life. Finnair, the major airline in Finland, provided the setting needed to apply relevant theories to practice. The purpose of this thesis is to present different valuation techniques from the existing literature that can be used when assessing a procurement of an aircraft and then test these methods in practice with the actual data provided by Finnair. The case framework used is an acquisition of a new Airbus A330-300 widebody airliner, which Finnair already has eight in its fleet. This thesis provides a selection of techniques that can be used in the future in the case company and enables an interesting opportunity to test these theoretical models in action. The effects and implications of the usage of different techniques are then discussed and compared. The eventual aim of my thesis is to provide a model for Finnair that can be used in real life with a set of inputs to analyse this financing decision.

An acquisition comprises an investment and a financing decision, at least in theory. The purpose here is particularly to analyse the financing decision and the problematic of deciding whether to purchase or to lease an aircraft. This means that the investment decision has already been done and now it is relevant to examine how to finance the acquisition. Many experts, however, suggest that these two decisions cannot and should not be separated in real life because of their strong influence on another. If you first choose the aircraft and only then analyse how to finance it you might not end up with the best result. One important reason for this is that different aircraft manufacturers can offer quite different finance terms. The fleet planning and acquisition of aircraft should from the start of the process be connected to the finance. However, because fleet planning escapes from the scope of this thesis, it is simpler to study the financing decision in isolation. The thesis will present both financial and non-financial aspects of the leasing dilemma and utilize a combination of different cash flow

based models from the academic literature to achieve the best possible solution for this rather complicated question. It is rather matter of using an appropriate and versatile tool set than relying only on some one method.

In addition to providing a model for Finnair, my thesis tries to answer a couple of relevant questions. Leasing is often thought to be more expensive than purchasing. A lessee is seen to make a choice between the decreased risk and increased price. However, because of the increased popularity of leases, one might argue that this is because leases are actually under-priced and therefore cheaper than the costs of actually buying an asset. Therefore, I will first ask if operating lease is cheaper than purchasing in typical time period of aircraft lease. This is followed by a supplement question does this also hold when the time period is extended. This is also relevant question as it is commonly referred that leases are preferable in short time horizons but purchasing is always better option in the long run. So, my hypotheses are:

H1: Operating lease is more cost-effective than purchasing in less than 10 year period.

and

H2: Operating lease is more cost-effective than purchasing in the long run.

1.3 Methodology of the study

My analysis will be based on cash flow-based valuation techniques such as Net Present Value (NPV) and its more advanced derivative adjusted present value (APV). I will then enhance the model with a sensitivity analysis and further with a sort of risk analysis tool utilizing Monte Carlo simulation where a thousand simulations are made to find the deviation of net present values. This measure makes it possible to explain with what probability the present value is for example positive and thus favours leasing. My analysis will exclude non-cash flow based models like real options analysis due to their challenging framework and a heavy required involvement of the management.

1.4 Structure of the study

The thesis is constructed as follows: It begins with this introduction chapter and then continues to present the case in chapter 2. Chapter 3 reviews definitions and previous literature and is followed by data and methodology presentation in chapter 4. Chapter 5 discusses about the results while chapter 6 finally concludes. References and appendices are found in the end of the study, in chapters 7 and 8.

1.5 Findings of the study in brief

The thesis presents literature and different valuation methods of leasing and uses cash flow based methods like NPV and APV to determine whether it is preferable to purchase an Airbus A330 airliner for Finnair or operate one under an operating lease agreement. My first hypothesis, “operating lease is more cost-effective than purchasing in less than 10 years' time”, was quite clearly accepted as the results from both NPV and APV were indisputable. The second hypothesis, that the above holds also if the time period is extended, remains unanswered or can even be rejected. Although APV still very strongly suggests leasing over purchasing, NPV starts to draw nearer to purchasing. Still statistically leasing is the preferable choice but it is apparent that when the time period is lengthened, the purchase becomes more tempting. In brief, it seems that in current market environment Finnair should lease the A330 under an operating lease agreement rather than buy it. This is true especially if they are considering a rather short deployment. Although interest rates are low which could encourage direct debt finance, this theoretical model illustrates that financing costs of leasing are lower than costs related to purchasing.

2 CASE

This chapter will now introduce the case studied. Chapter will start with an industry outlook including a presentation of aircraft finance business as a whole. It will continue then by introducing the case company and the specific acquisition under the loop of my thesis.

2.1 Commercial airline industry - overview

2.1.1 *Current market outlook*

Airline industry has always had its turbulences and the cyclicity comes with the business, and not least today. The industry has been forced to face one of the greatest and probably long-lasting challenges to date. The current global crisis or recession has been on-going since the end of 2007 and has taken many forms from burst of housing bubble in the United States to the credit crunch and from financial to European sovereign debt crisis. Although maybe the worst part could be already over, this prolonged state of instability and imbalance is toxic for airlines. The thick veil of uncertainty at the moment is evident and dominates the current market outlook. The economic environment is challenging altogether but especially for airline business which is very sensitive to overall condition of the economy. As a service industry,

air transport is heavily dependent on the state of the economy for its growth. When economy is struggling, it is felt immediately in airlines as business passengers dissolve to economy and the demand for air travel is decreased as a whole. In addition to economic conditions, also many other factors affect directly to airlines. Political tensions and wars naturally have an effect on oil prices and therefore on flying. Natural disasters like earthquakes and following tsunamis in Asia in 2004 and 2011 can decrease the demand of air travel substantially. Terrorist attacks such as those in 11.9.2001 in the United States can also have long-lasting effects. Furthermore, also major health issues like SARS or bird flu have seen to have an instant and powerful, and sometimes local, impact on passenger amounts and profitability of the airlines. What is common in all these events is that the negative effect on the industry can be noticed quickly whereas the revival from it is much slower.

Because of recent difficulties in economy, airline industry faces clear pressure for cost cuts. Profitability needs improvement as profit margins are low and the demand can be insecure. Meanwhile the cost structures are generally quite heavy in many traditional airlines, including Finnair. This has forced many airlines, again like Finnair, to introduce efficiency measures to push down costs. Especially fixed costs need to be brought down. Naturally also operating costs are tried to be diminished.

However, cost cuts are only a temporary solution. Airlines need to be profitable to sustain in the long run. Airline industry has historically been characterized by cyclicity, sensitivity and unfortunately low-profitability. Introduction of low-cost carriers have complicated the traditional air carriers' situation even further. LCC's have changed the field permanently by dumping prices and offering overcapacity with totally new business models and low cost structures. The heavy price competition is just one example of these newly witnessed features of the modern competition. Today bankruptcies are pretty common and consolidation is ever so popular, and not just through mergers and acquisitions but also via alliances. A rising trend is also privatization of carriers. Because of long traditions of being national necessities, airlines are historically government-owned. To become more market-oriented, many companies have been privatized during the last two decades. Finnair is actually one of the remainders of that privatization wave along with British Airways, Lufthansa and Iberia. Overall, I think it is reasonable to say that the whole business is in a sort of turning point. This revolution will eliminate the weakest competitors and only those who can adapt to today's market and its regularities can survive.

So, for airlines it is crucial to be able to adapt quickly to changing environment and to react to demand changes as quickly possible. This is what makes leasing so preferable in today's world of aviation. The flexibility is crucial to cope with the competition. In a highly capital intensive industry, this effect is emphasized. However, before explaining the finance field of airline business I will review the current market conditions followed by future outlook.

According to Oxford Economics every year approximately 2.5 billion passengers and 50 million tonnes of freight are flown worldwide.¹ In 2007, European airlines alone transported about 700 million passengers and carried 10 million tonnes of freight. The global industry produces annual revenues of over \$600 billion as IATA presents.²

In their December 2012 outlook and January 2013 financial monitor³, IATA, The International Air Transport Association, forecasts \$6.7 billion airline net profits in 2012. Despite continued high fuel prices and a slowing world economy, airline profits and cash flows managed to stay at levels similar to 2006/7, when economic environment was stronger and oil prices \$40 lower per barrel. Profits are still lower than in 2011 but yet better than expected due to challenging business environment.

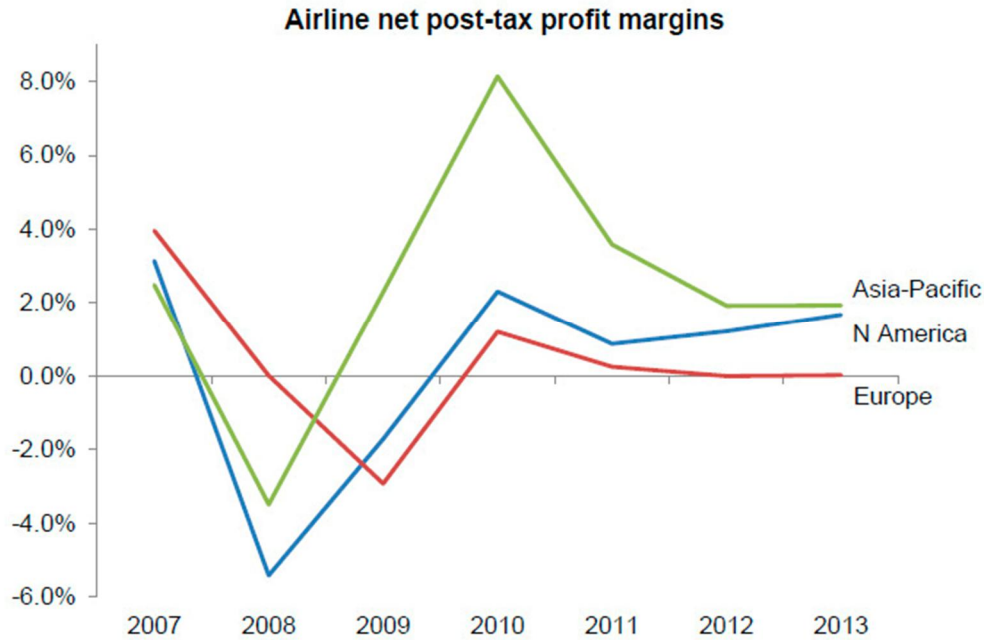
2012 started poorly but the second and third quarter showed an improved performance. This is mainly achieved by improved industry structure and airlines reacting to challenges with cost cuts. During the last quarter profits seemed to be settling but were still positive. Globally, the best performers are Asia-Pacific area and North America while Europe will only break even. That is, however, a solid achievement considering the damaged home markets due to Euro-zone crisis. IATA forecasts zero profit for Europe also in 2013.

¹ <http://www.oxfordeconomics.com/publication/open/222513>, retrieved 9.10.2012

² http://www.iata.org/pressroom/facts_figures/fact_sheets/Documents/industry-facts.pdf, retrieved 6.3.2013

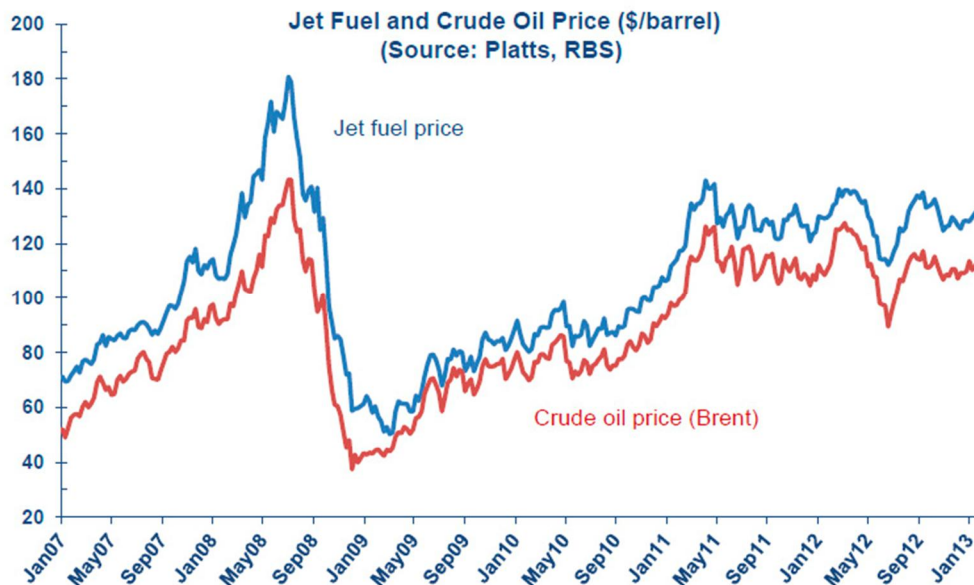
³ <http://www.iata.org/whatwedo/Documents/economics/Industry-Outlook-December2012.pdf>,

<http://www.iata.org/whatwedo/Documents/economics/AirlinesFinancialMonitorJan13.pdf>, retrieved 25.2.2013



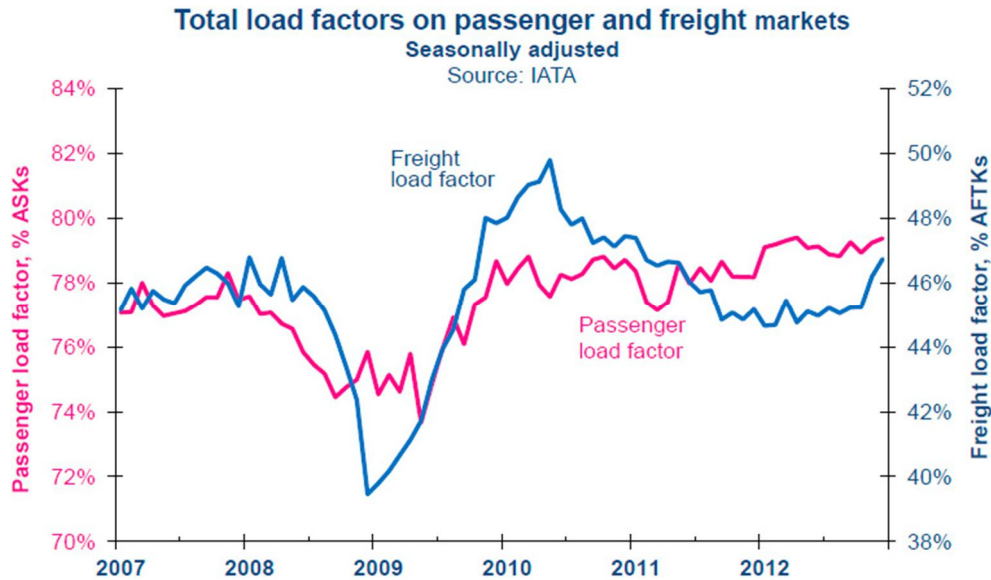
Graph 1. Airline net post-tax profit margins. Source: ICAO, IATA.

Jet fuel prices have fluctuated around \$130 a barrel for the past two years. There has been upward pressure on prices during 2012 which eased momentarily towards the end of the year but continued after OPEC cut crude oil production in December. This caused price to jump back above €130/bbl in January. Jet fuel prices have not increased substantially during past two years but they are considerable higher compared to pre-2010 levels. A higher kerosene price seems to be a new standard and this will have a great impact on airline profitability.



Graph 2. Jet fuel and crude oil price. Source: Platts, RBS.

A noticeable trend of 2012 was that airlines kept capacity growth below the increase in demand. This means that airlines are increasing their operations at slightly lower rate than the increase in demand. This is being done despite the strong number of new aircraft deliveries. As a result the load factors have increased and remained at record-high levels throughout the whole year.

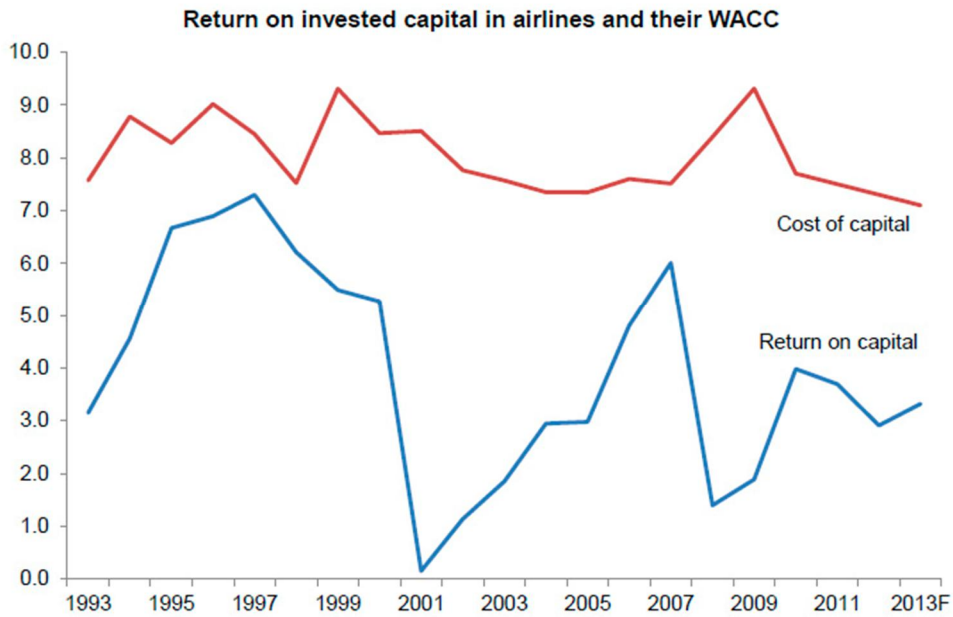


Graph 3. Total load factors on passenger and freight markets. Source: IATA.

Also a distinct feature in today's aviation market seems to be consolidation. It is most obvious on the US domestic market, where several mergers have contributed to the stability of capacity. Also new joint ventures have been witnessed. In Europe, the industry structure has been reshaped by exits. These concern both low cost carriers (LCC's) as well as network carriers. IATA explains that although the stronger airlines have improved their performance, the weak have got weaker and this has caused several bankruptcies. The number of start-ups has decreased substantially as a result of the financial crisis due to difficulties to raise finance.

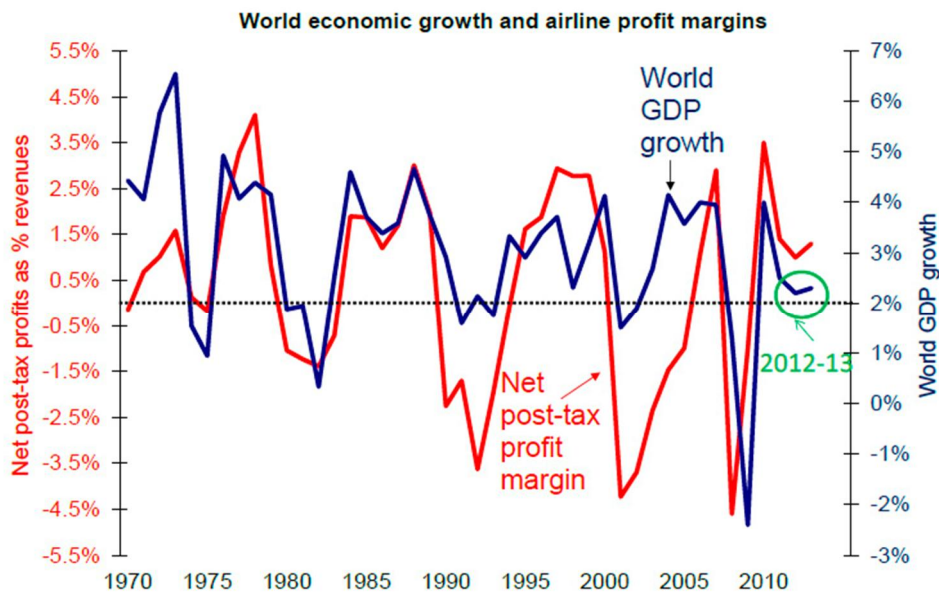
These changes in industry structure have been a significant factor in airline business resurrection. Airlines have been given a chance to gain from their efficiency measures and protect their cash flows while encountering weak economic growth and high fuel prices. However, that hasn't changed the fact that the industry remains highly competitive and the profitability and returns on capital remain very weak. As IATA describes, in a normal industry competition would force returns down to the cost of capital (WACC) but in the

airline industry competition is so intense that even in the good years returns on invested capital fail to reach the industry's cost of capital.



Graph 4. Return on invested capital in airlines and their WACC. Source: IATA.

In addition to already challenging business environment, the global economic growth has been very slow. The global GDP growth is close to 2% which has historically turned out to be a critical point where after airline industry profits turn to losses.



Graph 5. World economic growth and airline profit margins. Source: IATA.

Both passenger and freight markets finished 2012 strongly, supported by a further increase in business confidence. Even in difficult market environment, air traffic managed to grow 5.3%. This is in line with the long term averages and future forecasts by Boeing and Airbus reviewed later. Large airlines achieved EBITDA figures between 10-15%. Finnair's respective figure was 7%.

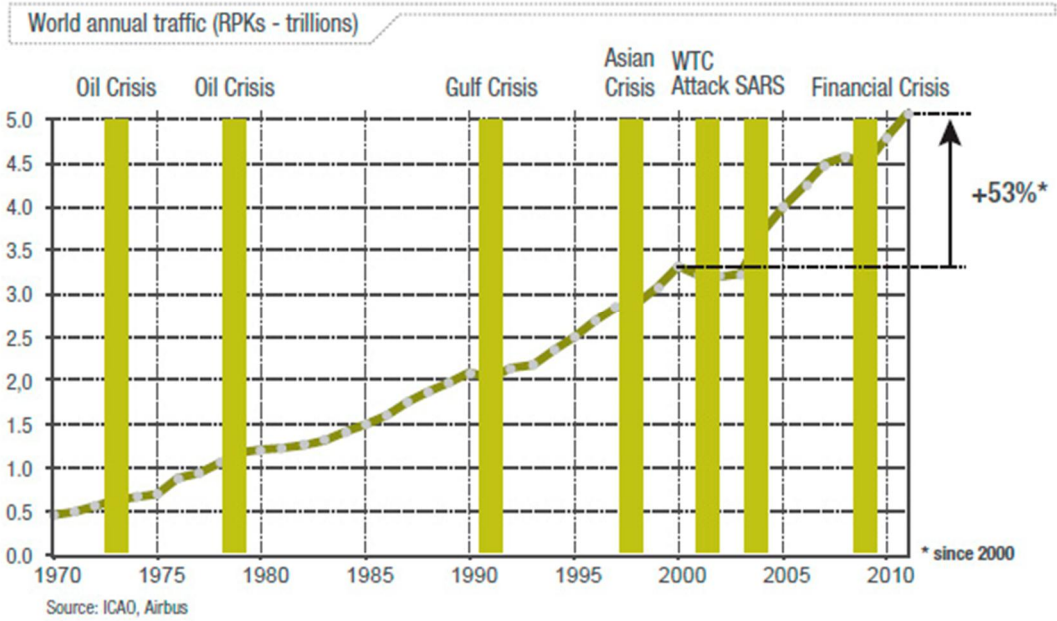
2.1.2 Future market outlook

Based on the better performance of the industry in 2012, IATA has revised their forecast of industry profits in 2013. They expect the net post-tax profits to cumulate up to \$8.4 billion this year which means a small, but less than expected, improvement from the year 2012. The growth is expected to be driven by slightly higher economic growth and slightly lower fuel prices. Anticipation for global economic growth, however, has been vanished. Overall, the global air travel is expected to increase but the growth can be slow. In addition, airline capacity management allows load factors to remain solid, thus helping financial performance. However, because of uncertainties in global economic growth, the demand for air transport remains fragile. According to IATA Business Confidence Survey, the survey made among airlines, Airline business confidence improved in January. Despite the global economic weaknesses, respondents showed improved profitability expectations in the next 12 months. Restructuring and consolidation actions together with efficiency measures have helped airlines and increased their confidence in the future.⁴

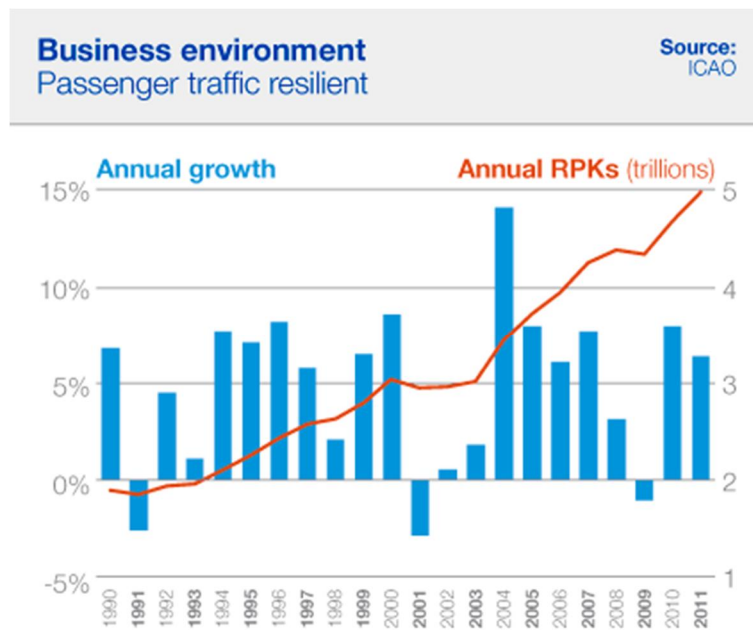
European aircraft manufacturer giant Airbus considers it remarkable that although the industry is facing one of its biggest challenges at the moment, it still has managed to grow over 50% since 2000 when measured with RPK.'s.⁵ Indeed, this time period includes such events as WTC attack, SARS and on-going financial crisis. This shows incomprehensible adaptability of the industry and confirms the constantly increasing demand for air travel. The graphs below illustrate how resilient the traffic growth in the end is to external shocks. Of course the impact of Gulf War, WTC attacks and global financial crisis are clearly seen in annual growth rates but annual RPK's are at worst remained constant. As Airbus puts it, people want and need to fly and that's the base of their future forecast as well.

⁴ http://www.iata.org/whatwedo/Documents/economics/BCS_Jan_13.pdf, retrieved 2.3.2013

⁵ Revenue passenger kilometres (RPK) is a common measure of the volume of passengers carried by an airline



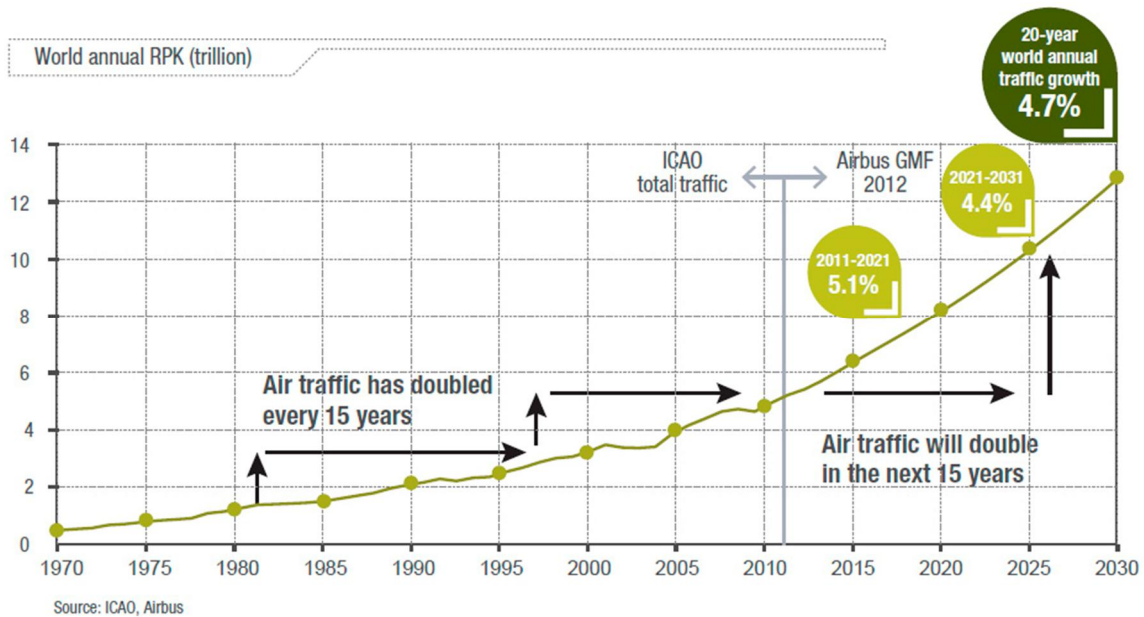
Graph 6. World annual traffic in RPKs since 1970. Source: ICAO, Airbus.



Graph 7. Annual growth and RPK's. Source: ICAO, Boeing

Airbus presents that the growth in airline business has come so far from the demographic evolution, increased wealth, progressive liberalization of air transport, globalization and availability of efficient, operationally capable aircraft. In the future, however, the two main factors driving the growth according to Airbus are global economic activity and the price of

travel. The growth seems to be approximately 5% annually. Both Airbus and Boeing forecast the average growth rate to continue as same 5% by year 2030.⁶



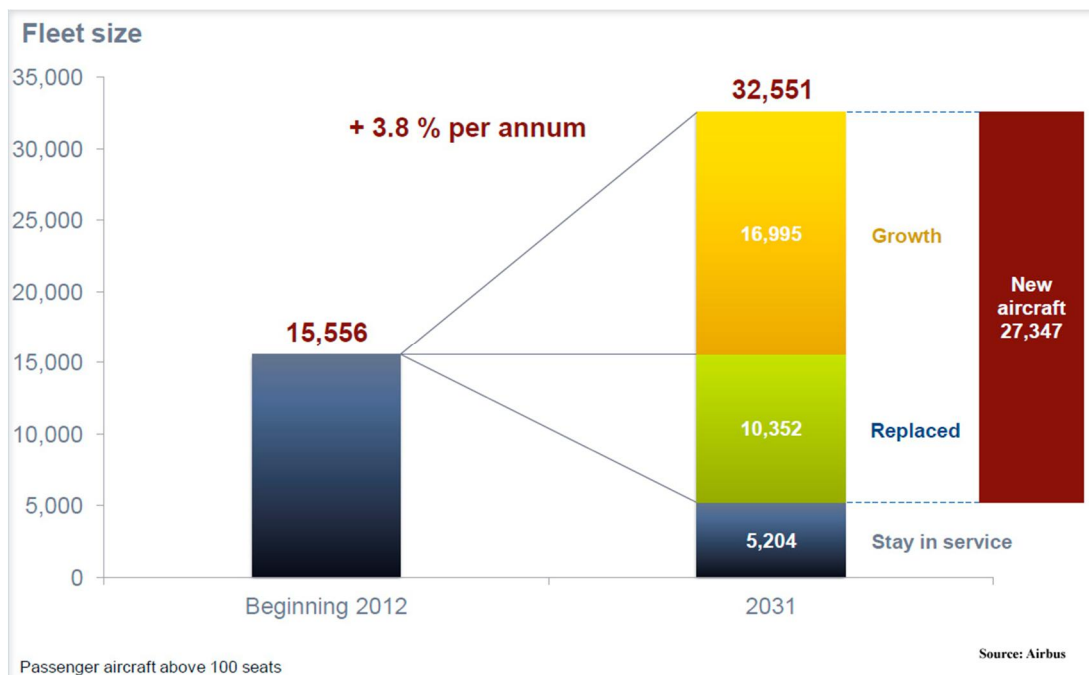
Graph 8. World annual RPK – forecast. Source: ICAO, Airbus.

Airbus expects the growth to be driven by emerging regions, especially China. China is currently the fastest growing market with lots of people, bigger cities and more wealth. An increased middle class means more first time fliers while the demand is stimulated by growing tourism and internationalization. Asia-Pacific area is an essential part of the global economy today, representing more than a quarter of it. Airbus describes how the economy in this area is growing 2.5 times faster than in Europe. This makes the region a main driver of global economic growth and air transport. In the future, its importance will be further emphasized as its market share is estimated to top one third of the world economy within twenty years. Airbus estimates that 56% of the economic growth between 2011 and 2031 will come from emerging regions. The three largest regions, as per airline bases, will be Asia-Pacific, Europe and North America with traffic contributions of 32%, 24% and 20%, respectively in 2031. The economic world in 2031, however, is probably quite different from today. China, the 3rd largest economy today, will soon take the second place over Japan while India, 8th at the moment, is estimated to squeeze into top three world economies by 2025. This estimated growth especially in Asia is naturally of the utmost importance to Finnair, whose core business will be long-haul flights to that region. More about Finnair's perspective will be

⁶ http://www.boeing.com/commercial/cmo/pdf/Boeing_Current_Market_Outlook_2012.pdf, retrieved 29.10.2012

covered later in this chapter. But overall, despite the positive outlook in the long run, the next few years may offer airlines still considerable challenges due to highly insecure environment.

This growth means naturally more aircraft. The Airbus Global Market Forecast (GMF)⁷ for 2012-2031 reveals a need for over 27,000 new passenger airliners delivered within that time frame. The Global Market Forecast also anticipates a more than doubling of the world's overall passenger aircraft inventory, from 17,000 in today to more than 35,500 by 2031. Boeing is even more courageous by estimating the need for 34,000 new airplanes to increase the total fleet to almost 40,000 aircraft in 2031. Today, 85% of all aircraft in the world is being delivered by these two main manufacturers, European Airbus and American Boeing.⁸ During 2012 they delivered 588 and 601 commercial aircraft, respectively. According to Aircraft Finance Report 2013 prepared by Flightglobal.com, net orders for Boeing and Airbus totalled 2036 aircraft accounting for a highest ever combined order backlog of 9055 aircraft.



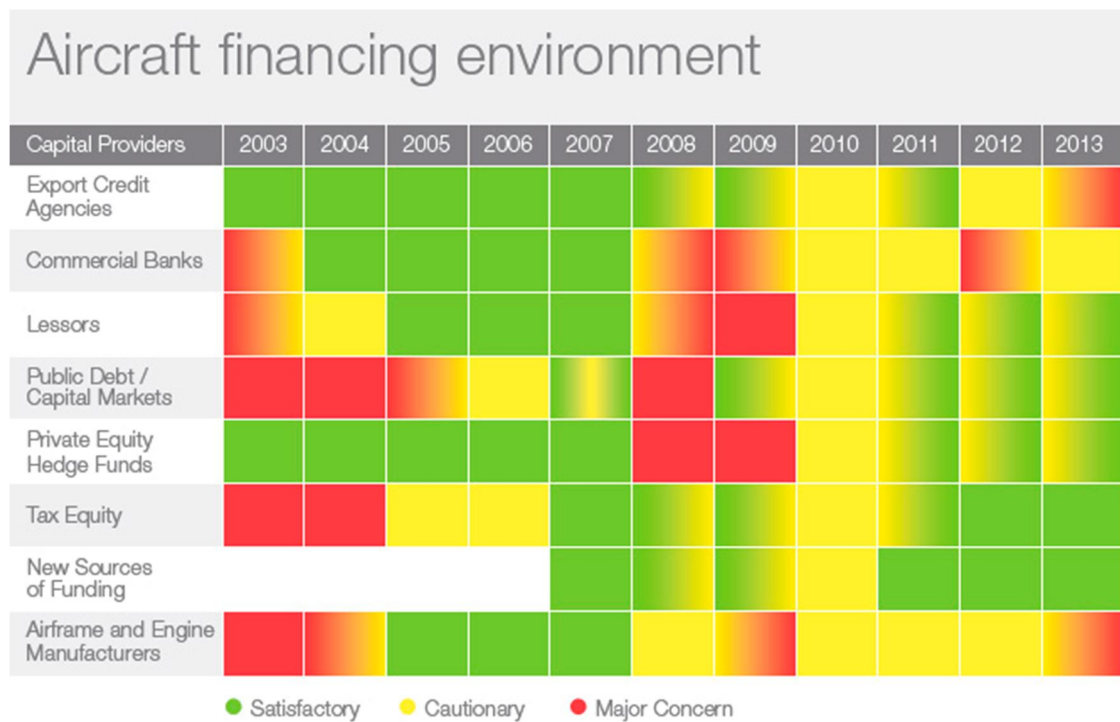
Graph 9. Global fleet development, 2012-2031. Source: Airbus.

⁷ http://www.airbus.com/company/market/forecast/?eID=dam_frontend_push&docID=27599, retrieved 2.3.2013

⁸ http://www.flightglobal.com/airspace/media/reports_pdf/emptys/102389/aircraft-finance-2013.pdf, retrieved 2.3.2013

2.1.3 Aircraft financing environment

According to Boeing⁹, stable demand growth together with high jet fuel prices is the key element which drives the aircraft replacement willingness to more fuel efficient airplanes. Main manufacturers have record-long backlogs which means long waiting times and scarcity of delivery positions. Boeing believes that this will ensure adequate availability of capital for airlines to fund the deliveries. Boeing expects aircraft financing markets to be liquid in 2013 despite the uncertainty but they are concerned about increasing fees and equity requirements for export credit transactions. At the same time, commercial bank debt is suspected to become more restrictive and expensive. Therefore, the role of the lessors and capital markets will be emphasized.



Graph 10. Aircraft financing environment. Source: Boeing.

During 2013, the aircraft industry are expecting deliveries worth roughly \$104 billion, an increase of 10% from \$95 billion this year, says Kostya Zolotusky, managing director at Boeing Capital Markets in Businessweek.¹⁰ 95% of these deliveries come from Airbus and Boeing. He expects this figure to go up to \$132 billion in 2017. So clearly this is a large and

⁹ <http://www.boeingcapital.com/cafmo/brochure.pdf>, retrieved 27.2.2013

¹⁰ <http://www.businessweek.com/news/2012-12-04/boeing-says-aircraft-financing-will-reach-104-billion-record>, retrieved 27.2.2013

constantly expanding business. The burning question today is who will finance all these deliveries?

The graph above illustrates the diversity of the aircraft financing environment. As Boeing explains in their Current Aircraft Finance Market Outlook¹¹, the sources of aircraft financing are changing because of the financial crisis in Europe. Timothy Myers, Vice President and General Manager of Aircraft Finance in Boeing, recognizes this change. He explains how traditional aircraft financiers, European banking community, are facing increased challenges and this has caused a shift in a market place. Also new regulations like Basel 3 are affecting these institutions. For 2013, the bank debt market appears to be stronger than year ago and more globally diversified as well. European banks continue to dominate but for example Japanese banks are expected to return to global markets with the support of banks from United States, Australia and Middle East. China recently loosened its monetary policy and this will increase the share of Chinese banks as financiers of domestic deliveries. Overall, Boeing believes that commercial bank market will improve in 2013.

Previously popular financing source, accounting for almost a third of all financing, the government backed-up export credit will become more expensive as the new Aircraft Sector Understanding (ASU) by Organisation for Economic Co-operation and Development will be fully implemented. This means higher fees and equity requirements. It is estimated that the new ASU will raise the credit premium for all borrowers but the stronger, and better rated, airlines will suffer the most from this new agreement.¹² Therefore the export credit support for new aircraft deliveries is expected to decline in 2013 as airlines will choose other more attractive options like commercial debt financing or operating leases, explains Kostya Zolotusky in Flightglobal's Aircraft Finance Report 2013.

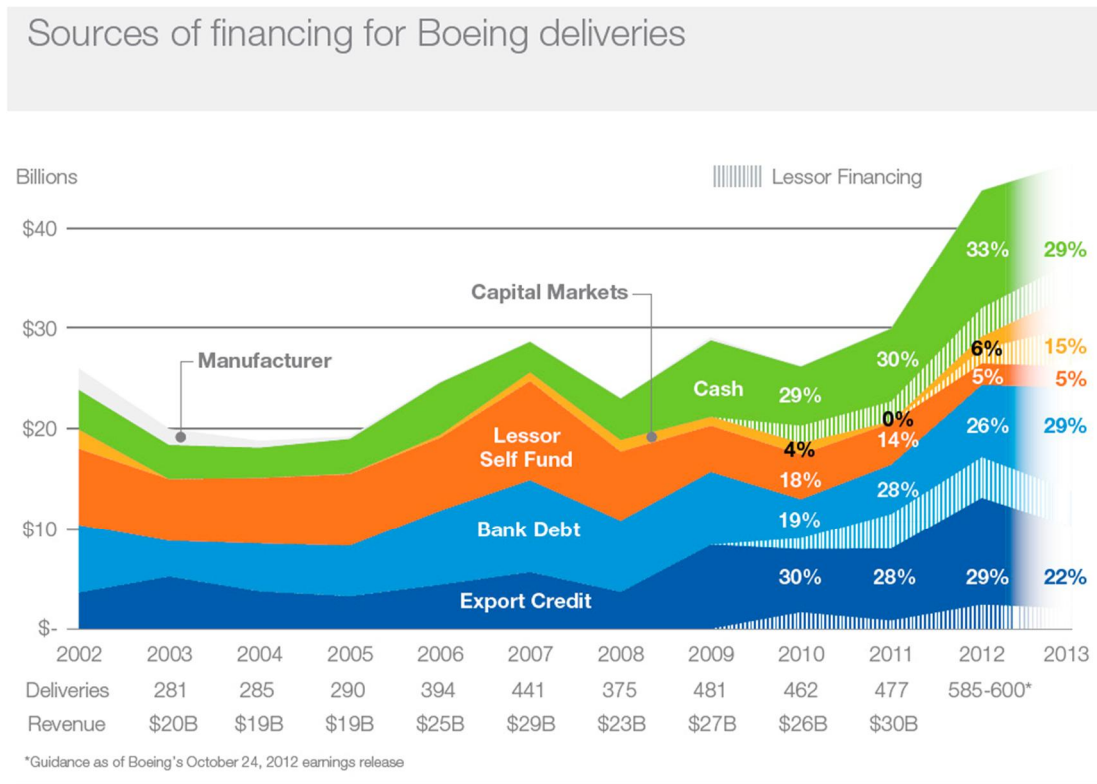
Zolotusky and Myers agree that this current setting will push more and more airlines to choose leasing rather than buying an aircraft. Myers believes that operators' fundamental desire isn't to own aircraft but focus on their main task, to fly people. Boeing reasons that with export credit and commercial bank debt available to fewer customers and at higher prices, more airlines are likely to lease airplanes. According to Flightglobal, operating leasing companies reached a 40% market share of new deliveries at Airbus in 2012. Boeing strongly believes that half of the global fleet is under an operating lease in ten years' time.

¹¹ <http://www.boeingcapital.com/cafmo/brochure.pdf>, retrieved 27.2.2013

¹² http://www.flightglobal.com/airspace/media/reports_pdf/emptys/102389/aircraft-finance-2013.pdf, retrieved 2.3.2013

The next natural question is where will the lessors find their financing? Lessors are used to be more self-funded but today only 5% of deliveries are financed from their parent companies' balance sheets. According to Scheinberg (2010), many corporate parents suffered from the recent economic collapse and lost large fortunes. Without the support from their parent, leasing companies are forced to turn to other options. Boeing thinks rapidly increasing participation of new and returning commercial banks together with a significant expansion of capital markets funding is the answer for the question above. Boeing's Zolotusky states that capital markets have become more important for lessors and foreign (not US-based) carriers. U.S. airline have traditionally used capital markets more extensively but now this trend is also landing in Europe. Boeing expects capital markets' contribution to increase significantly in 2013 resulting to segment financing 15 per cent of aircraft deliveries next year, up from 6 per cent in 2012. This will compensate the expected decline of credit export of 7 per cent.

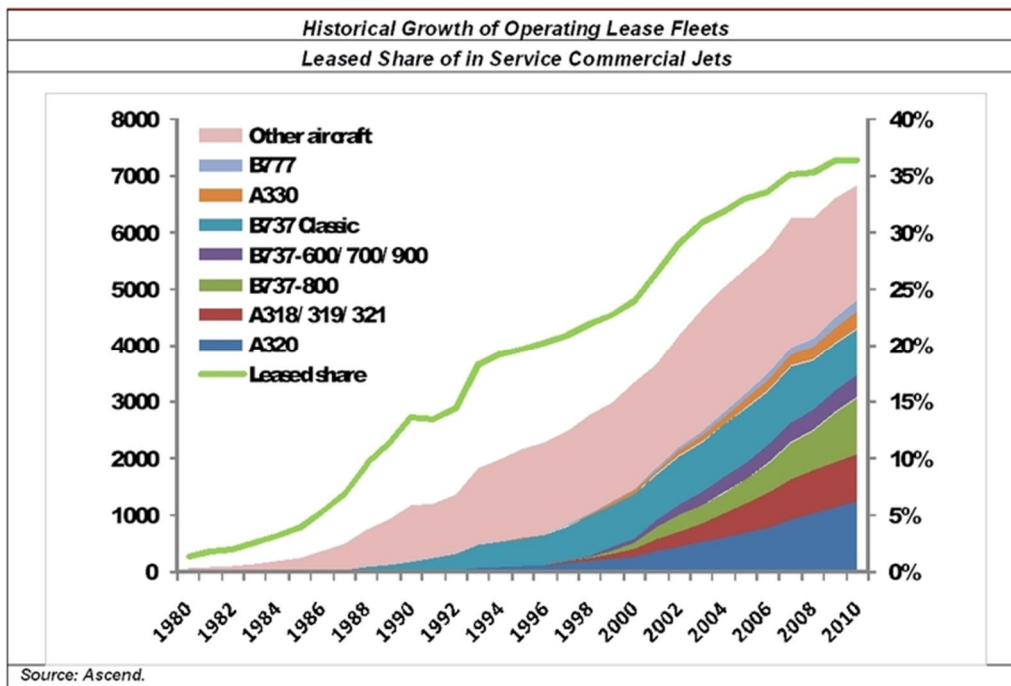
In addition to previously mentioned methods, Boeing reminds that the environment is still very uncertain and manufacturers may be forced to support buyers with some backstop financing for future deliveries. Myers adds that the industry may see an increased amount of also other forms of financiers, such as pension funds, insurance companies and sovereign wealth funds. He thinks that these are very ideal aviation financiers because they have long-term liabilities they need to match the assets with and aircraft are a perfect choice for that.



Graph 11. Sources of financing for Boeing deliveries. Source: Airbus.

2.1.4 Aircraft leasing

According to recent estimates, the increasing trend of operating leases in modern aviation business is evident as approximately one-half of the world's aircraft fleet is operating under some kind of lease and according to Gavazza (2010b) about one third specifically with the operating lease. Indeed, there is an increasing trend in favour of short-term operating lease. For example, Gritta et al. (1994) reported that, for a sample of major US carriers, percentage of planes leased increased from 19% in 1969 to 54% in 1991 and the percentage of aircraft under operating leases to total leased aircraft increased from 13% in 1969 to 82% in 1991. The share of new aircraft acquired by operating lessors has increased from close to zero in the early 1980s to above 40% recently¹³. According to Ascend, an aviation consultancy¹⁴, leasing is actually more pronounced especially in Europe and Latin America. They state that even 44% of aircraft in Europe are leased. As previously mentioned, Boeing expects that leasing will represent over half of worldwide fleet by 2020. In this thesis operating leases are being studied because of their dominating prevalence in capital financing of airlines.



Graph 12. Historical growth of operating lease fleets. Source: Ascend.

¹³ http://www.flightglobal.com/airspace/media/reports_pdf/emptys/102389/aircraft-finance-2013.pdf, retrieved 2.3.2013

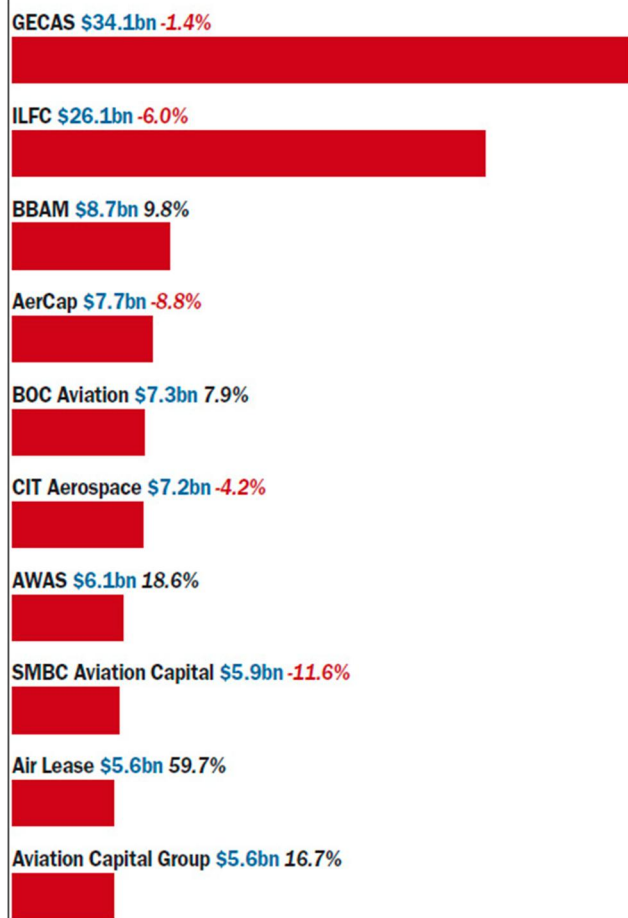
¹⁴ http://www.ascendworldwide.com/Ascend-OperatingLessorAnalysis_Q4-2010.pdf, retrieved 2.3.2013

Boeing estimates that there are currently over 150 lessors in the world and more than 700 customers in some 140 countries around the globe. Ascend describes that the amount of lessors has doubled in recent twenty years. However, the industry is led by only few large players. The pioneer in aircraft leasing, ILFC, together with another huge lessor GECAS are clearly dominating the market with a combined market share of about one third. Ascend continues that historically top 5 lessors have controlled about half of the leased fleet. Moreover, economist Paul Sheridan from Ascend notes that of the world's four largest owners of airliners, two are lessors.

GECAS has a fleet of 1,732 planes and ILFC 1,031. The biggest airline at time of the article measured with fleet size was

Delta, which owned “only” 800 aircraft.¹⁵ In this kind of market, the experience, outlook, market power and purchase power of leasing companies is clear.

In *Airline Fleet Management's* January – February issue¹⁶, Bill Collins, VP for leasing and asset management sales at Boeing, reasons for this increasing popularity of leases. According to him, the main reason is the low profitability of airlines, thus finding them hard to purchase an aircraft outright. He explains that airlines are trying to maintain liquidity and keep their liabilities off their balance sheets. As leasing holds capital costs down, it is most appealing to capital constrained airlines. He also reluctantly admits that highly experienced lessors have become market experts and airlines appreciate this increased consultant role of leasing companies. Collins clarifies that lessors are nowadays actually financing companies with better and cheaper access to financing. This is what makes them more profitable than airlines,



Graph 13. Top 10 aircraft lessors by fleet value.

Source: Flightglobal

¹⁵ <http://www.economist.com/node/21543195>, retrieved 1.10.2012

¹⁶ <http://viewer.zmags.com/publication/8477a87d?page=1#/8477a87d/41>, retrieved 25.2.2013

continues previously mentioned Kostya Zolotusky. Zolotusky continues that because commercial lenders will focus more and more on better rated customers, many airlines are unable to purchase aircraft and therefore the leasing business will grow even faster. The Boeing executive also stresses the importance of airline's own long-term desires when considering lease-versus-purchase question. Many airlines are beginning to think that it may be better to someone else to own the assets, treat them as investments and bear the associated risks. The drawback of leasing is of course tightened cash flows because of all airplane utilization and rent payments. So, owning an aircraft produces cash-flow flexibility but in order to gain from the owning, airline needs to make profit to have the taxation benefits.

Dick Forsberg¹⁷, a head of strategy of an aircraft lessor, is in line with Zolotusky and says that aircraft leasing is far more profitable and less risky business than airline business itself. He explains how lessors are less exposed to external variations directly and because of long-term agreements their cash flow is more stable. However, lessors do expose themselves to credit quality of their customers, airlines. Forsberg continues how despite volatility of air transport industry during past twenty years aircraft leasing companies have experienced relatively low fluctuation in their profitability and returns.

IATA regards the sharp decrease of lease rates in recent years, particularly for larger aircraft, the most influential reason for the lease popularity.¹⁸ They continue that while interest rates remain low, also the lease rates are attractive. IATA states that also delays of new Airbus and Boeing widebodies have contributed to growth of leasing as airlines are forced to enter into substitutive leasing agreements as a temporary solution. Indeed, the market have seen exceptional amount of sale and leasebacks. Those agreements benefit both airlines and lessors as former improves cash flow while the latter avoids pre-delivery payments and additional costs, states IATA. Also Finnair has entered into four financial leasing agreements, all of with the Airbus A330 aircraft.

CIT, corporate aircraft lessor, and Forbes carried out a survey of almost 136 airline executive around the world in 2010. In their survey over half of the respondents said that they lease more than 50% of their fleets.¹⁹ Interestingly, and on contrary, Finnair has announced that their strategy is to own more than a half of their fleet.²⁰ The strategy is in line with the current

¹⁷ <http://www.aviationfinance.aero/articles/11510/Leasing-can-provide-an-attractive-investment-opportunity-for-long-term-equity-investors%3A-Forsberg.>, retrieved 9.10.2012

¹⁸ <http://www.iata.org/publications/airlines-international/august-2010/Pages/07a.aspx>, retrieved 9.10.2012

¹⁹ http://catsr.ite.gmu.edu/SYST660/CIT_Aircraft_Leasing_Industry_Overview.pdf, retrieved 9.10.2012

²⁰ http://www.finnairgroup.com/linked/en/downloads/Finnair_IR_November_2012.pdf, retrieved 4.3.2013

situation as Finnair owns 66% of their fleet. The fleet is covered more thoroughly in next sub-chapter.

A curiosity from the academic world is the study of Bazargan and Hartman (2012), where they develop a model for aircraft replacement strategy for both small low cost carrier with narrow fleet and major airline with diversified fleet. They find that regardless of the airline network size and fleet diversity the suggestion is same: prefer leasing over purchasing, prefer short-term leases, discourage fleet diversity and sell over 12 years old aircraft. This strongly speaks for behalf of leasing as a strong preference in today's aviation world. This is in line with the findings of Oum et. al (2000) who consider leasing as an important tool for the modern airline industry

Despite the many optimistic predictions, the leasing market hasn't come clear just yet, writes AirFinance Journal in August 2012.²¹ Lease rates are pretty unstable and quite low at the moment, clearly lower than before 2007. Paper suggests that this is due to a combination of low interest levels, depreciation of aircraft values and low profit margins. The cost of debt is rising and pushing rates up but at the same time lessor competition will hold rates down. Also recent quite large acquisitions among the largest lessors may have an impact. There is also a great variation in rates between the aircraft types. Michael Inglese, Chief Financial Officer at Aircastle, says that the rates for narrowbodies have held up well over the past year. Widebodies struggle more but actually A330 seems to be returned to lease rate levels of 2007 due to high demand and lack of availability in the market. Especially in Asia, the demand for larger aircraft is indisputable.

Now, in the revival from the recent financial crisis, the world economy has rebounded and there has been a strong and rapid recovery among the aircraft lessors. More and more lessors are purchasing aircrafts from the manufacturers after a slower business cycle compared to airlines purchasing aircrafts directly themselves. In addition, the leasing market environment has changed during the crisis and several new players have entered the market. As conditions in the market continue to be uncertain, it may be that leasing companies emphasize increasingly creditworthy airlines in their customer selection. According to IATA, lessors are also looking to raise the security deposit and the maintenance reserve. Overall, leasing companies are generally reaching good profits, a trend that seems to continue. This increased role of the lessors emphasizes the highly topical question related to aircraft financing.

²¹ 2012 OPERATING LEASE SURVEY. Airfinance Journal. Jul/Aug2012, p1-1., retrieved 1.10.2012

Increased importance of aircraft leases in airline business clearly states that the debate of buy versus lease is going to become more and more relevant. Next sub-chapter will present the case company, Finnair.

2.2 Presentation of the case company

This section presents briefly the case company. It will start by describing the outlook of the company today and tomorrow. It will also take a look back and review the results and major events in 2012. This is followed by a presentation of Finnair's current fleet and how the aircraft financing is managed. Finally, the capital budgeting practices used are being discussed.

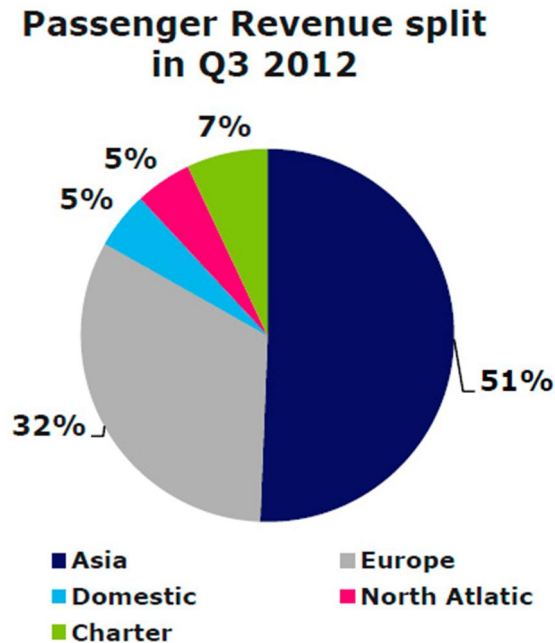
2.2.1 *Finnair in 2013 – Strategy and outlook*

Finnair is one of world's oldest continually operating airlines. The company was founded already in 1923 so Finnair will be celebrating its 90th anniversary in 2013. Finnair is for the most part state-owned. Although always being eager for long-haul expansion, Finnair was for a long time a basic point-to-point airline serving both domestic and European routes. Of course, in addition Finnair has for a long time had also broad long-haul coverage but not until past ten years the whole ideology is turned upside down and almost the whole fleet is actually harnessed to serve the Asian expansion. Now the role of the European flights are not just to bring Finnish people back home as it used to but to bring people from Europe to Helsinki and further to Asia and vice versa.

Indeed, in recent years, a key part of Finnair's strategy has been strengthening the company's position in the Asian market and particularly in traffic between Europe and Asia. Today, Finnair has been able to establish a solid position in traffic to Asia. This is heavily supported by the Finland's favourable geographical location. The shortest great circle route from Europe to Asia passes through Helsinki. This brings a clear competitive advantage. Finnair is currently operating scheduled flights to 12 long-haul destinations: Tokyo, Osaka, Nagoya, Beijing, Chongqing, Shanghai, Hong Kong, Bangkok, Delhi, Seoul, Singapore and New York.²² In summer 2013 Finnair will also introduce nonstop flights to Xian and Hanoi. The dominance of Asian destinations is clear. Finnair reports that the Asian share of the total capacity is already 49.8% while contributing to 45% of total passenger revenue at the end of

²² http://www.finnairgroup.com/linked/en/konserni/Finnair_Financial_report_2012.pdf, retrieved 8.3.2013

year 2012. The weekly frequency of Asian flights is, depending on the season, about 70 flights. In Asia, Finnair is the 3rd largest carrier in its destinations and has an estimated market share of 5.9% on those routes.



Graph 14. Finnair's passenger revenue split in Q3 2012. Source: Finnair.

About 20 million passengers travel annually on the Finnair's Europe-Asia routes which makes this globally one of the fastest growing traffic areas. In addition, the traffic between Europe and China is forecasted to triple during the next 30 year as Airbus forecasts. Finnair's core strategy is specifically based on this expected growth in Asia by providing the fastest connections between Europe and Asia, with high-quality service. Finnair strives to retain its reputation as one of the most punctual and safe airlines in the industry. Finnair will focus particularly in the fast growing Asian economies and to those European cities that do not provide direct connections to Asia. As Finnair states in its newest financial report, the growth of one percentage point in travel between Europe and Asia would mean approximately 200,000 potential new passengers annually. Airbus has forecasted that the expected annual growth would be 4.1% annually to 2031, measured by revenue passenger kilometres (CAGR). To Finnair, this naturally means excellent opportunities for growth.

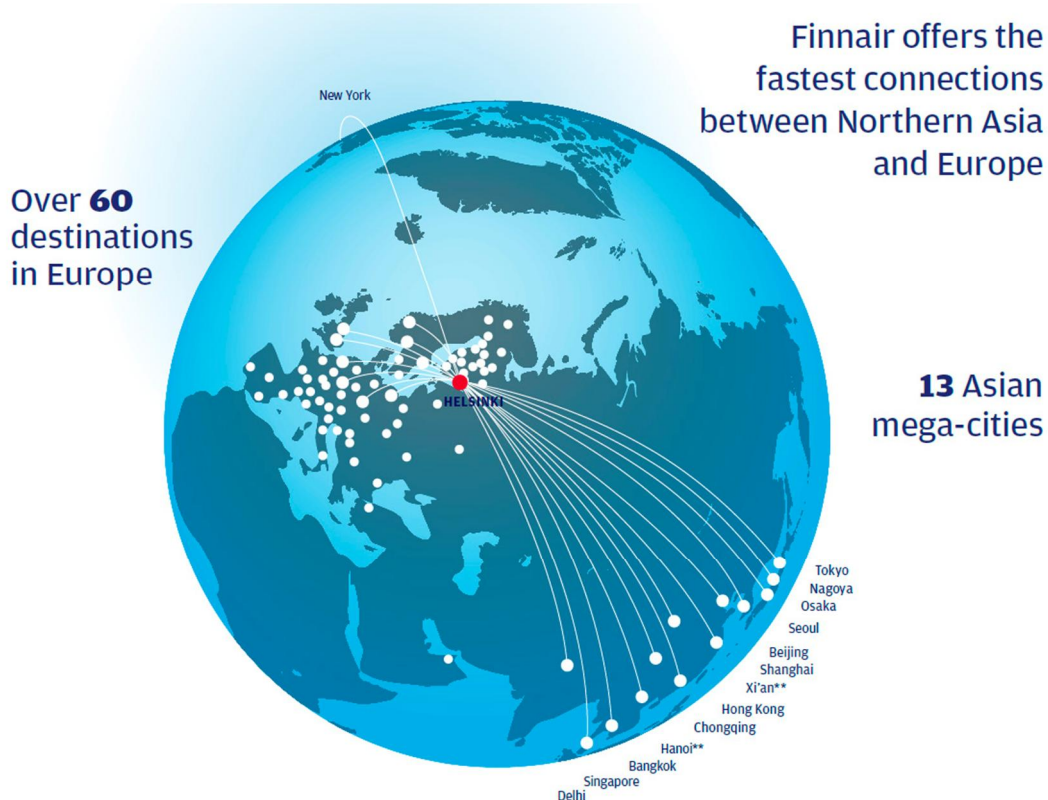


Figure 1. Finnair's route structure in 2013. Source: Finnair.

Next, I will take a quick glance at year 2012 and review the key factors influencing where the company stands currently. 2012 Finnair finally returned to profit after four consecutive years of losses. Improved unit revenues and a successful cost-reduction program have definitely contributed to this. Finnair succeeded in increasing its turnover by 8.5% to 2,449.4 million euros while at the same time the profitability improved, resulting to an operational result of 44.9 million euros. In 2012 Finnair was one of the best companies in the industry in terms of unit revenue development. The renewed revenue management and pricing made an impact and Finnair over-performed its competitors in unit revenue growth during the first half of the year.²³ Unit revenues of the full year improved by a record-breaking 7.7 percentages. This was achieved as both passenger load factor (PLF) and yield per revenue passenger kilometre (RPK yield) improved simultaneously.²⁴

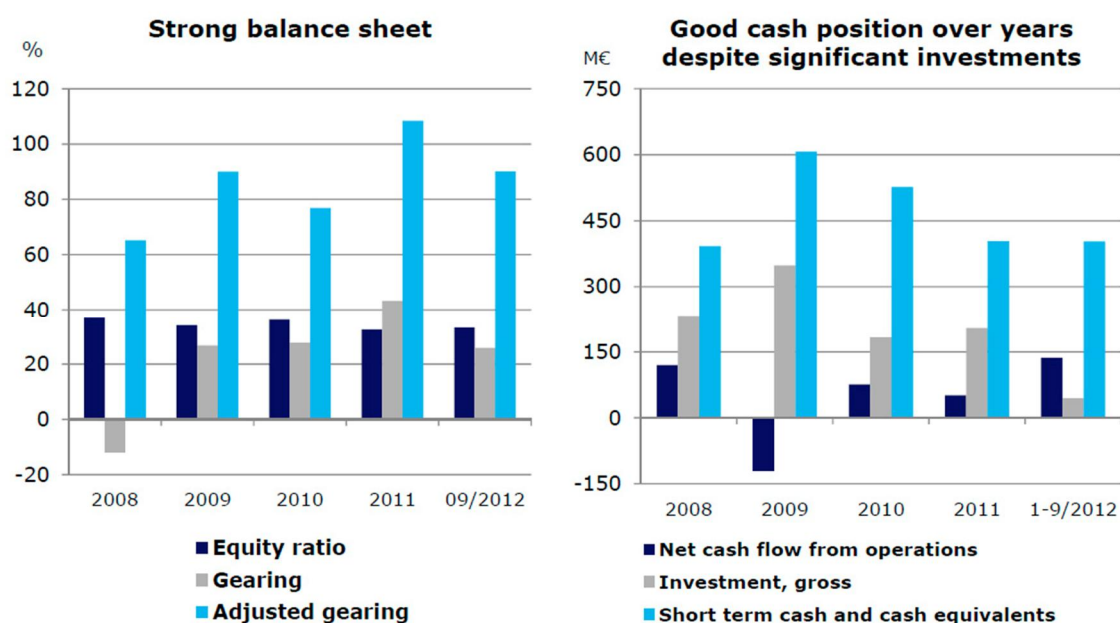
Being a traditional and long-serving airline has definitely both pros and cons. Of course the company culture is very strong and for example safety-orientation can be regarded as a self-evident truth. However, there are also downsides, one of which is the heavy cost structure.

²³ http://www.finnairgroup.com/linked/en/downloads/04_CMD_Pete_031212_FINAL.pdf, retrieved 4.3.2013

²⁴ http://www.finnairgroup.com/linked/en/downloads/05_CMD_Erno_031212_FINAL.pdf, retrieved 4.3.2013

Traditional airlines are built quite differently than for example low cost carriers. Also Finnair has been forced to restructure its businesses many times along the way as the environment constantly changes. In 2011 Finnair launched a structural change and cost-reduction program which aims to cumulated savings of 140 million euros by the end of 2013. By the end of 2012, already 100 million euros of permanent and annual savings were achieved. However, during 2012 Finnair introduced an additional cost-cutting program of 60 million euros to further improve the profitability and to ensure the future fleet investments. Finnair's CEO Mika Vehviläinen states that additional cost reductions are absolutely necessary to achieve sustainable profitability needed to finance the Airbus A350 investments. Those investments are, needless to say, vital for Finnair to be competitive in the future.

One of the major events in 2012 related to restructuring were the transfer of European Embraer traffic to Flybe Finland Oy, a Finnish subsidiary of British Flybe and Finnair, with a contract flying-agreement. This means that the commercial control over the routes and the risk remain with Finnair. Flybe was already in charge of Finnair's domestic flights. Other restructurings were related to technical services and catering.



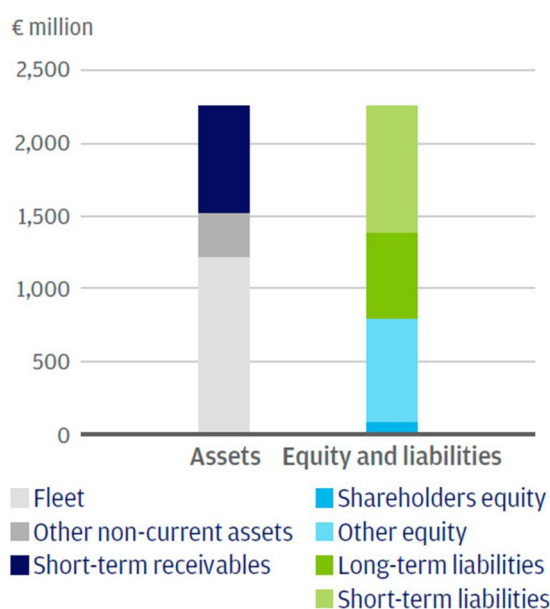
Graph 15. Finnair's debt ratios and cash flows. Source: Finnair.

Finnair has a strong financial position, which supports future investments. The company's net cash flow from operating activities was 154.7 million euros in 2012, a clear improvement to last year's corresponding figure. The balance sheet also strengthened during 2012. The equity

ratio was 35.7%, gearing 17.6% and adjusted gearing 76.8%. At the end of the period under review, interest-bearing debt amounted to 569.0 million euros. Also the liquidity remained good in 2012. The company's cash funds amounted to 430.5 million euros and in addition the company has the option for re-borrowing employment pension fund reserves worth approximately 430 million euros from its employment pension insurance company. Finnair also has funding available through an entirely unused 200 million Euro syndicated credit agreement, which will mature in June 2013. Finnair's assets and liabilities are visualized in the graph below. More Finnair key figures can be found in *APPENDICES*

Appendix I.

Assets and liabilities



Graph 16. Finnair's asset and liabilities. Source: Finnair.

Vehviläinen explains the Finnair's vision and condenses it to three main points. First, Finnair is striving to double its revenue from Asian traffic by 2020 compared with the level of 2010. Second, the company has set a goal to be the most desired option in traffic between Asia and Europe and among the third largest airlines on routes between Asia and Europe where passengers have to change planes. Third, Finnair also wants to be the number one airline in the Nordic countries and at the same time grow in this home market.²⁵

²⁵ http://www.finnairgroup.com/linked/en/downloads/01_CMD_Mika_1_031212_FINAL.pdf, retrieved 4.3.2013

According to Vehviläinen, this is done by focusing on core airline business in both scheduled long and short haul traffic, in leisure traffic and in cargo traffic. Profitability needs to be improved by improving operational efficiency, cutting costs and changing cost structure and by increasing revenues. He concludes that Finnair's strengths are a clear strategy, competitive advantage because of geographical location, modern, fuel-efficient fleet, high-class service, operational quality and efficiency, quality and capacity of Helsinki-Vantaa Airport and good financing position for implementing future fleet investments.

As Finnair states in one of its presentations²⁶, the company needs to change along with the environment to remain competitive. This is recently done for example by optimizing the narrowbody fleet. Nine aircraft have been totally removed from service and several lease agreements have been renegotiated with multiple Airbus lessors. Also route planning and aircraft utilization have improved with the help of new network forecasting and fleet planning tools. In addition, new partnerships are improving cost efficiency and flexibility. For example Flybe Finland provides a lower cost base for turboprops and small jets.

As previously reviewed the outlook in Europe remains challenging and uncertain. The traffic is expected to grow in moderation and jet fuel prices will most probably remain high. This will set up a difficult environment but Finnair estimates that it will increase its turnover in 2013. The company also expects that unit cost excluding fuel will decrease and operational result will be in profit.

2.2.2 Current fleet and aircraft financing

Finnair has one of the most modern fleets in the world. The average age of the fleet is about ten years and long-haul fleet about seven years. The fleet consists of narrowbody aircraft which fly domestic and European scheduled and leisure flights and widebody aircraft purposed to long-haul routes. Finnair's fleet is managed by Finnair Aircraft Finance Oy, a wholly-owned subsidiary of Finnair Plc. At the end of 2012, Finnair itself operated 45 aircraft, of which 15 are wide-body and 30 narrow-body aircraft. In addition to the aircraft operated by Finnair, its balance sheet includes 24 aircraft owned by the company and operated by other airlines, mainly by Flybe Finland. Finnair also has eight leased aircraft, which it has subleased and which are operated by other airlines. At the end of year 2012, two thirds of the fleet operated by Finnair was owned by the company while the remaining third

²⁶ http://www.finnairgroup.com/linked/en/downloads/03_CMD_Greg_031212_FINAL.pdf, retrieved 4.3.2013

were leased. The main purpose of this diversification of ownership according to Finnair is the management of residual value risk of the aircraft.

**Fleet operated by Finnair
on 31 Dec 2012**

	Seats	Pcs	Own	Leased (operational leasing)	(finance leasing)	Average age	Change from 31 Dec 2011	Ordered	Add. options
European traffic									
Airbus A319	123-138	9	7	2		11.5	-2		
Airbus A320	165	10	6	4		10.4	-2		
Airbus A321	196	6	4	2		12.0		5	
Embraer 170*	76	1	1			6.4	-4		
Embraer 190	100						-12		
Long-haul traffic									
Airbus A330	297/271/263	8	4	1	3	3.2			
Airbus A340	270/269	7	5	2		10.0			
Airbus A350	na.							11	8
Leisure traffic									
Boeing B757	227	4	0	4		15.0			
Total		45	27	15	3	9.8	-20	16	8

**Fleet owned by Finnair and operated by other
airlines on 31 Dec 2012****

	Seats	Pcs	Own		Average age	Change from 31 Dec 2011	Ordered	Add. options
ATR 72	68-72	12	12		3.4	+1		
Embraer 170	76	4	4		6.5	+4		
Embraer 190	100	8	8		4.0	+8		
Total		24	24		4.1	+13		

* The E170 aircraft leased to Honeywell and operated by Finnair.

** All ATR aircraft, all E190 aircraft and two E170 aircraft have been leased to Flybe Nordic and two E170 aircraft to parties outside the Group.

Table 1. Finnair's fleet on 31 Dec 2012. Source: Finnair.

The fleet operated by Finnair was reduced by an over-whelming twenty aircraft in total during 2012. Finnair transferred the traffic of its Embraer 190 aircraft to be operated by Flybe Finland Oy. This affected twelve aircraft. Additionally, the company received one ATR aircraft that is now leased to Flybe. Nine aircraft were additionally eliminated from the fleet when Finnair gave up four Airbus 32S series aircraft after the end of their leasing agreements and subleased four Embraer 170 aircraft to Estonian Air. Further, the company leased one Embraer 170 aircraft through a wet lease agreement to Honeywell for a year. It is noteworthy

that because of recent fleet restructurings, the share of owned aircraft has increased from 59% last year to previously mentioned 66% today. This is typical in insecure times in Finnair as during credit crisis Finnair took all the widebody aircraft into its balance sheet.²⁷

Finnair has several alternatives for financing their aircraft in addition to purchasing them.²⁸ Funding sources available for aircraft investments are both asset backed loans and bonds, export credit and (Japanese) operating lease. As can be seen many of these are secured by aircraft as collateral. Today's trend seems to be that also operating leases need an asset security (Scheinberg, 2010). In asset backed financing, the asset, in this case aircraft, functions as collateral. Common loan to values are 70-100% depending on the vehicle meaning that down payments amount from zero to about 30%. As previously reviewed in the current market outlook section, the government backed export credit is expected to lose its appeal because of new regulations making it more expensive. As also mentioned, capital markets are expected to source aircraft financing even more than before and that's why asset backed bonds may gain some popularity. Also Finnair has participated in capital markets as the company issued a hybrid bond loan of 120 million euros in 2012 and simultaneously repurchased 67.7 million worth of the 120 million hybrid loan issued in 2009.²⁹

Finnair is fairly well rated, so asset backed bonds may offer also some appealing alternatives. The company itself describes that the current state of credit market and Finnair's good debt capacity enable the financing of future fixed-asset investments on competitive terms. Finnair has 31 unencumbered³⁰ aircraft, whose balance sheet value corresponds to approximately 40% of the value of the entire fleet of 1.2 billion euros. This includes three finance lease aircraft. The number of unencumbered aircraft will increase to 36 by the end of 2013. Detailed figures can be found in *Appendix 2*.

However, the operating lease seems to be the trend today, especially when trying to diversify the residual risk. Increased share of owned aircraft in Finnair's fleet could encourage operating lease as a finance source. In the graph below left is illustrated all the lease commitments in Finnair, year by year. On the right are yearly operating lease liabilities of aircraft. In this graph, the annual lease rentals are multiplied by seven to achieve this figure.

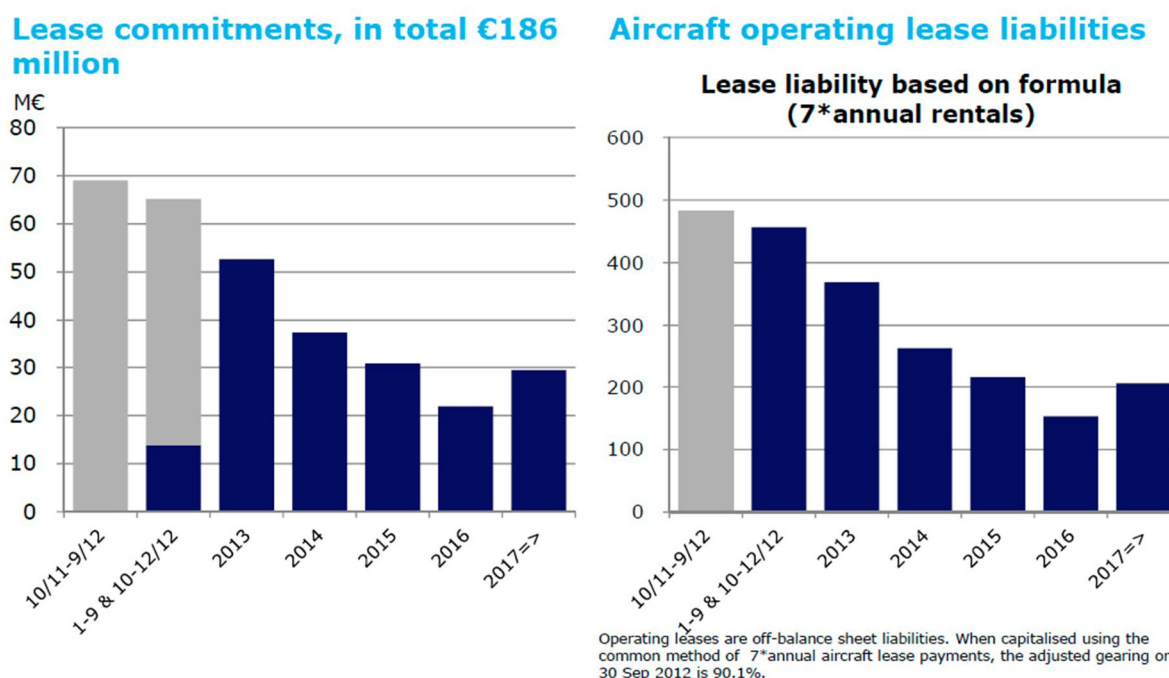
²⁷ <https://newsclient.omxgroup.com/cdsPublic/viewDisclosure.action?disclosureId=432730&lang=en>, retrieved 27.2.2013

²⁸ http://www.finnairgroup.com/linked/en/downloads/05_CMD_Erno_031212_FINAL.pdf, retrieved 4.3.2013

²⁹ <https://newsclient.omxgroup.com/cdsPublic/viewDisclosure.action?disclosureId=529822&lang=en>, retrieved 4.3.2013

³⁰ Unencumbered = the asset isn't as collateral in any agreement and thus can be used as one in the future

This is a common method of capitalizing the liabilities in the industry and to maintain comparability, also Finnair uses this formula. The formula is based on an assumption that the current leases are renewed, so that the demand for aircraft in use remains constant. Actual lease liabilities are naturally lower than reported due to expiring agreements.



Graph 17. Lease commitments and operating lease liabilities in Finnair. Source: Finnair.

Finnair has, however, stated that in the long-run, owning aircraft is the most cost-efficient way to finance their fleet. Nat Pieper from Delta agrees.³¹ He argues that big airlines are better off buying planes and keeping them for their full lifespan of 30 years or so. He reasons that like many other expensive commodities, buying is cheaper than renting in the long term. He fears that the growth and profitability of the aircraft-leasing business is actually a reflection of how short term the airline business has become. However, Finnair continues that their strategy is to own over 50% of their core fleet, an objective fulfilled at the moment. The company emphasizes that various sources and instruments are used for financing to ensure the lowest possible cost of financing and the best possible operational flexibility and continuity.

Finnair explains that fleet investments are usually done through secured financing, unsecured loans are then used for refinancing and flexibility. Sources of financing could be commercial paper program of €200 million, which has 61 million euros outstanding or revolving credit facility of 200 million euros which expires in Q2/2013 and is unutilized at the moment. Other

³¹ <http://www.economist.com/node/21543195>, retrieved 1.10.2012

potential funding sources could be non-core fleet sale and leasebacks, asset optimization, pension loan or senior unsecured bond.

According to Finnair, fleet renewal is an essential part in a successful strategy implementation. This is justified with reduced unit costs and improved fuel efficiency. In first phase in 2008-2010 MD11 fleet was replaced with Airbus 330/340 aircraft. The second phase was carried out in 2012 as 9 aircraft were reduced from European fleet and Embraer traffic was transferred to Flybe. The third phase is to be initiated during 2013-2014 when Boeing 757 fleet is going to be replaced with Airbus A321 ERs. The fourth and currently final phase from is scheduled to start in the second half of 2015 as Airbus 350 XWB aircraft arrive. They will partly replace current A340s and partly increase capacity. As a result, this harmonized Airbus fleet brings asset and crew utilization benefits. Overall, Finnair has very modern and quite consistent fleet. The company has the possibility to adjust the size of its fleet flexibly according to demand and outlook due to its lease agreements with different durations.

2.2.3 Financing decision analysis in Finnair

Currently financing decisions are being evaluated with a method where an implicit interest rate for a lease agreement is calculated. In other words, this implicit interest means a computational interest induced by leasing costs. More explicitly, it is an internal rate of return of the net cash flow of an equivalent debt with a certain advance rate. The implicit interest rate is then compared to the current cost of senior secured debt. This calculation takes an estimated residual value into account. What this method lacks is the comparison of actual cash flows of costs. Because of the one-sidedness of the analysis, it would be good that also other methods would be used. Therefore, I will make calculations using the NPV method and the APV together with Monte Carlo simulation.

2.3 Acquisition of Airbus A330-300

At the moment Finnair has a widebody fleet of 15 aircraft, eight Airbus A330's and seven A340's. Airbus A330's are a part of Finnair's long-haul traffic fleet modernization as they replaced long served MD-11's. A330 fleet had an average age of only 3.2 years at the end of year 2012. A330 flew its maiden flight already in 1994 but have seen several further developments since. The plane represented the latest technology in the widebody category for pretty long time but is now overtaken by more economical and technologically advanced

Boeing 787, launched finally in 2011. Airbus will respond with their brand new A350 extra-widebody which should be entering into service during 2015. In Finnair, A330 is used in shorter long-haul routes such as New York, Seoul, Delhi, and Nagoya. Among airlines A330 is considered to be very cost efficient with low operating costs per seat. It also has good cargo capacity and as a whole offers excellent operational flexibility. With total of 622 orders up to date A330-300 is Airbus' best-selling widebody. The A330-300 can carry more passengers than the B787, is cheaper and is more readily available.³²

When new aircraft types are launched, which occurs usually in about 20 year cycles, the values of older models in same category naturally tend to decrease. At the moment in the widebody category Boeing is on the verge of launching their new 787 Dreamliner to the market while their existing model 777 is still being produced with increasing rates. Meanwhile Airbus is producing both A330 and A340 types and the scheduled introduction of their newest widebody A350 is in the year of 2013. Naturally both manufacturers are now promoting the sales of their existing flagships but the risk of increased depreciation in the future is imminent. The production rates are thus high but the demand for widebody aircraft is still limited. The aftermarket of those aircraft can be challenging in the future. Indeed, smaller narrowbody aircraft are a lot more liquid than their larger counterparts. My data provider, the Aircraft Valuation Analysis Company, describes the current market as stable than before but at the same time mentions weakness of the global economy and fragility of the aviation industry. This can be seen as slightly negative effect on the current and short term market values of aircraft. However, it must be stated that although the market of used aircraft have slowed in general, A330-300 have regained the 2007 values and lease rates as previously mentioned.³³ The demand for A330-300 is solid and the scarcity of the aircraft pushes the values and rates up.

The popularity of A330 has been increasing ever since its launch. The aircraft seems to fit in the fleets of almost 100 hundred operators as the aircraft is considered very versatile and flexible. Also continuous improvements applied by Airbus to its jetliner result in lower costs and better operations for the A330-300. This would supposed to have a positive impact on the popularity. These advancements range from weight reductions in the airframe to introduction of modern passenger cabin features and form system improvements to engine upgrades and advanced navigation systems in the cockpit. They also result in longer maintenance check

³² "Widebody Values Could Gain From Growth." Aircraft Value News 22, no. 3: 5. Business Source Complete, EBSCOhost, retrieved 5.3.2013

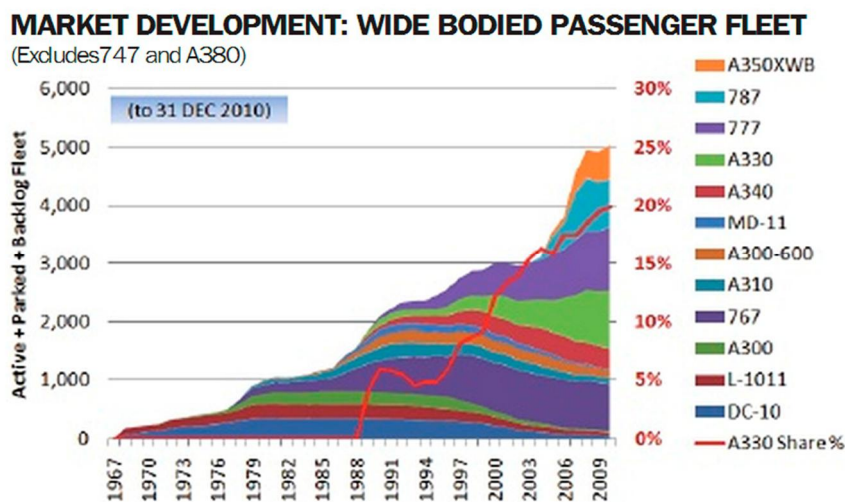
³³ 2012 Operating lease survey. Airfinance Journal. Jul/Aug2012, p1-1., retrieved 1.10.2012

intervals.³⁴ A330-300 is a good choice in Finnair's harmonized Airbus fleet because of lowered utilization costs of personnel and maintenance.

According to Aircraft Finance Guide, the global A330 fleet has an average age of less than seven years. This means that the majority of in-service aircraft are still with their original airline operators. Over 1,000 A330 passenger aircraft have been sold and more than 750 are in service with 95 operators. According to Ascend, only 10 A330s are in storage today, which reflects low supply. Airbus A330 has also been a very popular aircraft among the operating lessors. They actually manage 44% of the fleet currently in service. This is a high percentage and carries the risk that airlines may choose to manage capacity in future downturns by simply not renewing leases as they expire. As so many airlines have ordered either B787 or A350XWB, the threat to A330 residual values is clear. Despite all the cautions arisen by these issues, the fact remains that for many routes, the A330s are the most efficient aircraft of their size available today, and apparently for many years to come. According to Aircraft Finance Guide, it will take a long time before some new competitive model has sufficient amount of aircraft in the market. The 787-8 is set to be the first new aircraft to threaten the A330 but it could be 2017 before sufficient numbers of them are in service. The larger B787-9 and A350XWB-900 are not likely to reach sufficient numbers until perhaps as late as 2020, meaning that the threat to A330-300 values are likely to be lower.³⁵

³⁴ <http://www.airbus.com/aircraftfamilies/passengeraircraft/a330family/a330-300/>, retrieved 2.3.2013

³⁵ Aircraft Finance Guide 2012, UBM Aviation, <http://edition.pagesuite-professional.co.uk/launch.aspx?pnun=6&eid=1607145a-5fa1-4ac4-aae9-e66ea4abee12>, retrieved 2.3.2013



Graph 18. Development of A330 share of all widebodies.

This study is built around a hypothetical acquisition of a new Airbus A330-300 aircraft in the beginning of the year 2013. My purpose is to study particularly the financing decision of the acquisition not the investment decision. However, one can draw conclusions about the role of the possible new A330 aircraft. As Finnair states in their financial report 2012, the company is evaluating alternative to minimize the effect of possible delays on deliveries of A350. So, the acquisition of A330 would most probably be a temporary alternative due to delays or alternatively because of sudden increase in demand of long-haul routes. Because of Finnair's reliance on the success of long-haul operations between Europe and Asia, the need for fuel-efficient and modern widebody aircraft is undisputable.

3 THEORETICAL FRAMEWORK

This chapter is divided into three sections. The first one presents briefly few necessary definitions. The second section introduces the most relevant existing literature to date by first presenting the investment analysis with different methods and their benefits and challenges. Then the use of these methods in airline business is reviewed. Finally, few words about specific challenges of the estimation of the cost of capital and residual values are spoken. The third section explains tax and accounting treatment of leases more thoroughly.

3.1 Definitions

Based on International Accounting Standards (IAS 17)³⁶ established by International Accounting Standards Board (IASB): “leasing is an agreement that gave the landlord to the tenant, in exchange for payment of a lump sum of money, or a series of payments or contributions, the right to use an asset over a period of time.” Leases come in many forms but the basic idea is always the same. The *lessee* (user) makes a series of payments to the *lessor* (owner) for using an asset. Leasing is hence a source of financing. The leasing period can cover the whole estimated life of the equipment or it can be only a short term like is often the case with the aircraft leasing. Leasing agreements often contain options like options to purchase the asset or extend the lease. Leases can be cancellable, include services and the ownership of the asset can be passed on at the end of an agreement. So, by now it is clear that there is a need to define some basic terms used in this study.

Mainly it is important to make a distinction between two kinds of leases. Generally leases can be divided to *financial lease* and *operating lease* based on certain characteristics of the financial contract. According to IAS 17 in financial lease all risks and rewards of ownership of assets are transferred substantially to the lessee. If not, a lease is classified as operating lease. Basically the main difference between financial and operating lease is that the ownership and usage of the asset are being separated in the operating lease in a way that the ownership of the asset will not transfer to the lessee at the end of a contract. On the other hand financial lease can be seen a more debt-like financing instrument with periodical payments and at the end the asset transfer to the lessee.

Operating leases have a few distinct features over their financial counterparts that should be mentioned. First, an operating lease is generally much shorter than the actual life of the asset and therefore the present value of the lease payments is usually lower than the actual price of the asset. Second, at the end of an agreement the asset reverts back to the lessor who then releases or sells the asset. This means that the residual value risk, aroused from the difference of the forecasted and the actual value of the asset at the end of the lease, is borne by the lessor. This is one of the fundamentals of operating leases and could be one of the explanatory factors for the increased popularity of operating leases in aviation business. Third, an operating lease can be seen as a hybrid of financing and investing because a lease rental

³⁶ A revised standard replaces IAS 17 (revised 1997) Leases, and will apply for annual periods beginning on or after January 1, 2005.

contains both financing and operating cash flows. These are: capital cost of depreciating the asset, implicit interest charge for financing the asset and the cost of risk transfer. (Gibson and Morrell, 2004)

This thesis focuses mainly on operating leases due to their more common use, and increasing trend, in aviation leasing in general and especially in the case company. In fact it is estimated that about 80% (Gritta et al., 1994) of all commercial airliner leasing agreements are operating leases. Out of about 30 leasing contracts in Finnair, only 3 of them represent a true financial lease and are therefore dealt as debt. So, the overwhelming majority is operating leases and the choice of focus is therefore justified. The popularity of the leases will be covered more thoroughly in industry overview in chapter 2.

In general, a financial lease is more traditional and widely-used and therefore also more often studied in the leasing literature. That can also be due to a fact that definitions have been a little bit different in the past. Even in studies published in early 1980's the term operating lease referred to a lease that was cancellable. If it wasn't the right term to use was a financial lease. That's what makes it essential to clarify these definitions used in this study. So today, operating lease is a lease where all risks and rewards related to ownership of asset are *not* transferred to the lessee.

3.2 Accounting and tax treatment discrepancies

Because one of the justifications for a lease contract lies in their accounting and tax treatment, it is necessary to cover their basics. This subsection summarizes different accounting and tax practices from the lessee's perspective. First current practices are introduced and then the effect of proposed changes in international accounting standards is explained. Both widely-used IFRS and Finnish national accounting standards are covered. And although this thesis focuses on operating leases, to understand the incentive to use operating leasing rather than financial it is good to recognize differences in their treatment.

In Finland, listed companies are obliged to comply with IFRS standards. Previously mentioned IFRS standard IAS 17 states that financial leases have to be reported in the balance sheet as equivalent ownership of the asset and the lease obligations should be capitalized and shown on the liability side. On contrary, lease payments under an operating lease shall be recognized as a rental expense in income statement over the lease term and the future payments are disclosed only in the footnotes. This is the reason why operating leases are

sometimes referred as non-balance sheet financing. When off-balance sheet financing is obtained, the market value of company is increased due to the investment but financial leverage measures like debt-equity ratio or gearing can be distorted by understating the true degree of leverage. Other effects on key figures are that the volatility of earnings is increased because of fixed lease payments and the return on investment increases. However, to increase transparency many companies report adjusted ratios like adjusted gearing which takes into account the leasing liabilities. Many authors, including Brealey and Myers (2003), consider off-balance sheet characteristic as a dubious reason for leasing because they believe that financial analysts are not foolish enough to miss the relevant information in the footnotes. From the lessee point of view national accounting regulations³⁷ in Finland do not distinguish the treatment of operating and financial leases. Therefore the lessee does not recognize leases in their balance sheet but payments are shown as rental expenses in income statement and nominal values of future payments are disclosed in the footnotes.

What makes this topic current in the terms of accounting are the proposed changes to international accounting standards by IASB and FASB. When implemented in 2013, the new standards will especially impact on operating leases because according to the proposals all leases will need to be recorded on balance sheet as the present value of the “right-to-use” asset and a corresponding liability. This means that there will be no more a distinction between financial and operating lease and no more off-balance sheet possibilities. Furthermore lease payments will be treated as a finance cost rather than an operating rental expense as today. Finance cost will also comprise amortization on the right to use and interest on the liability. Also contingent rentals, like options to extend, must be taken into account when determining the lease term for present value calculations. Rating agencies and financial analysts already adjust for operating leases so there might not be any significant change in their valuations, unless their previous estimates were inaccurate or they see indebtedness differently. The most affected key figures are increased EBITDA, gearing and operating cash flow while EPS and interest cover are decreased.

The tax treatment of leases is considered one of the major reasons why some companies should rather lease than purchase an asset. While all lease payments are fully tax deductible, having debt only allows deducting interest payments of debt. Therefore to gain same tax benefit than with leasing, one should have a substantially larger claim and that would consequently lead to higher agency costs due to increased risk of insolvency. However, what

³⁷ Accounting Ordinance 30.12.1997/1339

balances the margin is the fact that depreciations of a purchased asset can be deducted from the taxable income. As financial leases are treated like debt, their amortization is deducted from the book income. However, one should remember that only profitable companies can benefit from these tax shields.

3.3 Related literature

This chapter introduces previous academic literature related to the topic and observes the issue from the both financial and less financial perspective. First the elementary leasing literature from the 1970's including investments analysis or in other words capital budgeting is reviewed. This includes a description of the most popular investment valuation methods and their characteristics. This is followed by a review of the non-tax incentives to lease. Then flexibility and other reasons why airlines lease are being reviewed. I also wanted to emphasize two challenging variables related to valuation of aircraft leases by creating separate sub-sectors for the cost of capital and residual value. Chapter continues by discussing about the popularity of different valuation methods in actual airline valuation practices. Also the lease-debt substitutability will be briefly opened up.

3.3.1 *The birth of leasing valuation*

Leasing has existed in some form for centuries but what we currently understand as leasing saw a resurrection and a rather fast gain of popularity in post-war rapid growth period. Leasing has been a popular financing source since but still there hasn't been introduced any comprehensive theory or model to answer the question whether an asset should be leased or purchased. Brealey and Myers (2003) offer an answer: "Buy if equivalent annual cost of ownership and operation is less than the best lease rate you can get from an outsider". While true, in real life this is unfortunately rarely very simple task.

The relevant academic literature related to leasing originated in early 1970's and is based on Modigliani and Miller's (1958) theorems which have formed the basis for modern thinking on capital structure. Their basic assumption is that in efficient market where taxes, agency costs, bankruptcy costs and asymmetric information do not exist, the capital structure is irrelevant to the value of the company. Of course this does not happen in real life but this basic theory is the basis of the capital budgeting analysis even today.

In early seventies academic society was bubbling over with leasing related studies while the definitions and acceptable theories sought for acceptance. Earlier capital budgeting methods were very primitive like simple but undeniably straightforward payback period (PBK) which calculates when the investment will be paid off and ARR (accounting rate of return) which calculates the return based on book values. These methods lacked the time value of money which was considered ever more important. It was then time for discounted cash flow (DCF) measures like net present value (NVP) which calculates the present value of an investment by discounting relevant cash flows to present day or internal rate of return (IRR) which determines the cost of capital when net present value is zero.

Since the Modigliani-Miller model and its correction with taxes (1963), the finance literature has analysed the leasing decision in that framework. It recognizes taxes and bankruptcy and financial distress costs so that the optimal capital structure lies somewhere where they cross. The basic ground work for constantly evolving leasing literature was laid by the three articles all published in the same number of the *Journal of Finance* in 1976. Miller and Upton (1976) study particularly operating leasing versus purchase question from the tax point of view and find that the valuation of leases differs from valuation of purchase because of differences in the tax treatment. They also point out that many companies are unable to capitalize on the tax benefits because of low profitability that is they do not necessarily pay taxes. This is emphasized with aircraft leasing due to low profitability in airline business.

Traditionally the main benefits of leasing are believed to arise from the different taxations between a lessor and a lessee. Myers, Dill and Bautista (MDB, 1976) examine the financial lease versus debt financing under the Modigliani and Miller environment (where a company is indifferent between leasing and buying if no tax differential exist) and state that the tax differential is the most important reason for existence of lease. A lessee with a lower marginal tax rate can transfer the tax benefit from the depreciation to the lessor with higher tax rate. Consequently the lessor compensates this benefit by offering lowered lease rates and both parties will benefit from this arrangement. Benefits can also be possible even though marginal tax rates were same for both. That is the case when a lessee cannot capitalize on the tax benefit of ownership presently for instance due to low profits but can transfer it to the lessor who can have a definite benefit. Situation is identical when the capitalization of tax benefit in the future is insecure. Lewellen, Long and McConnell (1976) also find the taxes to be the prime incentive for leases.

Above-mentioned MDB present the basic valuation model for leases by using the most common discounted cash flow technique today, net present value technique initially proposed in the 1960's. The method simply discounts all the relevant cash flows to the present with the firm's borrowing rate, usually WACC. WACC was first introduced by Modigliani & Miller in their proposition II in 1958. When applied to leasing from the lessee point of view, the acquisition price is the positive cash flow because not having to pay the price when leased. Cash outflow is comprised of the present value of after-tax (tax deductible) lease payments, the present value of the opportunity cost of the lost depreciation tax shield and finally the present value of the *change* in the interest tax shield on debt that is displaced by the lease financing. If the present value is positive it indicates that company would be better off by leasing rather than buying the asset. Their model is widely-used today and many different variations and refinements to their model have been introduced. Indeed, these 1976 studies were quickly followed by several other, also tax-based, researches like Franks and Hodges (1978) who brought MDB closer to practice and Brealey and Young (1980) who reminded that the preferred source of capital for a non-tax paying company is despite recent findings still equity.

Johnson and Lewellen (1972) argue that lease-or-borrow decision is incorrect approach because the cash flows include also financing costs and the correct question should be rather lease-or-buy. Myer, Dill and Bautista (1976) however answer that lease-or-buy question is meaningless because a company can arrange transaction so that the question becomes irrelevant. They also emphasize that lease-or-borrow does not mean that a firm either leases or borrows the amount of purchase price of the asset. It simply means that when entered into leasing agreement a firm reduces its ability to borrow from other sources. This implies that leasing displaces debt. Succeeding years refined the debate, operating and financing leases were more accurately defined and 'lease vs. purchase' problem was more clearly outlined as a 'lease vs. borrow' question.

However, related to operating leases this does not necessarily hold. As Gibson and Morrell (2004) point out it is not completely possible to distinguish investment and financing decision related to operating leases because operating lease payments include both implicit interest charge for financing the asset, the capital cost of depreciating aircraft and the cost of risk transfer. Therefore there lies the risk of using NPV in aircraft investment analysis through the including operating cash flows in the analysis and comparing them against purchasing cash flows. Airlines view operating lease payments as operating costs while interest is presented

below the operating profit line. In practice however, lease payments include both investing and financing cash flows. Therefore they are actually implying that the analysis should include both investing and financing decision, a view very much contrary to Brealey and Myers (2003) and Copeland et al. (2005) Furthermore, when using weighted average cost of capital (WACC) as a discount factor it emphasizes aircraft residual values and is therefore favourable to leasing because of the large initial investment. To overcome these challenges and to include the cost of the residual values risk transfer to valuation process, Gibson and Morrell suggest using the well-documented method of adjusted present value (APV). Under APV, cash flows of different risk classes are discounted at the discount rates that reflect the risk class of the cash flows. In practice this means that lease and debt payments are discounted with the cost of debt and investing and operating cash flows with the cost of equity. Authors emphasize that leasing is fundamentally a financing vehicle and should therefore be compared with the cost of debt. They consider an established practice of comparing operating lease cash flows and purchase cash flows together to be an incorrect method. Thus, they think that managers should compare financial cash flows to the ones of operating the aircraft. This method takes into account the cost of leasing flexibility and the shareholder's risk. The idea of APV first emerged when Schall (1974) stated that every distinct cash flow should be discounted with different rate. Then Myers (1974) introduced the basic version of APV which was then redeveloped by Myers et al. (1976). In the final version the main improvement for NPV was the consideration of the tax deductions on interest payments by discounting them with the cost of debt. Their basic idea of APV is that the NPV of the project is first calculated by discounting cash flows with the cost of equity, assuming thus all equity financing, and then "side-effects" of project are added. These side-effect cash flows may be discounted with the cost of debt because they can be seen as low risk. The benefit of APV is that it breaks the problem down into the value of the project itself (as it was equity financed) and the value of the financing. APV thus provides flexibility needed to investment analysis.

Tax-based discussion about leases was resurrected in the 1990's by Edwards and Mayer (1991) and Graham, Lemmon and Schallheim (1998) as latter study operating leases and support the existing view that firms with low tax rates tend to lease more. They also discover that firms with higher variability of earnings lease more. This could be particularly true in volatile aviation business. In support of their findings, Shanker (1999) comes to same conclusions that lower the marginal tax-rate, higher the use of leases. In this study a different

methodological approach is used in order to avoid the problematic of contingent rentals included in lease rentals. Sharpe and Ngyuen (1995) discover in their recognized study that companies with lower earnings to sales, lower credit ratings and smaller size, have higher operating lease share. Contrary to Graham, Lemmon and Schallheim, Erickson and Trevino (1994) suggest that high variability firms are renting less. They also find rare evidence for often mentioned tax motivations by receiving results that lease rentals are negatively correlated to the firm's tax status. They conclude their study by stating that operating leases are used by smaller firms, non-tax paying firms and firms experiencing more rapid sales growth. Incentive to lease has been traditionally been explained by taxes but there is more. The next sub-section will explain other incentives to lease.

3.3.2 Lease valuation based on non tax-incentives

During past two decades in academic literature this problematic and intriguing analysis about lease or buy decision in corporate finance has resurfaced quite intensively. Existing models and perspectives vary. Indeed in academic literature there are several new approaches compared to traditional leasing literature generated in the 1970's. As they built the basis of the leasing literature by concentrating on the financial aspects like debt-like characteristic, tax benefits and off-balance sheet features increasing amount of attention has been given since to other financial and more over fully operational aspects of the leasing decision. These aspects can be quite difficult to price and compare with financial ones because of their often complex and subjective nature but even remote estimates can increase the overall significance of valuation. Smith and Wakeman (1985) were the first to introduce some non-tax incentives to lease. In their broadly recognized study they discover that leasing is more likely if the value of the asset is less sensitive to use and maintenance decisions, if the expected period of use is short compared to the useful life of the asset, if the firm is closely held, if the lessor has market power or if the lessor has a comparative advantage in asset disposal. These all are very typical characteristics of airline business and apply well also to the case of Finnair who is for the most part state owned and the remaining share is largely owned by institutions. Aircraft value is less sensitive to use because several other factors also affect on the value. Additionally, aircraft are generally leased for a shorter period than their economic life. Also, lessors do have a market power and advantage when disposing aircraft due to their superior expertise in the market.

Research in the 1980's and 90's concentrate on the agency costs, asymmetric information and especially embedded options in the leasing contracts (McConnell and Schallheim, 1983). Sharpe and Ngyuen (1995) state that one incentive for leasing is asymmetric information because they find that with leasing those unfavourable effects of asymmetric information can be decreased. McConnell and Schallheim study different options attached to the operating leasing. Basis of their study is that operating lease is cancellable at any time which is against the current practice. However, in their comprehensive study they present a model to value lease with options like extension, purchase anytime, purchase at maturity and purchase requirement. Also Smith (1979) and Copeland and Weston (1982) evaluate leases with options. Latter explained that if for example an operating lease is cancellable, it can be thought to have an American put option attached. To capture the variation in the asset value, they use the standard deviation of asset returns as an estimate.

In the eighties it was already clear that basic discounted cash flow models aren't flexible enough for option valuation. There was a need for a more sophisticated method that could capture the uncertainty related to future cash flows in different states of nature and really value the flexibility gained from the different options. While basic DCF-methods can model risk, they do not contain any in-build uncertainty or probabilities. To answer this call, a real options analysis begun to form.

Earlier in the 1970,'s Black & Scholes (1973) had developed their continuous-time model for option pricing and were followed by Cox, Ross and Rubinstein (1979) who created a binomial pricing model with risk-adjusted decision trees. These authors laid the foundation for the modern day option valuation. Real option analysis (ROA) is a method derived from both DCF- and financial options valuation models. Grenadier (1995, 1996) is one of the many authors who apply this method to leasing.

While proven quite versatile tool it has a pitfall inherited from option pricing models. Those models are based on continuous trading in liquid markets which is not true regarding options in lease agreements. Nevertheless, this method has gained a substantial popularity in academic world. The actual analysis starts with basic DCF-model, then a Monte Carlo simulation is run to capture volatility and finally binomial lattice (decision tree) is created based on established volatility. In other words every nod of the tree is given a probability and this enables to calculate the volatility of investments present value. ROA provides thus means to value the flexibility by enabling to value projects in various states of nature. Downside is that this method easily gets quite complicated and takes some time to implement.

Stonier (1998, 1999, 2001) apply this concept especially to aircraft option valuation. He studies particularly aircraft purchase and delivery options by adapting manufacturing lead-times and the cyclical nature of the airline business to the options. Methodologically, he uses DCF analysis, decision trees and binomial real options valuation. He notes that although airlines realize that these options carry some value they do not actively use any accurate methods to capture that value. Meanwhile, also manufacturers are underestimating the value of these options giving away delivery slots for a low cost. This implies that airlines are somewhat aware of the real options analysis but its use isn't that common. Gibson (2010) applies this method to aircraft family conversion options in his study.

In his advanced study, Otero (2006) focuses on the finishing end of the leasing contracts in the option valuation as he study residual values and residual value guarantees (RVG's). He explains that RVGs are purchased from manufacturers, leasing companies, or insurance companies and can be full RVG's which are rare or partial guarantees that are more common. Because the pricing of their guarantees are naturally embedded into the agreements, he tries to price them with real options analysis. He models the future residual values in different states of nature using historical data and finds that nominal annual base value depreciation varies between 3.08% for single-aisle aircraft and 4.42% for wide-bodies. He also calculates price volatility as the standard deviation of such values and the outcomes vary from 4.10% to 4.15%. With his calculations, Otero find the values of the full RVG for a \$100m wide-body aircraft (by chance roughly estimation of the current market value of A330) vary under 3% of the residual value covered.

Monte Carlo simulation is a risk-analysis method that enhances the plain net present value method by taking uncertainties into account. Certain, or all, variables are given distributions or variations and the model is then run several hundreds or even thousand times. The result is a distribution of net present values. Thus, it is a method based on the basic NPV but adds the capability to capture the risk of airline cash flows. This is very useful method to capture usual uncertainties in the aviation business like residual values. This method requires subjective judgement or historical data and is therefore exposed to subjectivity. Monte Carlo simulation was first introduced by Hertz (1964). Initially it wasn't a great success and was criticized for example by Lewellen and Long (1972) and Bower and Lessard (1973) due to its complexity of use and hard interpretation of results. Gibson (2010) responds that this should not be a problem anymore because of increasing amount of easy to use Monte Carlo applications

available, especially as add-ins for Excel. Also this study will capitalize on this type of research method when analysing the acquisition of Airbus A330.

These recent applications of capital budgeting methods mean a significant improvement for the assessment of different agreements. They are especially significant when analysing leases because now one of the most important characteristic of a lease, flexibility, can be at least roughly valued. The static NPV analysis cannot really capture the flexibility needed due to prevailing uncertainty in the business.

3.3.3 Flexibility and other reasons why airlines lease

As mentioned, one of the most rationalized operational aspects of aircraft leasing is the flexibility. Leasing can induce flexibility in various ways. Next, I try to bring up the most important and most often quoted reasoning, particularly in the field of aviation.

Dick Forsberg, head of strategy at Irish aircraft lessor Avolon Company summarizes the basic reasons why airlines turn to lessors.³⁸ In Aviation International News, he says that lessors can offer three distinct features to airlines: flexibility to financing mix, availability of aircraft that are sold out from the manufacturer and provision of liquidity also to companies with weaker credit ratings. Indeed, airlines in a highly capital-intensive and low-profitable aviation business face often cash constraints and are therefore forced to favour debt or leasing. Leasing could also be an only choice to a company with covenant disabling the possibility for a debt financing. However, this is quite rare in nowadays where leasing is seen as a replacement for a debt. Nevertheless, leasing does not tie so much initial capital as purchase. Naturally when leased, an airline does not have to make a large purchase payment but also the pre-delivery payment usually needed when entered into leasing contract is much smaller than pre-payments required when purchasing the aircraft. It is estimated that on the day of the actual delivery, about 30% of the aircraft has been already paid as pre-payments (Finnair).

In airlines, flexibility relates often to fleet planning. Because of cyclical nature of the business, fleet flexibility is an asset itself in an airline. During different and fluctuating states of economy and demand airlines require flexibility to either quickly obtain or lay aside aircraft. To be able to increase or decrease capacity in short term basis can be necessary for instance when introducing new routes or to respond to fluctuating demand. It is generally believed that leasing offers this flexibility more than owning an aircraft. Leasing allows

³⁸ <http://www.ainonline.com/aviation-news/ain-air-transport-perspective/2012-10-22/sumitomo-seeks-top-three-slot-growing-lease-market>, retrieved 25.10.2012

airlines to quite rapidly include or displace aircraft. Leasing is often used when adopting new aircraft type or as an exit strategy (Gibson, Morrell, 2004) due to the ease of arranging contracts to terminate or start stepwise. Flexibility is increased also by arranging lease contracts so that they either differ with their maturity or do not terminate at the same time with each other. However, as pointed out from Finnair this may be not the whole truth because it depends heavily on the size of the fleet. For example Finnair with the fleet size of about 60 aircraft cannot naturally achieve the same level of flexibility than a larger airline with the fleet of such as 600 aircraft.

One important aspect of leasing is transaction costs. As Copeland et al. (2005) point out, shorter the need for an asset, for example a need of a car for a week, the more favourable it becomes to lease it because of the transaction costs. Transaction costs may include search costs, clerical costs and costs of valuating, assuring and maintaining quality. Transaction costs are always relevant when the time period of leasing is less than asset's economical life. Another operational perspective emerging in literature is the moral hazard problem of leasing. It refers to a situation where a lessee because of not owning the asset has no incentive to take as good care of it as when owned because a lessee does not have to worry about the residual value in the future. The problem is usually solved by adding a moral hazard cost in a lease payment or like in aircraft leasing where a maintenance obligation is included in a contract. With assets like aircraft this moral hazard may not be such a great problem after all because by regulations and law, aircraft should be kept in good condition and properly maintained at certain intervals due to nature of the business. However, if a company owns maintenance department this issue may raise its importance when considering a purchase of aircraft.

Usually under an operating lease, a lessee is committed to make either security deposit or maintenance reserve payments (or both). Security deposit is paid at the beginning of the contract and paid back when the asset has been returned in a pre-specified condition. The amount of the deposit can be for example three months rental. Maintenance reserves are paid along the agreement to ensure the lessor of the condition of the asset. This method mitigate the credit risk that lessor bears. In case a lessee defaults, maintenance reserves secure the cost of the required maintenance before the re-deployment of the aircraft to the next customer. Also some end of lease payments may occur if the equipment is returned under-maintained. Of course reasonable return conditions need to be agreed by both parties. Often a lessee is a receiving side and does not have that much room for manoeuvre. So, when evaluating

financing options these costs should also be taken into account. Lease rate estimates used in this study already include the maintenance reserves.

However, also purchase of an aircraft brings certain benefits over leasing. A purchase favouring aspect is the aircraft configuration. This can be actually very valuable aspect because airlines can only have an influence on limited features when leasing. But when purchased, aircraft can be assembled according to acquirer's preferences down to the smallest detail. This is an important feature to airlines as they then have a freedom to customize the aircraft prior to delivery rather than with extra cost when leased. One solution to this particular challenge is the sale and lease-back agreements where an airline purchases an aircraft but immediately sells it to lessor and leases it back. This arrangement enables the modifications made to the aircraft and the financing method wanted. Of course this method comes with also other advantages and challenges but they're outside of the range of this thesis. Lease contract requirements could also give support to purchasing. Aircraft leasing contracts often include some administrative, reporting or maintenance requirements for a lessee. Administrative and reporting costs can rise at least momentarily in the near future when new IFRS regulations take effect and also operating leases will transfer to the balance sheet. Thereafter, those agreements need to be monitored on same basis than financial ones.

Flexibility means often options. Options you can either exercise or choose not to. Aircraft purchase and leasing contain actually a lot of different options. Some of them were already mentioned in the previous sub-section but here is a brief overview of the relevant options. Increasing the fleet size can be achieved with *purchase options* and *purchase rights* that are call options. The first mentioned can actually mean two things. First, it could be related to operating lease agreement and enable the lessee to purchase an aircraft at the maturity of a lease with a pre-determined price. Second, it could also mean an option very commonly acquired at the same time when placing firm orders on aircraft. It allows an airline to delay the purchase of additional aircraft until market conditions are favourable or just to space out the purchases. Then, when needed, airline can confirm the purchase at the pre-determined price. This also allows airline to the manufacturing queue, that is, a delivery slot. Holloway (2003) points out, that manufacturers tend to sell these options on discount. *Purchase right*, also called *rolling option*, also means the right to purchase an aircraft at agreed price in the future but it does not have a delivery position attached to it so airlines are taking a risk that there isn't one available just when they need it and they end up in the back of the line. On the pro-side, with this option airlines spare themselves from deposit of 1-2% of the purchase price

usually demanded at the time of the order. McConnell and Schallheim (1983) value lease contracts with different options. They present a model to price an operating lease with a purchase option. The value of the option should therefore be added to lease rentals. However, they remind that often lessors grant the lessee an option to purchase the leased asset at its 'fair market value' at the maturity date of the contract. If you think it through, the lessee can purchase the asset at its market price at maturity of the lease whether or not the contract contains such an option. Therefore they stress that an option to purchase the asset at its fair market price is valueless.

Probably the two most common options related to aircraft leases are cancellation and extension options. These are pretty self-explanatory as the first allows the leasing contract to be terminated during the agreement and the latter enables airline to continue the lease agreement with terms agreed in advance. What isn't self-explanatory is their valuation. When considering the price of an option, it should be estimated with option pricing model. In general, airline managers tend to consider cancellation options quite expensive but extension options are more widely used.

Another asset flexibility provider is quicker deliveries. By using operating leases airlines can ensure to have aircraft delivered quicker for example when there is large demand for a certain new type being manufactured. This is due to the fact that usually first (and often largest) buyers of a new aircraft type are the lessor companies. It is possible that you would need to wait several years for a delivery of a new, popular aircraft with high number of backlog orders. But with leasing there is usually always some leasing company who can offer any type of aircraft quite instantly for use. However, occasionally it actually pays off to be among the first buyers of a new aircraft type. This can also bring substantial discounts. Finnair has former experience from the McDonnell Douglas-era when Finnair was the first operator of MD-11 widebody airliner. Finnair will also be the first European carrier to operate with the brand new Airbus A350 scheduled to launch in 2015. Finnair has made a firm order for 11 aircraft with 8 additional options. This project has been delayed several times and even the design needed to be changed on the way. Airlines already placed orders are being compensated for the delays and design alternations. Finnair has informed that they get new A350XWB's (extra wide-body) at the same price as the original version, presumed to be a lot cheaper.³⁹ This means substantial discounts, estimated amount of US\$400 million.⁴⁰ Even

³⁹ <https://newsclient.omxgroup.com/cdsPublic/viewDisclosure.action?disclosureId=171406&lang=en>, retrieved 24.10.2012

though discounts are pretty common in aircraft business, large price reductions like this are quite rare. Airbus is understood to be offering a discount of about 50% of the actual list price while the “normal” discounts end up being usually near 30-40%. In conclusion, one could argue that these first-in-line positions or delivery slots in the production line are very valuable in itself because airlines can give up their position in the queue for money.

Stonier (1998) notes that aircraft manufacturers have recently contributed to asset flexibility by reducing lead times and introducing product commonality. Lead time means an aircraft manufacture time, nowadays around 12-18 months.⁴¹ Product commonality on the other hand means similarity between different aircraft models in the same aircraft family. For example in Airbus family, there are 4 different sized single aisle aircraft (A318-321) that despite of different size have same cockpits and other interiors, can have same engines etc. In widebody territory Airbus has A330/340 variables which are very similar with few major external differences like the amount of engines. Of course the capacity to carry passengers and cargo and the range of these aircraft vary. This commonality reduces several costs like maintenance, training, spare parts etc. and offers increased flexibility for example in route planning. Manufacturers may thus offer *switching options* which means that after the initial order, the customer has a possibility switch between aircraft models prior to delivery. If for example passenger demand or route structure changes so that there is a sudden need for aircraft of different size or range, this option can be exercised.

At this point I would like to point out that the operational fleet planning goes beyond the scope of this research but it is good to remember that when an airline is planning what kind of equipment they need for their route structure and according to estimated passenger demand etc., the financing decision is definitely not the only question it faces. Of course it is rather important but many operational aspects affect also on the acquisition. In airlines there are quite typically separated departments for technical fleet planning and finance. If the co-operation between them isn't comprehensive enough, it may actually endanger the finding the best overall acquisition decision. Even though the purist financing theory criticizes combining the investment and financing decision, in real life it sounds incompetent. An example could be a pure technical choice of aircraft X because it fits perfectly for the route structure and has a sufficient range and capacity. The much cheaper aircraft Y will be abandoned because it is

⁴⁰ <http://www.theaustralian.com.au/business/airbus-resorts-to-huge-discounts-on-a350/story-e6frg8zx-111113379567>, retrieved 24.10.2012

⁴¹ The Aircraft Value Cycle, Pk AirFinance, Nils Hallerstöm, 15.05.2000, retrieved 1.10.2012 from <http://pricing.free.fr/docs/safe/safe2.pdf>

just barely inferior to X but would still qualify for the fleet. If the financing decision is made after the investment one, it could cause a substantial economic loss considering the price difference. In conclusion, it is wise to include the financing perspective to the fleet planning process from the very beginning.

For example above-mentioned commonality can play a big part in the decision making. It is very common that an airline has different aircraft from different manufacturers in their fleet but there are also airlines whose entire fleet consists of the same aircraft type. These are usually low cost carriers. For example, Ryanair has a fleet of 275 Boeing 737-800 aircraft and Norwegian Airshuttle 56 B737's. American Southwest Airlines including its subsidiaries fly with a whopping 698 B737 aircrafts. Easyjet operates with 193 Airbus A319/320 aircraft.⁴² These kinds of companies have taken the commonality at the highest level. Of course this cuts the operating costs but from the financing perspective it is obvious that large bulk discounts are given for large orders. For example when American Airlines and Delta Airlines placed large orders and committed to long-term relationship with Boeing in the mid-nineties, they both stated that Boeing rewarded them with price discounts and increased flexibility in the timing of the deliveries.⁴³

Price reductions are generally known to exist but however, this raises an interesting attention towards the relationships between airlines and lessors. Naturally bulk discounts are a part of the business practice but could there be other reasons for price reductions? If an airline is committed to certain manufacturer's planes, it is assumed that competitors will offer substantial price reductions when it is time to update the fleet. So, relationships with manufacturers can be important and aircraft acquisitions can even take political turns considering the nationalities of the main two aircraft manufacturers.

So when considering all the facts above, naturally the flexibility is worth something. But how much? According to classic option value theory the greater is the uncertainty the more worthy is the option. Therefore, in uncertain times or industries, the flexibility is very valuable. Barrington (1998) highlights that airlines using operating leases value flexibility so much that they accept the higher cash costs of leasing than induced by the ownership of aircraft. Stonier (1998) adds that in airlines required rates of return for investments are often significantly higher than the cost of capital. This implies that discount factors are being artificially raised to

⁴² Figures acquired from operators websites in 24.10.2012

⁴³ <http://www.nytimes.com/1997/03/21/business/delta-to-buy-only-boeing-jets-for-20-years.html>, retrieved 24.10.2012

meet the probable higher risks due to cyclical nature of business or whatever subjective reason of management. Of course, this leads more likely to abandonment of some investments. In fact, Stonier argues that this spread between the cost of capital and a hurdle rate is the value of flexibility that isn't included in classical capital budgeting analysis. He continues that in his opinion, the flexibility is created by asset flexibility, management's learning and adaptation to the dynamic environment. The most common method among the academics to value these different options is the above-mentioned real options analysis. Brealey and Myers (2003) also suggest the use of APV to capture the option induced premium.

As previously mentioned, one of the major advantages of operating leases is the residual value risk transfer to the lessor. Airline managers say it could be the most important thing when evaluating operating leases, and a very difficult one to value as well. Next sub-section covers the residual value in more depth and explains the essence of the aircraft value and asset liquidity.

3.3.4 Residual value - aircraft valuation - asset liquidity

A significant and probably the most important advantage of operating lease is the transfer of residual value risk to the lessor. Residual value risk is the uncertainty between the anticipated and the actual value of an asset at the end of an agreement. Because operating leases are often quite short term, do not cover the whole estimated life of the asset and most importantly do not involve transfer of the asset ownership at the end of an agreement, the residual value risk is bore by the lessor. This is especially valuable option for airlines in the business where the residual value risk can be substantial due to expensive assets and the estimation of the residual values can be quite challenging. That is because several factors affect on the value of the aircraft and only list prices of aircraft are public information while real purchase prices can be substantially lower due to bulk discounts.

Why lessors are ready to carry that risk then? First of all, of course they are compensated for it by including a risk premium in the lease rates. Future lease payments need not only cover the long-term financing costs of the asset but also an adequate compensation for carrying the residual value and other risk. Second of all, lessors are experts in the area of handling and re-allocating the aircraft so they have the best knowledge of demand of the certain aircraft and they have the network of operators ready when they need to find a new owner for aircraft. This means that a single airline disposing its aircraft spares on inconvenience and information

etc. expenses related to finding the buyer and negotiating about correct price when choosing to lease in the first place. Probably this is priced into the lease rentals though. Gavazza (2010b) explains that leasing companies have their own technical, legal and marketing professionals who constantly gather information from the market by monitoring the airlines' use of aircraft and their possible capacity needs. Eisfeldt and Rampini (2009) and Rampini and Viswanathan (2010) suggest that these "monitoring costs" cause the implicit lease rates to be higher than when owning an aircraft. Gavazza confirms this proposition by studying aircraft prices and lease rates and finding that indeed these lease rates are 20% higher than implicit rental rates.

Third, lessors have a substantial purchase power to aircraft manufacturers. Many airlines are facing constraints to purchase new aircraft, so they turn to lessors, many times their last resort of finance. And lessors act as manufacturers' distributors. Manufacturers rely on large orders placed by lessors and are therefore willing to give substantial price reductions. Stonier (1998) describes the relationship of the lessors and manufacturers "symbiotic". He also stresses that lessors often get short configuration lead times because the operator of the aircraft is often known only few months before the delivery. Stonier thinks that airlines value flexibility so much that leasing companies are actually successfully arbitraging aircraft delivery flexibility. Lessors can offer much faster access to aircraft due to their top delivery slots. Meanwhile, manufacturers are also increasing their delivery flexibility with reduced lead times. Stonier says it is interesting to see will these two sides continue to complement each other or will the competition be tightened. What makes this even more interesting is that manufacturers have started to also provide leasing services through their own subsidiaries. Theoretically this also has an effect on lease rates because the basis of their determination is the manufacturer's cost for a manufacturer but for third party lessor, the price paid to the manufacturer. To sum up, leasing companies are better suited to carry the residual value risk and lessees are willing to pay for this risk management.

Naturally however, the transfer of residual value risk comes with a price tag. Therefore under an operating lease, monthly lease payments include a premium to the lessor for bearing the risk. Gibson (2010) points out that operating lease payment includes also a capital cost of the depreciating aircraft and an implicit interest charge for financing the asset. So for an airline, in the end it comes down to the trade-off between the increased operational flexibility and higher financial costs due to short-term leasing. Oum et al. (2000) introduce a model to define the optimal mix of leased and owned aircraft in a particular fleet. They interestingly find that

the proportion of leased aircraft within 23 largest airlines in the world should range between 40% and 60%. The question here is how to quantify this operational flexibility and residual value risk transfer? According to Gibson and Morrell (2004) there are two methods, both based on discounted cash flow (DCF) techniques. The first is the previously mentioned adjusted present value (APV) method and the second one real options analysis (ROA). With APV different risk classes are discounted with proper costs of capital that reflect the real riskiness of the cash flows. They suggest that residual value should be discounted with the cost of equity to really capture the price of this flexibility. ROA captures the flexibility by enabling the problem arrangement with various states and different options to choose from.

Gibson (2010) doubts if residual value risk is correctly priced in reality. He justifies his doubts amongst with the facts like that the market for residual value risk is illiquid, there are only limited amount of sellers and buyers of used aircraft at any time, information availability of prices is poor and valuation techniques as real options analysis isn't yet in common usage. This means that residual values can easily be either over- or under-priced. Managers interviewed by Gibson say that currently residual values are rather under-priced. To cover the residual value risk, a residual value guarantee can offer a solution. Managers see the possible need for a guarantee especially in a case of large, illiquid aircraft which are expected to be replaced by newer models during the investment period. Airbus A330 could have some of those features even though its popularity is quite good at the moment. Widebodies are generally more illiquid and this aircraft type will be superseded by Airbus A350 in few years. However, third party insurers could be hard to find because the market for them isn't very developed in the current environment where large exotic risks are been avoided.

Residual value is very significant factor in the investment analysis. Shorter the selected time period for an investment, more emphasized its effect is. Gibson (2007) illustrates that in his study the present value of aircraft residual value represents almost 45% of the total value if the investment horizon is 7 years and decreased to 18% if the horizon is lengthen to 15 years. Gibson criticizes that too often airlines use short periods in their analysis. The estimated residual value can easily be the determining factor of an analysis with 10 year horizon. I'm recognizing this in my study by analysing financing decision in 8- and 16-year time period. I'm assuming a renewal of a lease after the first 8 years as Gibson suggests. Renewal considers a lease rental to be re-checked, thus forecasted lease rentals of that time will be used in the remaining 8 years.

As said, the actual purchase prices of aircraft aren't public information but rather closely guard secrets. It is general knowledge that no airline actually pays the full list price but there are always some sorts of discounts. It is been estimated that discounts vary from 20% to even 60% with an average around 45% of the list price. (Michaels, 2012) He calculated this from manufacturers' yearly published order backlogs which include contract values, planes ordered and their list prices. Thus, bargaining power of the parties plays a significant role in the pricing negotiations. Airline executives state however that much of that discount can be erased when taking into account inflation with the fact that usually planes are ordered in batches and delivered over many years. Why then this kind of secrecy prevails? Michaels explain that this is plain psychology; inexperienced buyers, although supposed reaching a good deal, do not want to embarrass themselves by revealing that they might have overpaid. At the same time, professional buyers understand not to anger manufacturers by talking too much and thus ensuring golden deals also in the future. He concludes that future will most probably bring increasing list prices and same time even larger discounts.

The capital cost of aircraft can represent over 15% of airline costs (Morrell, 1999). This makes the valuation pretty important. I mentioned earlier that the value of an aircraft depends on surprisingly many factors, next I'm going to explain the basic elements affecting the value of an aircraft.

Vasigh and Erfani (2004) list some factors affecting the theoretical value of an aircraft. Later the list was complemented by Gorjidoz and Vasigh (2010). First, the physical characteristics like specification, age, seat capacity, fuel efficiency and physical condition together with maintenance status have an effect on the value of an aircraft. In addition, external factors like state of the economy, inflation and interest rates, fuel cost, safety issues and regulation and environmentally regulations have an influence. However, according to the authors, the value depends mostly on the cash flows the aircraft can generate. Vasigh and Erfani propose that the expected theoretical value of an aircraft is the present value of the net cash flow it produces during its life span. In the same line continue Gorjidoz and Vasigh who create a comprehensive model to estimate the theoretical value of an aircraft, also based on future cash flows discounted back to current date.

Of course, also technical issues affect on the depreciation of the value because maintenance expenses will increase year by year due to physical deterioration. For example, aircrafts engines will require more maintenance; it will also gain weight over its life and suffer from increased drag due to repairs and dirt. This depreciation will increase operating costs.

However, the technical life of an aircraft is *theoretically* unlimited because it can be overhauled but its economic life is restricted. As Vasigh and Erfani point out, when an aircraft cannot produce a positive cash flow, its economical life ends and the asset is retired.

But why those operating cash flows turn in some point to negative? In addition to deterioration, these factors are explained below. At some point every aircraft will be superseded by a more modern aircraft model with improved qualities like increased fuel efficiency, reduced noise levels, improved aerodynamics, advanced systems, decreased weight and etc. This will again have affect on the cash flow generating capacity of the aircraft.⁴⁴ It is notable that aircraft delivered late in their production cycle will depreciate faster than those that were delivered early. On the other hand, the very early ones may suffer from excess weight and other early batch issues.

One already mentioned aspect relating to life span of aircraft is commonality. It can dramatically increase the service life of an airplane if it could be easily and with a low-cost modified. For example, Airbus considers freighter conversion as an important value creator for a used aircraft. Especially efficient and cost-effective widebodies can stretch their service time substantially when converted to cargo use. Older A300s and A310s have shown this in reality. Airbus thus informs that all their widebody aircraft have the optimised fuselage cross-sections, offering full interline capability, which creates good potential for freighter conversions at the appropriate time. Also further developments like increasing maximum take off-weight, which enables to take more cargo or passengers, have a value creation effect.

Fuel is also one of the key factors determining the value of an aircraft. Increased fuel prices have reduced the popularity of older aircraft types and are thus pushing operators to younger and more fuel efficient models. Jet fuel price is entirely dependent on crude oil price which is very sensitive to events in oil producer countries. This makes oil price to be volatile and the long-term trend is constantly upwards.

It is observed that aircraft values tend to rise when economy is booming and decline when economy is slowing down. Otero (2006) finds that airline profits are correlated with the aircraft orders, which makes a perfect sense. When profits are good, it means that seats are full and there is a high demand of aircraft and therefore aircraft values increase. On the other hand, during a downturn there is a surplus of capacity and profits as well as values decline. What happens is that new aircraft are been ordered during the times of strong growth but due

⁴⁴ Modeling aircraft loans and leases, Pk AirFinance, Nils Hallerstöm, 03/2010, retrieved 1.10.2012 from <http://www.pkair.com/pdf/article1.pdf>

to manufacturing lead times of about 18 months, delivered many times in the times of low profit. Nils Hallerström, the president of PK AirFinance (subsidiary of the largest aircraft lessor GECAS) discusses about aircraft valuation and especially about the cyclicity of the business.⁴⁵ He admits that values of aircraft are unpredictable and highlights depreciation life, capacity cycle, inflation and maintenance status as the key drivers for the value. He also shows a striking correlation between aircraft values and airline profits. He suggests different solutions to free up capital for example by leasing and emphasizes the importance of striving for highest return on risk capital rather than for the lowest cost of funds.

On top of all these features, the value is naturally determined by the supply and demand. Passenger traffic growth is very much correlated with the GDP trend. Traffic estimations and a market overview are further discussed later. Estimated value can also alter very rapidly due to changed demand caused by increased competition or shocking events like 9/11. Major shocks that have impacted our economy and therefore also the sensitive airline business are for example the Gulf War, 9/11, SARS, bird flu and the current economic downturn. What makes this current cycle different is that there seems to be a fundamental change in the challenges airline face today.⁴⁶ The peak in oil prices in 2008 caused increased costs and was faced especially airlines with older equipment. A need for more efficient aircraft emerged. However, although oil price has been stabilized, airlines now face much weaker state of economy as the anticipated growth has remained only at moderate level.⁴⁷

A methodology for estimating the cyclical effects on aircraft values has been developed PK AirFinance and by Nils Hallerström. He explains that three factors affect on the cycle of the aircraft value: traffic growth, deliveries of new aircraft and retirement of existing aircraft. In five year term, the first one is unpredictable, the second one somewhat predictable and the third one very much predictable. This lays the basics for their estimation of aircraft value development. He reminds that these cycles are caused by this ordering-production-delivery process that makes the supply and demand of aircraft go out of balance. This is due to quite long manufacturing lead times, typically 12-18 months, as discussed already earlier. The values of used aircraft rise when there is shortage of capacity and decrease in excess capacity.

⁴⁵ Set the capital free, Pk AirFinance, Nils Hallerström, retrieved 1.10.2012 from <http://www.pkair.com/pdf/Setthecapitalfree.pdf>

⁴⁶ AVAC – The Aircraft Value Analysis Company, Commercial Jets Volume 1, Current & Future Values & Lease Rates (2010-2030), Issue 38.1 - April 30th 2010, retrieved 16.1.2013 from <http://www.aircraft-values.co.uk/INTRO43mg.pdf>

⁴⁷ Airbus - Global Market Forecast 2012-2031, Full Book, retrieved 28.10.2012 from http://www.airbus.com/company/market/forecast/?eID=dam_frontend_push&docID=27599

As discussed, a launch of a competing aircraft type or also an advanced and more fuel economy engine can lower the value of an aircraft within few years after the competitive launch. New aircraft are introduced quite rarely and because of a long development and validation process there is some time to react to the news. But this is one important point to take into account before undertaking a long-term commitment. When considering an acquisition of certain aircraft types it is known that in few years a competing and more advanced model is also available in the market. This should be reflected also in the prices and lease rates. This cycle of new aircraft development can be predicted in some accuracy. The economical age of a particular aircraft model is thought to be around 25-30 years. However, the trend seems to be declining. Countries like Russia, Brazil, China and India have been formerly eager to take older aircraft but are now favouring more often newer equipment.⁴⁸ They seem to be rejecting aircraft older than 20 years which have led to a decreased demand for older aircraft. As Seidlitz predicts this could cause shorter finance terms and therefore increased uncertainty of residual values, lower advance rates and higher lease rates. It is been seen that aircraft values, default frequency and interest rates all seem to be affected by the cycle. If the cycle could be forecasted, it would ease the forecasting of aircraft values, default frequency and interest rates.

In the current market situation, the most influential factors for value are age, maximum weights and their upgradeability, configuration and enhancements such as winglets.⁴⁹ It is notable that today the manufacturing year is more relevant than before when in addition to chronological age also total flying time was a factor. Especially crossing the thresholds of 10, 15 or 20 years of age, decreases the value non-linearly. This indicates some sort of increased caution among the buyers. It can be anticipated that increased uncertainty can cause shorter finance terms and as a result higher lease rates. Also Kelly finds support for emphasized importance of age to the value. In his article published in *Airfinance Journal* he states that a whopping 66% of residual value is actually explained by aircraft's age after all.⁵⁰

What makes this valuation process so complex is that there are infinite amount of occurrences that can affect on these factors. Some are more predictable than others but always some subjective estimation is needed and often it is based on historical values. Aircraft values are

⁴⁸ <http://edition.pagesuite-professional.co.uk/launch.aspx?pnum=6&eid=1607145a-5fa1-4ac4-aae9-e66ea4abee12>, retrieved 25.10.2012

⁴⁹ Aircraft Finance Guide 2012, UBM Aviation, <http://edition.pagesuite-professional.co.uk/launch.aspx?pnum=6&eid=1607145a-5fa1-4ac4-aae9-e66ea4abee12>

⁵⁰ 2012 OPERATING LEASE SURVEY. *Airfinance Journal*. Jul/Aug2012, p1-1., retrieved 1.10.2012

thus very volatile and quite unpredictable in this dynamic industry. An important factor in aircraft value creation is also liquidity.

Baker and Hubbard (2004) study asset liquidity in the trucking context and they report that more liquid assets tend to decrease the cost of external financing, thus preferring leasing. The explanation is that more liquid assets are more redeployable (Shleifer and Vishny, 1992) and less specific (Klein, Crawford and Alchian, 1978). Gavazza (2010a) examines asset liquidity in aircraft leasing market and discovers that more liquid the asset, more likely it is leased, particularly through operating leases, shorter the lease period of operating leases and lower the mark-ups of operating lease rates. He actually suggests longer holding periods for illiquid assets. Paper explains how the illiquidity of aircraft is affected by two main factors: the production of new units and the retirement of old units. In other words, when the aircraft is still manufactured its liquidity is stronger but when the amount of the units starts to decrease, so does the liquidity. So, large operator base is the main key to liquidity. Gavazza also studied secondary aircraft markets and stated that they have grown steadily since mid-1980s and today transactions on used market are three times the amount of the purchases of new aircraft. This implies that the liquidity is at least increased. Gavazza backs up this argument by stating that all airlines around the world use more or less same types of aircraft, there are few aircraft types and this kind of asset can be flown to anywhere in the world in a day.

However, the type of an aircraft has a definite effect on liquidity. Usually narrow-body aircraft are much more liquid in the market than their more volatile wide-body counterparts. When assessing the market value of an aircraft and the willingness to bear the residual value risk in the future this is an issue to consider. Wide-body aircraft could be in that light more sensible to lease than purchase. Hallerström and Melgaard (2000) and Otero (2006) find the greater uncertainty of wide-body residual value forecasts relative to single-aisle aircraft. Also Gibson (2010) finds that the NPVs found to be lower for larger aircraft. General assumption is that larger aircraft are more risky due to market demand and a higher cost structure but also rewards can be higher. Gibson states that risks are indeed greater but he didn't find any increased profitability, probably due to cyclical effects and volatile fuel prices. Gavazza describes aircraft as differentiated products which implies that they are imperfect substitutes. He reasons this with an example that there are different airplanes for different purposes, mainly meaning different ranges and capacities. However, I want to note that there usually are competing airplane types for every different purpose. Main aircraft manufacturers Airbus and

Boeing (of course accompanied also with other manufacturers) will make sure that a customer always has a choice between at least these two types despite the purpose of the aircraft.

To conclude this sub-section, it can be stressed that the estimation of the value or residual value of the aircraft is very complex and requires advanced methods. Residual value risk seems to be very concrete and the increasing trend for airlines is thus to transfer this risk to the lessors who are more capable to manage that risk. This is done in the form of operating lease. In favour, airlines are accepting higher induced costs. There seems to be some trends what kinds of aircraft are first of all acquired today and secondly under which financing method. Vasigh mentions that rising fuel prices and low interest rates make airlines acquire rather new than used equipment at the moment. Gavazza continues that more liquid assets are more likely to be leased.

3.3.5 Estimating the cost of capital and risk adjustment

Modern cash flow based capital budgeting methods require an estimate of the required return on investment, calculated as a percentage. The return of the investment is then compared to that required return in order to determine the profitability of the project. NPV calculates the actual cash value originated from the project, using a calculated cost of capital to deduct the required rate of return in each period. IRR on contrary gives the project's rate of return, which can be compared to a required rate. So, with these DCF-calculations a cost of capital needs to be estimated. Usually it means both cost of equity and cost of debt.

Bower (1973) finds that most academics agree what are the relevant cash flows when assessing the value of lease. However, it varies what cash flows should be discounted with what discount rate. He suggests that lease rentals should be discounted with the firm's cost of debt and all other cash flows like tax shelters, ownership costs and residual value with after-tax cost of capital. Gordon (1974) and MDB argue for the use of before-tax cost of debt. On the opposing side are Ezzell and Miles (1983) who state that in certain situations the after-tax rate is the correct discount rate. Copeland and Weston (1982) agree by proposing that the correct discount rate is the after-tax one and adding that if the operating lease is cancellable then it should be higher and should be calculated as the option to cancel is an American put option. In the end, the use of after-tax cost seems to be the established practice today. Brealey and Myers (2003) justify this with the fact that the net cost of borrowing is the after-tax interest rate. In other words, company needs to pay tax on the interest received when lending money and can deduct interest payments from its taxable income when borrowing money.

In previously mentioned study Schall et al. (1978) find that the most common method to calculate the cost of capital or discount rate is the weighted average cost of capital (WACC) by Modigliani and Miller. The second most popular discount rate used is the cost of debt leaving the cost of equity quite unpopular. Also "risk-free return plus a premium" method is mentioned in the responses. As Gibson (2010) points out, this method is essentially a CAPM (Capital Asset Pricing Model) approach to estimating the cost of share capital. CAPM was introduced by few authors but maybe the greatest contribution to finance was given by Sharpe (1964). CAPM is used among other things to estimate the cost of equity. The model takes into account the correlation of the company's share price to market returns often represented by the beta (β) as well as the expected return of the market and the risk-free rate.

Schall et al. discover also that the overwhelming majority of respondents are using after-tax discount rate and after-tax cash flows. Interestingly, researchers discover quite significant use of subjective measures to estimate the cost of capital. This implies that managers often prefer to use a combination of objective and subjective methods to estimate cost of capital. To adjust for risk in practice, Schall et al. find that managers tend to raise the discount rate for NPV, shorten the PBK period and raise the required rate of return in ARR.

Surprisingly, in the mid-1990s, Trahan and Gitman (1995) describe in their survey that sensitivity analysis is the most commonly used technique to take risk into account. Over 60% of managers are using it according to results. This shows a substantial increase in its use. More advanced techniques such as Monte Carlo, and decision tree analysis weren't that popular but not because the managers didn't understand them. Bruner et al. (1998) find, in line with others, that DCF-models are the dominant valuation techniques and WACC is used to calculate cost of capital by the majority of companies. They also state that CAPM seems to be the dominant method in cost of equity estimation.

Graham and Harvey (2001) note that cost of debt for a WACC calculation is relatively easy to find, whereas cost of equity is far more difficult to estimate. They find that nearly 3 out of 4 respondents use CAPM to estimate cost of capital while 40% use average share market returns and do not adjust for the risk. One third found using the dividend discount model. They suggest that the use of multiple techniques means that managers prefer to compare several alternative measures to find an appropriate cost of equity. Related to risk adjustment in valuation, authors discover that over two thirds of respondents make adjustments for the market risk (β -value) of a project. They state that this confirms a wide use of the CAPM method and the so-called "project Beta" approach to estimating cost of capital.

Gibson and Morrell (2005) get similar responses from airline managers that previous studies suggest. The managers tend to prefer for WACC as a discount rate, followed by cost of debt. Authors interpret that the former implies a balanced view between shareholder and lender expected returns, while use of cost of debt may indicate that NPV analysis is used to justify projects to banks. They importantly also discover that while cost of equity is an important input to a WACC calculation, airline managers didn't indicate very broad use of any estimation method to estimate it. Therefore authors mention that the popularity of CAPM seems to be less pronounced than in Graham and Harvey study. However, measures based on "experience" seem to be as widely used as CAPM in airlines. This wider use of experience or heuristics seems to be quite typical for airline industry. Gibson and Morrell (2005) show that the most common way to take risk into consideration is to artificially raise the discount rate making investment projects more difficult to justify. This finding is in line with the findings of Stonier (1998). It is usually based on subjective estimates or plain guess. This reveals the use of experience-based risk management but managers leave the question of how much should the discount rate be raised unanswered. Gibson and Morrell (2005) continue that the second common method for adjusting for risk is – no adjustment at all! Only after that comes evenly popular Monte Carlo simulation and sensitivity analysis. Lowest preferences are found for Value at Risk (VaR) and "Beta"-method, latter being interestingly the most popular in Graham and Harvey study. Authors suspect that it is due to thinly-traded nature of the airline shares and the weaker preference for CAPM. Many financial managers reveal their negativity towards the Monte Carlo simulation as they find it a bit mysterious and a method that avoids responsibility in its results. Managers tend to prefer more visual than fully quantitative approach. Gibson and Morrell (2004) suggest that a better approach than "artificially raising the bar" to adjust for uncertainty is to use a moderate cost of capital. This can be done by either using market measures such as some airlines have done or alternatively using long-term regional benchmarks (Dimson et al., 2002).

As mentioned earlier, finding the cost of debt is relatively simple whether as estimating the cost of equity is pretty difficult. CAPM seems to be widely used also among airlines to estimate that cost. Under CAPM, historical share market returns on the firm and the market are used to estimate expected returns in the future. This will yield a β -coefficient that measures the specific risk and therefore expected return for a share. A β -value greater than 1.0 means the share is more volatile than the market overall. One could suspect that this is the case also in airline business which is known for highly cyclical demand patterns and volatile

input prices. However, as Turner and Morrell (2003) analyse 10 airline β -values, they find betas less than 1.0 on average. They also find that several financial information services provide substantially different betas for the same date. They explain that it could be due to the selected airlines, changes in the market as a whole or positive correlation with trading activity. Nevertheless, this reveals that estimating β , and therefore cost of equity, is not exact science but depends heavily on methods used and their underlying assumptions.

Authors also argue that when using CAPM, the estimates of cost of capital, especially β , might be distorted in companies with substantial amount of shares that are not traded. This is many times true regarding state-owned airlines and therefore questions the suitability of CAPM in airline business. For instance Finnair is a typical partially-privatized carrier with 56% state-ownership and in addition has large institutional investors with approximately 20% share. In several publicly available sources Finnair was given a β -value clearly under 1.0⁵¹ which is in line with the findings of Turner and Morrell. This raises the question of the understatement of Finnair's β in CAPM-calculus.

To conclude, as there have been a clear trend towards the use of cash flow based valuation techniques such as NPV and IRR, similarly the WACC has taken its place as the most reasoned discount rate. However, there seems to be differences in cost of capital estimation techniques. Usually managers prefer to use a combination of them, including both market based and heuristic methods. Subjective estimations are done quite universally. This is due to imperfect models or because historical data is not seen as relevant enough when predicting future values. Also the CAPM has found its place in valuation tool pack. However, some challenges are faced especially when estimating β -values of government held and thinly-traded airlines. Airline managers also take risk into account by using also sophisticated statistical methods like Monte Carlo and sensitivity analysis. However, at the same time as use of these methods has increased, statistical expected-return methods still remain problematic. The next sub-section discovers what valuation methods airlines actually use in their investment analysis.

3.3.6 Valuation techniques actually used in airlines

Now that I have explained the reasons behind the purchase or lease decision and previously presented the most common academic valuation techniques related it is time to explore what

⁵¹ <http://www.reuters.com/finance/stocks/financialHighlights?rpc=66&symbol=FIA1S.HE>, retrieved 1.3.2013

techniques actually are being used in airlines and what sort of challenges are involved in them. Schall et al. (1978) approached a large sample of U.S. companies and studied the popularity of methods like traditional Accounting Rate of Return (ARR) and Payback period (PBK) and classical Internal Rate of Return (IRR) and Net Present Value (NPV) in the investment analysis. He discovers that PBK was the most popular (74% of respondents) method used but also NPV, which was least used, was used over half of the respondents. More importantly, he showed that the overwhelming majority combined these methods in their analysis. Also most managers mixed the traditional and classical measures.

Trahan and Gitman (1995) continue to study the use of these methods in the 1990s. Their results confirm the clear acceptance of the classical valuation techniques and that these are substantially better understood than before and more frequently used than the traditional methods. The study was brought to 21st century by Graham and Harvey (2001), whose extensive U.S.-survey showed the dominance of NPV and IRR as primary methods used in investment analysis. Probably because of the development of cost of capital estimation techniques NPV is found almost as popular as IRR. Their study also includes more modern methods like adjusted present value and real options analysis which seem to enjoy very limited popularity. ROA was used 25% of respondents always or almost always as APVs respective percentage was only 10%, quite self-explanatory figure.

Gibson and Morrell (2005) applied this type of research in airline business by gathering 249 responds from airline Chief Financial Officers. Their survey is comparable to the one of Graham and Harvey as they use same choice of preferences. They gather responds from all over the world but they are slightly biased toward European airlines with relatively small fleets. Indeed, they state that their conclusions are most relevant for these groups. This suits very well the needs of this study as Finnair fits to this definition quite well.

In their study they find that NPV in general is used extensively in airlines around the world together with another cash-based measure, internal rate of return and the rather simple payback period. They find a stronger preference for NPV than Graham and Harvey. Airline CFO's seem to also favour PBK more than U.S. general business companies. Although being quite primitive method, it is very representational and understandable. McDonald (2000) and Alesii (2004) actually suggest that PBK may approximate the conclusions of more sophisticated techniques such as Real Options Analysis.

What surprises the authors is that accounting based method accounting rate of return ARR is clearly more popular in airlines than in general sample. The downside of using it is the lack of recognizing the time value of the money. Further, fewer CFOs said they use ROA always or sometimes compared to responds in Graham and Harvey. It is surprising considering airline business is known to have substantial amount different options related to aircraft acquisitions.

Use of APV, on the other hand, is more frequently used in airlines. However, it is notable that only about 20% of CFOs use APV or ROA always or sometimes. Respective figures for NPV, IRR and PBK are 80%, 65%, 95%. This highlights the broad use of several different methods in airlines although there are severe flaws related to some methods. Airline financial managers were found to prefer using more than one technique to analyse investments, ranging between two to six methods. Above-mentioned percentages also reveal to authors that in general, as financial theory has evolved, cash-based measures have become the primary tool in valuation but more advanced methods like ROA and APV are not yet fully utilised in airlines.

Above-mentioned results reveal that decisions made in airline managements are quite rarely based on more sophisticated techniques but usually on simple analysis and “gut feeling”. There is always subjectivity when making decisions and apparently aircraft acquisitions do not make an exception. Some amount of subjective assessment is naturally needed, especially when discussing about quite tailored products like aircraft. However, these assets are worth hundreds of millions of dollars in total and capital budgeting decisions at these volumes can make a critical difference to the profitability and even existence of an airline.

This raises a question why there isn't the most sophisticated tool set available in every airline finance department? However, one could stick up for financial managers saying that not always they have resources needed to familiarize themselves to the most recent academic researches. Academic models also too often suffer from complexity that is they are found difficult to adapt to real life applications. Moreover, these results are often found hard to believably sell to the management. It can be challenging to convince the board of directors which does not necessarily fully consist of financial experts and who are accustomed to be offered quite straightforward and simple numbers. When used advanced methods like ROA, directors are forced to evaluate the decision in different states of uncertainty and determine their tolerance to risk.

It is also good to remember that there are pitfalls in every single of these methods and that may eliminate some of them from the use. However, these pitfalls need to be understood before using them. I present the most common pitfalls of the methods described earlier and also used in my study. NPV is very popular among managers but contains some imperfections. The method requires the estimation of the cost of capital which can be quite difficult. This challenge is actually discussed in the next sub-section. Other drawback is that NPV is less intuitive than the simple percentage return, which is easy to compare to a bond return. Related to leasing, NPV does not recognize that lease payments include both financial and investing cash flows. (Gibson and Morrell, 2004) NPV also discounts all the cash flows with just one cost of capital regardless of their riskiness. The model also assumes that debt and lease are perfect substitutes. IRR calculation does not require a cost of capital but has other flaws. It can give contradictory results to NPV and can yield multiple answers if cash flows change sign more than once during the project. In addition IRR does not adjust for project size. Because of these deficits, academics tend to strongly favour NPV. To be able to estimate both the cost of equity and debt can be considered as one of the challenges of APV. Also the lower present value than in NPV counts for inconveniences of this method.

While very popular among academics, ROA has two major drawbacks. First, the volatility estimations are often based on historical and subjective management estimates which can question the suitability of the data points in today's market situation. Second, this method is used successfully for decades when evaluating financial options but still its popularity in real investment scenarios, especially among airline financial managers, is questioned. ROA seems to carry some sort of veil of mystery around it because Gibson finds that the method is perceived as too exotic while the relevance of its math is challenged. For some reason financial managers actually have troubles considering ROA as a discounted cash flow based model.

As a conclusion, it could be stated that since 1970's the cash flow based classical financial valuation methods have increased their popularity, the most common ones being currently NPV and IRR. These methods are found to be common also in aviation business but also traditional accounting and financial statements based valuation techniques have remained surprisingly common. Overall, the use of several different methods together is pronounced and the use of the most sophisticated techniques is scarce. So, clearly there is a need to ensure that the decisions are made with the best possible techniques available.

Gibson and Morrell (2005) thus suggest the use of APV, Monte Carlo simulation and ROA in investment valuation. They justify this by explaining that these applications extend classical techniques and bring broadly accepted statistical methods to the valuation analysis. These techniques are much more versatile and uncertainties for example in fuel price, market growth, type of aircraft or cyclical effects can be taken into account more extensively. In order to compare leasing and purchasing, they recommend the use of APV. This would help managers to convert investment decision from purely financial to more strategic one. In the next sub-section I will introduce the problematic related to choosing the right discount rate and more over estimating the cost of capital.

3.3.7 Lease as a substitute for debt?

One beneficial characteristic that leasing has said to have is that it provides "100% financing" meaning that capital investment requirements are reduced. This "leasing preserves capital" is however false reasoning because one could borrow the money needed while an asset serves as collateral. Another point made is that leasing provides an additional method of financing in addition to debt. This reason is seen today as a dubious reason for leasing by for example Brealey and Myers (2003) because they consider leasing and debt as substitutes. It means that company cannot think that leasing would provide some "additional funds" available on top of debt financing because lease always consumes the overall debt capacity of the company.

But how much is actually very relevant question. According to several studies leasing does displace at least some amount of debt but not necessarily in one-to-one relation. The issue of substitutability of debt and lease has been discussed among academics for years but empirical findings are controversial. Traditionally, in valuation of leases the basic principal is that a lease can be considered as an alternative to a debt. Benefits and disadvantages are different but it is common to think that certain amount of lease displaces same amount of availability for a new debt. That is, they are perfect substitutes. On this assumption rely for instance Marston and Harris (1988), Krishnan and Moyer (1994) and Copeland et al. (2005). This is regarded to be true at least in the case of financial leases which are more debt-like financing. On contrary, operating leases are different with their characteristics and are hard to classify as perfect substitutes for a debt. Indeed, other views are also present.

Term "leasing puzzle" was created by Ang and Peterson (1984) when they contrary to the previous studies found out that debt and lease could actually be even partial complements and were agreed by Lewis and Schallheim (1992) later on. Also a third opinion is presented in the

literature when some researchers have suggested that debt and leasing are partial substitutes, Yan (2006). Present understanding is that they might not after all be perfect substitutes which would favour leasing. Beattie et al. (2000) find in their UK-based study that operating leases are not displacing debt one-to-one. Their results imply that leasing and debt are partial substitutes, with £1 of leasing displacing approximately £0.23 of non-lease debt, on average. However, in this thesis I assume that leasing is a perfect substitute for debt and therefore the applied discount rate is after-tax WACC.

This quite extensive chapter presented the theoretical framework related to acquisition of an aircraft either by purchasing or leasing the asset. When putting all this theory into practice several challenges are been introduced and some underlying assumptions have to be naturally made. The methodology is briefed more closely in the next chapter.

4 DATA AND METHODOLOGY

This chapter presents the data and methodology used in the study. The choices and methodological selections are explained. First this chapter presents and justifies the selection of relevant data. Secondly, assumptions and realization of the study is detailed. The third chapter presents all the asset valuation techniques used in this study.

4.1 Data

First of all it is worthwhile to mention that the public data of the aircraft values is scarce due to the fact that majority of aircraft transactions' prices are not disclosed publicly. Aircraft manufacturers provide list prices but they substantially differ due to bulk or other discounts as previously discussed. Furthermore, a few "bluebook" companies exist but their estimates of market and base values are not publicly available for free. Fortunately this study has a possibility to utilize data from two data providers, The Aircraft Value Analysis Company (AVAC) and Aviation Specialist Group (ASG). The former has produced current and future *market values* as well as lease rates on yearly basis for the next twenty years. The latter one estimates current *market values* and in addition *base* and future *base values* for every common aircraft type in the market. As AVAC tries to estimate the market value of aircraft taking into account for example economic cycles, the time value of money and maintenance reserves etc., ASG specifically excludes all these aspects as well as transaction costs. As book value is only some theoretical "through the cycle" value, it does not have any real life

contribution and therefore this study will use only the market values of aircraft. This means excluding the data of ASG except their estimates of the current market value. Figures are prepared in the fourth quarter of 2012 and therefore reflect market conditions at that time.

Both data providers emphasize that their data represents rather objective estimations based on both market information and expertise than accurate values based exclusively on recent market transactions. As stated, different methodologies naturally exist between data providers and therefore they aren't necessarily comparable.

AVAC provides a wide range of data as they present yearly US dollar - figures of current and future market values of aircraft and current and future lease rates. Values are adjusted for inflation estimated by the company. All market values are based on the year of build of the aircraft, assumed to be in the equivalent of half-life condition. New objects are brought down to half-life in year four. It is important to understand that current values are assuming that an aircraft is sold by a player other than manufacturer. This means that the current value is not an estimated purchase price. The more precise definition assumes that one unit is bought for cash by a willing buyer from a willing seller. Overall, values assume a mediocre object with average condition, standard interiors, avionics and most popular engines. Other combinations will have either lower or higher value and therefore also low and high values are presented to better cater for different specifications and finance terms.

Lease rates are based on eight year lease term considering wide body airliner and that maintenance reserves are included so that the aircraft will be returned in the equivalent of half-life. A medium risk credit, varied between different aircraft types, is assumed. Usually, older aircraft tend to be leased on shorter terms than newer ones and widebodies on longer terms than narrowbodies. In addition to basic lease rental, also high and low current lease rentals are presented. They reflect differing terms and credits. The future lease rates reflect changing market conditions. Generally, during weak market conditions lease terms are shorter and vice versa. AVAC forecasts interest rates for each year separately and they have been built in the presented lease rentals.

As mentioned, AVAC only provide market values because they see base value too theoretical. As data provider explains, it is extremely difficult to predict future market values. Historical values provide some guide for the variation produced of some specific event but the nature of the industry will guarantee that such events will occur that have no previous reference. This makes room for judgement and presumptions, or subjectivity. It is being reminded that

reported values of transactions rarely represent all previously mentioned pre-assumptions and therefore should not put too much weight on. List prices can many times include additional cost items such as product support and training and financing levels for new aircraft can reflect list prices rather than the actual price paid.

As a service industry, air transport is heavily dependent on the state of the economy for its growth. The values of aircraft are at first forecasted based on their economic service life and then exposed to other internal and external macro- and micro-economic factors such as traffic growth, state of the economy and inflation. To estimate this fluctuation of supply and demand, AVAC utilizes estimates of some British clearing banks as well data from OECD. They also incorporate four variables: the price of oil, interest rates, inflation level and GDP growth which all can have an effect on supply and demand of aircraft. They use GDP growth as an estimate for RPK growth. Choice is made based on last 30 years of data showing a reasonably close correlation with the GDP and RPK growth. In addition to these factors different aircraft are given ratings based on almost 30 different general and specific variables affecting the asset strength. General variables are for example GDP, RPK, fuel, inflation, interest, yields and load factors. Specific variables can include for example orders, operators, number in service, backlog, geographical distribution, operator concentration, product life cycle, storage, level of availability, replacement proximity, replacement productivity, production rates, engine type, ETOPs, environmental compliance, MTOW, aircraft age, total hours an and cycles, registration, specification, lease rentals, number of lessors and retirement profile.

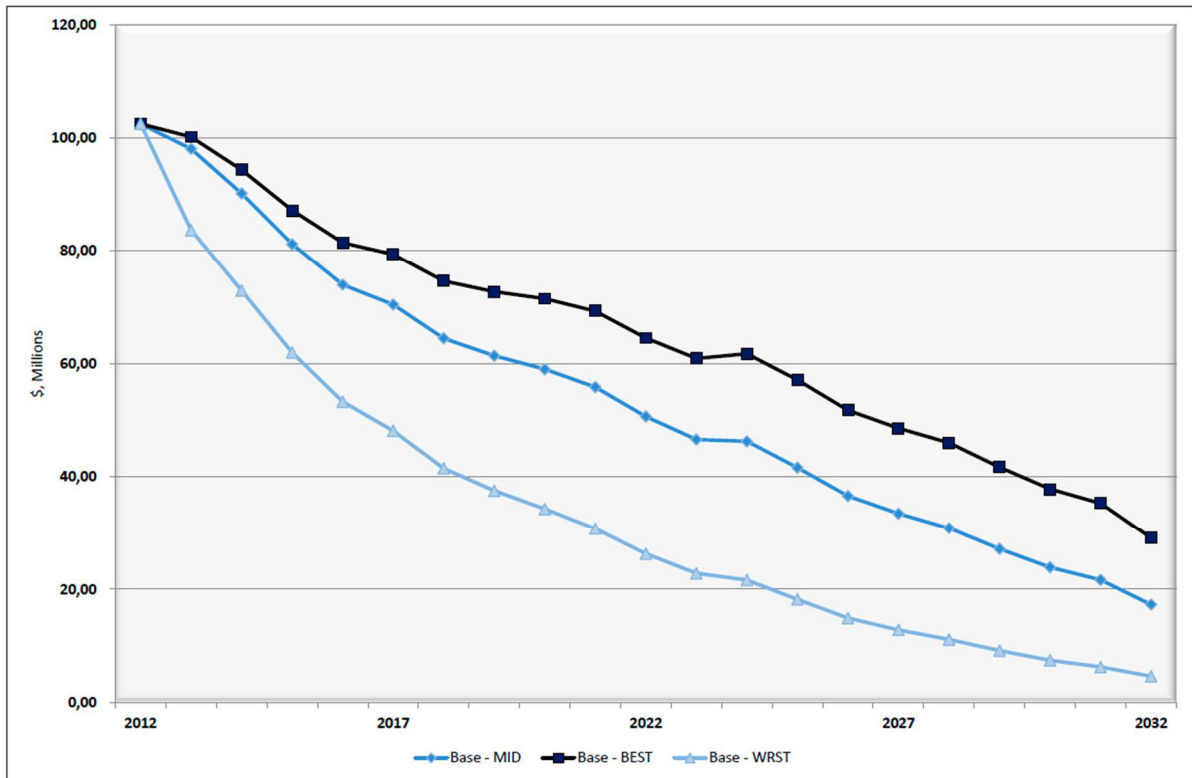
It is important to understand that each of the variables impacts the other factors to a greater or lesser extent. According to AVAC, there is a clear relationship between GDP, RPK and aircraft values but they remind that it is not constant. They explain that when the economy is strong, traffic increases. Airlines thus experience increased load factors followed by higher yields. Higher ticket prices and restricted capacity boost new and current airlines to introduce more capacity. However, aircraft manufacturers cannot instantly offer increased production and this can cause a temporary shortage. AVAC reminds that this shortage does not necessarily force airlines to acquire older equipment. As the shortage situation prolongs and the difference between supply and demand intensifies, values tend to rise. However, there is a lag between traffic changes, lease rental raises and increases in values. Traffic will rise first, followed by lease rentals and finally values. Contrary, during a downturn values may fall before lease rentals.

By combining all these features AVAC presents for every specific year three different market values aka three different scenarios based on future market conditions. These are Mid, Worst and Best. Mid represents normal market conditions, Worst weak market and Best respectively a booming market. In the first three years of each forecast, the Best & Worst represent 20 per cent probability levels; from years four onwards, the Best & Worst reflect ten per cent probability. AVAC states that the longest reasonable forecasting period is 15 years. As 8 years have passed, annual changes are less pronounced. It can be noticed from the decrease of variance between highs and lows.

So, to conclude AVAC provides future values of aircraft by using their flexible, rather market based, model which takes into account also external variables such as inflation. The model tries to embed the changes in the state of the economy and the cycles where airlines tend to order new aircraft during upswing which are due to long manufacturing times delivered not until there is already a downturn. Aircraft values will decline over a fifteen year period and increase only during growth periods. Every time an aircraft loses its value, it is more difficult to regain it.

AVAC's statement about longest reasonable forecasting period together with the suggestion of Gibson and the prominence of residual value in shorter time periods, made me choose also the 16-year period in my analysis. It is 16 rather than 15 because it is easy usage as combining two 8-year periods and renewing lease rates at time eight.

Below is a chart presenting estimated future values of A330-300 aircraft in three different scenarios in a twenty-year time period. It is notable that values decline in the same pattern because of the forecasted cycles and inflation are same in all scenarios. However, the worst case scenario seems to be declining at a higher rate than the other two. Best-case trend is very close to mid-case one but naturally values are higher. 2023 is a clearly an outstanding year as best-case value experiences even an increase and mid- and worst-case will decline only very slightly. This can be interpreted either as a forecasted boom period in the economy or an anticipated technical improvement for example of engines.



Graph 19. Estimated future values of A330-300 in US-dollars, in three different states of economy during twenty-year period. Source: The Aircraft Value Analysis Company.

In addition to aircraft values the financial data from Finnair's financial statements have been used. Data is processed and statistical analysis carried out with statistical software Microsoft Excel.

4.2 Implementation of the study

4.2.1 Research method

The research method of this thesis is a single-company case study. The purpose is to present and compare different asset valuation methods and their implications in the context of aircraft acquisition. Contrary to positivistic research, the purpose of a case study is not to produce new theory but instead examine the existing theory in a previously unexamined context or environment. However, I will create an excel-model, which enables comparison of financing methods with different variables. The model is built around the basic cash flow-based valuation techniques Net Present Value (NPV) and adjusted present value (APV). It also enables scenario and sensitivity analysis and Monte Carlo simulation. These methods are described in detail later in this section.

The basic idea of my analysis is to compare the differences of benefits between the two financing methods, leasing and purchasing. This is done by estimating which method produces higher net present value of costs. This excludes operational costs, because they are believed to be same in either way. According to Finnair, operating costs are not higher for leased aircraft. Companies with higher credit risk may suffer from this phenomenon but not Finnair. So, the investment decision has been already made and here I analyse just the plain financing decision for a single aircraft acquisition. My model just analyses which financing method is preferable, not should an aircraft be acquired in the first place. Next I will describe some presumptions made in my analysis.

4.2.2 Assumptions

In this sub-section I will explain some assumptions that I was forced to make regarding my analysis.

First of all, I want to clarify that the purpose of the model is that a user can easily try different inputs and see how it affects the financing decision. Results of the model are more suggestive than the exact truth. Suggestions reflect initial assumptions and the data accessible. Of course Finnair can use the model with increased precision due to their better knowledge of certain variables but for this study I will have to create an illustrative example which is an approximation. For example, I cannot use an actual purchase price of an aircraft but I have to estimate it from the list price provided by Airbus. However, my thesis still provides a decent tool for evaluation of the financing decision. Moreover, even if I had all the possible data in use, still probably the greatest factor of determining the lease or purchase question lies in the uncertain residual values (together with the initial price of course).

To get back to the purchase price, an average list price of A330-300 was \$239,4m in January 2013⁵², which reflects the time of the order. The average price reduction as previously referred (Michaels, 2012) tends to be 45% in the industry. However, this can vary substantially when comparing the price of a single aircraft when bought solely or included in larger order. Finnair does not belong to largest customers of the Airbus and does not generally place large orders when considering widebodies so it could be justified that the price reduction is in any case maximum 50%. When considering purchasing a single aircraft, which is fairly theoretical, the discount could be even smaller. Finnair does, however, have a close

⁵² http://www.airbus.com/presscentre/corporate-information/key-documents/?eID=dam_frontend_push&docID=14849, retrieved 5.3.2013

relationship with Airbus thanks to their previous orders of A320 family and widebodies A330 and A340. Finnair is also one of the initial orderers of yet to be launched widebody A350 XWB. These facts alone together with the previous history of large discounts between Airbus and Finnair already referred in sub-section 2.3.3 support a decent price reduction. Also the current state of the economy speaks for larger than “minimum” discount. Either way, it should be remembered that Finnair is still rather small airline in the order backlogs. Based on this breakdown I estimate the price reduction of 50% from the list price in a base case. This means a purchase price of \$119.7M. According to Aircraft Value News, in October 2012 a new A330-300 was being offered at \$102m so my estimate seems to be still on a conservative side.

Estimated current market value, lease rates and residual values are obtained from the AVAC's data. CMV, or current market value, is an estimated value for the standard aircraft with standard interior and avionics in January 2013. It is reasonable to believe that Finnair would be ordering an aircraft with quite standard characteristics, not the best possible but definitely not the minimum required equipment either. Current lease rate is also based on that. Current lease rates are generally quite low but actually rates of Airbus A330 have re-strengthened as mentioned earlier. Thus the monthly lease rate is estimated to be \$840.000 monthly. Future monthly lease rates and residual values depend on the choice of time period and the state of the economy. However, the actual user of this model can naturally replace this value with an actual value offered by a leasing company. All figures are in US dollars. Corporate tax-rate in Finland is 26%. Finnair states that their aircraft and engines as well as flight simulators are depreciated on a straight-line basis over their expected useful lives. The acquisition cost of aircraft is allocated to the aircraft fuselage, engines and heavy maintenance and these are depreciated as separate assets. Finnair also specifies their depreciation schedules for different assets. New A330 family aircraft are depreciated over 18 years to a residual value of 10%. Annual depreciation is thus 5%.

The time frame in my analysis is both eight and sixteen years. This is because data provider's lease rates are estimated assuming eight year lease term. However, I want to also include a longer period to avoid overemphasizing the impact of the residual value and because widebody aircraft will normally have longer rental terms than narrowbodies. Also new aircraft tend to be on longer terms than older ones. This selection is also done to support my hypotheses, that is, to study both short and longer time periods. Therefore sixteen-year time frame as an alternate is a justified choice. My analysis will treat 16-year period as two consecutive 8-year ones. This means that the lease is thought to be renewed at time 8 with a

lease rate of that time. My model assumes that lease payments are made in advance as in real life. However, in reality payments are due monthly but for simplicity my model runs on yearly basis.

For an additional curiosity, I will also calculate an implicit interest for the lease and compare it to the interest of the debt. This will tell how much more expensive the equivalent lease is than an ordinary debt. This is rather straightforward method but admittedly pretty easy to comprehend and compare. This kind of method has been also in use in Finnair. This implicit interest means a theoretical interest for a lease. I obtain it by calculating an internal interest rate for an imaginary liability amounting debt minus an estimated residual value. The debt is a debt in accordance with the advance rate. In this study the “debt” is considered to be particularly senior secured debt.

The advance rate, or the portion to be financed with the debt, is assumed to be the same as the present debt to total assets ratio. This is because theoretically WACC is the correct discount rate only when the capital structure of the investment and company are identical. Of course this isn't always the case but particularly in asset intensive companies like airlines this seems to hold true much better than in general. Airlines' capital structures resemble surprisingly well the actual investments.

Next I will describe the CAPM and WACC calculations which determine the costs of capital.

4.2.3 CAPM – Capital asset pricing model

$$r_e = E(R_j) = r_f + \beta[E(r_m) - r_f]$$

Equation 1. Capital Asset Pricing Model, CAPM. r_e = cost of equity, $E(R_j)$ = expected return of equity, r_f = risk-free rate, β = the sensitivity of the expected excess asset returns to the expected excess market returns, $E(r_m)$ = expected market return.

Capital asset pricing model was introduced by Sharpe (1964) and is used among other things to estimate the cost of equity. The model takes into account the correlation of the company's share price to market returns often represented by the beta (β) as well as the expected return of the market and the risk-free rate. It is pretty straightforward and thus widely criticized but no better replacement has been introduced yet. Probably the most problematic part of the model is the estimation of the beta-coefficient.

Morrell (1997) explains that airline industry is typically more risky than an average industry and therefore expects β -values between 1.2-1.4. In practice, however, Turner and Morrell (2003) find that β -values are much lower and very unsecure and depend heavily on the calculation method. They find a maximum β of 0,150 for Finnair and even a negative one with another method. Authors thus suggest that these figures should be interpreted with caution and possibly CAPM isn't the most suitable method for β -value calculations. Reuters provide a β -value of 0.74 for Finnair and 0.58 for the airline industry.⁵³ Damodaran⁵⁴ has found an average leveraged β of 1.21 for the airline sector in his calculations based on 36 companies. Chee-Wooi and Lee (2012) estimate systematic risk in East Asia and present average β 's around 1.0. The uncertainty and volatility of estimated betas makes me wonder the correct one to use in my analysis. To accurately emphasize the riskiness of the business and not to distort the analysis by overemphasizing the value of β , I choose to use a β of 1.2. The results from my CAPM calculations are presented in the next sub-section together with the WACC.

4.2.4 WACC – Weighted average cost of capital

Modigliani & Miller (1963), after-tax Proposition II:

$$WACC = r_e \frac{E}{V} + r_d (1 - T_c) \frac{D}{V}$$

Equation 2. Weighted average cost of capital, WACC. r_e = shareholders' expected annual return, r_d = annual interest rate on borrowing, E = the market value of the firm's shares, D = the market value of the firm's debt, V = the total market value of debt and equity.

To calculate the weighted average cost of capital or WACC, I need to know the capital structure of the company and estimate the cost of debt and the equity. In WACC calculation it is suggested to use only market values, especially regarding equity. When concerning debt I will use book values because the market value of the debt is very hard to obtain.

Damodaran (2009) summarizes the usual characteristic of debt which includes commitment to make fixed payments in the future, payments are tax-deductible and that failure to make payments can lead to default. When using this principle, he suggests also including all

⁵³ <http://www.reuters.com/finance/stocks/financialHighlights?rpc=66&symbol=FIA1S.HE>, retrieved 1.3.2013

⁵⁴ http://people.stern.nyu.edu/adamodar/New_Home_Page/datafile/Betas.html, retrieved 12/2012

interesting bearing debt and the present value of operating lease commitments in the debt when calculating WACC. Finnair treats operating lease liabilities of aircraft as rental expenses in the income statement. Lease payments due in future years under agreements are presented in the notes to the financial statements. At the end of the year 2012, Finnair had approximately 128 million shares and the share price was closed at €2.38 resulting to a market capitalization of €305m. The book value of equity was at the same time 785.5m. The company had interest bearing debt of €69m and operating lease liabilities amounted to 463.4m with a common capitalization method where annual lease payments are being multiplied by seven. In reality, lease liabilities are lower due to expiring lease agreements. Liabilities thus sum up as €1.032 billion and the debt ratio is 0.77. As finance literature suggest, I will use the market value of equity in this calculation. In Finnair, the book value of equity is used. Although it is against the common theory, they say that lower WACC wouldn't feel appropriate. This leads to a higher WACC and also better capital structure. Finnair takes into account also short-term receivables and cash when they determine the capital structure of the company. They thus find the debt ratio to be only 0,5. As a remark, finance lease liabilities are already included in the interest bearing liabilities as a net present value of their future minimum lease payments.

As a risk-free rate I use the Finnish government 10 year bond, which had a yearly average of 2.0% in November 2012.⁵⁵ For the sake of comparison, the yearly average of over €1m and over 1 year corporate loans was only 2.39%.⁵⁶ Twelve month Euribor averaged at 1.3%⁵⁷ as reference rate from Op-Pohjola Group, Op-prime, had a yearly average of 1.4%.⁵⁸ Because fixed-rate loans tend to have slightly higher margins, I estimate a 2.0% margin which results as 4.0% interest rate. This is my cost of debt for an eight-year time period. For the longer sixteen-year term I assume a slightly higher margin of 2.5% and thus a 4.5% cost of debt. Equity risk premium, or expected market return deducted with risk-free rate, is estimated as 6.0%.⁵⁹ With given values, I obtain the cost of equity of 9.2% and thus WACC of 4.4%. For comparison, HSBC analysed Finnair in October 2012 and ended up with a WACC of 7.8% (equity risk premium also 6.0%, risk-free rate 3.0% and sector β of 1.2). Finnair itself has set

⁵⁵ http://www.suomenpankki.fi/fi/tilastot/korot/Pages/tilastot_arvopaperimarkkinat_velkapaperit_viitelainojen_korot_fi.aspx, retrieved 12.1.2013

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http://www.suomenpankki.fi/fi/tilastot/tase_ja_korko/Pages/tilastot_rahallaitosten_lainat_talletukset_ja_korot_lainat_talletusten_ja_lainojen_korot_fi.aspx, retrieved 18.1.2013

⁵⁷ http://www.suomenpankki.fi/fi/tilastot/korot/Pages/tilastot_markkina_ja_hallinnolliset_korot_euribor_korot_short_fi.aspx, retrieved 18.1.2013

⁵⁸ https://www.op.fi/op/?sivu=rates.html&id=32405&group=op_prime, retrieved 18.1.2013

⁵⁹ http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/ctryprem.html, retrieved 12/2012

a target of creating positive value over pre-tax WACC of 9.5%. My WACC may seem low compared to for example 10-year moving average for the airline industry of 6.0% by Wojahn (2012) but this could be explained by the low interest rates and high gearing in the company. Finnair itself reports gearing so that the equity value used is the book value. The change is significant when I'm using the market value of equity as suggested commonly in finance literature. However, as my results already suggest leasing rather than purchasing, if WACC would be increased to 6%, the results would be even clearer.

4.2.5 NPV – Net present value

$$NPV = I - \sum_{t=0}^N \frac{L_t(1 - \tau_c) + \tau_c dep_t}{(1 + WACC)^t} - \frac{E(RV)_N + [E(RV)_N - BV]\tau_c}{(1 + WACC)^N}$$

Equation 3. Net present value. I = Purchase price, L_t = Lease rental, dep_t = depreciation, τ_c = lessees tax-rate, $E(RV)_N$ = expected residual value, BV = Book value, $WACC$ = after-tax weighted average cost of capital

The net present value method discounts all the relevant cash flows to the present with the selected cost of capital or interest rate. Relevant cash flows are purchase price, lease rentals, expected residual value as well as depreciation and lease payment tax shields. Also capital gain or loss induced tax effect on residual value is taken into account. In other words, if the actual salvage value of an asset is greater than the book value of the asset, the capital gain is taxable. Vice versa, the capital loss entitles to tax deductions. Usually net present value calculation contains also operating cash flows but in this case when comparing benefits of leasing and buying they can be left out. There could be an additional term for increased/decreased operating costs when an aircraft is leased but a company credit rated as Finnair does not usually suffer from those, states the Finnair representative. As justified earlier, I will use after-tax WACC as a cost of capital in my NPV analysis. Interest tax shield is left out from the formula because they have been taken into account already when used an after-tax discount rate. There is an upfront lease payment at time zero because lease payments are assumed to be made in advance which is the common practice in the industry.

To clarify, this is a NPV for a lease. When the net present value is positive it means that the benefits of leasing an asset are greater than when purchasing one and thus suggests leasing. In other words, if NPV is positive the financial costs of purchasing an aircraft are higher than when leased. These costs can be compared together because operating costs are same in each

scenario. The present value isn't just some abstract figure but an actual dollar amount of how much valuable a specific financing decision is. NPV is thus very popular because it is comprehensible and easy to sell for example to the management. Although, in real life and also in Finnair percentage returns are even more popular because their quick and easy comparability for example with an equivalent loan. So, as discussed earlier NPV has its pitfalls and therefore also an adjusted present value is presented. This enables the model to discount different cash flows with respective cost of capital and thus taking into account the riskiness of the separate cash flows.

4.2.6 APV - Advanced present value

$$APV = I - \sum_{t=0}^N \frac{L_t(1 - \tau_c) + \tau_c dep_t}{(1 + r_d)^t} - \frac{E(RV)_N + [E(RV)_N - BV]\tau_c}{(1 + r_e)^N}$$

Equation 4. Adjusted present value. I = Purchase price, L_t = Lease rental, dep_t = depreciation, τ_c = lessees tax-rate, $E(RV)_N$ = expected residual value, BV = Book value, r_d = cost of debt, r_e = cost of equity

Application of APV into aircraft investment analysis was proposed by Gibson and Morrell (2004) with their expansion beyond the classic APV. Their model expands classic NPV by discounting the lease payments and loan repayments at the cost of debt to quantify the cost of leasing flexibility and discounting the high-risk investing and operating cash flows at the cost of equity reflecting the shareholders' risks. They state that rather than comparing benefits of leasing and purchasing together, they should be compared to operating the aircraft. So they calculate present values with both NPV and APV for both lease and purchase scenarios and then compare them. In their example, NPV-based calculation prefers leasing but with APV, the choice turns to favour a purchase. Overall values are lower with APV because the operating cash flows are discounted using the higher equity rate. This naturally makes it harder to sell to the management. On contrary to his analysis, I will compare only the benefits of leasing and purchasing together but will utilize the use of APV also in that frame work. One should remember that Gibson includes also operating profits in his analysis which I have left out for three reasons: simplicity, scarcity of reliable data and due to the fact that financing decision can be analysed decently also with plain benefit comparison.

As can be seen from the formula above, in my analysis the residual value and its tax effects are discounted with the cost of equity and lease rental cash flows together with tax shields with the cost of debt. A noteworthy question here is what should be the discount rate for the tax shields. The question is controversial and justified for example because if the company does not make profit it cannot capitalize on tax shields. Also tax rates can change. This makes them somewhat uncertain and could be argued to be discounted with a higher rate. However, traditionally finance literature sees tax shields as riskless cash flows and teaches that they should be discounted with the cost of debt and many times even at risk-free cost of debt. (For example Modigliani and Miller (1958, 1963), Myers (1974), Luehrman (1997), Brealey and Myers (2003)) But also other opinions exist. Miles and Ezzell (1980, 1985), Harris and Pringle (1985) and Ruback (2002) argue for the unlevered cost of equity as Kolari and Vélez-Pareja (2010) stand for the levered cost of equity to be the correct discount rate. In his APV analysis, Gibson (2010) recognizes this difficulty but he still discounts tax shields “just” with the cost of debt. In case of Finnair, I think it could be justified to use a slightly higher discount rate than the cost of debt because the company didn’t reach for profit in four consecutive years until now, which shows the challenging nature of the low-profitable airline business. However, discounting with the cost of equity seems also a bit too harsh. Therefore, I will discount the tax shields with the cost of debt as traditional literature suggests.

4.2.7 Sensitivity/break-even analysis

Also the plain results from the NPV and APV are of course useful but to increase depth in the analysis, I will run a sensitivity analysis. Sensitivity analysis will reveal which input values have the biggest impact on the final result or present value. It is very important to be aware what kind of influence each variable have before jumping to conclusions. Without sensitivity analysis, what might first look as a good decision may quickly backfire if an overly predominant variable changes.

I will study the impact of key variables to net and adjusted present value. This will reveal how much the present value will change if a certain variable alters for example 10%. In other words, how sensitive the financing decision is to the movement of that particular variable. I will also show graphically the clearance of the variable before changing the entire financing decision. This is often called a break-even analysis. Particularly key variables such as purchase price, residual value, lease rate, WACC, cost of equity and cost of debt are monitored.

I will also include a scenario tool in my model which enables a user to easily change several input variables at the same time and see how it affects on the desired other variables as well as the financing decision as a whole. For example one could create a scenario of low interest rates and a poor state of the economy and enter corresponding input values to the model and instantly see what is the suggested financing decision and for example the value of WACC. To further develop this idea, an advanced simulation is carried out next called Monte Carlo simulation.

4.2.8 Risk analysis with Monte Carlo simulation

A Monte Carlo simulation is an enhancement of basic cash flow models. It is a sort of a risk analysis tool to bring some more depth and uncertainty consideration to the analysis. The basic idea is that certain input variables of the model are given probabilities or distributions instead of steady values. This means that with given probability the value of a variable will vary within its distribution. After distributions for all necessary variables are determined, the otherwise unchanged present value model is run several, in this case, thousand times. This will produce a thousand present values and from them it is possible to calculate a mean, a standard deviation and therefore a distribution. And further, with a distribution of present values it is possible to present results in form of probabilities. For example: “The present value is positive in three out of four times” or “The leasing is more preferable than purchasing with a probability of 75%”.

The state of the economy with respective probabilities is built in the Monte Carlo model. The Best- and Worst-case scenarios are given 10% and Mid-case scenario 80% probability, respectively. The Best-case scenario assumes a significant increase in travel demand over the next twenty years as a result of sustained economic growth and that capacity will continue to be slightly below demand. However, economic cycles will continue to occur. The Worst-case assumes that capacity will consistently exceed demand because of depressed economic conditions and this will occasionally result in depressed prices. During the Mid-case, or normal, scenario there will be occasions when capacity exceeds demand and values will drop as a result.

To determine the variables that are given probabilities, my model will emphasize the volatile residual values. They have nevertheless a great impact in my model and at the same time they are pretty hard to predict. Monte Carlo simulation is like made for this kind of situation where we can give a probabilistic distribution to residual values and simulate the most probable

values. In Airfinance Annual (2012)⁶⁰, which is an annual publication of Airfinance Journal, a vice president of a well-known valuation company Avitas explains their forecasting models. He states that 95% of their forecasted residual values lie within 2 standard deviations of the mean and that these 2 standard deviations are +/- 25% from the mean. This statistic includes all jets they have valued and takes into account economic and regulatory variables such as inflation. AVAC does not present such estimates on the validity of their data but I will utilize the above mentioned statistic. To be more conservative I expand slightly the outer limits and apply a standard deviation of 15% to my residual value estimation. As a mean I will use the residual value from the AVAC data, depending on the state of the economy. An important assumption here is that these values are normally distributed and that seems to be the case according to Avitas.

The lease rate in the beginning of the contract is the same as in my basic NPV-model. However, the lease rate for remaining eight years is dependent on the state of the economy at that time. The state of the economy is also separately simulated at the sixteenth year to estimate the residual value. This method recognizes that economic conditions are equally uncertain at every point of the contract. Eventually, this simulation enables me to find the mean and deviation for net and adjusted present values. Next, I will present the results of my model.

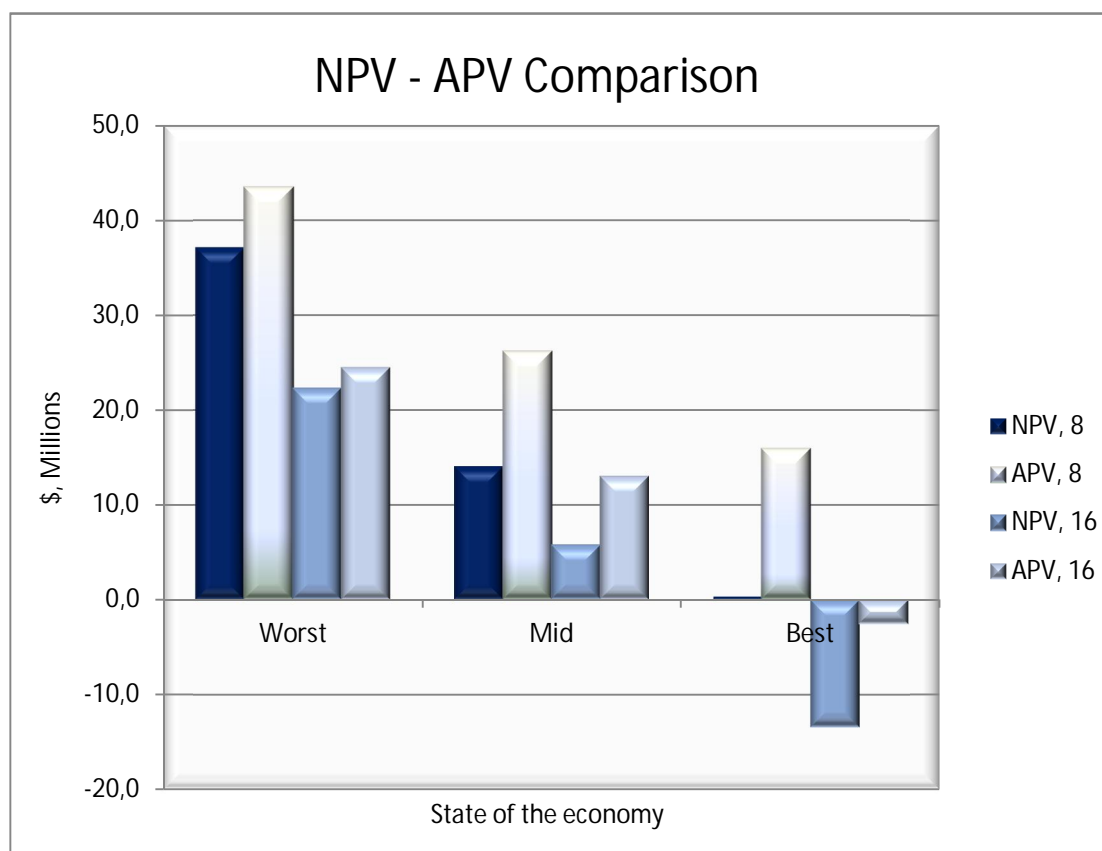
5 PRESENTATION OF RESULTS

In this chapter I will present the results of my analysis and discuss about them. First I introduce calculated present values from Net Present Value and Adjusted Present Value – methods. Then the results of sensitivity analysis are gone through and finally this chapter is completed with the findings from the Monte Carlo simulation.

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<http://www.avitas.com/publications/airfinancejournal/Airfinance%20Forecasting%20Aircraft%20Values%2024-30.pdf>, retrieved 20.1.2011

5.1 NPV & APV



Graph 20. Net and adjusted present values in US-dollars according to eight- and sixteen-year time period and with worst, mid and best states of the economy.

The figure above presents the results from the net present value and adjusted present value calculations. At first glance it is notable that all but two values are positive and therefore imply the choice of leasing. Next obvious observation is that present values tend to be higher in bad times of economy. When economy is in a depression or more over recession, aircraft values are lower than on average and so are lease rates. This naturally favours leasing. Also, longer time period decreases the present value. This is due to smaller estimated residual value at the end of an agreement. Attention should be paid to the fact that APV is always higher than NPV because the residual value is discounted with the higher cost of capital to reflect the risk of the shareholders.

It is generally believed that in short periods of time leasing is always more worthy option. My model seems to confirm that view as all present values are positive when the chosen time period is eight years. It also looks like that during bad times of economy, it is preferable to lease rather than buy. This is natural because during the weak times residual values are lower

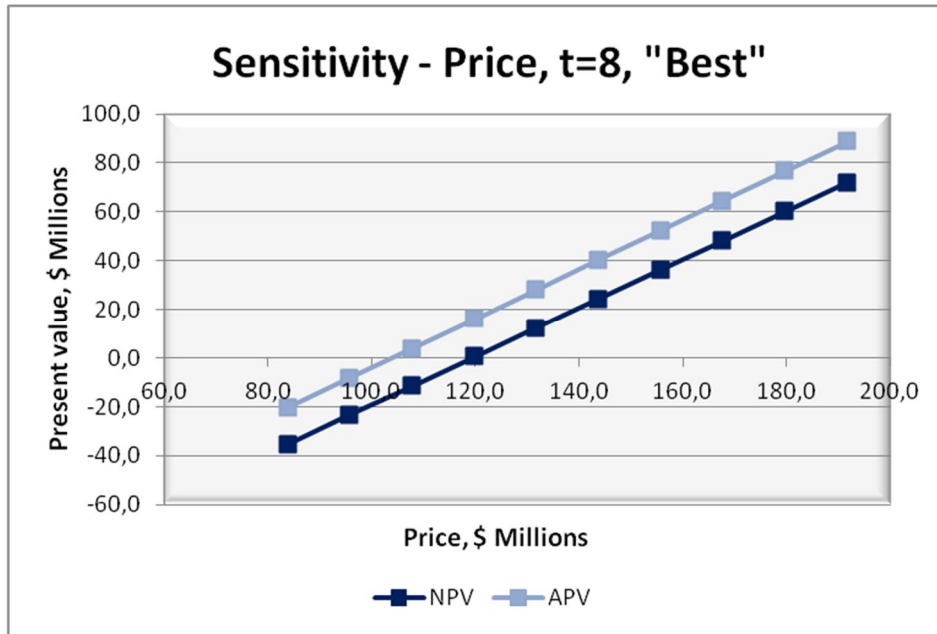
as well as lease rates. However, it is good to understand that in this basic version my model assumes that the chosen state of economy is the same throughout the whole period. This means that if for example the best state of economy is forecasted and the time period is 16 years, both the residual value at time 16 and new lease rate at time 8 are considered according to values reflecting the best state of the economy. This issue is fixed in Monte Carlo simulation where the state of the economy is simulated separately at time eight and sixteen. Anyhow, the only negative present values are resulted in a situation where time period is sixteen years and the state of the economy is “Best”. This shows that longer the time frame, more obscure the financing decision becomes.

Present values are as a whole quite high because of current situation of exceptionally low interest rates and thus costs of capital. This seems to be the right time to lease rather than purchase an asset. Of course interest rates can and eventually will rise and this effects to this decision. The sensitivity analysis will answer the question how much interest rates need to change before, *ceteris paribus*, purchasing becomes more preferable.

5.2 Sensitivity analysis

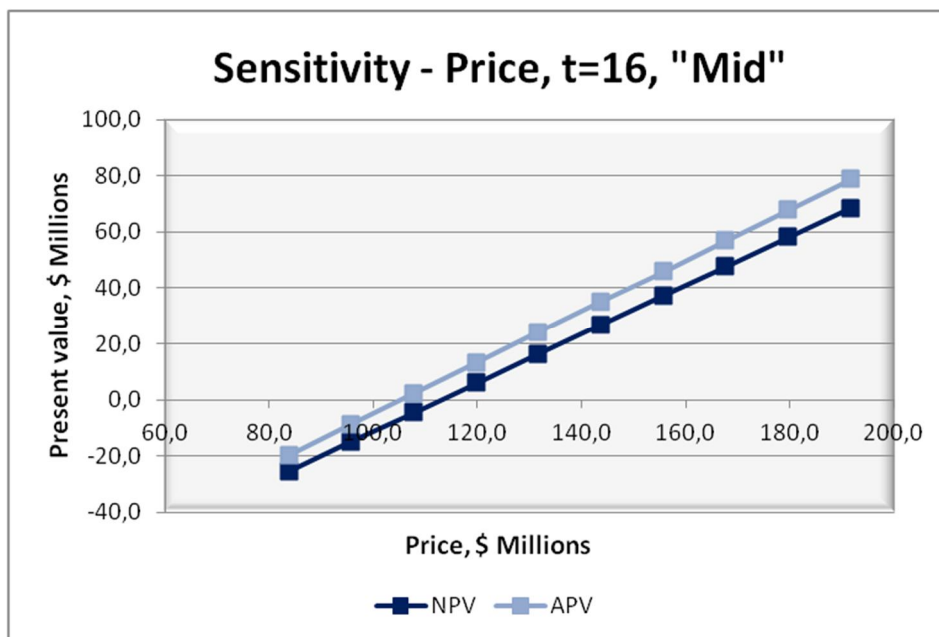
To determine what variables are most prone to impact the financing decision, a sensitivity analysis is run. Key variables such as purchase price, residual value, lease rate, WACC, cost of equity and cost of debt are monitored. Because user can select between eight- and sixteen year-period and three different states of economy, there is a considerable amount of these sensitivity graphs and therefore only the most relevant are presented here. All the break-even values can be found in the appendices.

Of course the most interesting findings of sensitivity analysis are the ones where a relatively small change in a variable makes a large impact on the outcome. Therefore, I will concentrate more on those situations. In eight-year time frame only noteworthy results were found in a strong economy scenario. According to net present value-method and when the chosen time period is 8 years, if the price of the asset decreases below \$119.3M, Finnair should go ahead purchasing the aircraft. (*Graph 21*) This is actually very near the current estimated price of €19.7M and so even slight change alters the suggestion of the model. At the same time APV suggests that the limit is \$104M. Although the economic outlook at the moment is poor, in eight, let alone sixteen, years' time the conditions might appear highly improved.

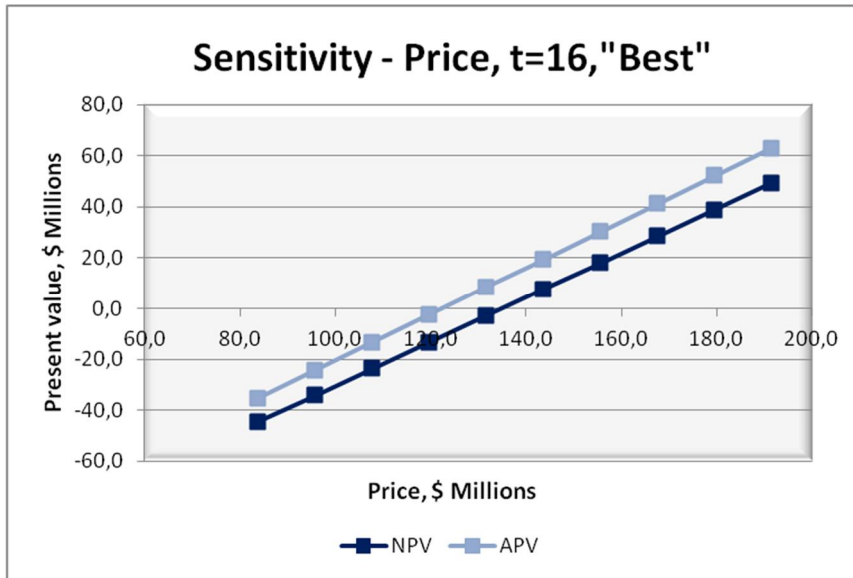


Graph 21. Sensitivity of present values to price, $t = 8$. State of the economy "Best".

In other scenarios the suggestion to lease is so much stronger that it is not sensible to believe that any variable would shift significantly enough. However, when the contract length is changed to sixteen years, this analysis tool becomes more useful. During weak times of economy, again the price seems to be the most sensitive piece in the puzzle. When the economic outlook is estimated as "Mid", NPV suggests purchasing if the price is reduced below \$113.0M and APV if below \$105.4M. (Graph 22).

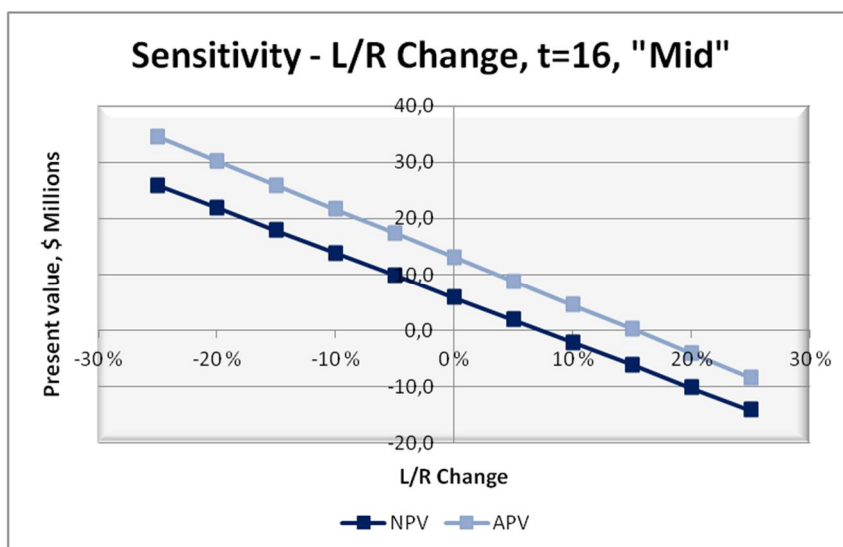


Graph 22. Sensitivity of present values to price, $t = 16$. State of the economy "Mid".



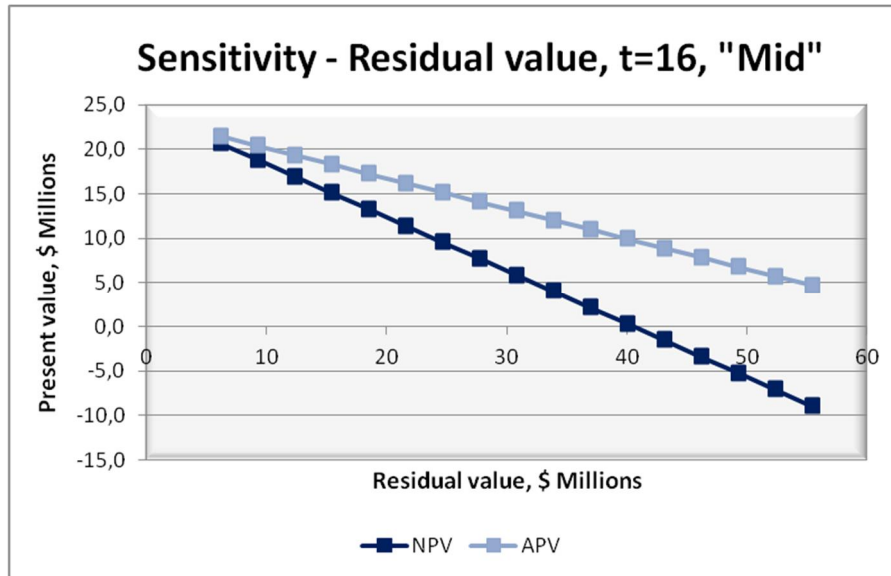
Graph 23. Sensitivity of present values to price, $t = 16$. State of the economy “Best”.

Finally, when the state of the economy is “Best”, clearly many variables become more influential as the present values circle around zero at these extreme limits. This was the only scenario where a “buy” recommendation was given. It can be seen in the *Graph 25* that even small changes in the purchase price will have an effect on the suggestion of lease or buy. With price of \$119.7M, about a fifteen million increase in price changes the NPV to positive. Alike, only a three million increase makes APV positive. This shows how sensitive this model is to price changes in long time frames and when economy is booming, that is values and rents are high.



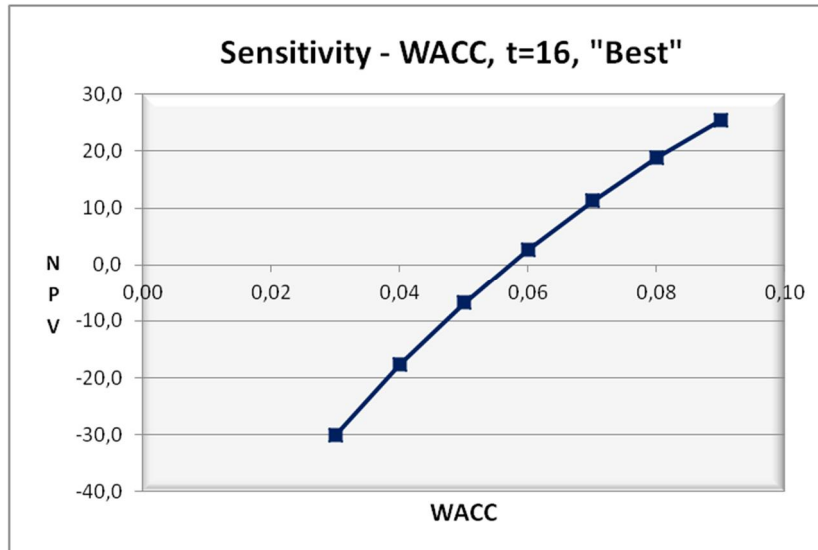
Graph 24. Sensitivity of present values to lease rates, $t = 16$. State of the economy “Mid”.

When time period is 16 years and the state of the economy “Mid”, if lease rate increases over 7% (NPV) or 15% (APV), which sounds fairly little, the asset should be purchased as presented. (*Graph 24*)



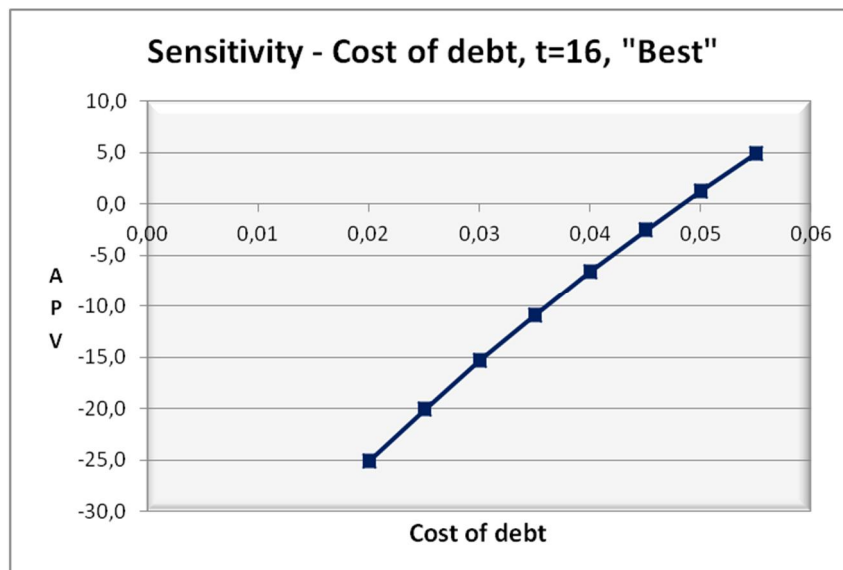
Graph 25. Sensitivity of present values to residual value, $t = 16$. State of the economy “Mid”.

The residual values are in general more sensitive in NPV calculation than in APV, where the residual value is discounted with the higher cost of equity. Overall, residual values make a great impact on the financing decision when the time period is longer. Their sensitivity is emphasized when the market conditions are expected to be moderate or good. *Graph 25* shows sensitivities of residual values when time is 16 years and economy moderate. It can be seen that only a €10M improvement of the residual value makes the NPV negative and thus suggests purchasing. However, with APV the lease seems to be a clear choice as it would need to residual value to go over \$70M to have an effect.



Graph 26. Sensitivity of NPV to WACC, $t = 16$. State of the economy "Best".

Next, I will present what kind of effect discount rates or costs of capital have on the present values. First, as *Graph 26* indicates at my pre-determined WACC of 4.4% the NPV is negative and therefore suggests purchasing. However, only a minor increase of WACC to 5.9% will change the present value to positive. In APV calculation the cost of equity however isn't that prone to changes. On contrary, the cost of debt is a sensitive variable. As cost of debt for long term debt was determined to be 4.5%, *Graph 27* reveals that if it alone increases to 4.8% or above, the APV becomes again positive and then favours leasing over purchasing.



Graph 27. Sensitivity of APV to cost of debt, $t = 16$. State of the economy "Best".

To conclude, sensitivity analysis definitely cumulate the information on top of the plain present values by showing how changes of key variables affect them. At the same time this analysis increases understanding about the model and show some of its weaknesses. It becomes evident that especially purchase price has a great impact on the financing decision. Although it seems that this model is quite sensitive to price change, this isn't a big problem for Finnair who knows the actual price. This academic estimation will suffer more from this issue.

It also becomes clear that many variables seem to be closer to make a difference on financing decision according to NPV. APV on the other hand has more conservative or lagging effect. So, if we consider APV to be more sophisticated and correct way of looking this problem, the majority of the scenarios then quite definitely prefer leasing of the aircraft. Actually, with caution I can state that only vague condition is when time period is sixteen years and the state of the economy is "Best". With these specifications the theoretical decision can go either way quite easily. The sensitivity analysis illustrates the difficulty of estimation when the time period is long and uncertainty is thus increased.

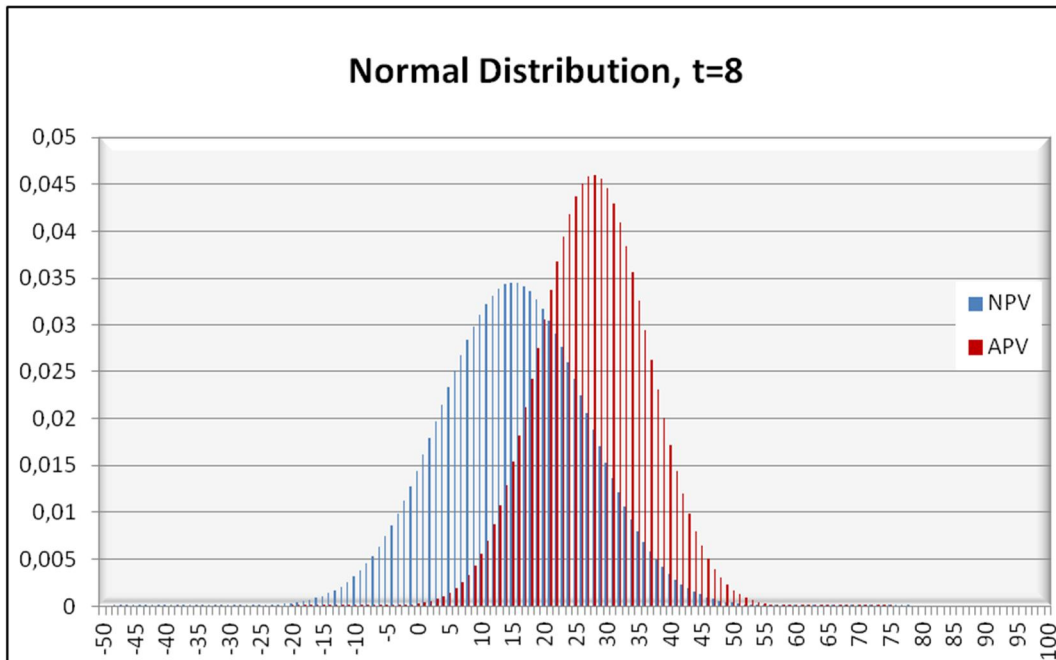
While being quite useful tool, sensitivity analysis is based on *ceteris paribus* – thinking or that only one variable is changed at a time and others are held constant. In real life however, it is often necessary to see the effect when several variables move concurrently. That's why I also developed a scenario analysis tool, where it is possible to create different scenarios: This means that one can alter easily all the variables needed and see instantly the effect on present values and on monitored variables. This is handy considering variables that correlate with each other and need to be studied in tandem. For example when economy is struggling, it does not affect only on aircraft values and rental rates but also on cost of capital. Next, result chapter is concluded by the findings from the Monte Carlo simulation.

5.3 Monte Carlo simulation

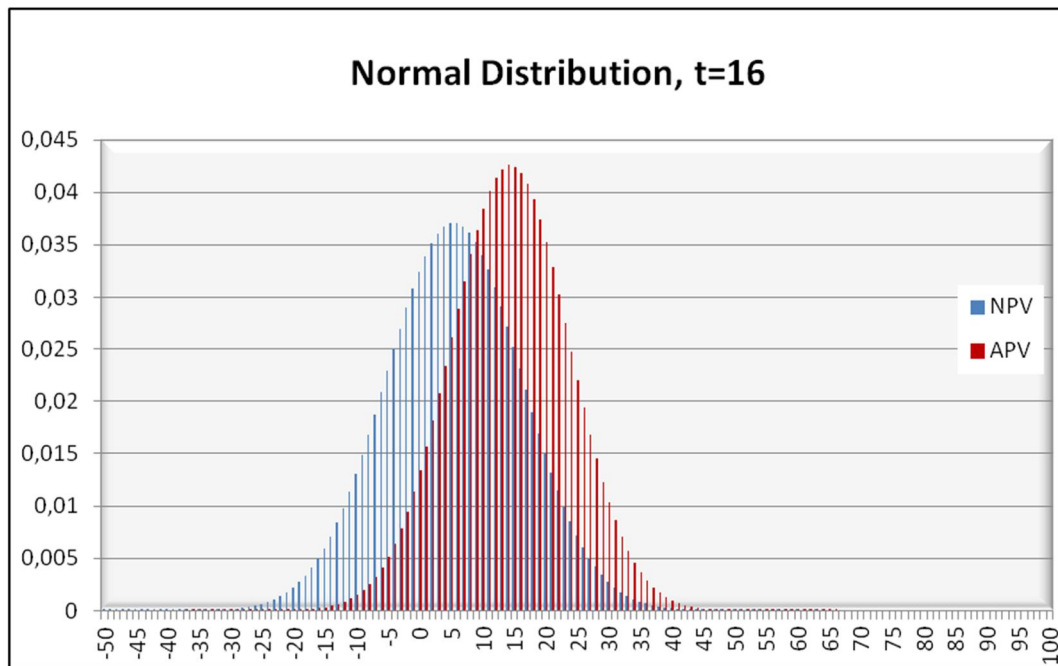
Finally, it is time to introduce the results from the Monte Carlo simulation. This simulation is carried out to find the distribution of net and adjusted present values. The basic idea is that some variables are determined to be stable but the most uncertain and most influential values are given probabilities or ranges wherein they can move. Then the simulation is run thousand times resulting a thousand NPVs and APVs. Then it is possible to see their mean, standard deviation followed by normal distribution.

First of all, when the simulation is run 8 years the result is strikingly clear. The NPV mean is 15.3 with a standard deviation of 11.5 meaning a 90.7% probability that NPV is positive. APV is even more confident as the model returns with a sounding 99.9% probability for a positive APV. This can be interpreted so that if the financing horizon is only eight years, with these assumptions leasing is a definite choice.

When the horizon is lengthened to 16 years, the increased uncertainty can be observed but simulation still speaks quit strongly in favour of leasing. Mean of the NPV is 5.6 with a standard deviation of 10.8. This lowers the probability of positive NPV to 69.7% which is still dominating but clearly not decisive. This suggests that longer period improves the profitability of the purchase alternative. Respective figures for APV are mean 14.2, standard deviation 9.4 and probability for positive APV 93.6%. Although the suggestion isn't that crushing, also in this case the results speak for themselves. It is distinctively clear that the longer the financing horizon the more the suggestion turns towards the purchasing an asset. However, in shorter time horizon the choice of leasing is very clear. This seems to support my hypothesis and the current market consensus, the increasing popularity of leases among airlines.



Graph 28. Monte Carlo simulation. Normal distribution of NPV and APV, $t=8$.



Graph 29. Monte Carlo simulation. Normal distribution of NPV and APV, $t=16$.

6 CONCLUSION

6.1 Limitations and summary of the study

This thesis has presented literature and different valuation methods of leasing and has used cash flow based methods Net Present Value (NPV) and Adjusted Present Value (APV) to determine whether it is preferable to purchase an Airbus A330 airliner for Finnair or operate one under an operating leasing agreement. The model was further enhanced with Monte Carlo simulation to capture the risk associated especially with residual values. At the same time I have tried to answer my hypotheses. My first hypothesis, “operating lease is more cost-effective than purchasing in less than 10 years' time”, was in my opinion confirmed quite clearly. The results from both NPV and APV were indisputable. The second hypothesis argued that this holds also if the time period is extended. The result is debatable. Although APV still very strongly suggests leasing over purchasing, NPV starts to draw nearer to purchasing. Still statistically leasing is the preferable choice but it is apparent that when the time period is lengthened, the purchase becomes more tempting. Indeed, even Finnair itself states that owning aircraft is the most cost-effective way of financing in the long run. Therefore, the second hypothesis cannot be confirmed but is rather undecided or even rejected.

To summarize, it seems that in current market environment Finnair should lease the A330 under an operating lease agreement rather than buy it. This is true especially if they are considering a rather short deployment, which seems to be the case as this investment in my opinion is only a temporary solution as the deliveries of A350 are delayed. Although interest rates are low which could encourage direct debt finance, this theoretical model illustrates that financing costs of leasing are lower than costs related to purchasing.

When studying this lease or purchase question, the nature of the analysis has to be taken into account when evaluating the limitations of this study. Even the basic cash flow based models have several different variables and therefore require many presumptions, for example when calculating the cost of capital. When the analysis is enhanced with probabilities, and therefore inserting uncertainty, the amount of subjectivity is further increased. In this thesis many assumptions and some subjective views from the references needed to be applied. All this have naturally impacted on the results of this model and needs to be understood.

In addition, when assessing flexibility, all the possible benefits, gains or elasticity induced by flexibility are impossible to incorporate into the analysis. Therefore some amount of sentiment is always included in the decision making. But to restrict managers from artificially increasing the discount factors the risk analysis tool of Monte Carlo analysis was introduced to capture the risk. It would be good to incorporate the risk in the decision making and to challenge also board members to take the uncertainty into account in their decision making rather than having just yes or no suggestions to financing decisions.

The basic problems related to Monte Carlo simulation are usually mean reversion and autocorrelation. Gibson (2010) gives a notable example of autocorrelation by explaining the relationship between aircraft market values and operating lease rates. In my model this does not seem to be a problem because they both depend on the state of the economy which my model acknowledges. Mean reversion means that in a cyclical industry, many inputs tend to correct themselves over the cycle, reverting to a long-term trend or average. Another limitation is the volatility. The NPV and APV are both subject to the assumption of a constant discount rate throughout the project. Turner and Morrell (2002) point out that discount rate estimates are variable, and clearly, companies' costs of capital vary over time. This is however, not taken into account.

6.2 Future research

To further enhance this analysis, a substantial amount of new variables could be assigned distributions in Monte Carlo simulation. This would even further increase the accuracy of the model and even more consider different uncertainties. Another possible improvement is related to involvement of more cash flow variables. For example, pre-payments (purchasing) could be taken into account, as well as lease reserves. Also, the model does not take into account the time difference between the time of order and delivery. Usually an airline is obliged to make pre-payments, probably in many instalments, before the actual delivery of the aircraft. Sometimes even three years prior the delivery. It is estimated that even 30% of the aircraft is already paid when it arrives.⁶¹ This is a deadweight cost for an airliner because this does not increase revenues or lower the costs. However, my model does not at the moment recognize it, which means that the purchase price is somewhat underemphasized. Also possible pre-payments or certain reserves of lease are excluded. Maintenance reserves, however, are included in the lease rates as AVAC declares. The future research of this subject could be applied also to markets. It would be interesting to find out how markets react to acquisition news if it is announced whether the asset is leased or purchased.

⁶¹ <https://www.iata.org/publications/airlines-international/august-2010/Pages/07.aspx>, retrieved 9.10.2012

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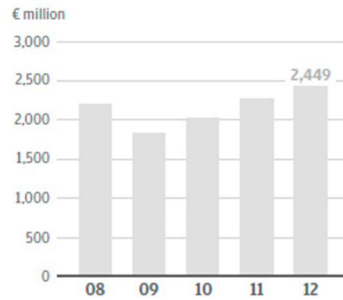
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8 APPENDICES

Appendix 1. Finnair key figures in 2012. Source: Finnair.

Key figures

Turnover



Operational result, EBIT*



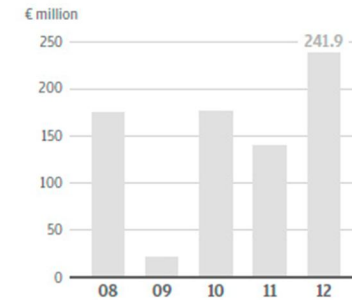
— % of turnover
 * Operating result excluding changes in the fair values of derivatives and in the value of foreign currency denominated fleet maintenance reserves, non-recurring items and capital gains.

Operating profit, EBIT



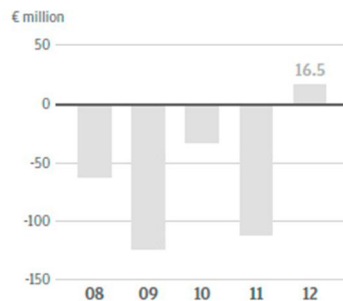
— % of turnover

Operational EBITDAR*

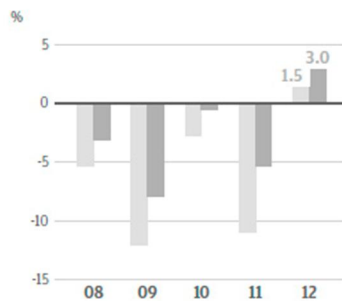


* EBITDAR excluding changes in the fair values of derivatives and in the value of foreign currency denominated fleet maintenance reserves, non-recurring items and capital gains.

Result before taxes

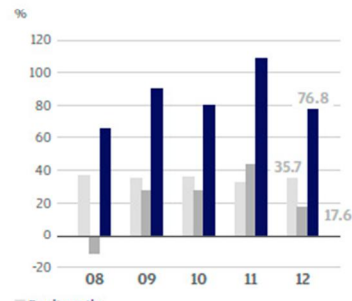


Return on equity (ROE) and return on capital employed (ROCE), %



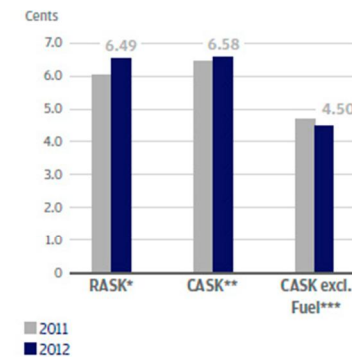
■ Return on Equity (ROE)
 ■ Return on Capital Employed (ROCE)

Equity ratio, gearing and adjusted gearing, %



■ Equity ratio
 ■ Gearing
 ■ Adjusted gearing

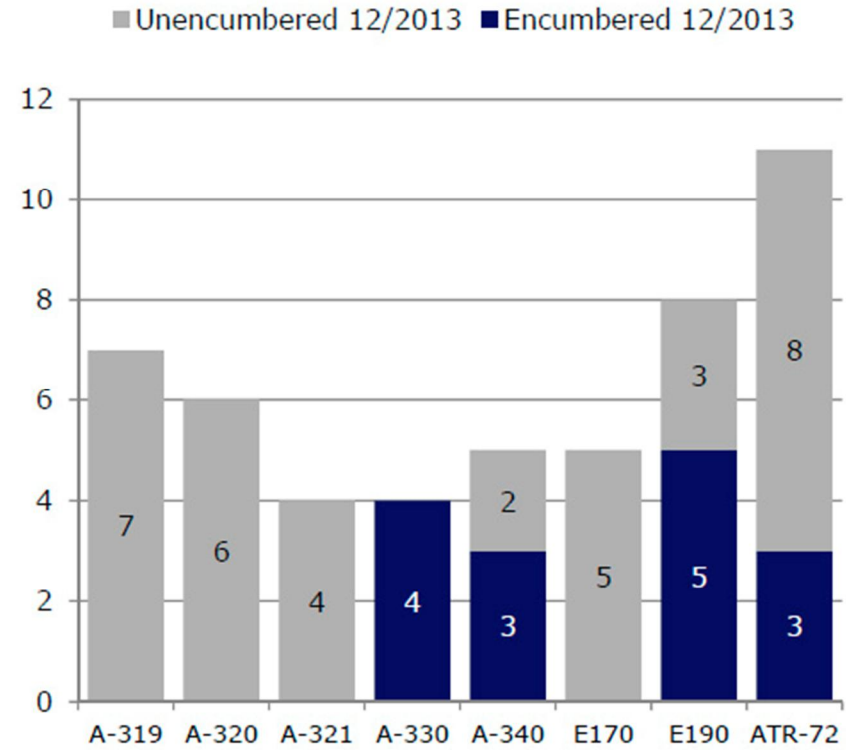
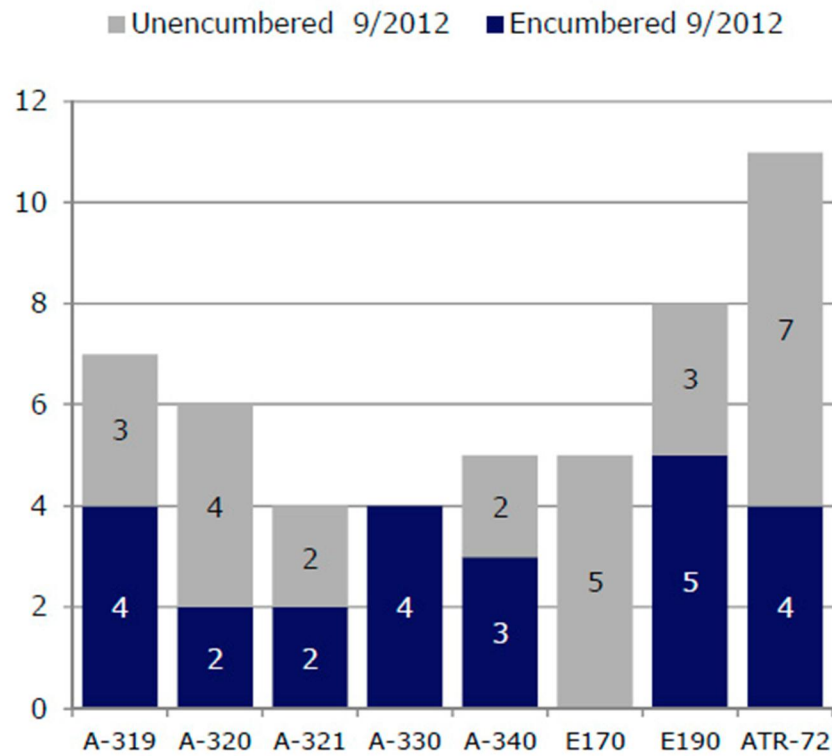
Airline Business: unit revenue and unit cost (cents/Available seat kilometre)



* Revenue per Available Seat Kilometre
 ** Cost per Available Seat Kilometre
 *** Cost per Available Seat Kilometre excluding fuel

Appendix 2. The amount of unencumbered and encumbered aircraft in Finnair.

Unencumbered means the asset is not as collateral in any agreement and thus can be used as one in the future. Source: Finnair.

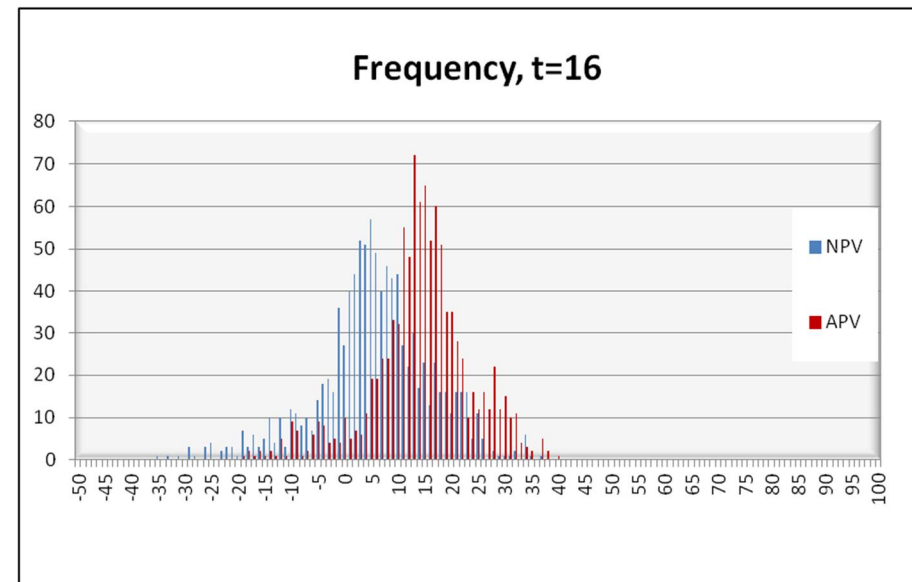
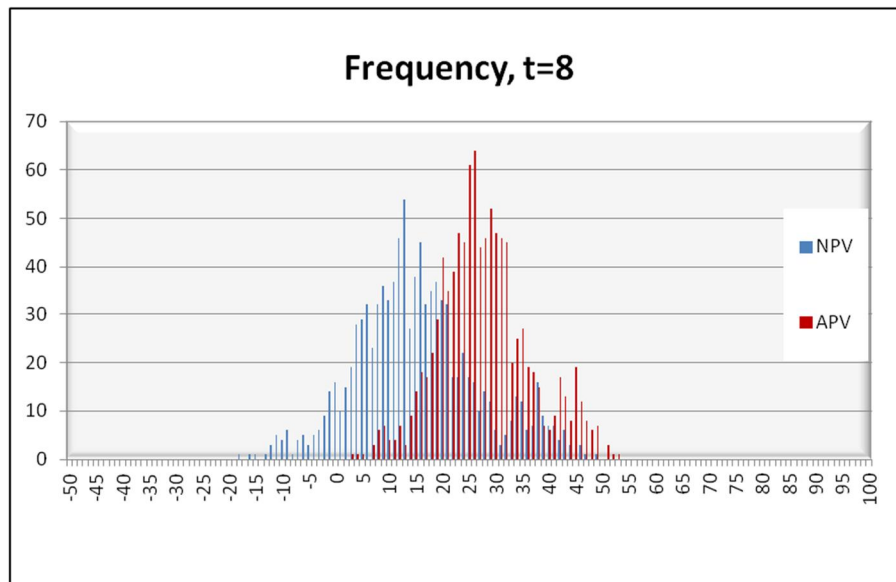


Appendix 3. Financing decision model. Net Present Value and Adjusted Present Value.

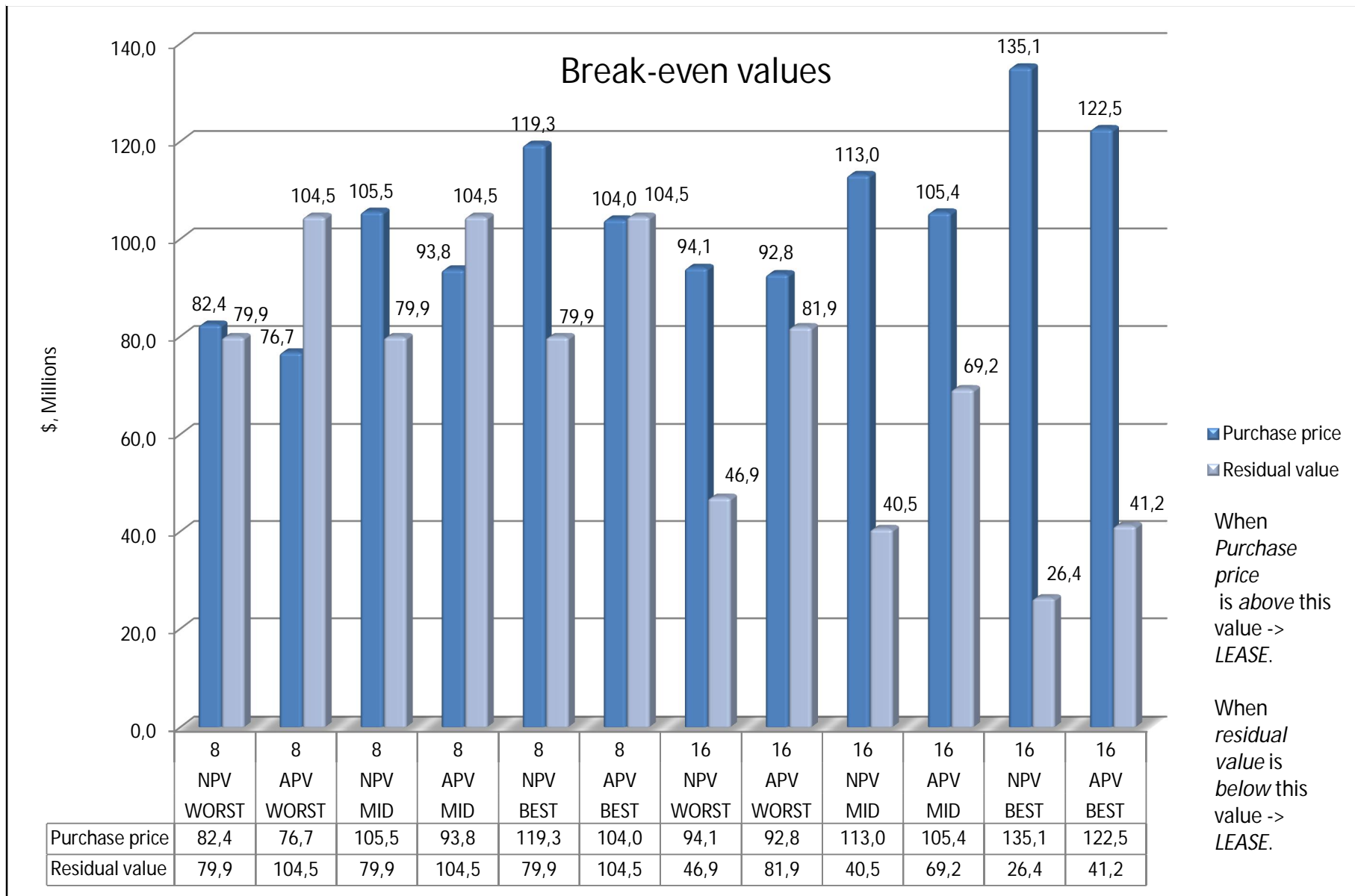
\$ (1 000 000)			Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Data			t	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
State of the economy	MID																			
List price (Airbus, 01/12)	239,4	Loan																		
Price reduction	0,5	Debt outstanding		95,76	95,76	89,78	83,79	77,81	71,82	65,84	59,85	53,87	47,88	41,90	35,91	29,93	23,94	17,96	11,97	5,99
Price	119,7	Principal			-5,99	-5,99	-5,99	-5,99	-5,99	-5,99	-5,99	-5,99	-5,99	-5,99	-5,99	-5,99	-5,99	-5,99	-5,99	-5,99
CMV	106,0	Interest			-4,31	-4,04	-3,77	-3,50	-3,23	-2,96	-2,69	-2,42	-2,15	-1,89	-1,62	-1,35	-1,08	-0,81	-0,54	-0,27
Debt	95,8	Interest Tax shield			1,12	1,05	0,98	0,91	0,84	0,77	0,70	0,63	0,56	0,49	0,42	0,35	0,28	0,21	0,14	0,07
Advance rate	0,8	Net cash flow		95,76	-9,17	-8,97	-8,78	-8,58	-8,38	-8,18	-7,98	-7,78	-7,58	-7,38	-7,18	-6,98	-6,78	-6,58	-6,38	-6,18
Residual value	30,8																			
	63,2																			
	30,8	"Implicit interest premium analysis"		105,997	-4,06	-4,06	-4,06	-4,06	-4,06	-4,06	-4,06	-4,06	-4,06	-4,06	-4,06	-4,06	-4,06	-4,06	-4,06	-4,06
t (years)	16	Implicit interest			5,25 %															
Lease rate, monthly, t=1-8	0,840	0,84																		
Lease rate, monthly, t=9-16	0,653	0,6528																		
Tax rate	0,26	Operating lease																		
Annual depreciation	0,05	Purchase/Sell price		119,70								0,0								-30,8
Maintenance reserves		Lease Payments		-10,08	-10,08	-10,08	-10,08	-10,08	-10,08	-10,08	-10,08	-7,83	-7,83	-7,83	-7,83	-7,83	-7,83	-7,83	-7,83	-7,83
Risk-free rate	0,02	Maintenance reserves										0,00								-1,78
Debt interest, t=8	0,04	Tax shield on lease payments		2,62	2,62	2,62	2,62	2,62	2,62	2,62	2,62	2,04	2,04	2,04	2,04	2,04	2,04	2,04	2,04	0,00
Reference rate	0,013	Tax shield on maintenance reserves		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,46
Margin	0,02	Lost depreciation tax shield			-1,56	-1,56	-1,56	-1,56	-1,56	-1,56	-1,56	-1,56	-1,56	-1,56	-1,56	-1,56	-1,56	-1,56	-1,56	-1,56
Debt interest, t=16	0,045	Net cash flow		112,24	-9,02	-9,02	-9,02	-9,02	-9,02	-9,02	-9,02	-7,35	-7,35	-7,35	-7,35	-7,35	-7,35	-7,35	-7,35	-33,67
Margin	0,025	Discount Cash Flow FACTOR		1,00	0,96	0,92	0,88	0,84	0,81	0,77	0,74	0,71	0,68	0,65	0,62	0,60	0,57	0,55	0,53	0,50
After-tax cost of debt	0,030	Discount cash Flow		112,24	-8,64	-8,27	-7,93	-7,59	-7,28	-6,97	-6,68	-5,22	-5,00	-4,79	-4,59	-4,40	-4,21	-4,03	-3,86	-16,95
Cost of equity	0,092	Cumulative Discount Cash Flow		112,24	103,60	95,33	87,40	79,81	72,53	65,56	58,89	53,67	48,67	43,88	39,29	34,90	30,69	26,65	22,79	5,83
12/2012 Number of shares	128 M											3 %								8 %
Share price	2,38 €	APV																		
Market cap	305 E	Cash flows discounted with cost of debt		-10,08	-10,08	-10,08	-10,08	-10,08	-10,08	-10,08	-10,08	-7,83	-7,83	-7,83	-7,83	-7,83	-7,83	-7,83	-7,83	-1,32
Book value of debt	1 032 D	Cash flows discounted with cost of equity		122,32	1,06	1,06	1,06	1,06	1,06	1,06	1,06	0,48	0,48	0,48	0,48	0,48	0,48	0,48	0,48	-32,35
E/(D+E)	0,23 %	Net cash flow		112,24	-9,02	-9,02	-9,02	-9,02	-9,02	-9,02	-9,02	-7,35	-7,35	-7,35	-7,35	-7,35	-7,35	-7,35	-7,35	-33,67
D/(D+E)	0,77 %	Discount Cash Flow FACTOR (debt)		1,00	0,96	0,92	0,88	0,84	0,80	0,77	0,73	0,70	0,67	0,64	0,62	0,59	0,56	0,54	0,52	0,49
WACC (after-tax)	0,044	Discount Cash Flow FACTOR (equity)		1,00	0,92	0,84	0,77	0,70	0,64	0,59	0,54	0,49	0,45	0,41	0,38	0,35	0,32	0,29	0,27	0,24
Equity risk premium	0,06	Discount cash Flow (debt)		-10,08	-9,65	-9,23	-8,83	-8,45	-8,09	-7,74	-7,41	-5,51	-5,27	-5,04	-4,83	-4,62	-4,42	-4,23	-4,05	-0,65
Beta	1,2	Discount cash Flow (equity)		122,32	0,98	0,89	0,82	0,75	0,69	0,63	0,58	0,24	0,22	0,20	0,18	0,17	0,15	0,14	0,13	-7,91
CAPM	0,092	Discount cash Flow (TOTAL)		112,24	-8,67	-8,34	-8,02	-7,70	-7,40	-7,11	-6,83	-5,27	-5,05	-4,85	-4,64	-4,45	-4,27	-4,09	-3,92	-8,57
		Cumulative Discount Cash Flow		112,24	103,57	95,23	87,22	79,51	72,11	65,00	58,17	52,89	47,84	43,00	38,35	33,90	29,63	25,54	21,62	13,06
NPV (by Excel FUNC)	5,8																			
NPV (by formula)	5,8	Depreciaton																		
APV (by formula)	13,1	Value start of year		119,70	119,70	113,72	107,73	101,75	95,76	89,78	83,79	77,81	71,82	65,84	59,85	53,87	47,88	41,90	35,91	29,93
Lease or buy? (NPV)	LEASE	Depreciation			5,99	5,99	5,99	5,99	5,99	5,99	5,99	5,99	5,99	5,99	5,99	5,99	5,99	5,99	5,99	5,99
Lease or buy? (APV)	LEASE	Value end of year		119,70	113,72	107,73	101,75	95,76	89,78	83,79	77,81	71,82	65,84	59,85	53,87	47,88	41,90	35,91	29,93	23,94

Appendix 4. Monte Carlo Simulation results and frequency graphs.

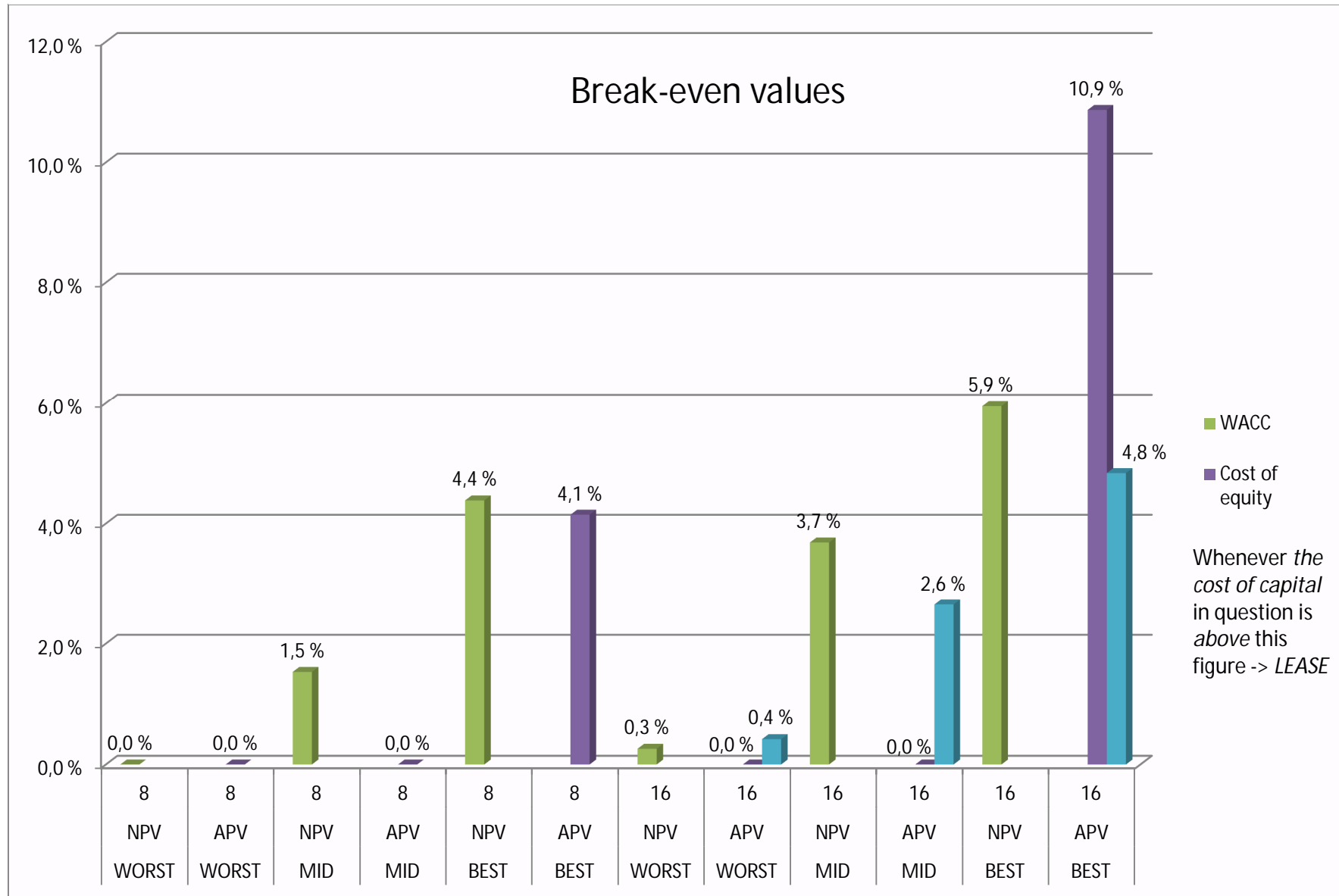
Time horizon	Number of Samples	NPV Mean	NPV - Standard Deviation	Minimum	Maximum	APV Mean	APV - Standard Deviation	Minimum	Maximum
8	1000	15.3	11.5 (76%)	-17.6	48.6	27.8	8.67 (31%)	3.1	52.9
16	1000	5.6	10.8 (194%)	-35.1	37.1	14.2	9.37 (66%)	-19.2	39.9



Appendix 5. Break-even values of purchase price and residual value in millions of dollars.



Appendix 6. Break-even values of WACC, cost of equity and cost of debt in percentages.



Appendix 7. Break-even values of lease rate changes in percentage.

