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Ralf Günther

Impact of Aircraft Sourcing & Financing on Financial Success

A strategic view on basic aircraft sourcing & financing characteristics and their impact on stock market and long term financial performance of aircraft operating and holding companies



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Bis 2018 erschien der Titel im Kölner Wissenschaftsverlag, Köln
Dissertation, Wirtschafts- und Sozialwissenschaftliche Fakultät der Universität zu Köln, 2013

Edition KVV
ISBN 978-3-658-24093-6 ISBN 978-3-658-24094-3 (eBook)
<https://doi.org/10.1007/978-3-658-24094-3>

Library of Congress Control Number: 2019933395

Springer Gabler

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Originally published by Kölner Wissenschaftsverlag, Köln, 2013

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The registered company address is: Abraham-Lincoln-Str. 46, 65189 Wiesbaden, Germany

To my parents
& my wife

Preface

In the view of current developments in the airline market the present thesis investigates the question, whether fundamental characteristics of an aircraft fleet have a (statistically significant) correlation to the financial accomplishments of an airline or to a corresponding holding company, respectively. For this, an empirical analysis is carried out to examine the influence of elementary decisions concerning aircraft acquisition and financial structures upon the development of stock values and of selected performance figures of airlines. Hereby a strategic viewpoint of investors and of top decision-makers of airlines is chosen, which directly results in the choice of the empirical method of multivariate regression analysis with abnormal gains or losses of stocks as well as with key indicators of profitability, efficiency and sales increase of companies.

In addition to this perspective and methodical extension, the present dissertation complements previous studies with till now not examined aircraft fleet characteristics and their influence on the financial success of airlines. These features include the relation of own to leasing, the ratio of already planned aircraft acquisitions compared to the size of the existing fleet and the proportion of prolonged parked or temporarily not used aircraft in comparison with those operatively in use. For all these variables the analyses of this study prove a statistical relevance in reference to abnormal returns in stock prices, to profitability and to sales growth of airlines. Additional new knowledge is gained relating to the financial variables equity ratio, ratio of net debt over earnings before interest, taxes, depreciation and amortization (EBITDA) as well as to interest coverage and their correlation with long-term growth in turnover and high profit margins.

Analyses of the development of stock prices of airlines during economic cycles or following industry-wide or company-specific incidents already exist repeatedly in the literature. Examples for this are among others the events of 9/11, the reaction of stock markets to airplane crashes and the cyclical industrial development over several years. In addition, the present thesis analyzes the consequences of the financial crisis 2008 for the performance of airline stocks. By supplementing this research period, the effects of two shock-events and the resulting global crises (referring to the airline industry) can for the first time be compared with each other.

Altogether, the present dissertation explores – in examining the connection between strategic aircraft fleet decisions and short- or long-term stock price development or key performance indicators, respectively – a theoretically demanding and a practically

contemporary and relevant subject area. The undertaking to present a differentiated empirical research to this topic bears considerable potential. The study imparts very informative and innovative results. I wish this thesis a lively discussion in science and in practice.

Werner Delfmann

Acknowledgement

The dissertation project took more than five years from the first thought till publication. Although a doctoral thesis is a lonely undertaking for many hours, it does not succeed without supporting inspiration, trust, and motivation from others to discuss content and to stay focused on the objectives.

My thanks go to Professor Dr. Dr. h.c. Werner Delfmann, Department of Business Policies and Logistics at the University of Cologne, for the scientific support as my doctoral father and guidance throughout the time of my research, as well as to his team members with whom I enjoyed discussing and laughing over the last years,
to Charles Graham, former CEO Global Aviation at DHL Express and former CEO of AWAS, for inspiration, trust in the idea of my thesis, and for immediate commitment of sponsorship by DHL Express,
to Charlie Dobbie, EVP Global Network Operations at DHL Express, for continuous business sponsorship, as well as to my DHL colleagues who supported me in the early stage to shape the topic.

I highly appreciate the time and insights that were shared in 2009 at the start of my thesis project by William Flynn (President and CEO Atlas Air Worldwide Holdings), Harry Forsythe (EVP Marketing and at that time SVP Sales and Marketing Macquarie AirFinance), Jason Grant (at that time SVP and CFO Atlas Air Worldwide Holdings), Stephan Sayre (Managing Director and at that time Investment Adviser at Deucalion Aviation Funds, DVB Bank SE), Crispin Maunder (Executive Chairman and at that time CEO Lease Corporation International), Jaspal Jandu (CFO Lease Corporation International), Ray Sisson (CEO of AWAS and at that time CEO Titan Aviation Leasing Ltd.), and Carter White (Head of and at that time SVP Aircraft Trading at AWAS), who confirmed the interest of the industry in the research topic and encouraged me to continue this project.

Further, I would like to thank Sabine Mueller (EVP) and Olaf Hermann (Partner) from Deutsche Post DHL Inhouse Consulting for providing me with a stable and still flexible working environment to pursue my thesis and for supporting my personal development.

I would like to thank my parents and my wife for their support, understanding, and encouragement throughout the years of my study.

Ralf Günther

Abstract

Aircraft operating and holding companies apply different strategies to source and finance aircraft. The basic sourcing decision is to acquire air capacity on demand or to plan future capacity by committing to aircraft firm orders and purchase options. The general financing choice is between buying (via direct purchase or capital lease) and operating lease of aircraft.

This study takes the perspective of investors and evaluates the correlation of basic sourcing and financing strategies with a company's financial success in shocks and crises, company specific isolated positive and negative events, and over long term business cycles.

Multivariate regression methodology is used to analyze abnormal returns in stock market's reaction to the terrorist attacks on September 11, 2001, the Financial Crisis 2008, and to aircraft accidents and aircraft orders 1994-2009. In further regressions the relationship of basic aircraft fleet and fleet planning variables to a company's long term revenue growth and profitability is examined.

The findings show a positive correlation of aircraft ownership (buy or capital lease) and of future oriented aircraft acquisition (firm orders and purchase options) with a company's long term average EBITDA and EBIT margins. Merely in times of strong business growth, operating lease is the right measure to quickly supply capacity, beside firm orders and purchase options. The findings further support the theory of rational pricing and the assumption that the stock market distinguishes between different basic aircraft sourcing and financing strategies. A high portion of owned or capital leased aircraft in the fleet, long term orders, and purchase options proved to positively influence also a company's stock return in times of crises. Exception to this is found when governmental financial aid actions influenced stock market's behavior. The analysis of stock market reaction on aircraft accidents and aircraft firm orders is of low explanatory power; hence, the results allow for speculation but not for reliable conclusions on the influence of basic fleet characteristics.

The findings of this study suggest to companies, which historically have been relying on operating lease and purchasing capacity ad hoc, to review their aircraft sourcing and financing strategy. This is stated under the assumption that demand of air transport grows as currently predicted by the aviation industry and anticipating an increasing shortage of capacity and price increase caused by ongoing carrier consolidation, insolvencies among airlines, decommissioning programs for aging aircraft, shortage in production slots for new aircraft, and an insufficient number of passenger-to-cargo conversions.

Table of content

Preface.....	vii
Acknowledgement	ix
Abstract.....	xi
Index of tables.....	xvi
List of abbreviations & symbols	xviii
1. Introduction.....	1
1.1 Research background and motivation	1
1.2 Research aim and objectives	6
1.3 Research questions	7
1.4 Research structure and thesis layout	7
2. Basics of aircraft sourcing and financing	11
2.1 Overview on air capacity alternatives and basic financial structures	11
2.2 Players in the air capacity market	17
2.2.1 Aircraft manufacturers	17
2.2.2 Aircraft operating and holding companies	19
2.3 Fleet Planning	32
3. Development of the air capacity market.....	37
3.1 Air traffic growth	37
3.2 Air capacity development 1993 to 2000	39
3.3 The aftermath of 9/11 – Crisis and recovery until Q3 2008	40
3.4 Financial Crisis Q4 2008 to Q1 2010.....	41
3.5 Forecast and industry expert expectations – The need for change in behavior	42
4. Financial performance of airlines and airline holdings.....	45
4.1 Stock market performance	45
4.2 Key operating figures from the financial statements	50
5. Summary of current situation and link to research topic	55
6. Research hypotheses and scope	57
6.1 Key research hypothesis.....	57
6.2 Definition of fleet variables and financial performance measures	58
6.2.1 Basic aircraft financing and sourcing characteristics in focus	58
6.2.2 Taking the right perspective – Choosing the right measures & methodology.....	58
6.3 Testable hypotheses	61

6.4	Sample – Aircraft operating and holding companies in scope.....	70
6.5	Summary of analysis scope.....	74
7.	Analysis of fleet planning decisions and financial success.....	77
7.1	Empirical methodology.....	77
7.1.1	Multivariate regression model (MVRM) and test statistics	77
7.1.1.1	MVRM with abnormal returns in stock prices.....	78
7.1.1.2	MVRM with long term avg. revenue growth, EBITDA and EBIT margins	87
7.1.2	Definition of explanatory and control variables.....	91
7.1.3	Analysis process – Flow of multivariate regressions	101
7.2	Stock performance in times of crises – Analysis of shocks.....	102
7.2.1	Terrorist attack on September 11, 2001.....	103
7.2.1.1	September 11, 2001 – Observation periods and course of events.....	103
7.2.1.2	September 11, 2001 – Alpha, beta, and the shift in risk	108
7.2.1.3	September 11, 2001 – Analysis results: Stock market's reaction.....	112
7.2.2	Financial crisis 2008.....	132
7.2.2.1	Financial Crisis – Observation periods and course of events.....	132
7.2.2.2	Financial Crisis – Alpha, beta, and the shift in risk	137
7.2.2.3	Financial Crisis – Analysis results: Stock market's reaction	141
7.2.3	Summary of stock market's reaction to shocks & crises.....	153
7.3	Special events – Company specific positive and negative event days.....	156
7.3.1	Special events – Observation periods.....	157
7.3.2	Special events – Alpha, beta, and the shift in risk.....	167
7.3.3	Special events – Analysis results: Stock market's reaction.....	175
7.4	Business cycle – Analysis of long term financial performance.....	184
7.4.1	Business cycle – Observation period and company sample.....	185
7.4.2	Business cycle – Analysis results: companies' long term performance.....	186
7.5	Summary of success factors for aircraft operating and holding companies	190
8.	Discussion of results against hypotheses and literature	195
9.	Conclusion and recommendation	203
	Literature references	205
	Interview references.....	215
	Appendices.....	217

Index of figures

Figure 1: Overview on research structure and thesis layout	9
Figure 2: Overview on operational air capacity alternatives and key differentiators	12
Figure 3: Deliveries of commercial long-haul and regional jets per manufacturer 1993-2008.....	18
Figure 4: Operating and net results of ICAO scheduled airlines 1989-2010.....	19
Figure 5: Airlines' market share of total revenue passenger kilometers (RPK) 2008	21
Figure 6: Airlines' market share of total freight ton kilometers (FTK) 2008	21
Figure 7: Ownership share of the three major owner categories in Airbus and Boeing aircraft 1993-2009	23
Figure 8: Development of aircraft prices versus annual lease rates 1993-2008 (examples: B747 and A320)	26
Figure 9: Aircraft orders placed by financial and operating leasing companies vs. total orders placed 1993-2008.....	27
Figure 10: Aircraft leasing companies and their share of global asset portfolio 2004	28
Figure 11: Orders placed at Airbus and Boeing by owner category 2010-2020	29
Figure 12: Review of strategic sourcing & financing in the ideal aircraft fleet planning process	33
Figure 13: Percentage growth of air traffic versus world (real) GDP growth 1993-2008	38
Figure 14: Deliveries and net orders of Airbus and Boeing aircraft versus air traffic growth 1993-2000.....	39
Figure 15: Deliveries and net orders of Airbus and Boeing aircraft versus air traffic growth 2001-2008.....	41
Figure 16: MSCI stock indices 1995-2010 – World vs. Air Freight/Logistics vs. Airlines.....	46
Figure 17: MSCI stock indices time series Q1 1995 to Q2 2001, Q3 2001 to Q2 2008, Q3 2008 to Q4 2010	46
Figure 18: Major full service carrier stock return indices vs. sector and global indices Q1 2000 to Q2 2010	47
Figure 19: Non-major full service carrier return indices vs. sector and global indices Q1 2000 to Q2 2010	48
Figure 20: Low cost carrier stock return indices vs. sector and global indices Q1 2000 to Q2 2010	48

Figure 21: Freight carrier stock return indices vs. sector and global indices Q1 2000 to Q2 2010	49
Figure 22: Average annual EBITDA margins of airlines and airline holding companies 2002-2007 and 2009	51
Figure 23: Average annual EBIT margins of airlines and airline holding companies 2002-2007 and 2009	52
Figure 24: Average annual revenue growth of airlines and airline holding companies 2002-2007 and 2009	53
Figure 25: Analysis cube – Slices of the evaluation of companies' stock market and financial performance	75
Figure 26: Regression analysis process.....	102
Figure 27: Stock market development 1997 to 2002 – Sector indices versus the general market	113
Figure 28: Stock market development post 9/11 – Sector indices versus general market Q4 2001 to Q2 2007	131
Figure 29: Stock market development Q1 2004 to Q4 2009 – Sector indices versus general market	141
Figure 30: Stock market development post Financial Crisis 2008 – Sector indices versus general market.....	153
Figure 31: Distribution of aircraft numbers per order placed 1994-2009 – Selected orders.....	162
Figure 32: Samples for multivariate regression analysis of stock market's reaction to aircraft firm orders.....	163
Figure 33: Overview on observation periods and company samples for analysis of long term business cycles	186
Figure 34: Summary of results – Correlation of key financial and aircraft fleet factors with abnormal returns in stocks, revenue growth and profitability	192

Index of tables

Table 1:	Expected impact of basic aircraft fleet and fleet planning variables.....	62
Table 2:	Overview on sample companies and match to observation periods....	72-73
Table 3:	Overview on explanatory and control variables for MRVM analyses.....	94
Table 4:	Expected effect of non-fleet and fleet planning explanatory and control variables.....	97-100
Table 5:	Aircraft operating and holding companies in scope of the analysis of shocks and economic crises.....	103
Table 6:	Overview on time windows for 9/11 regressions – Actual trading days and trading day matching	107
Table 7:	Alpha, beta and the shift in risk with 9/11 for all sample firms and portfolios	109-110
Table 8:	Abnormal returns Sep 11-24 and cumulated abnormal returns Sep 12 - Nov 5, 2001	115-116
Table 9:	Overview on regression results for stock market's reaction on the first trading day after 9/11 (y_1)	119
Table 10:	Overview on MVRM results for stock market's reaction in the short term after 9/11 (y_{2-6})	124
Table 11:	Overview on MVRM results for stock market's reaction in the mid term after 9/11 (y_{7-36}).....	128
Table 12:	Alpha, beta and the shift in risk with the Financial Crisis 2008 for all sample firms and portfolios	138-139
Table 13:	Alpha, beta and the change in risk with 9/11 and the Financial Crisis 2008	140
Table 14:	Abnormal returns Sep 15-30 and cumulated abnormal returns Sep 16 - Oct 31, 2008	143-144
Table 15:	Overview on MVRM results for stock market's initial reaction in the Financial Crisis 2008 (y_{1-4}).....	147
Table 16:	Overview on MVRM results for stock market's short-/mid term reaction in the Financial Crisis 2008.....	151
Table 17:	Summary of stock market's reaction to shock events & crises.....	154-155
Table 18:	Overview on aircraft accidents 1994-2009 in scope of the analysis of company specific events.....	159
Table 19:	Aircraft accident statistics of companies with aircraft hull losses 1994-2009	160
Table 20:	Overview on aircraft firm orders of selected companies with 1-40 aircraft per order	164-165

Table 21:	Overview on aircraft firm orders of selected companies with more than 40 aircraft per order	166
Table 22:	Alpha, beta and the shift in risk with aircraft accidents (hull losses).....	169-170
Table 23:	Correlation of beta and shift in beta with incident specific factors in aircraft accidents.....	171
Table 24:	Alpha, beta and the shift in risk with aircraft orders (1-40 aircraft per order)	172-173
Table 25:	Alpha, beta and the shift in risk with aircraft orders (41-120 aircraft per order)	174
Table 26:	Correlation of beta and shift in beta with incident specific factors in aircraft orders.....	175
Table 27:	Abnormal returns $y_1 - y_6$ and cumulated abnormal returns y_{2-6} after aircraft hull losses	178
Table 28:	Abnormal returns $y_1 - y_6$ and cumulated abnormal returns y_{2-6} after aircraft orders (1-40 aircraft per order)	179-180
Table 29:	Abnormal returns $y_1 - y_6$ and cumulated abnormal returns y_{2-6} after aircraft orders (41-120 aircraft per order)	181
Table 30:	Overview on regression results for stock market's reaction on aircraft accidents and firm orders.....	183
Table 31:	Overview on regression results for financial performance in the long term business cycle.....	187

List of abbreviations & symbols

*	Statistically significant at the ten percent level
**	Statistically significant at the five percent level
***	Statistically significant at the one percent level
=	equals
<	is less than
≤	is less than or equal to
>	is greater than
≥	is greater than or equal to
#	number (count)
%	percent
Σ	sum
1YOPTION	Explanatory variable: number of purchase options with execution day in the next calendar year over total number of aircraft in the fleet
3PL	Third-party logistics
9/11	September 11, 2001
α	Alpha (residual risk)
α'	Change in alpha
β	Beta (systematic risk)
β'	Change in beta
Δ	Delta
ε	Epsilon (random disturbance term)
σ	Sigma (standard deviation)
A	Airbus (e.g. A320 Airbus 320)
A/C	Aircraft
A/L	Airline
AAGR	Average annual growth rate
AARG	Average annual revenue growth (average annual rate of net sales or revenue growth with one year equal to a full calendar year ending December 31)
AB	Aktiebolag [Swedish for: stock company]
ABX/ABX Air	Airborne Express
ACMI	Aircraft, Crew, Maintenance, and Insurance
ACPORDER	Explanatory variable: aircraft per order (number of aircraft per single firm order)
add.	additional

AG	Aktiengesellschaft [German for: stock company]
AIG	American International Group
AMR	American Airlines
AMR/UAL	Explanatory variable: American Airlines or United Airlines
ANA	All Nippon Airways
AOC	Air Operator Certificate
APAC	Asia Pacific
AR	Abnormal return
ARG	Annual revenue growth (year-on-year revenue growth with one year equal to a full calendar year ending December 31)
ATA	Air Transport Association (not to confuse with ATA Holdings)
ATI	Air Transport International
ATK	Available Ton Kilometer
AVAC	Aircraft Value Analysis Company
AVGAGE	Explanatory variable: average age of total number of existing aircraft in service or stored
AVGEBITDAMAR	Average margin of annual earnings before interest, taxes, depreciation and amortization
AVGEBITMAR	Average margin of annual earnings before interest, taxes, depreciation and amortization
B	Boeing (e.g. B737 Boeing 737)
bn	billion
C	Consumption
CAGR	Cumulated Annual Growth Rate
CAR	Cumulative Abnormal Return
CASM	Cost per Available Seat Mile
CEO	Chief Executive Officer
CFO	Chief Financial Officer
cf.	confer (compare)
Co. (or comp.)	Company
Corp.	Corporation
OYJ	Osakeyhtiö [Norwegian for: stock company]
CRSP	Center of Research in Security Prices
D _s	Dummy variable representing a shift in stock risk after an event
DEA	Data Envelopment Analysis
e.g.	exempli gratia [Latin for: for example]
EBIT	Earnings before interest and taxes (operating income)
EBITDA	Earnings before interest, taxes, depreciation and amortization

EBITDAFY	Total earnings before interest, taxes, depreciation and amortization in a company's fiscal year
EBITDAMAR	EBITDA margin (earnings before interest, taxes, depreciation and amortization over total operating revenue)
EBITFY	Total earnings before interest and taxes in a company's fiscal year
EBITMAR	EBIT margin (earnings before interest and taxes over total operating revenue)
EMEA	Europe, Middle East and Africa
EQUITRAT	Explanatory variable: equity ratio (owners' equity over total assets)
EUR	Euro
excl.	excluding
f	risk free rate
F-stat.	F-statistics
FAA	Federal Aviation Administration
FATALITY	Explanatory variable: on-board fatality (number of passengers and crew killed in an aircraft accident over total number of passengers and crew on board)
FedEx	Federal Express
Fin. (or fin.)	Financial (or financial)
FLYI	Independence Air (former Atlantic Coast Airlines)
FREIGHT(ER)	Freight carrier
FTK (or RTK)	Freight Ton Kilometer (or Revenue Ton Kilometer)
FTKMKTSHR	Explanatory variable: Freight Ton Kilometer Market Share
G	Government spending
G7	Group of seven (industrial nations)
GDP	Gross Domestic Product
GWP	Gross World Product
Hlg.	Holdings
H.R. (or HR)	(U.S. Congress) House Bill
I	Investment
i	Individual company stock
ICAO	International Civil Aviation Organization
i.e.	id est [Latin for: that is to say]
Inc.	Incorporated
incl.	including
INJURY	Explanatory variable: on-board injury (number of passengers and crew injured in an aircraft accident over total number of passengers and crew on board)

INTRSTCOVRG	Explanatory variable: interest coverage (interest expenses for debt over earnings before interest and taxes)
IR	Interest rate
IT	Information Technology
JAR(s)	Joint Aviation Requirement(s)
JAR-OPS	Joint Aviation Requirement for the operation of commercial air transport (aeroplanes)
JIT	Just in time
JP	Japan
KLM	Koninklijke Luchtvaart Maatschappij (Royal Dutch Airlines)
LAN	Línea Aérea Nacional (de Chile)
LATAM	Latin America
LCC	Low Cost Carrier
LIQUIDITY	Explanatory variable: cash & cash equivalents over current liabilities
LN	Natural logarithm
LOSTVALUE	Explanatory variable: lost value (book value of the aircraft before hull loss)
Ltd.	Limited (company)
M	Import
m	market (benchmark)
mYTFYE	Number of months from calendar year start to end of a company's fiscal year
MAIR	Mesaba Holdings
Mesa	Mesa Air Group
MFSC	Major Full Service Carrier (or major network carrier)
mn	million
MSCI	Morgan Stanley Capital International
MTOW	Maximum Takeoff Weight
MVRM	Multivariate Regression Methodology
n	(total) number of something (1, 2, ..., n)
N/A (or n/a)	not applicable or not available
NASDAQ	National Association of Securities Dealers Automated Quotations
NDTEBITDA	Explanatory variable: net debt over earnings before interest, taxes, depreciation and amortization
NFSC	Non-major Full Service Carrier (or non-major network or regional carrier)
NORAM	North America
Nov	November

nYROPTION	Explanatory variable: total number of purchase options total number of aircraft in the fleet count
nYRORDER	Explanatory variable: total number of jet aircraft orders to existing fleet count
NYSE	New York Stock Exchange
O&D	Origin & Destination
Oct	October
OECD	Organisation for Economic Co-operation and Development
OEM	Original Equipment Manufacturer
OPSLEASE	Explanatory variable: operating lease (ratio of aircraft on operating lease to total number of aircraft)
p. (pp.)	page(s)
p.a.	per annum
PFREIGHT	Explanatory variable: portion of freight business (revenue of express, cargo and mail over total operating revenue)
PINT	Explanatory variable: portion of international business (non-intra-regional revenue over total operating revenue)
PINT1	Explanatory variable: portion of international business (non-narrow home market revenue over total operating revenue)
PLC	Public limited company
Q	Quarter
r	Excess return
R	Revenue (full calendar year net sales or revenue)
R ²	Coefficient of determination of the proportion of variability; in this thesis R ² refers always to adjusted R ² (adjusting for the number of explanatory terms in a model)
RFY	Revenue of fiscal year (full fiscal year net sales or revenue)
RI	Return index
RoW	Rest of world
RPK	Revenue Passenger Kilometer
RPKMKTSHR	Explanatory variable: Revenue Passenger Kilometer Market Share
RTK (or FTK)	Revenue Ton Kilometer (or Freight Ton Kilometer)
S.A. (SA)	Sociedad Anónima (or Société Anonyme)
SARS	Severe Acute Respiratory Syndrome
SAS	Scandinavian Airline Systems
SEC	(U.S.) Security and Exchange Commission
Sep	September
SIZE	Explanatory variable: natural logarithm of total assets
SPC	Special purpose company

STORAC	Explanatory variable: stored aircraft (ratio of aircraft on storage to total number of aircraft)
t (or T)	time (referring to a day t in the MVRM)
T-bill	Treasury bill
T-stat.	T-statistic
TAM	TAM (Táxi Aéreo Marília) Linhas Aéreas
TOTALAC	Explanatory variable: total aircraft (sum of all jet aircraft in a fleet)
U.S. (or US)	United States
UAL	United Airlines
UPS	United Parcel Service
USD	United States Dollar
WaMu	Washington Mutual
X	Export
y	Daily abnormal return
Ye	Year end



1. Introduction

The strategies according to which airlines and other air transport companies manage their aircraft portfolios are as multifarious as the number of firms in the industry. Some buy aircraft, others trust in leasing. Some order aircraft many years ahead and deal with options, others procure capacity ad hoc. Some fancy to operate a very young fleet, others prefer older aircraft or simply care less about average fleet age. What all these companies have in common is that they have to plan and secure air capacity in one or the other way to stay competitive in the market. This has become more difficult in the past two decades. Not only had the industry to deal with the typical economic cycles, but also a number of external events caused or still cause severe impact on the business. This thesis is based on the assumption that actual standard fleet planning is not sufficient to face future business challenges and that aircraft portfolios and fleet plans should be optimized on a higher strategic level regarding basic aircraft sourcing and financing decisions. It is further believed that this adjustment has a positive impact on a company's financial performance throughout normal business cycles, in times of crises, and potentially also in company specific isolated positive and negative events, such as aircraft acquisition or loss.

1.1 Research background and motivation

The world of aircraft sourcing and financing has been in a status of uncertainty since the end of the year 2008. The global financial crisis has increasingly influenced demand and supply of aircraft and respectively its price, and has been changing the risk perception of airlines, aircraft leasing companies and the capital market. Once again, after the terrorist attacks on September 11, 2001, the Severe Acute Respiratory Syndrome (SARS), and the Iraq war, the air transport industry has to face a severe business challenge and in parallel has to plan and secure the future need of air capacity.

Despite the aftermath of the recent crisis, air traffic and respectively air capacity demand are growing again and the interaction of different trends in the industry might easily cause a capacity shortage in the future. Recent economic forecasts predict an annual growth of global trade of 3.3% until 2031 based on the world's real gross domestic product (Federal Aviation Administration, 2009 and 2011). Traditionally, the aviation industry has developed relatively synchronically to the world gross domestic product (Federal Aviation Administration, 2008) and popular forecasts of the aviation business usually build upon this key influencing factor. Hence, an increasing demand in sufficient air capacity can be expected while companies have to focus more than before on profitability and maximizing shareholders' value. The two major airframe manufacturers Airbus (2011) and Boeing

(2011) predict an average positive annual growth trend in global air transport until 2030 of 4.8% based on passenger traffic, 5.1% based on revenue passenger kilometers¹ and 5.6% and freight ton kilometers² (positively adjusting their earlier predictions in 2009 of 4.6% to 5.2% until 2028; in Airbus, 2009 and Boeing, 2009). Naturally, the manufacturers see this positive trend as significant sales opportunity but do not provide details to the question whether they will be able to serve this high demand in terms of timely production and deliveries. A decrease in available capacity relative to demand is expected by an increasing number of industry experts (Expert interviews with Atlas Air, AWAS, DVB Bank, LCI Aviation, Macquarie AirFinance, and Titan Aviation Leasing, 2009). Reasons mentioned for the anticipated capacity shortage are ongoing consolidation and insolvencies among the airlines. Recent examples for the latter are Frontier Airlines and Air Midwest in the passenger sector and Ocean Airlines, Transmile, Kitty Hawk, Tradewind and Gemini in the air cargo business. In addition, most airlines run decommissioning programs for their aging aircraft and the market already faces today – impacting cargo and passenger business – a shortage in production slots for new aircraft and – specific to the cargo business – an insufficient number of passenger-to-cargo conversions. Production slots for new aircraft have mainly been blocked by some future oriented well established airlines with respective options at the manufacturers (Interview with Macquarie AirFinance, 2009). Conversion slots are lacking because of the small capacity of the conversion service providers. Considering all of the above, not all suppliers of air transport will be able to serve their customer's demand in the future.

Based on current expectations regarding both the financial and the capacity market, all air transport dependent business models face the same questions: How to secure future competitiveness in terms of air capacity and simultaneously prepare best for demand fluctuation in the normal business cycle and with regard to unexpected events? And, how do the different ways of planning and managing an aircraft portfolio influence the company's financial and stock performance?

The state of scientific literature can only partly be used to answer the question regarding the right strategy to secure air capacity for different business models. Most literature focuses on established passenger airlines reflecting the state of knowledge *ex ante* or *ex post* 9/11³. Current theories and models, of which some will be mentioned in more detail in the following, just start to consider the impact of the financial and economic crisis 2008. The air transport industry has not been evaluated holistically although, whenever it comes to air capacity and aircraft fleet planning, the key to a successful business seems to lie somewhere

¹ Revenue Passenger Kilometers (RPK): "The sum of the products obtained by multiplying the number of revenue passengers carried on each flight leg by the flight leg distance (one fare-paying passenger transported one kilometer)." (Butler & Keller, 2000, p. 671)

² Freight Ton Kilometers (FTK): also called Revenue Ton Kilometers (RTK); "the number of tones carried multiplied by the number of kilometres flown." (Butler & Keller, 2000, p. 671)

³ 9/11: Terroristic attacks in the United States of America on September 11, 2001

between or in a balance of aircraft financing decisions, successful sourcing of capacity and other factors that can influence an air transport company to react flexibly on demand fluctuation.

The following paragraphs summarize trend statements in the air transport industry and describe why these statements are believed to be insufficient and how this thesis is planned to add further insights into the topic of high level financing, sourcing of aircraft, and fleet planning.

Regarding aircraft financing, Abeyratne (2001) describes in his publication *Aviation Trends in the New Millennium* aircraft leasing, especially operating leasing, as “strategic commercial manoeuvre” of airlines in the past 20 years to acquire air capacity without high capital impact. Abeyratne details the benefits of operating leasing and emphasizes risk allocation (between lessor and lessee), tax advantages and immediate operational flexibility. Nevertheless, the long term impact of operating leases in comparison to ownership on a company’s financial performance is not considered and its behavior in times of crisis is covered neither by Abeyratne nor in other empirical studies. The theoretical basis for quantitative evaluation of decisions in aircraft acquisition and financing are so far mainly based on Morrell (2007) and Littlejohns & McGairl (2003). Models of both authors include primarily discounted cash flow analyses, capital value analyses, residual value analyses and special tax models and were already tested in practice by e.g. Gibson & Morrell (2004). Yet, all methods focus on concrete buy versus lease decisions on a single aircraft basis and purely consider monetary comparison of the two options. This thesis lifts the decision of buy versus lease to a strategic level and tests whether high level financing structure in an aircraft portfolio has a positive or negative impact on a company’s performance in normal business cycles, in times of crisis, and in times of aircraft acquisition or loss. In other words, this thesis tries to find evidence for the hypothesis that the simple ratio of owned versus leased aircraft has an impact on a company’s business success.

In terms of aircraft sourcing, Clark’s (2007) second edition of *Buying the Big Jets* is probably one of the most elaborated works on aircraft fleet planning. Clark lists precisely the requirements of both long term fleet planning and capacity planning and explains the various possibilities of aircraft acquisition (e.g. purchase options, firm orders, operating leasing). Additional topics touched are airlines’ behavior in the business cycle and factors such as life cycles of aircraft types and flexibility in capacity adjustment. Clark’s elaborations on the interaction of company profit, firm orders and aircraft deliveries are of special interest for this thesis. Astonishingly, the correlation shows that the majority of companies place firm orders when the market is in an up-cycle or even at peak. Vice versa, aircraft are delivered when capacity demand has declined. Consequently, this lack of

synchronization has to be compensated by the airlines with higher flexibility in the overall fleet composition and short to mid term grounding of aircraft. Logically, there is an advantage of synchronizing market development and companies' decisions regarding aircraft acquisition. On the other hand it is understandable that top management is reluctant to approve major capital investments in times of economic downturn. This thesis tries to find quantitative evidence of the advantage of future oriented capacity acquisition in form of firm orders and purchase options and its effect on companies' financial performance and investors.

In daily business, the focus of fleet planning is on calibrating capacity demand versus aircraft size and optimizing total cost in the airline's network. Fleet rationalization plays a major role. Button & Kilpi (2007) further developed the "Fleet Standardization Index" introduced by Pan & Santo (2004) to numerically analyze the correlation of fleet size and harmonization of aircraft types in airlines between 1952 and 2005. The results show that though fleet size constantly increased, the degree of uniformity declined. This is mainly triggered by capacity expansions in economic booms. During such periods, airlines pay less attention to additional costs connected with non-standardized fleets. On the other hand, fleet harmonization increases with growing cost pressure in times of economic downturns. This finding is of interest for this thesis, showing that airlines tend to make changes in their aircraft portfolios regularly, giving the possibility to also strategically improve the fleet composition in terms of aircraft acquisition and financing. This finding also provides an argument for the lack of consequent strategic optimization of aircraft portfolios. It gives room for speculation that the same airlines treat decisions on aircraft acquisition and financing or other opportunities to improve fleet composition with the similar carelessness when not facing cost pressure. This thesis considers the introduction of a new step ahead of actual investment planning and aircraft acquisition in a company's overall fleet planning process. In this step the aircraft portfolio is reviewed from a strategic aircraft sourcing and financing perspective.

A recent work by Merkert & Hensher (2011, p. 686) makes a further step towards the evaluation of "the impact of strategic management and fleet planning on airline efficiency". Merkert & Hensher start with a similar question: "what survival and cost management strategies should airlines choose in order to remain in the market or to grow and perform well under current market conditions?" Their approach is to determine the impact of several fleet mix characteristics, such as aircraft size, aircraft family diversity in the fleet, and age of fleet on "three types of airlines efficiency: technical, allocative and [...] cost efficiency." The method used is DEA⁴ efficiency scoring with bootstrap approach. The global sample consists of 56 passenger airlines with data from the years 2007-2009. Some of the findings support hypotheses formulated for this thesis that fleet planning and some fleet

⁴ Data Envelopment Analysis