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Deutsche Lufthansa AG

Equity Valuation

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Abstract

Title: Deutsche Lufthansa AG – Equity Valuation

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It is usually the case that the market value of a share differs from its fair value, as a share's market value incorporates not only cash and future earning of a company but also investors' expectations, added to the uncertainty about the future.

Bearing this in mind, an evaluation of the share of Deutsche Lufthansa AG was performed in this Dissertation, with the purpose of understanding if, on March 31st 2019, the market value of this company's share differs or equals its fair value.

A Discounted Cash Flow model and a Multiple valuation were chosen to assess the firm's fair share value, yielding a final value of €23.49. This valuation was supported by a thorough research on the company, the airline industry and overall macroeconomic conditions.

Subsequently, comparing this result with the actual share's market value on March 31st, 2019, which equaled €19.56, a HOLD/BUY recommendation to Deutsche Lufthansa AG's share was proposed.

At the end, the results achieved are compared with the results of an Equity Research Report of the Bank Credit Suisse, which yielded the same conclusion as the valuation performed in this Dissertation.

Resumo

Título: Deutsche Lufthansa AG – Equity Valuation

Autor: Sofia Natário

Palavras-chave: Indústria da Aviação; Relatório de Pesquisa; Avaliação de Empresas; Deutsche Lufthansa AG

Geralmente, o valor de mercado de uma ação difere do seu valor teórico, já que o valor de mercado de uma ação incorpora não só o dinheiro em caixa e os rendimentos futuros de uma empresa, mas também as expetativas dos investidores e a incerteza sobre o futuro.

Tendo esta informação em conta, foi realizada nesta Dissertação uma avaliação do preço teórico da Deutsche Lufthansa AG, com o objetivo de perceber se, a 31 de março de 2019, o valor de mercado das ações da empresa difere ou iguala o seu valor justo.

Os modelos DCF e Avaliação Relativa (Múltiplos) foram os escolhidos para avaliar o valor justo das ações, resultando num valor final de €23.49. Esta avaliação foi suportada por uma pesquisa detalhada sobre a empresa, a indústria da aviação e as condições macroeconómicas generalizadas.

Subsequentemente, comparando estes resultados com o valor de mercado da ação a 31 de março de 2019, a qual igualou €19.56, uma recomendação HOLD/BUY para as ações da Deutsche Lufthansa AG foi emitida.

Por fim, foi efetuada a comparação dos resultados obtidos com os resultados de um Relatório de Pesquisa do Banco Credit Suisse.

Preface

Firstly, I would like to express my gratitude to Professor José Carlos Tudela Martins for his availability, helpful insights and guidance throughout this process, all fundamental to the completion of this Dissertation.

Secondly, I want to express a word of gratitude to my family, for all the continuous support they have given me throughout my life. Without them, reaching this, and many other milestones would not have been possible. And for all that, I can never thank them enough.

Lastly, I would like to thank my friends, from the ones I have known for many years, to the ones I have known only for a few, to the Portuguese, but also to the ones from around the World. My academic experience and personal life over the last years have been shaped by each one of them, and so I thank them for that.

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1. Executive Summary

Considered one of the biggest airline companies in the World, the German Aviation Group Deutsche Lufthansa AG operates in numerous geographies and has been evidencing a continuous growth, especially in the last few years, consequence of globalisation and the overall increase in tourism.

The aim of this thesis will be to conduct an evaluation of the fair share price of Lufthansa AG, on March 31st, 2019, consequently comparing it with its market value.

With this purpose, this Dissertation is divided into five main chapters. In the first, the Literature Review, a summary of the different valuation models is presented. Two chapters containing, respectively, an overview of the Aviation Industry and Deutsche Lufthansa AG, follow. Subsequently, a methodological explanation of the forecasts is scrutinised and, finally, in the closing main chapter, the results from the analysis are compared with the ones from an equity Research Report of Credit Suisse.

2. Literature Review

2.1 Introduction

"Valuation is vague and arbitrary, when there is no assurance that it will be generally acquiesced in by others."

Jean-Baptiste Say

According to Damodaran (2006) *"*valuation can be considered the heart of finance*"*, being important in its different scopes, from Corporate Finance to Portfolio Management. On this ground, it would have been expected that, throughout the years, a consensus on the methods which to be used to value a company would have been reached. However, this has not happened. Damodaran (2002) highlights that the choice of valuation methods depends on the valuer's opinion as well as the choice of inputs. This fact makes valuation subjective and uncertain, even if the models themselves are quantitative.

All in all, valuation is important in different angles and should be, therefore, dealt with a high level of importance.

2.2 Valuation Models

Starting with the acknowledgment that the abundance of methods makes the overall valuation message less relevant, Young *et al.* (1999) show that valuation methods, under simplifying assumptions, can be proven as "different expressions of the same underlying model". Additionally, their belief is that no model is utterly suitable and reliable in all situations. Each case should be analysed individually, and many approaches could be considered to pursue a valuation.

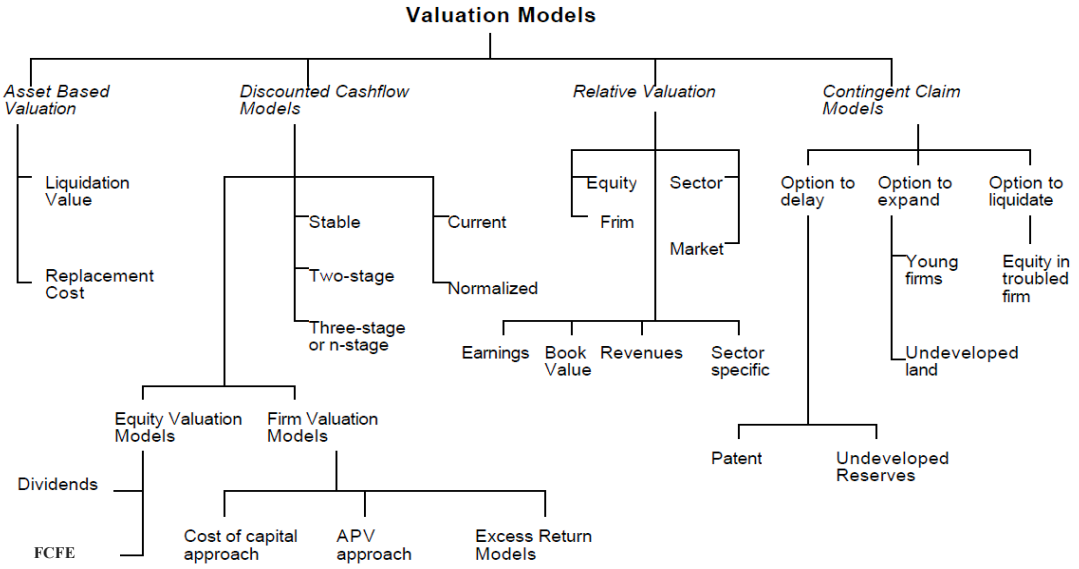
While Luehrman (1997) defends that in all cases, valuation is a function of three factors – cash, timing and risk, in a different approach, Damodaran (2002) advocates for the allocation of valuation models into three main approaches:

- **Discounted Cash Flow Valuation**
- **Relative Valuation**
- **Option Contingent Valuation**

In addition, the author mentions an alternative method, the asset-based valuation (values the firm's asset through accounting estimates), considering it, however, redundant to regard as a fourth approach. Nonetheless, in *Figure 1*, the author compares this model alongside the others mentioned, specifying each one's sub-models.

In this Dissertation, Damodaran's suggested division into four different approaches was adopted as a baseline structure for the literature review due to its clear and intuitive partition.

Figure 1: The choices in valuation models, according to Damodaran



Source: Damodaran (2002)

2.2.1 Discounted Cash Flow Valuation

Distinguished by Damodaran (2002) as the "foundation on which all other valuation approaches are built", the discounted cash flow valuation values a company by discounting its expected future cash flows to be generated into the present. From an opposing position, Luehrman (1997) disregards this technique, particularly the WACC-based model, arguing that it is outdated and there are many other up-to-date and suitable ones.

Generally, the cash flows of the firm are projected for a determined number of years (the so-called explicit period), which varies according to the company being analysed. Beyond these

years, a terminal value might be established, considering the company is going concern. The general model is given in *Equation 1*.

Equation 1:

$$Value\ of\ a\ Firm = \sum_{t=1}^{t=n} \frac{CF_i}{(1+k)^t} + \frac{Terminal\ Value_n}{(1+k)^n}$$

where: CF_i = cash flow generated by the company in the period i

$Terminal\ Value_n$ = terminal value of the company in the year n

k = appropriate discount rate for the cash flows' risk

It is important to note that the discount rate should be adjusted to the risk of the future cash flows and be consistent with the cash flows used (to equity or to the firm) to avoid any bias.

Broadly, the discounted cash flow methods can be divided into equity valuation and firm valuation.

2.2.1.1 Firm Valuation

Cost of Capital Approach (FCFF and WACC)

The free cash flows to the firm are the cash flows available to be paid out to the firm's stockholders, debtholders and preferred equity holders (*Equation 2* and *Equation 3*).

Equation 2:

FCFF = Free Cashflow to Equity + Interest Expense (1 - tax rate) + Principal Repayments - New Debt Issues + Preferred Dividends

Equation 3:

FCFF = EBIT (1 - tax rate) + Depreciation - Capital Expenditures – Δ Working Capital

To obtain the value of the firm, the FCFF are discounted to the present using the weighted average cost of capital (WACC) as a discount factor. If the firm presents a stable growth (at a g_n rate), reaching the steady state after n years, the value of the firm is calculated as represented in *Equation 4*.

Equation 4:

$$\text{Value of Firm} = \sum_{t=1}^{t=n} \frac{\text{FCFF}_t}{(1+\text{WACC})^t} + \frac{[\text{FCFF}_{n+1}/\,(\text{WACC} - g_n)]}{(1+\text{WACC})^n}$$

where: FCFF_t = expected cashflow to firm in period t

WACC = Weighted Average Cost of Capital

g_n = growth rate in the FCFF (forever)

So as to deepen the way to calculate the WACC, please refer to the section "Variables and Further Considerations" below.

Adjusted Present Value (APV)

As a firm value approach, the APV is an alternative approach to the FCFF. It starts by valuing the firm assuming it is only equity financed (unlevered firm value), adding subsequently the marginal impact of debt, the present value of tax shields, and deducting the expected bankruptcy costs to that value (*Equation 5* and *Equation 6*).

Equation 5:

Value of firm = Value of all-equity financed firm + PV of tax benefits - Expected Bankruptcy Costs

Equation 6:

$$\text{Value of a firm} = \frac{\text{FCFF}_1 \times (1+g)}{(\rho_u - g)} + t \times D - \pi_a \times BC$$

where: FCFF_1 = expected FCFF in the following year

ρ_u = unlevered cost of equity

g = expected growth rate

t = tax rate

D = debt

π_a = probability of bankruptcy

BC = present value of bankruptcy costs

Luehrman (1997) defines the APV as better alternative to the FCFF, especially due to its versatility and reliability, measuring the firm's operations.

On a different note, Goedhart *et al.* (2015) highlight that one of the biggest differences between this approach and the FCFF is that the adjusted present value easily accommodates changes in the debt ratio throughout time, unlike the former where these changes can be implemented but that process is more onerous. If the company, however, presents a stable debt ratio, the FCFF is a better model of valuation.

A disadvantage of the APV is, however, the difficulty in estimating parameters such as the default probability and the costs of bankruptcy.

Lastly, it is important to notice that APV and FCFF may not yield the same value as, on one hand, bankruptcy costs are considered in different ways in each approach. However, the conclusions tend to be similar with both methods.

Excess Return Models

The excess return models are approaches which purpose is to obtain the value of the firm through the estimation of the cash flows in excess of the required return (Damodaran, 2002).

The **Economic Value Added (EVA)** is probably the most prominent of the excess return models, computed as presented in *Equation 7*.

Equation 7:

$$\begin{aligned}\text{Economic Value Added} &= (\text{Return on Capital Invested} - \text{Cost of Capital}) * (\text{Capital Invested}) \\ &= \text{After tax operating income} - (\text{Cost of Capital}) * (\text{Capital Invested})\end{aligned}$$

2.2.1.2 Equity Valuation

Free Cash Flows to Equity (FCFE)

In general terms, the free cash flows to equity are the cash flows of a firm that are available to be paid out to the firms' equity holders. They include dividends and stock buybacks and assume that the firm distributes all its excess returns to its investors (*Equation 8)*.

Equation 8:

Free Cash Flow to Equity (FCFE) = Net Income - (Capital Expenditures – Depreciation)
- (Change in Non-cash Working Capital)
- (Preferred Dividends + New Preferred Stock Issued)
+ (New Debt Issued – Debt Repayments)

All in all, to calculate the value of equity using this method, the FCFE need to be discounted to the present, using the cost of equity (return required by the investors) as a discount rate.

Equation 9:

$$\text{Value of Equity} = \sum_{t=1}^{t=n} \frac{\text{CF to Equity}_t}{(1+\text{k}_\text{e})^\text{t}} + Terminal\ Value$$

where: $\text{CF to Equity}_\text{t}$ = Expected Cashflow to Equity in period t
k_e = Cost of Equity

It is important to highlight that if the assumptions on financial leverage made under the FCFF and the FCFE are consistent, the value of equity obtained under both approaches should be equal (Damodaran, 2002).

Dividend Discount Model (DDM)

As a specific case of the equity valuation methods, and an alternative to the FCFE method, the dividend discount model discounts the future expected dividends of the firm's stocks to the present, using the cost of equity as a discount rate (*Equation 10*).

Equation 10:

$$\text{Value per share of stock} = \sum_{t=1}^{t=\infty} \frac{\text{E}(\text{DPS}_\text{t})}{(1+\text{k}_\text{e})^\text{t}}$$

where: DPS_t = Expected dividends per share
k_e = Cost of equity

The idea behind the use of this model is that an investor who buys a stock expects its future cash flows to be dividends or dependent on dividends. Discounting these expected cash flows

to the present is then an appropriate way to calculate the equity value of a firm (Damodaran, 2002).

2.2.1.3. Terminal Value

As previously mentioned, the value of a firm is calculated by the sum of the cash flows of the explicit period and the terminal value, all discounted to the present with the appropriate discount rate (*Equation 1).*

However, it is relevant to mention that the terminal value parcel is extremely important for the final valuation, accounting for a large portion of the total value. While trying to prove the equivalency between the various valuation models, Young *et al.* (1999) assumed that the value of the firm was given by the terminal value, considering that it accounts for more than 79% of the total value when the explicit period is of 10 years or less (according with an analysis of long-term consensus data).

To estimate the terminal value of a firm, Damodaran (2002) considers three possible approaches:

- Liquidation Value
- Multiple Approach
- Stable Growth Model which assumes that the cash flows after the explicit period follow a constant growth. The terminal value is then calculated using a perpetuity formula, represented in *Equation 11.*

Equation 11:

$$\text{Terminal Value}_t = \frac{\text{Cash Flow}_{t+1}}{r - g_{stable}}$$

where: Cash Flow_{t+1} = expected cash flow in period t+1

r = discount rate

g = stable growth rate

2.2.2 Relative Valuation

The underlying idea of relative valuation, also designated as multiples valuation, is that comparable assets are valued similarly in the market, being this comparison based on distinct variables such as earnings, cash-flows, book value and revenues.

Accordingly, this method demonstrates a different approach to valuation when compared with the discounted cash-flow model, focusing on a market comparison instead of the calculation of the intrinsic value. However, if the calculations are performed in a consistent way, the valuation resulting from both approaches should be equal (Damodaran, 2006).

When classifying multiples, many approaches can be undertaken. Firstly, it is important to distinguish between the focus of valuation using multiples: while some value the whole firm, others simply value its equity. Secondly, multiples can be categorised as forward or trailing: while forward multiples look at forecasted values, trailing look at historical values. Lastly, it is also possible to differentiate between transaction and trading multiples: while the first are based on multiples paid in past acquisition transactions, the second are based in the current multiples of the firms' publicly traded competitors.

Goedhart *et al.* (2005) and Liu *et al*. (2002) advise to use forward-looking multiples as, through empirical evidence, they have been proven as more reliable.

To perform a relative valuation, Damodaran (2006) defends that three main steps should be followed:

- define a peer group
- compute the multiples of different variables
- adjust for differences between the assets on fundamental characteristics

An advantage of the multiples approach, when compared with other models, is the fact that it is simpler (there is more available information and less assumptions are needed), especially if there are many similar companies in the market.

Nevertheless, this method also evidences some disadvantages, being its simplicity one of them, making values vulnerable to manipulation. Additionally, the fact that the market is assumed to be making correct valuation is a limitation since, if it is not, the relative valuation will be built on errors (Damodaran, 2002).

2.2.2.1 Peer Group

According to Damodaran (2006) "a comparable firm is one with cash flows, growth potential, and risk similar to the firm being valued", being that firms do not need to belong to the same industries to be comparables. It is important, however, that the afore mentioned characteristics should be similar. Partially supporting Damodaran, Vernimmen *et al.* (2005) defend that a peer group of a firm should consist of listed companies with similar sector features, but also "similar operating characteristics, such as ROCE and expected growth rates".

On the other hand, Liu *et al.* (2002) defend that if the firms chosen belong to the same industry, the comparables valuation will be more accurate.

Goedhart *et al.* (2005) add that the companies chosen for the peer group should present similar growth and return on invested capital (ROIC) forecasts, highlighting the choice of comparables as an extremely and sophisticated and important step in this type of valuation.

2.2.2.2 Multiples

According to Fernandez (2007) the multiples most commonly used by analysts in the valuation of European companies are P/E and EV/EBITDA. However, the author also alludes to the fact that this is not a rule, and there are exceptions, especially as different industries have different multiples which suit them better.

In the following sections, each multiples' category will be presented.

Earnings Multiples

Earnings multiples evaluate the earnings generated by the asset being valued and are the most common used multiples (Damodaran, 2002). This valuation can be either of the equity value (P/E, PEG) or of the firm value (EV/EBITDA, EV/EBIT).

Book Value Multiples

Book value multiples are useful to value companies with several assets. They are used by investors due to its stability and intuitive measure of value. Moreover, firms with negative

earnings can be evaluated through this method, contrary to the afore mentioned earnings' ratios (Price/Book Value).

Revenue Multiples

Revenue multiples measure the equity or firm value relative to its revenues (EV/Revenue). For interpretation purposes, low revenue multiples are associated with cheap companies when comparing with firms with higher multiples (Damodaran, 2002).

Sector Specific Multiples

In the same way as revenue multiples, sector specific multiples have also been used as an alternative to earnings multiples. Usually, they are computed using enterprise value in the numerator and the operating units that generate revenues and profits for the firm in the denominator (Damodaran, 2002).

These multiples are not reliant on accounting items and link a firm's value to its operating detail, making it appealing for many analysts (Damodaran, 2002).

Airlines

In the specific case of airlines, Morrel (2007) refers one specific multiple as is regularly used to perform a valuation, the EV/EBITDAR, (Enterprise Value / Earnings Before Interest, Taxes, Depreciation, Amortization and Restructuring or Rent Costs). EBITDAR, EBITDA with rent expenses included, is relevant as it takes into consideration this specific cost.

However, EV/EBIT is a common substitute of this multiple, discharging the aircraft financing methods as well as the firm's depreciation policy, albeit disregarding capital costs and its relationship with other operating cost (Morrel, 2007).

A more detailed analysis on the multiple's valuation can read in *Appendix 1*, as well as an overall analysis to the Contingent Claim Model and the Asset Based Valuations.

2.3. Variables and Further Considerations

2.3.1 Capital Asset Pricing Model (CAPM)

Developed by Sharpe (1964) and Lintner (1965), the Capital Asset Pricing Model (CAPM) demonstrates the relation between the expected return and (systematic) risk. To compute the expected return, the model considers 3 different variables: the risk-free return rate (rf), the Beta (β) and the expected return of the market (Goedhart *et al.,* 2015). This equivalence describes the Security Market Line (SML) and is presented in *Equation 12*.

Equation 12:

$$Er_i = r_f + \beta_i(Er_M - r_f),$$

where: Er_i is the expected return on an (arbitrary) stock or security *i*.
β_i is security i's beta.
rf – risk free rate
E_{rM} – expected return of the market
E_{rM} - rf = market risk premium

Additionally, it is important to point out that CAPM lies upon some assumptions: the markets are frictionless (no trading costs, no taxes and no restrictions to borrowing or lending); all existing assets are traded; investments are endlessly divisible; there is homogeneous information meaning that all investors are fully rational and possess equal information.

A problem is the fact that many of the presented assumptions are quite unrealistic considering the real markets and their complexity (Mullins, 1982). However, despite these limitations, CAPM is considered a relevant model to compute the cost of equity.

Risk Free Rate

Damodaran (2002) advocates that "an asset is risk-free if we know the expected returns on it with certainty – i.e. the actual return is always equal to the expected return". So that this preposition is valid, two assumption must be made: there is no default risk nor reinvestment risk.

Subsequently, to obtain the risk-free rate, the rate of return on a riskless investment such as a of short-term Treasury Bill rates or yields of government bonds are generally used (Mullins, 1982).

A 10-year time frame for Government bonds is commonly defined as more suitable to be used as risk free due to its accuracy in terms of inflation and a higher connection with cash flows. In the specific case of European companies, Goedhart *et al.* (2015) advise that 10-year German government bonds are used as risk free assets due to its lower credit risk and frequent trading.

As an end note, it is important that the yields are presented in the same currency as the company's cash flows and that the inflation rate is also consistent in both variables.

Beta (ß)

As a measure of systematic risk in CAPM, beta (β) evaluates the sensitiveness of the stock price of a company relative to the movements of the global market (i.e., systematic risk). Consequently, it can also be seen as a measure of the stock's volatility. Thus, the higher the beta, the higher the required return is by the investor (Goedhart *et al.*, 2015).

Regarding the measurement of this variable, the authors highlight the difficulty to obtain its precise values, suggesting the use of the betas of the firms in the company's peer group to compute it.

Market Risk Premium

Through diversification, investors can eliminate unsystematic/idiosyncratic risk (specific from the company) however, the systematic risk is not diversifiable. Consequently, an equity risk premium (weighted by risk) is added to the risk-free rate to obtain the firm's cost of equity.

Named equity risk premium when it refers to stocks, it is also called market risk premium when referring to all financial instruments.

Clark *et al.* (2008) refer that the "outlooks for economic growth, consumer demand, inflation, interest rates, and geopolitical risks" as variables which influence the investors' view of the equity risk premium.

Defending that the MRP is estimated to range from 5% to 7%, Clark *et al.* (2008) consider that there are various methods to estimate it. However, there is no agreement on which the best method is. Therefore, a sensitivity analysis should be performed to better evaluate their influence in the firm's value.

2.3.2 Cost of Capital

WACC – Weighted Average Cost of Capital

Under the Free Cash Flows to the Firm (FCFF) approach, the cost of capital (WACC) is the rate used to discount the firm's cash flows (available to equity and debt holders) to the present. This discount rate weights both the cost of equity and the cost of debt by the market values of equity and debt, respectively.

Equation 13:

$$\text{WACC} = \frac{D}{V} k_d (1 - t_m) + \frac{E}{V} k_e$$

where: D/V = target level of debt to enterprise value using market-based (not book) values
E/V = target level of equity to enterprise value using market-based values
k_d = cost of debt
k_e = cost of equity
t_m = company's marginal income tax rate

Below, the fundamentals used to calculate the WACC are explained.

Cost of Equity

To calculate the cost of equity through the CAPM model, the beta levered needs to be computed (*Equation 14*). One way is resorting to the formula presented below which uses the beta unlevered, the tax rate and the debt to equity ratio of the firm (*Equation 15*).

Equation 14:

$$\beta_{\text{levered}} = \beta_{\text{u}} \left(1 + (1 - \text{t}) \frac{\text{D}}{\text{E}}\right) - \beta_{\text{debt}} (1 - \text{t}) \frac{D}{E}$$

where: D/E = debt-to-equity ration
t = tax rate
β_u = beta unlevered
β_{debt} = beta of debt

Equation 15:

$$\text{Cost of Equity} = \text{Risk free rate} + \beta_{\text{levered}}(\text{Risk Premium})$$

Cost of Debt

The firm's cost of debt will depend on the default risk of the company. The risk of default of a firm increases the more it contracts debt, leading to a consequent increase in the cost of debt.

As a result, calculating the default risk is an important step to define the cost of debt. One way to estimate it is using bond ratings and translating it into a default risk value (Damodaran, 2002).

Goedhart *et al.* (2015) also mention the firm's debt ratings to estimate its cost of debt, referring it as an option for a firm which does not trade frequently or does not trade at all.

2.3.3 Tax Rate

There are two types of tax rates, the marginal tax rate and the effective tax rate. While the first translates as the percentage of incremental tax to be paid for an extra unit of taxable income, the second presents the percentage of income tax actually paid.

The decision on which one to use to in valuation does not have a right answer however, Damodaran (in his website) defends that the best is to use the effective tax for initial forecasts and the marginal tax for the future ones.

2.3.4 Growth Rate

As an important variable in the definition of the terminal value, there are various issues to consider when calculating the growth rate (Damodaran, 2002):

- it should not be higher than the growth rate of the economy;
- it should be consistent with the valuation;
- it varies according to the currency in which the valuation is being performed in.

2.3.5 Cyclical Firms

Cyclical companies are the ones whose earnings are fairly volatile, usually coincident with the economy's business cycles. One specific cyclical industry is air transport: airline stocks are cyclical as leisure travellers and businesses cut back on travel plans when there is economic uncertainty and are more likely to make travel plans when they have confidence in the economy.

Due to these specificities, the valuation of cyclical firms becomes more complex as business cycles are hard to predict precisely.

Arising from what was previously mentioned, an appropriate valuation method which should be applied is the DCF. In this cyclical firm context, however, the explicit period should be longer than usual to more easily control business cycles, alteration which will decrease the importance of the terminal value. Additionally, in order to compute the terminal value, an average of past and forecasted cash flows including good and bad times should be used, as a way to smooth these cycles.

2.3.6 Leasing

The majority of airline companies sustain these types of contacts, especially regarding aircrafts, their most expensive assets, being that the airline firms can behave as either a lessee or lessor. Consequently, leasing is an important concept which should be carefully considered in airline valuation.

Lease contracts can be classified as either operating or financing, being that operating leasing tends to be more attractive to companies, as it is left out of the balance sheet and, occasionally, allows for the deferral of expenses (Damodaran, 2002).

Consequently, there are some important considerations when valuing a company with these debt-like items. Goedhart *et al.* (2005) present as a solution to this problem the adjustment of financial statements. This adjustment should start with the capitalisation of operating leases and its consequent deduction from a firm's enterprise value as it is not an equity claim.

2.4 Chosen Models

After the careful analysis of the existing valuation methods, the ones believed to be the most appropriate were chosen to value Lufthansa AG.

On one hand, asset-based models are appropriate to valuate distressed firms instead of healthy ones with future growth prospects (Damodaran, 2006). Taking this into consideration, neither of these asset-based valuations will be used to in the valuation of Lufthansa AG, a company which is considered as mature and is expected to experience future growth.

On the other hand, the multiple approach is a more adaptable valuation method. In the case of the airline industry, this type of valuation is fairly common, being used as a complementary valuation method to other methods chosen. As a result, the multiple valuation will be used in the subsequent valuation, namely through the forward multiples EV/EBITDA, EV/EBIT, EV/Revenue and P/E.

The option valuation is typically best suited for firms which cash flows are hard to forecast, which is the case of young firms as well as firms in the tech industry. Consequently, this method would not be the most suitable to value a company such as Lufthansa.

As for the discounted cash flow valuations, they appear to be a viable valuation approach as the company finds itself in a mature industry, consequently making it more likely to reach accurate estimates based on historical data and forecast. Adding to this, despite the fact that there has been a regular change in capital structure throughout the last years, the firm has reached a vale close to its target capital structure of 1 (D/E=1) and, as a result, capital structure is assumed to be constant in the future. Consequently, the Free Cash Flow to the Firm model will be used in the valuation of this company.

Taking all this into consideration, the methods which will be used to value Lufthansa will be:

- **Free Cash Flow to the Firm -WACC**
- **Multiples Valuation**

3. Industry Overview

In the following two chapters, an introduction to the airline industry as well as to Lufthansa will be made, representing a framework to this dissertation and serving as a foundation to the forecasts and overall company valuation.

3.1 Industry Description

In the past few years, the airline industry has faced a large global expansion, with revenues increasing from $379 billion in 2004 to an estimate of $821 billion in 2018, totalling a 116% increase, according to IATA's statistics (*Figure 2*).

This increase has been a consequence of multiple factors, including the continuous growth in tourism and overall number of passengers, which increased by 91.8% in a 14-years period, from 294 billion people in 2004 to an expected 564 billion in 2018. Additionally, the development of the world's emerging markets, air traffic liberation, the privatisation of airlines and airports and the continuous increase in cost efficiency have also taken an important role in this growth.

All these aspects have as well led to an increase in competition in the overall industry, with the average ticket prices continuously decreasing, and profit margins also declining (the latter, also a consequence of rising costs). Furthermore, low-cost carriers (LCCs) have been another main contributor to the increase in competition and the price reduction. With focus in short-haul routes and especially developed in the European and North American markets, LCCs have been operating since the 1990's, primarily targeting leisure travellers, a segment characterised by low propensity to pay and high travel flexibility. This new business model manages then to capture these costumers from other carriers, increasing competition.

Associated to this overall increase in activity are also the record levels of orders and deliveries of aircrafts reached, with a consequent increase in the levels of production as well as leasing agreements.

Regarding general characteristics, it is worth mentioning that the airline industry is considered to be cyclical as it was mentioned in the previous chapter, since earnings tend to vary with the economy's business cycles.

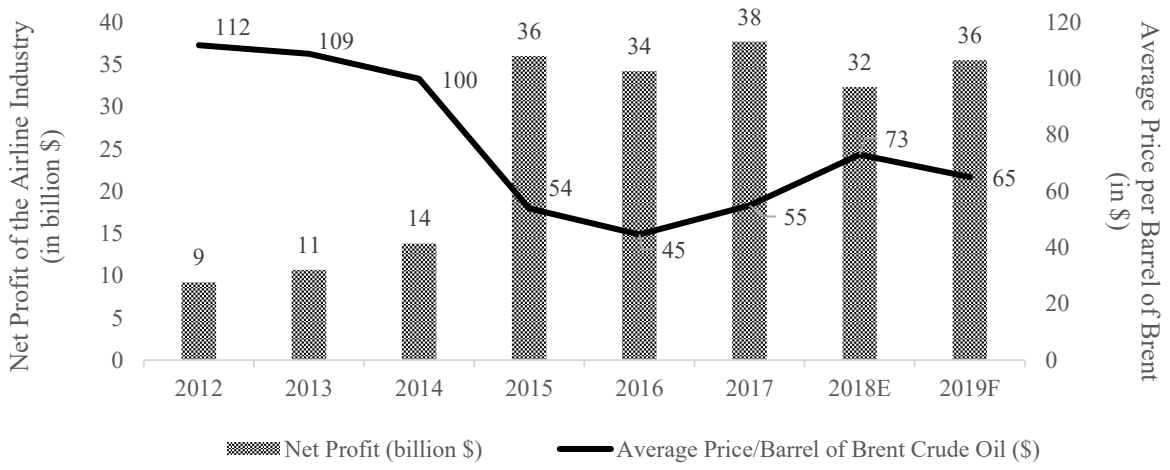
3.2 Industry Relevant Variables

Oil prices are a key variable affecting airline costs. Jet Kerosene is the most common type of fuel used by airlines and it is usually correlated with the price of Brent Crude.

Fuel costs are estimated to represent 23.5% of the global airline industry operating expenses in 2018, considering a price of $73.0 per barrel of Brent. In 2019, IATA forecasts an increase in this percentage to 24.2% of operating expenses at $65 per barrel of Brent. As a general rule, the airline's net profit is highly impacted by the price of oil, increasing during years with low oil price and decreasing when oil prices are high, as it can be seen in *Figure 2*.

As a way to attenuate this impact, firms tend to hedge against fuel, protecting themselves against oscillations in the price of oil.

Figure 2: Net Profit of the Airline Industry vs. Average Price per Barrel of Brent



Source: IATA

Moreover, labour costs, also a crucial part of airline costs, have been increasingly more significantly due to a general increase in labour prices, consequence of pilots and technicians pressure to wage increases.

In a macroeconomic perspective, GDP growth, interest rates and exchange rates are three important variables which have an impact in the overall industry. As the airline industry is considered to be cyclical, changes in GDP will have a direct impact on travelling patterns, affecting the aviation services revenues. Regarding interest rates, the fact that many airlines finance the acquisition of new aircrafts with bank loans, makes it an important variable which

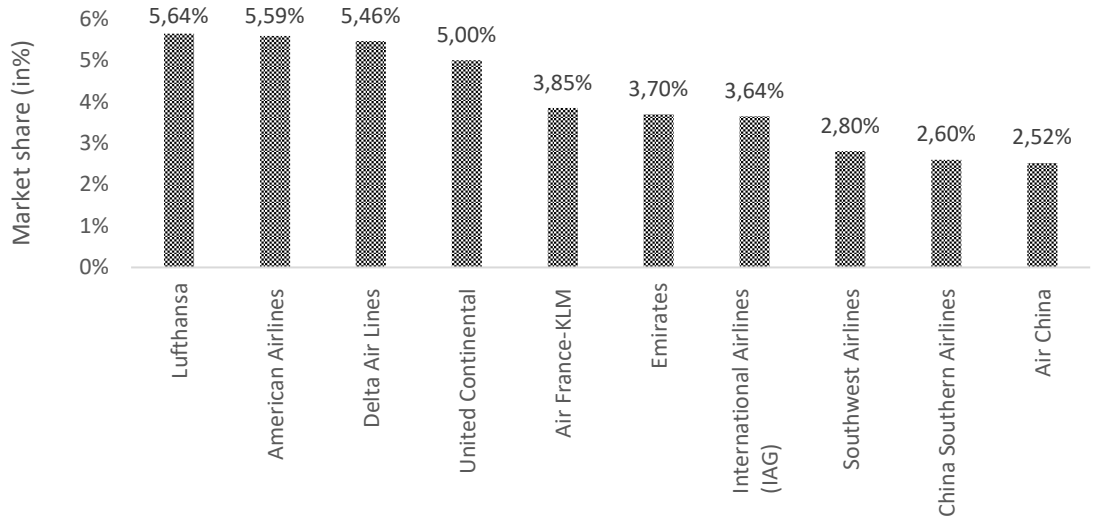
can impact the firm. As for exchange rate movements, it can impact the revenues of world operating companies, influencing its overall profit.

Considering this, such as with fuel, interest rates and exchange rates can also be subject to hedging policies as a way to manage its implied risk.

3.3 Main Industry Players

Based on each company's reported revenues of 2017 and IATA's statistics, Lufthansa was the airline with the highest market share in 2017 at 5.64% of the revenues of the total airline industry, followed by the American Airlines Group with 5.59% market share and Delta Airlines with 5.46%. In fifth place comes another European Airline, Air France-KLM, with a market share of 3.85%.

Figure 3: Market share of Airline Global Industry main players in 2017



Source: IATA

United Continental Holdings, Air France-KLM, Emirates Group, International Airlines Group (IAG), Southwest Airlines, China Southern Airlines and Air China are the remaining airlines in the top 10 airlines by market share, as it can be seen in *Figure 3*.

3.4 Porter's Five Forces

Porter's Five Forces help in the understanding of the industry as a whole, looking at five difference parameters which help measure competition. This analysis was thus performed to measure competition in the airline industry.

- **Bargaining Power of Buyers (Medium)**

As it is relatively simple for buyers to switch to another competitor, especially when switching costs are not much significant, they have a high bargaining power. However, since, in some routes and regions, there are not many options, regarding routes and prices, consumers might not have as much power. Consequently, the bargaining power of buyers is considered to be moderate.

- **Threat of Substitutes (Medium)**

There are quite many substitutes to air travel: from train, to bus, car or even boat, the choice will depend on the switching cost. However, air travel is generally the most convenient way, as it is usually faster and cheaper than other means of transportation. For this reason, it was considered that the threat of substitutes is low.

- **Threat of New Entrants (Low)**

Overall, the threat of new entrants is low due to high barriers of entry, especially high fixed costs, being this industry capital-intensive. The risk to enter is therefore high, pulling away some possible new entrants. Additionally, brand recognition and a formed costumer base make it difficult for a new company to strive in this industry, as the majority costumers will be reluctant to trust in a company they do not know.

- **Bargaining Power of Suppliers (Medium)**

The main airline industry suppliers are aircraft manufacturers, fuel providers and labour suppliers. The two main airplane manufactures, Airbus and Boeing dominate the market, making it hard for airlines to find other providers. However, the same happens the other way, as airlines are almost the sole clients of these manufacturers. The same thing happens with fuel and labour suppliers, which also can exert their power over airlines, even though they also depend on them. In conclusion, the bargaining power of suppliers is considered, overall, to be medium.

- **Competitive Rivalry (High)**

As already mentioned, the airline industry is characterised by its strong competition, constituted by various competitors which have been in the market for a long time. Additionally, consolidation amongst airlines has been growing (such as the alliance between Continental and United Airlines), increasing even further the competition and also refraining new potential firms to enter the market. Furthermore, the exit price and the fixed costs are also high, making the firms being more competitive as to remain in the market.

3.5 Future Perspectives

When discussing future events which might have an impact in the world and, in specific, the airline industry, the exit of the United Kingdom from the European Union is a common topic. Additionally, trade wars (namely between US and China) and an increase in protectionism present as other prospective problems which might impact aviation worldwide. According to IATA forecasts, these events could lead to a slowdown in the expected CAGR of 3.5% in 2027 to an expected CAGR of 2.4%, in a scenario called “reverse globalisation”.

Furthermore, on a more positive note, IATA projects a shift in the aviation activity from the Americas and Europe to the Middle East and Asia/Pacific in the next few years, result of the continuous economic growth of this region.

Regarding overall competition, an even further increase is expected, with LCCs having recently been taking their first steps in the expansion into long-haul routes segment.

Bottom-line, the general outlook for the industry is favourable. However, geopolitical and macroeconomic conditions might affect the course of events. Overall, many predict a moderate level of growth in future years, in opposition to a sharp fall or a continued exponential growth.

4. Company Overview

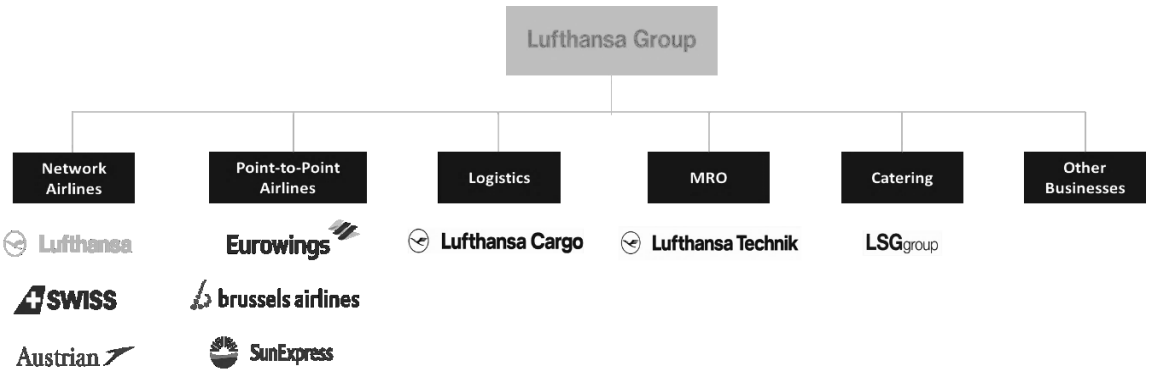
4.1 Company Description

Headquartered in Cologne, Germany, and founded in 1953, Deutsche Lufthansa AG is an aviation group with operations around the globe, generating however most of its revenues (around 40%) in Europe. It is one of the founding members of the Star Alliance, a global airline alliance, has generated €35.58 billion of revenues in 2017 and has more than 500 subsidiaries.

4.1.1 Business Segments

Lufthansa AG is organised into three main business segments, Network Airlines, Point-to-Point Airlines and Aviation Services (encompassing Logistics, Maintenance, Repair and Overhaul and Catering segments), to which Additional Businesses and Group Functions is added. *Figure 4* describes systematically its organisation.

Figure 4: Lufthansa Group organizational chart



Source: own design

Network Airlines

As the segment which yields the highest revenue share to the Lufthansa group (61.5% as of September 2018), the Network Airlines segment is composed by Lufthansa German Airlines, as well as SWISS and Austrian Airlines. Its main target are passengers seeking a premium service allowing for high travel flexibility resulting from its multi-hub system.

Eurowings Group (previously Point-to-Point Airlines)

Unlike the Network Airlines, Point-to Point Airlines, renamed in 2018 as Eurowings Group focuses on price-sensitive passengers using direct traffic routes, competing consequently with low cost carriers (LCCs). It is composed by the Eurowings Group (Eurowings, Germanwings, Eurowings Europe), Brussels Airlines and a 50% equity investment in SunExpress, all of which account for 12% of Lufthansa Group's total external revenue, as of September 2018.

Logistics

With airfreight transportation as its core activity, Lufthansa Cargo is the group's specialist in logistics and yields around 7.2% of Lufthansa's total external revenue. Besides the freighter fleet, belly capacity of some of the long-haul passenger airlines aircrafts is also part of the overall capacity.

MRO

Lufthansa Technik AG represents Lufthansa's Maintenance, Repair and Overhaul (MRO) segment, operating for civil aircraft. With its business units, Lufthansa Technik provides the Lufthansa Group 10.5% of its total external revenue, as of September 2018.

Catering

LSG Lufthansa Service Holding AG is the segment of Lufthansa focused on airline catering, with a 7% of the Group's total external revenues (as of September 2018). It is posited as leader in the high-quality in-flight catering market with its LSG Sky Chefs brand.

Additional Businesses and Group Functions

Accounting for only 1.8% of the group's total external revenue (as of September 2018), this segment comprises, amongst others, Lufthansa's Aviation Training and IT firms.

4.1.2 Competitors

In addition to the aforementioned airline companies in the section "Main Industry Players" above, other airlines can be considered as competitors of the Lufthansa Group:

- Europe - Turkish Airlines and the LCCs, EasyJet and Ryanair
- Americas - Air Canada
- Asia-Pacific - Air China, ANA Group, Singapore Airlines and Qantas

- Middle East/Africa - Qatar Airways and Emirates

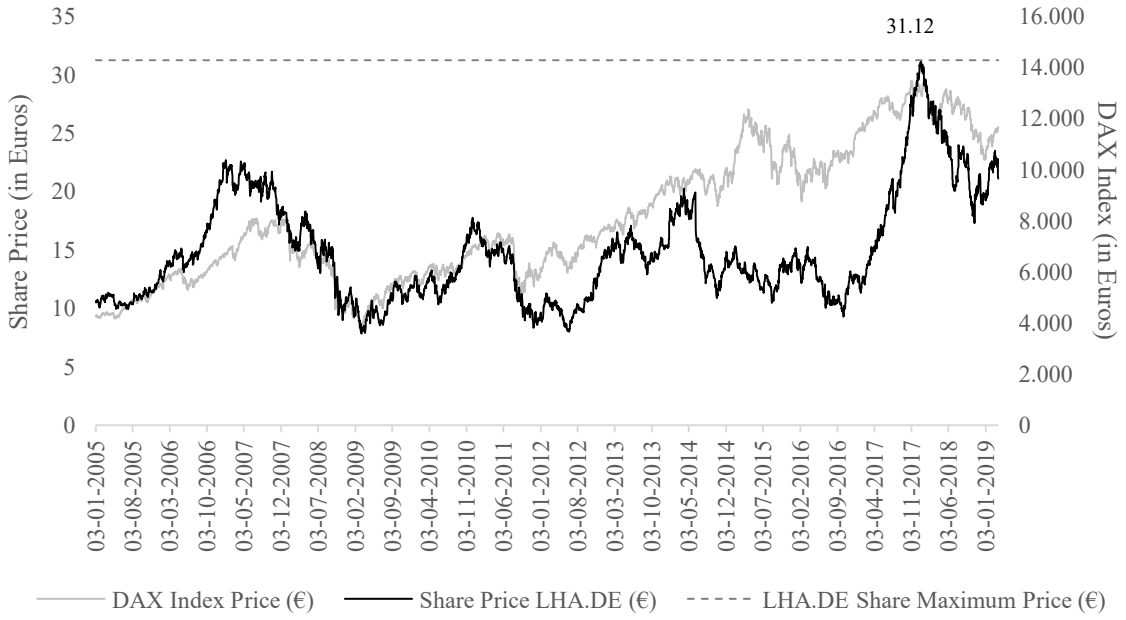
This specific topic will, however, be analysed with more detailed in the chapter ahead regarding Relative Valuation.

4.2 Historical Performance

4.2.1 Share Performance

Deutsche Lufthansa AG is listed in the German Stock Exchanges since its IPO in 1966. It is one of the 30 companies included in the German DAX index, and it is traded in XETRA, the Frankfurt Stock Exchange, besides floor trading, at 100% free float.

Figure 5: Deutsche Lufthansa Share Price Evolution vs. DAX Index price



Source: Thomson Reuters

As it can be seen in *Figure 5*, the share price has been oscillating throughout the years, in general terms, following the pattern of the DAX index.

On the 28th of December 2017, after the regulatory approval by the EU Commission of the acquisition of parts of Air Berlin, the share price of Lufthansa took off, reaching its all-time peak of €31.12 per share.

4.2.2 Operating and Financial Performance

Appendix 2 shows a summary of Lufthansa's key financial and operating measures. EBITDA has been growing, with an EBITDA margin also moving in the same direction, indication of an overall better performance of the company.

As for the Return on Invested Capital (ROIC), it has also shown an overall increase throughout the last few years, translating in a higher return to the firm's investors.

Regarding the firm's capital structure, the target debt-to-equity ratio of Lufthansa is 1, according to company data. In 2017, this ratio stayed closer to the firm's goal, reaching 0.83, with the book value of equity slightly higher than the book value of debt.

4.3 Company Future Strategy

As a way to improve their future strategy and tackle eventual threats, a SWOT analysis of a company is a useful measure in identifying the factors which may influence it, both in the firm or from external sources. Below, the strengths, weaknesses, opportunities and threats of the Lufthansa Group will be analysed.

Strengths

- Brand recognition
- Travel flexibility and vast route network
- Diversified services and business profile
- Robust financial performance

Weaknesses

- Part of a cyclical industry
- High competition

Opportunities

- Development in tourism and increase in the number of passengers
- Growth of the Eurowings segment to more directly compete with LCCs
- Increase in the level of operations in emerging markets
- Cost reduction resulting from increasing aircraft efficiency

Threats

- Terrorist Attacks
- Cyber Attacks
- Low-Cost Carriers Competition
- Market Consolidation
- Interest Rate movements
- Fuel Price movements
- Exchange Rate movements

Overall, the main objective of Lufthansa's management is costumer, employees and shareholders satisfaction. To reach this goal, the company proposes to focus in consolidation, flexibilization and digitalisation activities, aspiring to grow and become an industry leader, investing progressively and remaining competitive. All this will be based on cost reduction, fleet renewal and higher efficiency.

5. Forecasts

In the following section, a description of the forecasts and assumptions made to assess Lufthansa's fair market valuation is depicted. With this purpose, a Relative Valuation and a WACC - Free Cash Flows to the Firm method were used.

5.1 Discounted Cash Flow Valuation

So as to perform this absolute valuation of the company using a DCF model, an Income Statement forecast by segment up until EBIT was done, proceeding consequently to its consolidation, due to the lack of further detailed information on each specific segment.

5.1.1 Revenues

Unarguably one of the most important elements to be forecasted, a detailed analysis of revenues was performed to obtain the most accurate predictions of its future values.

As a way to more accurately assess each of the segments' revenue, a regional level analysis (with data based on the original sale location) was performed in the segments Network Airlines, Eurowings Group (previously known as Point-to-Point Airlines) and Lufthansa Cargo.

As for the remaining segments (MRO, Catering and Other Businesses), a division in regions would not be relevant as their revenue originates from network results instead of regional earnings contributions. Consequently, they were analysed at a network level.

As a starting point, it is important to distinguish between **Traffic Revenue** and **Other Revenue**, the two components of **Total Revenue**

- **Traffic Revenue,** the main driver of Total Revenue, is the sum of the Traffic Revenue of Network Airlines, Eurowings Group and Lufthansa Cargo;
- **Other Revenue** accounts for the revenue of MRO, Catering and Other Businesses, as well as the external (revenue external to the company) non-traffic revenue of the Network Airlines, Eurowings Group and Lufthansa Cargo and finally each segment's inter-segment revenue.

In the following sections, a more detailed explanation on the forecasts for each segment is presented.

Network Airlines and Eurowings Group

Due to a lack of historical data on the Eurowings Group (previously known as Point-to-Point Airlines, segment created in 2016), it was decided that the traffic revenue of both of these segments were to be computed jointly.

For these computations, three main value drivers were analysed:

- **Revenue per Passenger Kilometre (RPK)**[1]
- **Number of Kilometres Flown**
- **Average Fare**[2]

For the years of 2018 and 2019, forecasts on Revenue Passenger Kilometre (RPK) (a measure of demand) per region from the International Air Transport Association (IATA) were used. As for the period from 2020 until the end of the explicit period (2026), predictions from Boeing of the CAGR of RPK per region between 2018 and 2037 were employed.

However, the growth rates from Boeing were believed to be too optimistic considering Lufthansa's historical data and future uncertainty arising from topics such as Brexit and possible trading disputes. When comparing past forecasts of Boeing with historical growth rates from Lufthansa, a disparity can be observed. For instance, in the period 2008-2027, according to Boeing, the forecasted CAGR of RPK was of 5%. However, during the period 2012-2017, according to Lufthansa's historical values, the growth rates of this variable have been around 2.5%, evidencing a difference between Boeing's forecasts and the actual data of the company. Consequently, based on Boeing's estimates, a more conservative set of data was derived through a 20% discount on these rates, considering that, in the future, the actual rates should start converging closer to Boeing's forecasts

From these results, a calculation of the total RPK and consequently of the total number of passengers was obtained, after the prediction of the total number of kilometres flown. It was assumed that, until 2020, the kilometres flown would grow by 3% a year after the increase in aircrafts resulting from the Air Berlin acquisition, followed by a 2% growth until the end of the forecasting period.

[1] **RPK**: measure of passenger demand; RPK = Number of Kilometers Flown * Number of Passengers
[2] **Average fare:** Average Fare = Traffic Revenue/Number of Passengers (Average Fare Per Passenger, Per flight)

As for the number of seats available, a growth rate was calculated recurring to the expected fleet growth during the period 2018-2025 and considering the number of seats of each new aircraft.

Regarding the average fare a decreasing tendency has been observed both in the overall market, as well as in the specific case of Lufthansa, in the past years. In the next years, this tendency is expected to remain, also promoted by a higher investment in the Point-to-Point segment, focused on more price sensitive costumers. It was consequently assumed a growth rate of -0.6% per annum of the average fare, aligned with the Japan Aircraft Development Corporation.

Traffic revenue from passenger airlines was then computed as the average fare multiplied by the number of passengers expected.

Table 1: Passenger Airlines Traffic Revenue

in million € (unless stated otherwise)	2017	2018E	2019F	2020F	2021F	2022F	2023F	2024F	2025F	2026F
Traffic Revenue	25,465	26,129	26,682	26,960	27,242	27,527	27,817	28,110	28,407	28,709
yoy change (%)	14.4%	2.6%	2.1%	1.0%	1.0%	1.0%	1.1%	1.1%	1.1%	1.1%
Passengers	130	134	138	140	142	145	147	150	152	155
yoy change (%)	18.5%	3.2%	2.7%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%	1.7%
Average Fare (in €)	196	195	194	192	191	190	189	188	187	186
yoy change (%)	-3.4%	-0.6%	-0.6%	-0.6%	-0.6%	-0.6%	-0.6%	-0.6%	-0.6%	-0.6%
RPK	261,156	277,673	293,816	304,642	315,877	327,537	339,638	352,199	365,236	378,768
yoy change (%)	15.2%	6.3%	5.8%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%

Source: Lufthansa, own computations

With regards to **Other Revenue**, it was assumed that the non-traffic external revenue would remain as a fixed percentage of the segment traffic revenue in the future, while the **inter-segment revenue** would grow at an average historical rate.

It was consequently assumed that, in future years, 80% of this Traffic Revenue would be attributed to the Network Airlines, while the remaining 20% to the Eurowings Group, comparing with 84.6% and 15.4% in 2017, respectively. This change was due to an increasing focus in the Point-to-Point segment, expected to become more relevant for the group in future years.

Logistics

Regarding the cargo segment traffic revenues, two main value drivers were analysed:

- **Revenue Cargo-Tonne Kilometre or Freight Tonne Kilometre (FTK)[3]**
- **Average Traffic Revenue/ Yield[4]**

For the years of 2018 and 2019, forecasts of Freight Tonne Kilometre (FTK) (a measure of demand) per region from the International Air Transport Association (IATA) were used. As for the period from 2020 until the end of the explicit period (2026), predictions also from IATA of the CAGR of FTK per region between 2018 and 2037 were employed.

However, similarly to the situation of the passenger airlines forecast, the growth rates were believed to be too optimistic considering Lufthansa's historical data and all the future uncertainty. With an historical average growth of FTK, from 2012 to 2017, of 0.4%, comparing with a 5.8% CAGR forecasted by Boeing during the period 2008-2027.Consequently, a more conservative set of data was derived through a 20% discount on Boeing's forecasted rates.

With regards to the Yield, a forecasted increase aligned with the forecasted inflation was used as a basis for the predictions, considering this growth relative to 2016 instead of 2017 due to abnormal increase in the overall demand of the market in the year of 2017, not expected to remain at this level in the following years.

The **Traffic Revenue** of this segment was subsequently calculated as the product between the Yield and the FTK.

Table 2: Logistics Traffic Revenue

in million € (unless stated otherwise)	2017	2018E	2019F	2020F	2021F	2022F	2023F	2024F	2025F	2026F
Traffic Revenue	2,373	2,114	2,239	2,302	2,430	2,499	2,637	2,713	2,864	2,946
yoy change (%)	19.5%	-10.9%	5.9%	2.8%	5.5%	2.9%	5.5%	2.9%	5.6%	2.9%
FTK	8,886	8,665	8,954	9,209	9,471	9,742	10,020	10,308	10,605	10,911
yoy change (%)	6.0%	-2.5%	3.3%	2.8%	2.8%	2.9%	2.9%	2.9%	2.9%	2.9%
Yield (in%)	0.27	0.24	0.25	0.25	0.26	0.26	0.26	0.26	0.27	0.27
yoy change (%)	12.8%	3.0%	2.5%	2.5%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%

Source: Lufthansa, IATA, Boeing, own computations

[3] **FTK**: measure of cargo demand; FTK = Number of Kilometers Flown * Number of transported tonnes of freight
[4] **Average Traffic Revenue**: Average Traffic Revenue = FTK / Traffic Revenue

With regards to **Other Revenue**, it was assumed that the non-traffic external revenue would grow with inflation, while the **inter-segment revenue** would grow at an average historical rate.

MRO (Lufthansa Technik), Catering (LSG Sky Chefs) and Other Businesses

As for the Maintenance and Repair segment, which revenues come either from other segments or external non-traffic sources, expected inflation was held to be the most suitable growth rate of revenues. The revenues of the Catering segment were calculated as a percentage of total traffic revenue, due to the high correlations to this variable and, lastly, regarding other businesses segment of the Lufthansa Group, inflation was again used as a forecast growth rate.

After adding the revenue from all segments, the value for the Group's Total Revenue was reached, which can be seen in *Table 3*.

Table 3: Total Group Revenue

in million €	2017	2018E	2019F	2020F	2021F	2022F	2023F	2024F	2025F	2026F
Traffic Revenue	28,399	28,804	29,482	29,823	30,232	30,587	31,015	31,384	31,832	32,216
yoy growth (%)	12.4%	1.4%	2.4%	1.2%	1.4%	1.2%	1.4%	1.2%	1.4%	1.2%
Other Revenue	7,180	7,859	7,992	8,220	8,484	8,732	8,987	9,248	9,517	9,792
yoy growth (%)	2.6%	9.5%	1.7%	2.8%	3.2%	2.9%	2.9%	2.9%	2.9%	2.9%
Total Revenue	35,579	36,655	37,459	38,020	38,684	39,279	39,951	40,571	41,275	41,923
yoy growth (%)	12.4%	3.0%	2.2%	1.5%	1.7%	1.5%	1.7%	1.6%	1.7%	1.6%

Source: Lufthansa, IATA, Boeing, own computations

5.1.2 Operating Expenses

Operating expense are divided into four main categories: material costs, staff costs, depreciation and amortisation and other operating expenses. In the following sections, a more detailed explanation on the forecasts of each of these components is presented.

Cost of Materials and Services

In the case of the MRO, Catering and Other Businesses segments, material costs are evaluated as a whole, and were forecasted to grow with the forecasted total revenue of the segment, considering an historical average ratio between material costs and the segment revenue.

In the case of the Network Airlines, Point-to-Point Airlines and Cargo segments, material costs are further subdivided into Fuel, Fees & Charges, Operating Lease and Other Material Costs, being the first two the most significant in overall expenses.

Accounting for 15% of the Lufthansa's Group total operating, fuel expenses are an extremely important cost. For this reason, Lufthansa (as the majority of airline companies) hedges fuel prices (mainly crude oil due to market liquidity) with a time horizon of up to 24 months through the use of financial instruments (futures and option combinations), reducing the company's exposure to fluctuations in the price of this commodity. As a result, fuel expenses are not expected to suffer from massive fluctuations.

Additionally, through the investment in new aircrafts such as the A320neo and A321neo, more fuel efficient than the non neo aircrafts, with an average saving 15% per year in fuel versus the regular A320, one of the main objectives of Lufthansa is to decrease the amount of fuel consumed.

Taking all the above information into consideration, fuel costs were forecasted resorting to a simple linear regression computed from historical values, with fuel costs as a dependent variable and the price of fuel as an independent variable (*Appendix 3).*

Two different regressions were estimated, one for the Passenger Airlines Segments (Network Airlines and Eurowings Group, due to the lack of historical information on the former segment) and another to the Logistics segment, presented in *Equation 16* and *Equation 17* below, respectively.

Equation 16:

$$\text{Passenger Airlines Fuel Costs (€)} = 3095.5 + 43.20 * \text{Average Crude Oil Prices (€)}$$

Equation 17:

$$\text{Logistics Fuel Costs (€)} = 97.69 + 5.55 * \text{Average Crude Oil Prices (€)}$$

During the forecasted period, the oil price is assumed to be relatively constant, around $70 per barrel, with each year's price of crude oil ($) retrieved from estimates of the World Bank. Additionally, in line with the Bank of Canada forecasts, the euro/dollar exchange rate will oscillate between 1.23 and 1.09 during the period from 2018 until 2025. Considering all this information, the price of oil per barrel will be of around €60 during the predicted period.

According to this information, fuel costs for the Passenger Airlines and the Logistics segments were forecasted. At the end, a discount of 15% on the total amount spent in fuel was applied, due to the forecasted increase in fuel efficiency brought by the future acquisition of the A320neo and A321neo aircrafts.

At the segment level, it was assumed that 85% of the fuel costs of Passenger Airlines would be attributed to the Network Airlines and 15% to Point-to-Point Airlines, replicating the distribution of 2017.

Regarding the remaining components of material costs (fees & charges, operating leases and other material costs) it was assumed a future growth aligned with the revenue of that specific segment, based on a fixed average historical ratio of each component over the traffic revenue of the segment.

Staff Costs

While fuel costs have seen an overall decreasing tendency since 2012, surpassing wage and salaries costs during the period 2012-2014, this situation has seen a turning point due, on one hand due to the increase in employees and their demand for higher wages but also to an increase in the aircrafts fuel efficiency. Consequently, wage costs have surpassed fuel costs, accounting for €7 billion in 2017 versus €5.2 billion in fuel costs. In future years it is expected that this tendency will remain, with the further increase in aircraft fuel efficiency, as well as increase in employees and their nominal wages in line with expected inflation.

The value of wages and salaries has been calculated assuming the average wage per employee equal to €0.05 million in 2017 will increase at the inflation rate in future years. With the number of employees increasing at 1.03% (the average of the past 4 years growth in this variable), the future wages and salaries were consequently computed.

Regarding social security contributions, taking into consideration historical values, it was assumed to remain at 13.3% (last 3-year average) of total wage and salaries costs.

Expenses for pension plans and other employee benefits are mainly constituted by additions to the pension provisions. In 2016, it saw a decrease when comparing with 2015 after the restructuring retirement and transitional benefits the Lufthansa Passenger Airlines segment's cabin crew at. From 2016, these values are consequently expected to be lower than in previous years after the conversion of existing domestic retirement benefit commitments into defined-contribution schemes, transferring the risk to employee (as employees will set aside part of their income for their future pensions, instead of that being solely the responsibility of the employer as in defined benefit plans). In 2017, it registered a 711% increase relative to 2016 (from 27 to 219 million), consequence of lower savings from former service expenses *(Appendix 4).*

All the values per segment were consequently calculated through to the historical weight of each segment's cost out of total costs registered in 2017.

Depreciation and Amortization

Overall, the value of all amortisable and depreciable assets (intangible assets with an indefinite useful life, aircraft and reserve engines, property, plant and other equipment (PP&E) and long-term investments) was aligned with the overall Capital Expenditures forecasts of the firm.

Subsequently, considering an historical average of the ratio between overall depreciation and the value of amortisable and depreciable assets, a 9.6% depreciation ratio was obtained.

Taking this rate of depreciation into account, and the forecasted value of assets aligned with Capex, the expected costs of depreciation and amortization were computed *(Appendix 5).*

Depreciation and Amortization for each segment was consequently allocated to each one through the weight of that segment's revenues as a percentage of total revenues.

Bottom line, the firm's total expenses are represented in *Table 4,* with other operating expenses calculated as a per segment historical average of revenues.

Table 4: Operating Expenses

in million €	2017	2018E	2019F	2020F	2021F	2022F	2023F	2024F	2025F	2026F
Cost of materials and services	19,013	18,441	19,406	19,447	19,935	20,222	20,734	20,903	21,214	21,509
Staff Costs	8,172	8,497	8,797	9,108	9,439	9,781	10,137	10,505	10,887	11,282
D&A and Impairement	2,052	2,039	2,067	2,093	2,120	2,145	2,185	2,224	2,254	2,267
Other Operating Expenses	5,571	7,641	7,730	7,796	7,874	7,943	8,067	8,140	8,223	8,299
Total Expenses	34,808	36,618	38,001	38,443	39,368	40,091	41,123	41,772	42,578	43,357
yoy growth (%)	9.6%	5.2%	3.8%	1.2%	2.4%	1.8%	2.6%	1.6%	1.9%	1.8%

Source: Lufthansa, own computations

5.1.3 CAPEX

In the specific case of Lufthansa, Capex can be divided into 3 main groups:

- Primary Investments: down and final payments for aircrafts and aircraft repairs and equipment

- Secondary Investments: Capex for other PP&E items and intangible assets (for example licences and IT software)

- Financial Investments: cash outflows for share purchases, loans and fixed interest rate deposits

Primary investments are the most relevant of all investments, accounting for 82.04% of total Capex in 2017. The projected values were forecasted in line with the expected fleet expansion of Lufthansa, which is predicted grow from 728 aircrafts in 2017 to 798 in 2026, in line with Lufthansa's annual reports information. A ratio equal to the historical average of the total number of aircrafts over the historical capital expenditures on aircraft overhaul and equipment was then computed and assumed to remain in future years, with primary investments increasing consequently with total fleet.

Secondary investments were forecasted to increase with expected inflation, while financial investments were expected to grow as a fixed percentage of the firm's Total forecasted Revenue (*Appendix 7).*

In a further analysis, when comparing the levels of Capex with the amount of depreciation, it is possible to notice that, in steady stated, its value is higher than depreciation. This goes against the usual situation where, in steady state, the value of depreciation should be similar to the value

of Capex. However, in this case, this difference is justified by the continuous need of investment in new aircrafts and their maintenance (which allow for the continuity of the business and to promote its growth), as well as the overall increase in the prices of aircrafts throughout the years.

As a way to fundament this analysis, in *Appendix 6,* it is possible to observe historical values of Capex and depreciation of Lufthansa, as well as the ratio between the two, inferring consequently that, structurally, Capex tend to be higher than depreciation.

Additionally, as a justification to the overall increase in the prices of aircrafts, data on the historical prices of common airplanes in Lufthansa's fleet were retrieved from Airbus' website and are presented in *Appendix 8.* However, it is important to note that these are ask prices and, as a result, prices paid by airlines might differ.

5.1.4 Operating NWC

While Capex mainly focuses in evaluate the long-run, the operating Net Working Capital is a measure of the short-term liquidity of a company.

In order to compute a firm's Free Cash Flows, the change in the Net Working Capital is included in the calculations as a way to reflect the possible increase in the cash requirements of the company.

In the case of Lufthansa, a negative working capital has been registered throughout the last few years, with the firm's current liabilities surpassing current assets. This trend is expected to endure in future years, consequence of the expected growth in total revenues and the increase in the overall fleet, which will require the company to increase liabilities to suppliers in the short and long-term as a way to support this growth *(Appendix 9).*

5.1.5 Debt

Lufthansa, such as the majority of companies, takes both traded and non-traded debt. Consequently, to calculate the market value of debt of the firm, a sum of the non-traded portion of debt has to be converted to market values.

According to Lufthansa's 3rd Interim Report, evaluated at the 3rd of September 2018, the market value of non-current borrowing was €6,551 million. This included bonds (€1,043 million),

liabilities to banks (€2046 million) and financial leasing liabilities and other loans (€3,462 million). The market value of bonds was equal to its listed prices, while the market values of the remaining debt was based on market information of interest rates (until maturity) and the repayment structure of the company. This value was consequently assumed as an approximation to the market value of debt at the valuation date.

Additionally, in the specific case of airlines, the present value operating leases should also be added to the usual market value of debt. Since operating leases are recorded as an operating expense and not deducting them from the Enterprise Value might distort the real value of the company. The present value of future lease expenses, according to Lufthansa, were then computed, discounted at the firms' cost of debt (*Table 5*). A value of €2,966 million was reached.

Table 5: Present Value of Operating Leases

Maturity	Operating Lease Expenses	Discount Factor	Present Value
2018	528	-	-
2019	562	1.03	548
2020	562	1.05	534
2021	562	1.08	520
2022	562	1.11	507
2023	333	1.14	293
2024	333	1.17	285
2025	333	1.20	278
		PV Operating Leases	**2966**

Source: Lufthansa, own computations

5.1.6 Effective Tax Rate

Lufthansa faces various types of tax, such as income tax (corporation tax, the solidarity surcharge, trade tax and other income taxes paid outside Germany) and air-traffic tax, in many countries around the world (each with different tax and case laws). Due to this complexity, it is impossible, during the course of business, to evaluate tax liabilities with accuracy. Thus, material assumptions are essential to evaluate future income taxes, estimations corrected when actual values are available.

As a way to forecast future taxes expenses, Lufthansa uses an average 25.00% tax rate over the pre-tax profit of the parent company (value used in 2016 and 2017).

Taking all this information into account, it was the assumed that the future effective tax rate will be constant at 25% throughout the forecasted period.

5.1.7 Payout Policy

As a way to include the firm's shareholder's in the firms' success, in 2015, Lufthansa set a long-term target of the dividend payout ratio between 10% and 25% of EBIT.

Additionally, in the case the company shows an abnormally positive performance, special dividends or share buy-backs are allowed.

After no dividends paid in 2012 and 2014, Lufthansa's dividend payout ratio has reached its target in the following years, remaining, however, closer to its lower limit, with values of 10.3% and 11.4% in 2016 and 2017, respectively.

Taking all of this into account, it was assumed that the firm's payout ratio will remain stable in future years at a conservative level of 15%, considering this measure's historical values, as well as the positive outlook of Lufthansa.

5.1.8 WACC

Cost of Debt

The firm's cost of debt was calculated from the sum between the default credit spread of Lufthansa added to the risk-free rate. With a rating of BBB- according to Moody's, Lufthansa's corresponding default credit spread in line with Damodaran's website is 2.5% (for non-financial firms in developed markets and with a market capitalisation higher than $5 billion). Adding this value to the risk-free rate of 0.1%, it is possible to reach a cost of debt of 2.1%.

Cost of Equity

As mentioned in the literature review, one of the best methods to estimate a firms' cost of equity is through the CAPM model. With this purpose, three inputs are needed: Market Risk Premium,

risk free rate and the levered beta of the company, all explained below. Through the application of the CAPM formula, a cost of equity of 6.1% was obtained.

Risk Free

The value of risk-free rate used should be the one corresponding to the currency in which the valuation is performed. Taking this into account, the 10-year German government bunds' yield was used as a risk-free rate, at 0.1%.

Market Risk Premium

As for the Market Risk Premium, there is no consensus amongst authors on which value to use. In this specific case, a revenue weighted average of each region's MRP where Lufthansa operates, retrieved from Damodaran's Website was computed, yielding a value of 6.1%.

Beta

Through the formula, the levered beta will depend on the unlevered beta, the firm's target capital structure and the tax rate. With a target capital structure of D/E=1, a tax rate of 25% and the beta unlevered computed as the average of the unlevered betas of Lufthansa's peer group, the value of levered beta of Lufthansa reached was 0.93.

As for the beta of debt, due to the low market risk, it was assumed to be zero, a common assumption for firms with low risk of going bankrupt.

Capital Structure

The debt structure used should be the firms' target value at market value. According to Lufthansa's information, its target debt-to-equity ratio is 100%. As a result, it was assumed a constant debt-to-equity ratio of 1 for the forecasted period.

Taking into consideration all the information on the inputs to calculate this variable, a WACC of 4.04% was reached.

5.1.9 Free Cash Flows

With all the information, the Free Cash Flows to the Firm were computed. A relatively stable level of cash flows is expected for the forecasting period, evidencing, however, an overall decreasing tendency, result of an increasing Capex and decreasing EBIT*(1-t).

Table 6: FCFF forecasts

in million €	2017	2018E	2019F	2020F	2021F	2022F	2023F	2024F	2025F	2026F
EBIT*(1-t)	2,521	2,140	1,783	1,941	1,819	1,797	1,610	1,668	1,675	1,660
D&A	2,052	2,039	2,067	2,093	2,120	2,145	2,185	2,224	2,254	2,267
Δ Net Working Capital	-1,023	177	-122	-94	-58	-89	-74	-105	-103	-98
Capex	3,141	3,128	3,169	3,206	3,245	3,280	3,340	3,397	3,440	3,455
FCFF	2,455	873	804	921	753	752	530	600	593	571

Source: own computations

5.1.10 Terminal Value

Growth Rate

Regarding the growth rate, the first restriction was that, in perpetuity, it should not be higher than the expected growth of the overall economy (with GDP growth predicted to equal, according to the IMF, 3.6% worldwide and 2.1% in advanced economies). Additionally, with a prediction of continuously negative working capital, the growth of the firm will likely be low, as it may lack resources to finance future expansions. Furthermore, the expected growth rate of world population in 2018 is predicted to be 1.1%.

Considering all the above-mentioned information, a growth rate of 1% was considered the most suitable value to use in perpetuity.

To calculate the terminal value of the firm, a stable growth rate model was used once the company was considered to be in steady state (2026).

An average of the cash flows from 2013 to the end of the forecasting period was used as the cash flow input due to the cyclicality of the firm. WACC remained constant 4.04%, and the growth rate in perpetuity at 1%.

The terminal value obtained was of €18,260 million.

5.1.11 Target Price

After the deduction of net debt, operating leases and all non-equity claims (minority interests, and preferred shares) the fair market value of equity reached was €10,964 million. Dividing this value by the total amount of shares outstanding, a Fair Share Price of €23.07 for each trading share of Lufthansa was obtained, on the 31st of March 2019.

Table 7: Target Price Calculations

in million € (unless stated otherwise)	
Enterprise Value	23,425
(-) Net Debt	9,392
Market Value of Debt	6,551
Cash	2,328
Pension Provisions	5,169
(-) Minority Interests	103
(-) PV Operating Leases	2,966
(-) Preferred Shares	-
Market Value of Equity	10,964
Market Value of Equity (in €)	10,963,892,359
Number of Shares Outstanding (in units)	475,210,729
Share Fair Value (in €)	23.07

Source: own computations

5.1.12 Sensitivity Analysis

As a way to stress test some of the assumptions made in the afore mentioned valuation, a sensitivity analysis was performed, analysing the impact on Lufthansa's target share price.

Consequently, a breakdown of the impact of the WACC, the growth rate in perpetuity, the MRP and the beta levered on the share fair value was completed.

In the first analysis using the WACC and the perpetuity growth rate (which, in perpetuity should be lower than inflation), variations in these variables of 0.5% and 0.25%, respectively, were analysed. Being both of these variables extremely important in the computation of the terminal

value, an amount which accounts for a big part of the Enterprise Value, it was relevant to analyse the impact resulting from their variations.

The result of the overall analysis was an upside of 50.2% and a downside of 35.4% relatively to the target price achieved, with prices ranging from €34.6 to €14.9 (*Appendix 10*).

Additionally, an analysis of the variation of the MRP and the Levered Beta of the firm was also completed, leading to an upside of 43% and a downside of 34.5% relatively to the target price achieved, with prices ranging from €33.0 to €15.1 (*Appendix 11*).

5.2 Relative Valuation

As a complement to the DCF analysis, a relative valuation was performed, using for this purpose the Lufthansa Group consolidated values. This valuation was consequently used as a benchmark to the DCF valuation.

5.2.1 Peer Group

As a starting point, a primary set of data on 30 companies (including Lufthansa) was collected from Thomson Reuters, selected due to the presence of one or more of the following characteristics, in common with Lufthansa:

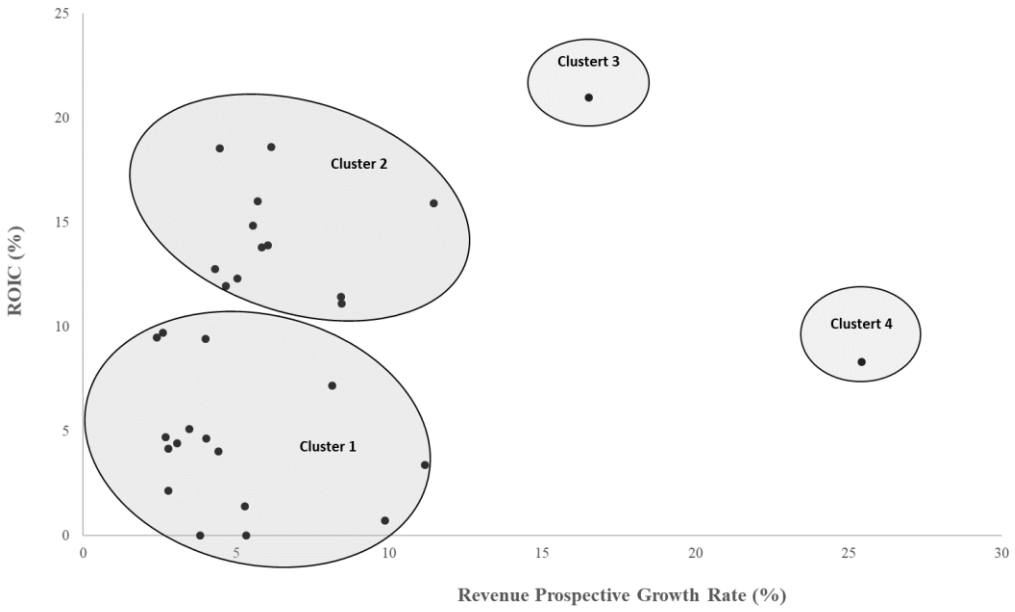
- same or similar industries
- related geographies and macro-economic indicators

Subsequently, to find Lufthansa's restricted peer group, measures of dimensions, profitability and risk were used to narrow down the original set of firms.

At a primordial level, a cluster analysis was undertaken considering two of the most important characteristics according to Goedhart *et al.* (2005): ROIC (measure of profitability) and revenue growth estimates (measure of prospective growth).

The result yielded a reduced group of 14 companies, composed by: Air Canada, Air France KLM, Air New Zealand, Alaska Air Group, American Airlines, Delta Air Lines, EasyJet, Finnair, International Consolidated Airlines Group (IAG), JetBlue Airways, Qantas Airways, Ryanair, Southwest Airlines, United Continental.

Figure 6: Cluster Analysis



Source: own computations

From all these 14 firms, 5 were afterwards excluded due to their different range of operations, comparing with Lufthansa's: Air Canada, Air New Zealand, Alaska Air, JetBlue and Southwest. The majority of these companies (all except for Air Canada and Air New Zealand) operate mainly in the US., focusing on the country's domestic routes, a sector in which Lufthansa is not allowed to operate due to US Legislation. This cabotage (i.e. the transportation inside the same country of goods and or passengers) legislation results in a US domestic market dominated by US Airlines. As for Air Canada and Air New Zealand, similar problems to the ones mentioned arise. Due to the above-mentioned reasons, these companies were excluded from the peer group.

With regard to Finnair, it was disregarded due to its much lower capacity (ASK[5] equal to 22.9 billion versus 209.8 billion of Lufthansa) and consequently, dimension (market capitalisation of €2.9 billion versus €11.03 billion of Lufthansa).

Additionally, after an overall market analysis, it is possible to note that there is one company which was excluded according to the two metrics (ROIC and revenue growth estimates) but that can also be considered as a peer: Turkish Airlines. After a 3rd quarter with abnormally high growth (30% year-on-year increase in revenues), the year-end expected growth rate of revenues

[5] **ASK:** Available Seat Kilometer

is expected to be extremely high, main reason for this company's peer group exclusion. However, in further years, this firm's growth will surely stabilise and consequently remain closer to the value of Lufthansa. Nevertheless, the fact that this firm has a Cargo, MRO and Catering segment similarly to Lufthansa, as well as relatively similar cash flow level (€1.09 billion versus €2.1 billion of Lufthansa) and capacity (ASK equal to 107 billion versus 209 billion of Lufthansa) makes it relevant to include in the peer group.

From this analysis, the pre-final Peer Group chosen was composed by 9 firms: Air France KLM, American Airlines, Delta Air Lines, EasyJet, IAG, Qantas, Ryanair, Turkish Airlines and United Continental.

However, considering the different models of business between Lufthansa and Ryanair, EasyJet and Qantas, a reduced peer group was used in further analysis, excluding these three companies

5.2.2 Multiples

Four forward looking multiples where subsequently retrieved from Thomson Reuters terminal for each of the peer groups: EV/Revenue, EV/EBITDA, EV/ EBIT and P/E. A simple average of each of the multiples was consequently computed and the result used as Lufthansa's multiple (*Table 8*).

Table 8: Forward looking multiples for each selected peer

Companies	EV / Revenue (NTM)	EV / EBITDA (NTM)	Price / EPS (NTM)	EV / EBIT (NTM)
Air France KLM	0.44	2.84	7.47	8.73
American Airlines Group	0.77	4.69	5.75	8.16
Delta Air Lines	0.92	4.80	7.75	6.89
EasyJet	0.71	5.55	10.98	-
International Consolidated Airlines (IAG)	0.55	3.17	6.33	4.64
Qantas Airways	0.69	3.82	8.81	7.88
Ryanair Holdings	1.79	7.89	12.85	11.57
Turkish Airlines	0.72	4.23	4.44	9.01
United Continental Holdings	0.80	4.86	7.67	7.80
Deutsche Lufthansa AG	0.82	4.65	8.01	8.08
Deutsche Lufthansa AG (Restricted Peer Group)	0.70	4.10	6.57	7.59

Source: Thomson Reuters

The target prices according to each multiple and peer group were subsequently calculated, considering the Revenue, EBITDA, EPS and EBIT forecasted for Lufthansa for the year 2019. The share prices achieved are presented in *Table 9.*

Table 9: Target prices according to each multiple and peer group

In €	EV / Revenue (NTM)	EV / EBITDA (NTM)	Price / EPS (NTM)	EV/EBIT (NTM)	Average
Peer Group	38.62	19.74	26.24	22.32	26.73
Restricted Peer Group	29.12	14.28	21.53	19.33	21.06

Source: own computations

A price range from €21.06 to €26.73 was reached, obtained from a simple the average of the upper and lower bound (Peer Group and Restricted Peer Group, respectively) of each multiple's valuation.

The target share price from resulting from this relative valuation was €23.9, the median value of the range obtained.

6. Equity Research Report Comparison

As a way of assessment and framing of the results of the analysis performed throughout this dissertation, a comparison with an Equity Research Report from Credit Suisse, dated from the August 1st, 2018, was performed.

Also resorting to a discounted cash flow analysis and a relative valuation, the Credit Suisse Research Analysts reached a target price of €30.58 from December 27th, 2018.

From a first look at the table in *Appendix 12,* it is possible to not that the time frame differs in terms of number of years forecasted, with the estimate presented by Credit Suisse being only until 2022 for Revenue, D&A, Capex and FCF and until 2020 for EBIT and Net Income.

When comparing both forecasts present in *Appendix 12*, the biggest disparity can be observed between the free cash flows which, in 2022 are forecasted by Credit Suisse to be more than double of this Dissertation's predictions (€1,876 million versus €752 million). In 2020, the forecasted EBIT also presents some differences, likely caused by lower values of forecasted operating expenses by the Research analysts. As for the level of Total Revenues and Capex similar values are forecasted by this Dissertation and the Equity Research Report.

Similar to Credit Suisse, a 50/50 weight was attributed to each model to find a final share price. With the final target price according to this Dissertation being €23.49 and, according to the Credit Suisse Report, it should be equal €30.59, both outperform the value on March 31st, 2019, equal to €19.56.

Overall, through the analysis of *Table 11*, indeed there is a large difference between the predictions of Credit Suisse and this Dissertation, being the former more optimistic in its forecasts. This disparity can be attributed to a higher WACC and terminal growth rate in the case of the DCF valuation. In the case of the multiples approach, the use of different multiples (EV/IC and EV/EBITDAR) might have been a reason for the difference in results.

Table 10: Valuation comparison between the Dissertation and the Equity Research Report

	Dissertation	**Equity Research Report**
Method	DCF / Forward Multiples	DCF / Forward Multiples
WACC	4.04%	8.50%
Terminal growth rate	1%	2%
Price Target DCF	€23.07	€28.09
Price Target Multiples	€23.90	€33.08
Weight of each method	50%	50%
Price Target	**€23.49**	**€30.59**

Source: Equity Research Report; own computations

7. Conclusion

The purpose of this Dissertation was to evaluate if the share price of the German Airline operator, Deutsche Lufthansa AG, was fairly priced in the market on the 31st of March 2019.

With this purpose, this valuation was performed resorting to two different valuation methods, the Discounted Cash Flow valuation and the Multiples valuation, found to be the most adequate to value this company. A careful choice of assumptions was afterward conducted, with the objective to obtain the most accurate valuation possible, taking into consideration both macroeconomic, financial and operating conditions. Furthermore, the uncertainty regarding some volatile variables, such as the terminal growth rate and the WACC, was examined through the elaboration of a sensitivity analysis, evidencing the great impact of both in the target price.

With a fair share value, according to this dissertation equal to €23.49 (obtained as a 50/50 weighted average between the DCF valuation price target of €23.07 and the Relative valuation price target of €23.90), compared with the actual price of the share on the 31st of March 2019, equal to €19.56, a 20% upside potential was registered.

Subsequently, a comparison with a Credit Suisse Equity Research Report showed this Dissertation's valuation to be comparatively more conservative, with the former yielding a €30.59 share fair price.

Taking all of this into consideration, as well as an overall positive outlook to the aviation industry, a HOLD/BUY recommendation is given to Deutsche Lufthansa AG share.

8. Appendices

Appendix 1: Valuation Models

1.1 Asset-Based Valuation

Damodaran (2002) explains that the asset-based valuation bases itself in book value and accounting estimates to obtain the value of the firm's assets, living through two different methods: liquidation value and replacement cost.

1.1.1 Liquidation Value

The liquidation value method values the assets of the company, considering the prices of similar assets currently in the market. Essentially, it estimates how much would it yield if the company's assets were to be sold in the future, after finishing operations. Damodaran (2006) highlights that this method should yield a value equal to the one obtained with a DCF valuation of the individual assets however, an urgency sale discount must be applied.

1.1.2 Replacement Cost

The replacement cost approach provides an estimate of the firm's value through the calculation of the cost of replacing all the assets currently held by the firm. Damodaran (2002).

A disadvantage of these methods is its static view of reality, ignoring possible future gains or losses. Additionally, they exclude situations which are not reflected in the firms' financial reports, such as the current industry status, for example (Fernandez, 2007).

1.2. Multiples

1.2.1 Earnings Multiples

According to Damodaran (2002), "firms with higher growth, lower risk and higher payout ratios, with other things remaining equal, should trade at much higher multiples of earnings than other firms".

Two disadvantages of earnings ratios are the fact that they cannot be employed when a firm has negative earnings and that they depend on the firm's accounting decisions.

P/E – Price to Earnings Ratio

$$\text{PE} = \frac{\text{Market Price per share}}{\text{Earnings per share}}$$

Damodaran (2002) refers to the P/E multiple (or PER) as the "most widely used and misused of all". It is an equity value multiple (measure of equity earning, both in the numerator and denominator) which links the value of the firm to its profits, giving the estimated amount an investor should invest to receive one euro of the earnings of the firm.

Even though P/E is such a popular ratio due to its easiness to compute, Goedhart *et al.* (2005) highlight two flaws of this method: the fact that it is dependent on the firm's capital structure and dependent on earnings, which can lead to misleading results. As an alternative, the authors advise that enterprise-value multiples ought to be used instead.

Consequently, this ratio is more suitable for stables companies with small growth and positive earnings.

EV/EBITDA – Enterprise Value to EBITDA Ratio

$$\text{EV/EBITDA} = \frac{\text{Enterprise Value}}{\text{EBITDA}}$$

$$\text{EV/EBITDA} = \frac{\text{Market Value of Equity} + \text{Market Value of Debt} - \text{Cash}}{\text{EBITDA}}$$

Through the enterprise value to EBITDA ratio, it is possible to calculate the firm's value, which considers not only the equity but also the debt of the company.

This multiple yields several advantages when compared to other methods, such as not being affected by the differences in depreciation (Damodaran, 2002) nor the differences in capital structure (being the ratio given by the firm value to pre-debt earnings) (Goedhart *et al.* 2005) of the different firms.

EV/EBITDA is particularly useful to value "firms in sectors that require large investments in infrastructure with long gestation periods" (Damodaran, 2002).

1.2.2 Book Value Multiples

Book value multiples are useful to value companies with several assets. They are used by investors due to its stability and intuitive measure of value. Moreover, firms with negative earnings can be evaluated through this method, contrary to the afore mentioned earnings' ratios (Price/Book Value).

However, some disadvantages are the fact that these ratios are affected by accounting decisions and are not a good measure of value for firms with many intangible assets.

PBV – Price to Book Value Ratio

$$\text{Price to Book Ratio} = \text{PBV} = \frac{\text{Market Value of Equity}}{\text{Book value of equity}}$$

This equity value multiple can be calculated in a per share basis or company basis, yielding the same result through both ways.

PBV is suitable to use in low growth, conservative firms, becoming meaningless when inflation is high.

1.2.3 Revenue Multiples

Revenue multiples measure the equity or firm value relative to its revenues. For interpretation purposes, low revenue multiples are associated with cheap companies when comparing with firms with higher multiples (Damodaran, 2002).

These multiples are a good alternative to earnings multiples when the earnings of a company are negative. Additionally, the fact that they do not depend on accounting values makes them more unbiased, with revenues being hard to manipulate. Its lower sensitivity to economic fluctuations is also an advantage when compared with earnings, making these multiples useful to value cyclical firms.

However, this measure also has a downside as high revenues are not enough condition to deduct that a firm is profitable, considering it might not be generating earning cash flows, needed for a firm's survival.

EV/Sales – Enterprise Value to Sales

$$\text{Enterprise Value to Sales Ratio} = \frac{\text{Market Value of Equity} + \text{Market Value of Debt} - \text{Cash}}{\text{Revenues}}$$

Widely used, and more robust than the price to sales ratio, the enterprise value to sales ratio compares the value of both debt and equity of the firm to its revenues. Its robustness comes from the fact that by netting off cash, the multiple is consistent, as the income from cash is not accounted in revenue (Damodaran, 2002).

1.3. Contingent Claim Valuation

The contingent claim valuation employs option pricing models to compute a firm's value of assets. This approach was created as a response to the lack of acknowledgement of future business opportunities (which, at a financial level, can be compared with options) by the existing valuation methods, bringing flexibility into the equation: "When comparing across investments, the traditional approach of picking the model with the highest return or net present value may short-change investments that offer a firm more flexibility in operations and investing" (Damodaran, 2005).

As Luehrman (1997) highlights, "for some firms, opportunities are the most valuable things they own". This is the case of companies in fast-growing markets, companies with new technologies and product development opportunities, as well as firms with potential access to new markets. One specific example are firms which function based on the exploitation of commodities.

As a result, the fact that some firms' assets have features of options, contingent on future happenings, makes this model more accurate to use in certain valuations, complementing (though not substituting) the valuations obtained with other methods Damodaran (2002). The resulting valuation is usually higher when compared with other valuations due to the accountability of options not evaluated by the latter.

A disadvantage of these methods, when comparing to others is the difficulty and impracticality of implementation: the truth is that the valuation of real businesses is more difficult than the valuation of simple options, calls and puts (Luehrman, 1997).

Appendix 2: Lufthansa Key Data and Metrics

in million € (unless stated otherwise)	2012	2013	2014	2015	2016	2017	Q3-2018
Total Revenue	30,135	30,027	30,011	32,056	31,660	35,579	26,897
yoy growth (%)		-0.4%	-0.1%	6.8%	-1.2%	12.4%	-
Total Expenses	31,411	31,377	31,234	33,536	31,749	34,808	25,914
yoy growth (%)		-0.1%	-0.5%	7.4%	-5.3%	9.6%	-
Gross profit margin (%)	40.4%	41.7%	42.4%	45.0%	46.0%	46.6%	49.7%
EBITDA	3,461	2,618	2,407	3,270	3,959	5,205	3,737
EBITDA margin (%)	11.5%	8.7%	8.0%	10.2%	12.5%	14.6%	13.9%
EBIT	1,716	975	1,000	1,676	2,275	3,310	2,361
EBIT margin (%)	5.7%	3.2%	3.3%	5.2%	7.2%	9.3%	8.8%
Net Profit/Loss	1,228	313	55	1,698	1,776	2,364	1,742
Effective Tax Rate (%)	7.0%	40.3%	58.3%	15.0%	19.8%	24.8%	22.0%
Operating Cash Flow	2,842	3,290	1,977	3,393	3,246	5,035	3,771
CAPEX	2,359	2,470	2,759	2,545	2,194	3,141	2,494
PP&E	2,081	2,059	2,109	2,173	2,199	2,186	2,180
Total Liabilities	23,720	23,000	26,443	26,617	27,548	26,669	27,802
Total Assets	28,559	29,108	30,474	32,462	34,697	36,267	39,247
Shareholder's Equity	4,839	6,108	4,031	5,845	7,149	9,598	11,445
Equity Ratio (%)	16.9%	21.0%	13.2%	18.0%	20.6%	26.5%	29.2%
ROE (%)	25.4%	5.1%	1.4%	29.1%	24.8%	24.6%	15.2%
ROIC (%)	10.9%	4.0%	2.4%	7.5%	9.0%	12.5%	15.9%
Adjusted Net Debt	7,778	6,393	10,649	9,973	11,065	8,000	7,278
D/E at Book Values (%)	160.7%	104.7%	264.2%	170.6%	154.8%	83.4%	63.6%
Market Capitalisation	6,550	7,110	6,400	6,766	5,752	14,477	11,680
Market Value of Adjusted Net Debt	9,340	8,227	11,465	11,489	11,886	8,756	8,033
D/E at Market Values (%)	142.6%	115.7%	179.1%	169.8%	206.6%	60.5%	68.8%
Total Passengers (million)	104	105	106	108	110	130	109
Number of Flights (million)	1.067	1.028	1.002	1.004	1.022	1.130	925
Aircrafts in Service (units)	627	622	615	600	617	728	-
Passenger Load Factor (%)	78.8%	79.8%	80.1%	80.4%	79.1%	80.9%	82.0%
Cargo Load Factor (%)	69.7%	69.9%	69.7%	66.3%	66.8%	69.1%	66.4%

Source: Thomson Reuters

Appendix 3: Fuel Costs

in million € (unless stated otherwise)	**2017**	**2018E**	**2019F**	**2020F**	**2021F**	**2022F**	**2023F**	**2024F**	**2025-26F**
Crude oil (average price/Barrel $)	52.8	72	74	69	69.1	69.2	69.3	69.4	69.5
FX Rate Euro/USD	1.20	1.15	1.23	1.23	1.15	1.13	1.09	1.13	1.13
Crude oil (average price/Barrel $)	44.0	62.8	60.2	56.1	60.3	61.1	63.3	61.4	61.5
Passenger Fuel Costs	4,905	4,936	4,841	4,691	4,846	4,875	4,957	4,887	4,890
yoy change (%)	0.6%	-1.9%	-3.1%	3.3%	0.6%	1.7%	-1.4%	0.1%	0.1%
Network Airlines Fuel Costs	4,172	4,199	4,559	4,418	4,564	4,592	4,669	4,603	4,606
Eurowings Fuel Costs	259	379	367	348	368	371	382	373	373
Logistics Fuel Costs	259	379	367	348	368	371	382	373	373
yoy change (%)	46.4%	-3.2%	-5.2%	5.7%	1.0%	2.8%	-2.4%	0.1%	-

Source: Lufthansa Annual Report 2017; World Bank; Bank of Canada; own computations

Appendix 4: Staff Costs

in million € (unless stated otherwise)	2017	2018E	2019F	2020F	2021F	2022F	2023F	2024F	2025F	2026F
Wages and Salaries	7,015	7,300	7,560	7,829	8,115	8,413	8,720	9,040	9,370	9,713
yoy change (%)	8.3%	4.1%	3.6%	3.6%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%
% of operational expenses	20.2%	19.9%	19.9%	20.4%	20.6%	21.0%	21.2%	21.6%	22.0%	22.4%
Average Wage per employee	**0.05**	**0.06**	**0.06**	**0.06**	**0.06**	**0.06**	**0.06**	**0.07**	**0.07**	**0.07**
yoy change of average wage/employee (%)	3.6%	3.0%	2.5%	2.5%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%
Social Security Contributions	938	971	1006	1042	1080	1119	1160	1203	1247	1293
yoy change (%)	10.5%	3.6%	3.6%	3.6%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%
Contributions per employee	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**
% of Wages and Salaries	13.4%	13.3%	13.3%	13.3%	13.3%	13.3%	13.3%	13.3%	13.3%	13.3%
Expenses for pension plans	219	226	231	237	243	249	256	263	269	276
yoy change (%)	711.1%	3.0%	2.5%	2.5%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%
Expenses per employee	**0.002**	**0.002**	**0.002**	**0.002**	**0.002**	**0.002**	**0.002**	**0.002**	**0.002**	**0.002**
Total Staff Costs	8,172	8,497	8,797	9,108	9,439	9,781	10,137	10,505	10,887	11,282
yoy change (%)	11.1%	4.0%	3.5%	3.5%	3.6%	3.6%	3.6%	3.6%	3.6%	3.6%
Employees (in units)	128,856	130,187	131,532	132,891	134,264	135,651	137,053	138,469	139,899	141,344
yoy change (%)	4.5%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Total Revenue / Number of employees	**0.28**	**0.28**	**0.28**	**0.29**	**0.29**	**0.29**	**0.29**	**0.29**	**0.30**	**0.30**

Source: Lufthansa Annual Report 2017; own computations

Appendix 5: Depreciation

in million € (unless stated otherwise)	2017	2018E	2019F	2020F	2021F	2022F	2023F	2024F	2025F	2026F
Balance Sheet Values of assets										
Intangible assets with an indefinite useful life (including goodwill and other intangible assets)	1,835	1,683	1,725	1,768	1,814	1,862	1,910	1,960	2,011	2,063
as a % of Intangible Assets Capex	17.31	15.42	15.42	15.42	15.42	15.42	15.42	15.42	15.42	15.42
Aircraft and reserve engines	15,959	16,156	16,332	16,485	16,639	16,770	17,055	17,318	17,494	17,494
as a % of Aircraft Overhaul and Equipment Capex	6.19	6.19	6.19	6.19	6.19	6.19	6.19	6.19	6.19	6.19
Property, plant and other equipment	2,186	2,192	2,247	2,303	2,363	2,425	2,488	2,552	2,619	2,687
as a % of PP&E Capex	6.8	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
Long Term Investments	838	1,114	1,138	1,156	1,176	1,194	1,215	1,234	1,256	1,276
as a % of Financial Investments Capex	6.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2
Sum of balance sheet items	20,818	21,146	21,442	21,712	21,992	22,251	22,668	23,064	23,379	23,519
Income Statement Values										
Depreciation, Amortization and Impairement	2,052	2,039	2,067	2,093	2,120	2,145	2,185	2,224	2,254	2,267
as a % of depreciable and amortizable assets	9.9%	9.6%	9.6%	9.6%	9.6%	9.6%	9.6%	9.6%	9.6%	9.6%

Source: Lufthansa Annual Report 2017; own computations

Appendix 6:: Relationship between Capex and Depreciation

in million € (unless stated otherwise)	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
D&A and impairment	1,289	1,475	1,654	1,722	1,839	1,767	1,528	1,715	1,769	2,052
Capex	2,152	2,304	2,271	2,560	2359	2470	2759	2545	2194	3141
Capex/Depreciation	1.7	1.6	1.4	1.5	1.3	1.4	1.8	1.5	1.2	1.5

Source: Lufthansa Annual Report 2017; own computations

Appendix 7: Capex Forecasts

in million € (unless stated otherwise)	2017	2018E	2019F	2020F	2021F	2022F	2023F	2024F	2025F	2026F
Primary Investments										
Aircraft Overhaul and Equipment	2,577	2,609	2,637	2,662	2,687	2,708	2,754	2,796	2,825	2,825
yoy change (%)	51.9%	1.2%	1.1%	0.9%	0.9%	0.8%	1.7%	1.5%	1.0%	0.0%
Number of aircrafts	728	737	745	752	759	765	778	790	798	798
Number of aircrafts / Capex in Aircraft Overhaul and Equipment	28.2%	28.2%	28.2%	28.2%	28.2%	28.2%	28.2%	28.2%	28.2%	28.2%
Secondary Investments										
Property, plant and equipment	322	332	340	348	358	367	376	386	396	406
yoy change (%)	-6.7%	3.0%	2.5%	2.5%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%
Intangible Assets	106	109	112	115	118	121	124	127	130	134
yoy change (%)	-10.9%	3.0%	2.5%	2.5%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%
Financial Investments										
Financial Investments	136	78	80	81	83	84	85	87	88	90
yoy change (%)	300.0%	42.4%	2.2%	1.5%	1.8%	1.6%	1.7%	1.6%	1.8%	1.6%
as a % total revenue	0.4%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Total Capex	3,141	3,128	3,169	3,206	3,245	3,280	3,340	3,397	3,440	3,455
yoy change (%)	43.2%	-0.4%	1.3%	1.2%	1.2%	1.1%	1.8%	1.7%	1.3%	0.4%
as a % of total revenues	8.8%	8.5%	8.5%	8.4%	8.4%	8.3%	8.3%	8.4%	8.3%	8.2%

Source: Lufthansa Annual Report 2017; own computations

Appendix 8: Historical ask prices of Lufthansa's most common Airbus Aircrafts

in $	2012	2013	2014	2015	2016	2017	2018
A319	80.7	83.6	85.8	88.6	89.6	90.5	92.3
A320	88.3	91.5	93.9	97	98	99	101
A319neo	88.8	92	94.4	97.5	98.5	99.5	101.5
A320neo	96.7	100.2	102.8	106.2	107.3	108.4	110.6

Source: Airbus Price List Press Release (2012-2018)

Appendix 9: NWC Forecasts

as a % of total revenue	2017	2018E	2019	2020P	2021P	2022P	2023P	2024P	2025P	2026P
Current Assets										
Inventories	907	935	955	970	987	1,002	1,020	1,036	1,054	1,071
yoy change (%)	11%	3%	2%	2%	2%	2%	2%	2%	2%	2%
as a % of total revenue	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Trade receivables and other receivables	5,314	5,263	5,379	5,461	5,557	5,644	5,742	5,832	5,935	6,030
yoy change (%)	16%	-1%	2%	2%	2%	2%	2%	2%	2%	2%
as a % of total revenue	15%	14%	14%	14%	14%	14%	14%	14%	14%	14%
Deferred charges and prepaid expenses	197	192	197	200	203	206	210	213	217	220
yoy change (%)	18%	-2%	2%	2%	2%	2%	2%	2%	2%	2%
as a % of total revenue	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Effective income tax receivables (Tax Assets)	58	22	9	3	34	38	54	45	37	40
yoy change (%)	57%	-62%	-58%	-67%	1025%	11%	42%	-16%	-18%	9%
as a % of EBIT	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Assets held for sale	6	92	94	95	96	97	99	100	102	102
yoy change (%)	-95%	1440%	1%	1%	1%	1%	2%	2%	1%	0%
as a % of total capex	0%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Current Liabilities										
Other Provisions	990	1,133	1,158	1,175	1,196	1,215	1,236	1,255	1,277	1,298
yoy change (%)	-7%	14%	2%	2%	2%	2%	2%	2%	2%	2%
as a % of total revenue	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Trade payables and other financial liabilities	5,250	5,461	5,582	5,667	5,767	5,857	5,959	6,052	6,159	6,257
yoy change (%)	12%	4%	2%	2%	2%	2%	2%	2%	2%	2%
as a % of total revenue	15%	15%	15%	15%	15%	15%	15%	15%	15%	15%
Liabilities from unused flight documents	3,773	3,575	3,655	3,710	3,776	3,834	3,901	3,963	4,032	4,097
yoy change (%)	24%	-5%	2%	2%	2%	2%	2%	2%	2%	2%
as a % of total revenue	11%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Advance payments received, deferred income and other non-financial liabilities	992	1,028	1,045	1,067	1,079	1,103	1,115	1,140	1,153	1,178
yoy change (%)	13%	4%	2%	2%	1%	2%	1%	2%	1%	2%
as a % of total revenue	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Effective income tax obligations	838	490	501	509	518	526	535	543	553	562
yoy change (%)	115%	-41%	2%	2%	2%	2%	2%	2%	2%	2%
as a % of total revenue	2%	1%	1%	1%	1%	1%	1%	1%	1%	1%
Liabilities related to assets held for sale	0	0	0	0	0	0	0	0	0	0
Total										
Working Capital	-5,361	-5,184	-5,306	-5,400	-5,458	-5,547	-5,622	-5,727	-5,830	-5,928
yoy change (%)	24%	-3%	2%	2%	1%	2%	1%	2%	2%	2%
Variation in Working Capital	-1,023	177	-122	-94	-58	-89	-74	-105	-103	-98
yoy change (%)	-852%	-117%	169%	-23%	-38%	53%	-17%	41%	-2%	-5%

Source: Lufthansa Annual Report 2017; own computations

Appendix 10: Sensitivity Analysis Through WACC and the Perpetuity Growth Rate

		Growth Rate				
	23.07	0.50%	0.75%	1.00%	1.25%	1.50%
WACC	3.04%	34.6	40.1	46.8	55.5	66.9
	3.54%	24.7	28.3	32.6	37.8	44.3
	4.04%	17.6	20.2	23.07	26.5	30.6
	4.54%	12.3	14.2	16.3	18.7	21.5
	5.04%	8.2	9.6	11.1	12.9	14.9

Source: own computations

Appendix 11: Sensitivity Analysis Through MRP and the Beta Levered

		MRP				
	23.07	6.00%	6.25%	6.47%	6.75%	7.00%
Beta Levered	0.83	33.0	30.7	28.8	26.6	24.7
	0.88	29.7	27.5	25.8	23.7	21.9
	0.93	26.8	24.7	23.07	21.1	19.4
	0.98	24.2	22.2	20.6	18.7	17.2
	1.03	21.8	19.9	18.4	16.6	15.1

Source: own computations

Appendix 12: Comparison of the forecasts of selected variables between the Dissertation and the Equity Research Report

in million €	2018E	2019F	2020F	2021F	2022F	2023F	2024F	2025F	2026F
Total Revenues									
Dissertation	36,663	37,474	38,043	38,716	39,319	40,002	40,632	41,349	42,008
Equity Research Report	35,618	37,109	38,388	39,655	40,919	-	-	-	-
EBIT									
Dissertation	2,853	2,378	2,588	2,426	2,396	2,147	2,224	2,234	2,213
Equity Research Report	2,884	3,113	3,409	-	-	-	-	-	-
D&A									
Dissertation	2,039	2,067	2,093	2,120	2,145	2,185	2,224	2,254	2,267
Equity Research Report	1,821	1,837	1,862	1,888	1,916	-	-	-	-
Capex									
Dissertation	-3,128	-3,169	-3,206	-3,245	-3,280	-3,340	-3,397	-3,440	-3,455
Equity Research Report	-3,400	-3,300	-3,300	-3,400	-3,500	-	-	-	-
Net Income									
Dissertation	1,924	1,562	1,714	1,587	1,560	1,365	1,415	1,417	1,398
Equity Research Report	2,005	2,326	2,563	-	-	-	-	-	-
Free Cash Flow									
Dissertation	873	804	921	753	752	530	600	593	571
Equity Research Report	1,196	1,355	1,647	1,782	1,876	-	-	-	-

Source: Equity Research Report; own computations

Appendix 13: Income Statement Forecasts

in million €	2017	2018E	2019F	2020F	2021F	2022F	2023F	2024F	2025F	2026F
Traffic Revenue	28,399	28,804	29,482	29,823	30,232	30,587	31,015	31,384	31,832	32,216
Other Revenue	7,180	7,859	7,992	8,220	8,484	8,732	8,987	9,248	9,517	9,792
Total Revenue	35,579	36,663	37,474	38,043	38,716	39,319	40,002	40,632	41,349	42,008
yoy change (%)	12.4%	3.0%	2.2%	1.5%	1.8%	1.6%	1.7%	1.6%	1.8%	1.6%
Changes in inventories	106	106	106	106	106	106	106	106	106	106
Other Operating Income	2,276	2,507	2,603	2,687	2,777	2,868	2,968	3,062	3,162	3,261
Total Other Operating Income	2,382	2,613	2,709	2,793	2,883	2,974	3,074	3,168	3,268	3,367
Cost of materials and services	-19,013	-18,441	-19,406	-19,447	-19,935	-20,222	-20,734	-20,903	-21,214	-21,509
Staff Costs	-8,172	-8,497	-8,797	-9,108	-9,439	-9,781	-10,137	-10,505	-10,887	-11,282
Wages and salaries	-7,015	-7,300	-7,560	-7,829	-8,115	-8,413	-8,720	-9,040	-9,370	-9,713
Social security contributions	-938	-971	-1,006	-1,042	-1,080	-1,119	-1,160	-1,203	-1,247	-1,293
Expenses for pension plans	-219	-226	-231	-237	-243	-249	-256	-263	-269	-276
Depreciation, Amortization and Impairement	-2,052	-2,039	-2,067	-2,093	-2,120	-2,145	-2,185	-2,224	-2,254	-2,267
Other Operating Expenses	-5,571	-7,641	-7,730	-7,796	-7,874	-7,943	-8,067	-8,140	-8,223	-8,299
Total Expenses	-34,808	-36,618	-38,001	-38,443	-39,368	-40,091	-41,123	-41,772	-42,578	-43,357
yoy change (%)	9.6%	5.2%	3.8%	1.2%	2.4%	1.8%	2.6%	1.6%	1.9%	1.8%
Profit/ Loss from Operating Activities	3,153	2,658	2,183	2,393	2,231	2,201	1,952	2,029	2,039	2,018
Result of equity investments accounted for using the equity method	118	156	156	156	156	156	156	156	156	156
Result of other equity investments	39	39	39	39	39	39	39	39	39	39
EBIT	3,310	2,853	2,378	2,588	2,426	2,396	2,147	2,224	2,234	2,213
Interest Income	178	178	178	178	178	178	178	178	178	178
Interest Expenses	-373	-432	-437	-443	-448	-453	-461	-469	-475	-478
Other Financial Items	72	72	72	72	72	72	72	72	72	72
Financial Result	34	13	8	2	-3	-8	-16	-24	-30	-33
Profit/Loss before income taxes	3,187	2,672	2,190	2,395	2,228	2,193	1,936	2,005	2,009	1,985
Income Taxes	-789	-713	-594	-647	-606	-599	-537	-556	-558	-553
Profit/Loss after income taxes	2,398	1,958	1,596	1,748	1,621	1,594	1,399	1,449	1,451	1,432
Profit/Loss attributable to minority interest	-34	-34	-34	-34	-34	-34	-34	-34	-34	-34
Net Profit/Loss attributable to shareholders of Deutsche Lufthansa AG	2,364	1,924	1,562	1,714	1,587	1,560	1,365	1,415	1,417	1,398
Effective tax rate	25%	25%	25%	25%	25%	25%	25%	25%	25%	25%
Basic/ diluted earnings per share in € - EPS	5.03	4.07	3.28	3.57	3.28	3.20	2.78	2.87	2.85	2.79

Source: Lufthansa Annual Report 2017; own computations

Appendix 14: Balance Sheet Forecasts

in million €	2017	2018E	2019F	2020F	2021F	2022F	2023F	2024F	2025F	2026F
Intangible assets with an indefinite useful life	1,343	1,232	1,263	1,294	1,328	1,362	1,398	1,434	1,472	1,510
Other intangible assets	492	451	463	474	486	499	512	525	539	553
Aircraft and reserve engines	15,959	16,156	16,332	16,485	16,639	16,770	17,055	17,318	17,494	17,494
Repairable spare parts for aircraft	1,758	1,473	1,489	1,503	1,517	1,529	1,555	1,579	1,595	1,595
Property, plant and other equipment	2,186	2,192	2,247	2,303	2,363	2,425	2,488	2,552	2,619	2,687
Long Term Investments	838	1,114	1,138	1,156	1,176	1,194	1,215	1,234	1,256	1,276
Loans and Receivables	475	475	475	475	475	475	475	475	475	475
Derivative financial instruments	642	642	642	642	642	642	642	642	642	642
Deferred charges and prepaid expenses	9	18	15	16	15	15	14	14	14	14
Effective income tax receivables	12	18	15	16	15	15	14	14	14	14
Deferred tax assets	1,523	1,569	1,604	1,628	1,657	1,683	1,712	1,739	1,770	1,798
Non-Current Assets	25,237	25,341	25,682	25,994	26,314	26,610	27,079	27,528	27,889	28,057
Inventories	907	935	955	970	987	1,002	1,020	1,036	1,054	1,071
Trade receivables and other receivables	5,314	5,263	5,379	5,461	5,557	5,644	5,742	5,832	5,935	6,030
Derivative financial instruments	600	600	600	600	600	600	600	600	600	600
Deferred charges and prepaid expenses	197	192	197	200	203	206	210	213	217	220
Effective income tax receivables	58	22	9	3	34	38	54	45	37	40
Securities	2,551	2,551	2,551	2,551	2,551	2,551	2,551	2,551	2,551	2,551
Cash and cash equivalents	1,397	2,328	1,713	1,576	1,145	865	312	42	-212	-349
Assets held for sale	6	92	94	95	96	97	99	100	102	102
Current Assets	11,030	11,983	11,498	11,455	11,173	11,003	10,587	10,420	10,284	10,266
Total Assets	**36,267**	**37,324**	**37,180**	**37,449**	**37,487**	**37,613**	**37,666**	**37,947**	**38,173**	**38,323**
Issued Capital	1,206	1,215	1,223	1,232	1,241	1,250	1,258	1,267	1,276	1,286
Capital Reserve	263	263	263	263	263	263	263	263	263	263
Retained Earnings	4,141	3,803	3,521	3,214	2,927	2,643	2,388	2,125	1,860	1,598
Reclassification		1,588	1,628	1,669	1,712	1,757	1,802	1,849	1,897	1,946
Other neutral reserves	1,521	1,521	1,521	1,521	1,521	1,521	1,521	1,521	1,521	1,521
Net Profit/Loss	2,364	1,924	1,562	1,714	1,587	1,560	1,365	1,415	1,417	1,398
Equity attributable to shareholders	9,495	10,314	9,718	9,613	9,251	8,993	8,599	8,441	8,234	8,012
Minority interests	103	103	103	103	103	103	103	103	103	103
Shareholders' Equity	9,598	10,417	9,821	9,716	9,354	9,096	8,702	8,544	8,337	8,115
Pension Provisions	5,116	5,169	5,222	5,276	5,331	5,386	5,441	5,498	5,554	5,612
Other provisions	601	601	614	624	635	645	656	666	678	689
Borrowings	6,142	6,001	6,082	6,156	6,231	6,302	6,413	6,519	6,604	6,644
Other financial liabilities	243	243	243	243	243	243	243	243	243	243
Advance payments received	1,289	1,316	1,343	1,372	1,400	1,429	1,459	1,490	1,521	1,553
Derivative financial intruments	190	190	190	190	190	190	190	190	190	190
Deferred tax liabilities	449	463	473	480	489	496	505	513	522	530
Non-current provisions and liabilities	14,030	13,983	14,168	14,340	14,519	14,691	14,907	15,118	15,313	15,461
Other provisions	990	1,133	1,158	1,175	1,196	1,215	1,236	1,255	1,277	1,298
Borrowings	672	1,112	1,127	1,141	1,155	1,168	1,188	1,208	1,224	1,231
Trade payables and other financial liabilities	5,250	5,461	5,582	5,667	5,767	5,857	5,959	6,052	6,159	6,257
Liabilities from unused flight documents	3,773	3,575	3,655	3,710	3,776	3,834	3,901	3,963	4,032	4,097
Advance payments received,	992	1,028	1,045	1,067	1,079	1,103	1,115	1,140	1,153	1,178
Derivative financial intruments	124	124	124	124	124	124	124	124	124	124
Effective income tax obligations	838	490	501	509	518	526	535	543	553	562
Liabilities related to assets held for sale	0	0	0	0	0	0	0	0	0	0
Current provisions and liabilities	12,639	12,924	13,191	13,393	13,614	13,826	14,058	14,285	14,523	14,747
Total Liabilities	26,669	26,906	27,359	27,733	28,133	28,517	28,965	29,404	29,835	30,208
Total shareholders' equity and liabilities	**36,267**	**37,324**	**37,180**	**37,449**	**37,487**	**37,613**	**37,666**	**37,947**	**38,173**	**38,323**

Source: Lufthansa Annual Report 2017; own computations

Appendix 15: Inflation Forecasts

in %	2018E	2019F	2020F	2021F	2022F	2023F	2024F	2025F	2026F
World Inflation Rate	3.0%	2.5%	2.5%	2.6%	2.6%	2.6%	2.6%	2.6%	2.6%

Source: Pwc - Global Economy Watch - Projections

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