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AIRLINE INDUSTRY REPORT

KEY CHALLENGES FOR THE EUROPEAN AND NORTH AMERICAN AIRLINE INDUSTRY

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INTRODUCTION

The airline industry is a highly competitive and fast-paced environment which is heavily dependent on macro-economic development, innovation, and regulation. Since its rise in the 1950s, airlines have overcome significant challenges. Between 1954 and 1963, the airline industry faced a deep structural change as propeller machines were replaced by combustion engines. This innovation drove technological progress and subsequently enabled aviation to be available for the masses. 10 years later, the oil price crisis in 1973 substantially hit the airline industry as successive oil shocks and subsequent increasing oil prices forced airline profitability down (Iatrou 2014). Five years later, US deregulation was pushed forward leading to sector liberalization and growing competition. In turn, a more dynamic market environment emerged due to the new business model of low-cost carriers (LCC) that aggressively competed with the existing full-service carriers (FSC) (Peterson 2018). In Europe, deregulation started in 1987 followed by further liberalisation of the industry in 1993 as a consequence of the creation of the European single market (ICAO 2013).

Between 1995 and 2000, the airline industry experienced a strong period of growth. This growth period was mainly accelerated by a global economic expansion and an increased demand for air travel which consequently resulted into strong annual growth rates of roughly 4–6%. This trend, however, did not continue in the following years. The economic recession beginning in early 2000 and the terrorist acts of 11 September 2001 aggravated the situation (Cento 2009).

The new century was a starting point for a market environment that deteriorated over the course of the next 10 years due to its high sensitivity and dependency on macroeconomic instabilities (Macário and Van de Voorde 2009). The world financial crisis in 2008/2009 significantly hit the airline industry as the subsequent great recession reduced the demand for air travel (Scovel III 2012). As airlines scrambled to fill seats, prices plunged in order to desperately capture market share (Rhoades 2009). Consequently, airlines experienced one of the largest declines in revenues (IATA 2009).

Driven by an improved macroeconomic environment, the airline industry was able to recover from the financial crisis in the subsequent years. Global passenger demand for air travel continuously improved and grew at more than 5% per year between 2010 and 2019. In Europe, the number of passengers carried reached 1.1 bn in 2019 vs. 752 mn in 2009 after 10 years of consecutive growth (Statista 2021c, 2008–20). In line with this development, North America carried 1.0 bn passengers in 2019 vs. 732 mn in 2009 (The World Bank 2021).

By the end of 2019, the outbreak of Covid-19 had significantly influenced the airline industry and the record highs of 2019 substantially plunged. 2020 was recorded as the worst year in aviation history with revenue passenger kilometres (RPK) decreasing by 65.9% compared to the previous year. Furthermore, only 1.8 bn global passengers were carried in 2020 as a consequence of grounded fleets, representing a decrease of 60% (IATA 2021e). Unsurprisingly, airlines are now struggling to survive in this fragile environment given the uncertainty of reaching post-pandemic levels. 30 airlines have filed for bankruptcy since the start of Covid-19 in 2020 (CAPA 2021a).

Accelerated by Covid-19, climate change has significantly gained more importance in the recent past as greenhouse gas emission substantially decreased as a consequence of national lockdowns (Klenert et al. 2020). For example, carbon dioxide (CO_2) emissions fell by c. 14% year-on-year in April 2020. The airline industry represents a crucial role in reducing carbon emissions and ultimately fighting climate change as it accounts for around 2-3% of worldwide emissions (Hasan et al. 2021). Consequently, the industry is currently adapting to a new market environment by setting carbon emission strategies which will drive sustainability and increase contributions to reduce climate change. However, reforming airlines to be more sustainable requires enormous investments into new technologies. Combined with a fragile financial situation triggered by Covid-19 and an increasing uncertainty of reaching post-pandemic market conditions, the future of aviation is confronted with a mountain of obstacles it has never experienced before.

The following work project answers the question which airlines are best positioned to operate in a sustainable post-Covid environment. The impact of political events is not part of the work project. The structure of the report is as follows. At first, the work project presents an overview of selected peer groups, followed by an overview of the methodology and data collection process. The subsequent parts analyse the European and North American airline industries regarding their key challenges of Covid-19 and sustainability. First, it investigates which airlines exhibit the greatest crisis-resistance in the context of the Covid-19 pandemic. By answering this question, the work project investigates which airlines were most affected by Covid-19 (*Section A*) followed by a critical assessment of measures implemented by airlines as a reaction to the Covid-19 crisis (*Section B*). Second, it examines which airlines place the greatest emphasis on sustainability. Answering this question includes an analysis on regulatory requirements airlines are required to meet (*Section C*) followed by an assessment of the impact of technology on airlines' sustainability (*Section D*). The work project closes with a conclusion.

INTRODUCTION OF AIRLINE PEERS

This work project focuses on analysing European and North American airline carriers. A further subdivision is a distinction between LCCs and FSCs (ICAO 2017), resulting in four different peer groups as shown in *Table 1* below.

Table 1: *Peer group overview*

Low-cost Europe	Full-service Europe	Low-cost North America	Full-service North America
Ryanair Holdings	International Consolidated Airlines Group	Southwest Airlines	Delta Air Lines
Wizz Air Holdings	Deutsche Lufthansa	JetBlue Airways Corporation	United Airlines Holdings
easyJet	Air France-KLM	Allegiant Travel Company	American Airlines Group
Jet2	SAS AB	Frontier Group Holdings	Alaska Air Group
Icelandair Group	Finnair	Spirit Airlines	Air Canada

The peer group selection only considers public listed companies to ensure high availability of data. For each peer group, the five largest airline groups regarding their market capitalization (as of 17 September 2021) were selected. Some groups cannot be categorized fully as either LCC or FSC but still had to be assigned to one of the two groups for this report. Corresponding airlines were assigned to either LCC or FSC due to nature of their business model and their primary revenue stream.

METHODOLOGY AND DATA COLLECTION

The database used to analyse and gain insights of the commercial airline industry was mainly retrieved from S&P Capital IQ (hereinafter "Capital IQ"). Capital IQ is part of S&P Global, one of the largest providers of market insights and data. Capital IQ's database is based on the company's official reported numbers (Phillips 2012). The data sourced was separated into annual and quarterly terms in order to better understand the effects of Covid-19. To account for the different reporting dates of the various firms, Capital IQ offers a conversion function. For example, Q4 of Ryanair (reporting date 31 March) is compared with Q1 of Deutsche Lufthansa (reporting date 31 December). Furthermore, all figures have been converted to United States Dollars (USD) using appropriate conversion rates from Capital IQ to ensure comparability. Any additional data was retrieved through the companies' annual reports, Refinitiv, and Bloomberg. However, it is worth mentioning that not every airline reports the same amount of data. As a result, specific airlines were left out of some analyses throughout the course of the report to not distort the overall picture. Corresponding passages are marked with the help of footnotes.

WHICH AIRLINES EXHIBIT THE GREATEST CRISIS-RESISTANCE IN THE CONTEXT OF THE COVID-19 PANDEMIC?

To answer the question which airlines exhibit the greatest crisis-resistance in the context of the Covid-19 pandemic, the following section investigates two main questions. First, it analyses which airlines were most affected by Covid-19 (*Section A*) and second, it examines which airlines have implemented the most effective measures in reaction to the crisis (*Section B*).

(A) Which airlines were most affected by Covid-19?

Background information about Covid-19 and its impact on the airline industry can be found in *Appendix 1*.

(A) Which airlines were most affected by Covid-19?

In this part, the work project analyses the impact of Covid-19 on the selected peer group companies and ultimately answers the question which airlines were most affected by Covid-19. To arrive at this point, the following parts cover both a quantitative and qualitative perspective of the subsequent dimensions: market capitalisation (A1), revenue (A2), profitability (A3), liquidity (A4), leverage (A5), and cash burn (A6).

(A1) Covid-19 and a volatile market environment accelerated significant price movements in airline stocks

In February 2020, the global stock markets experienced record highs before the outbreak of Covid-19 triggered a severe crash in financial markets (Bradley and Stumpner 2021). According to Bloomberg, on 16 March 2020, S&P 500 plummeted almost 12% in only one day and Euro STOXX 50 decreased by 12.4% already 4 days earlier. Furthermore, since the outbreak of Covid-19, financial markets have faced a period of increased market volatility (Baker et al. 2020, 19). As a result of this, global stock markets are characterised by major price movements and shock waves (Zhang et al. 2021). Moreover, CBOE Volatility Index (VIX), which measures the volatility of US financial markets, reached its peak in March 2020 for the first time since 2008 (Baek, Mohanty, and Glambosky 2020). Consequently, Covid-19 has thrown the world economy into a loop, wreaking havoc on an unparalleled scale (Khatatbeh, Bani Hani, and Abu-Alfoul 2020). However, the financial consequences of this crisis are unevenly spread across industries (Bloom, Cadarette, and Sevilla 2018). While large tech companies can be seen as potential winners (Markowicz 2020), the airline industry has been one of the most affected industries worldwide (Vidovic 2021). McKinsey & Company found out, that the airline industry experienced the largest decline in weighted average shareholder returns across 30 industries between February and March 2020 (Bradley and Stumpner 2021).

This further becomes clear by analysing the stock market performance of the selected airline peer groups.

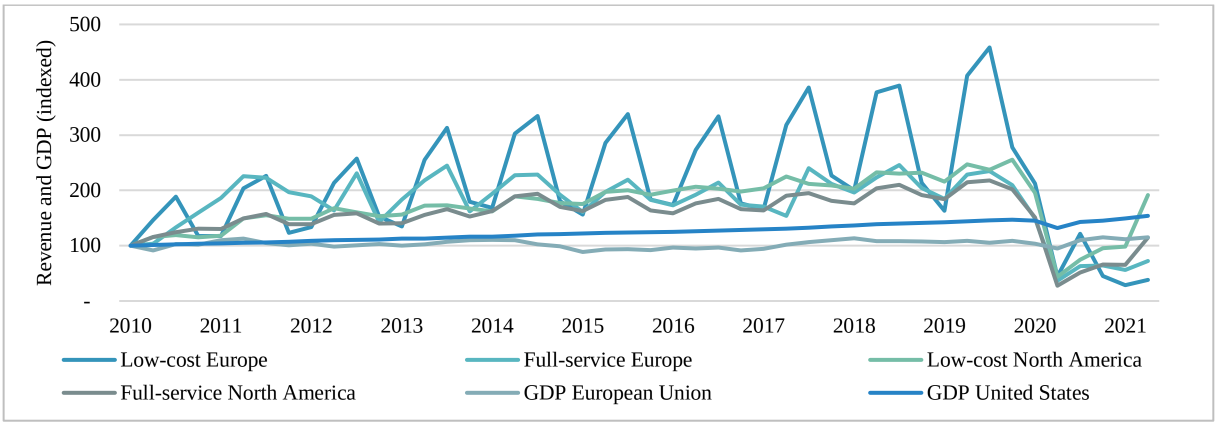
Driven by the stock market crash in March 2020, the analysed peer groups experienced the most profound decrease in market capitalisation within Q1 2020. In general, the market capitalisation plummeted between c. 41% and 59%, whereas North American and European FSCs showed the strongest decrease. LCCs in Europe and North America followed the same performance with market capitalisations almost halved in Q2 2020. Analysing this development in respect to the beta (5 year) of each peer group, FSCs in North America showed on average the highest numbers (2.3x). In line with the stock price performance of LCCs in Europe and North America, the betas for LCCs were as high as 1.6x and 1.8x respectively. From a theoretical perspective, a beta of 1 denotes that a security is as volatile as the entire market (Rosenbaum and Pearl 2009). Given the fact that the betas of all peer groups are significantly greater than one, airlines operate in a high-risk market. Hence, airlines have a higher exposure to systematic risk and face greater volatile price movements compared to the entire market. Euro STOXX 50 and S&P 500 can be considered as a broad respective market for the European and North American peer groups. Within Q1 2020, Euro STOXX 50 decreased by 26.4% and S&P 500 plummeted more than 19.5%. Consequently, comparing the price movements of the European and North American peer groups with the respective indices confirms that on average the share price performance of airlines developed as expected in regard to their betas.

(A2) Significant revenue drop in Q1 2020 with Europe being affected the most

After the global financial crisis in 2008/2009, economic conditions improved, and airlines were able to recover and overcome the financial crisis. Being more resilient to economic downturns was the starting point of a success story in 2010. As air travel demand is closely connected to the global economy (Tozer-Pennington 2021), *Figure 1* compares the revenue development of the selected peers with the respective GDP growth since 2010.

(A) Which airlines were most affected by Covid-19?

Figure 1: *Revenue vs. GDP growth (2010 – 2021)*



From 2010 until 2019, nominal US (Europe) GDP had risen 49.7% (5.1%), presenting an attractive revenue environment for airlines (Stalnaker, Usman, and Taylor 2017). Driven by this development, airline peers across North America and Europe were able to sustainably increase their economic importance (Scovel III 2012). Unsurprisingly, the outbreak of Covid-19 from 2020 onwards put a stop to the success story of European and North American airlines, entering into unprecedent times as airlines were facing "the most difficult year in its history" (IATA 2021h). The substantial plunge in demand for passenger air transportation as a result of implemented containment measures was jeopardizing the revenue generation and consequently the sustainability of many airlines in the aviation industry (OECD 2020b). *Figure 1* also illustrates that the airline industry has been one of the most affected industries by Covid-19 (Haydon and Kumar 2020). In 2020, revenues of European airlines dropped 74.1% and 63.4% for LCCs and FSCs respectively. In North America, revenues of LCCs plummeted 59.1% while FSCs lost 63.9% in revenues. According to this development, European LCCs suffered most from the outbreak of Covid-19 which can be attributed to the fact that travel bans and restrictions were implemented during Q2 2020. Additionally, the revenues of LCCs in Europe are highly sensitive as most of their business is generated during the summer months (IATA 2021f).

(A) Which airlines were most affected by Covid-19?

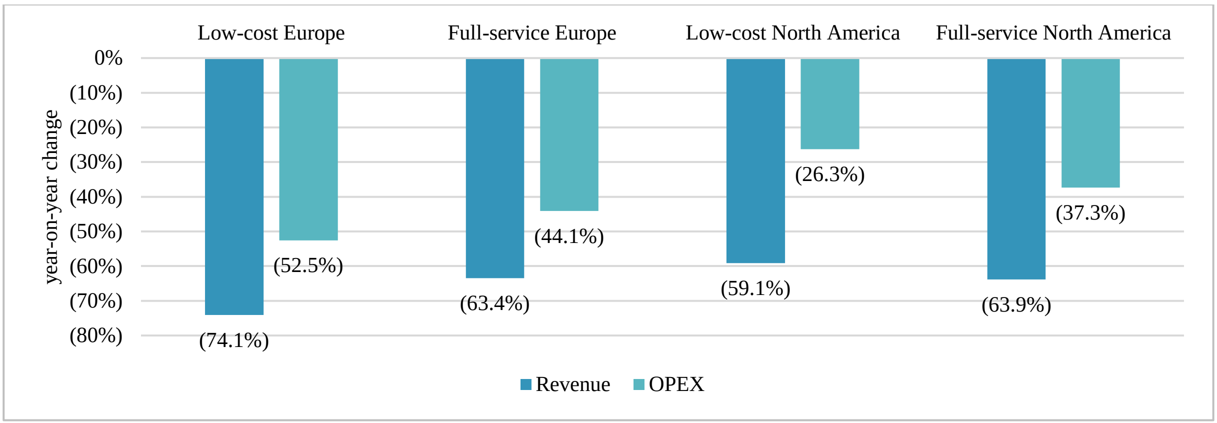
Entering 2021, airlines in North America recovered faster from the effects of Covid-19 than their European peers although revenue growth remained double-digit negative for both European and North American airlines in Q1 2021. However, North American players benefited from a stout tailwind in revenue which was accelerated by a considerably bigger domestic market and a relatively speedy vaccination campaign. Higher Covid-19 caseloads hindered the recovery of a fast air traffic demand in Europe. Additionally, changes in European border regulations also created uncertainty, discouraging would-be travellers from making plans (Bushey and Georgiadis 2021a). Comparing the revenue growth of Europe and North America for the second quarter of 2021, European airlines grew up to 98.0% on average while North America has surpassed a sound three-digit growth.

(A3) Dependence on fixed costs and high break-even load factors in combination with decreasing revenues have resulted into massive profitability plunge

Unsurprisingly, global travel bans did not only lead to a massive plunge in revenues but also in airline profitability. Since the financial crisis in 2008/2009, airlines had been profitable for the tenth year in a row, representing the longest streak in airline history. This development was mainly driven by a robust economy and decreasing oil prices (Gole, Dobrea, and Gombos 2021). After being profitable for a decade, the outbreak of Covid-19 has provided for the fact that profitability went through the floor, especially in Q2 2020 when airline profitability was hit hardest (IATA 2021e). In general, profitability of FSCs suffered more from Covid-19 than LCCs in their respective country due to higher operational costs (Benitez and Lodewijks 2010).

Load factor and the cost structure of airlines are two of the most important drivers for profitability and therefore significantly influenced the profitability of airlines during Covid-19 as a principle consequence (Fickling 2021). Hence, one of the most challenging obstacles of airlines in terms of profitability is to rebuild capacity to pre-Covid levels while simultaneously reducing overhead in order to survive if demand returns more slowly and unevenly than expected (Kletzel, Stillmann, and Wysong 2020). However, cutting costs is capped at a certain level, given the fact that airlines are heavily dependent on fixed costs (IATA 2021e). For example, no matter how many people are on board, the landing and navigation fees remain the same but vary with the number of flights performed. Even labour costs are relatively fixed as the number of cabin staff needed is mainly governed by the number of seats on an aircraft instead of their occupancy (Fickling 2021).

Figure 2: *Revenue and OPEX year-on-year change in 2020*



By comparing revenues with OPEX during 2020, *Figure 2* depicts airline dependence on fixed costs as OPEX have not changed in proportion to the decrease in revenues. While revenues for LCCs in Europe fell 74.1%, OPEX decreased just slightly more than 50%, with an even worse picture for FSCs and LCCs in North America as well as FSCs operating in Europe. Therefore, cutting variable costs alone will not be sufficient to return to profitability. It is crucial to reduce fixed costs to levels that enable airlines to continue operating with lower revenue while simultaneously generating enough cash to service increasing debt loads. As a principal consequence, airlines require fundamental adjustments to their cost structure and overheads while maintaining flexibility in their operations (Kletzel, Stillmann, and Wysong 2020).

Apart from being significantly dependent on fixed cost, the airline load factor during Covid-19 was the main driver for low profitability (Fickling 2021). In order to prevent the virus from spreading, airlines introduced measures to reduce the capacity of their charters following the recommendations of global health authorities (Gole, Dobrea, and Gombos 2021). According to the US Centers for Disease Control and Prevention, infections could be reduced up to 57% if middle seats are not allocated (Dietrich et al. 2021). This measure ultimately resulted in a 33% lower capacity, assuming a 3-3 configured seat layout (Gole, Dobrea, and Gombos 2021). Additionally, travel behaviour changed significantly in 2020 as people aimed to limit their exposure to Covid-19 by travelling less (Abdullah et al. 2020). Consequently, airline capacity dropped further in 2020 which becomes clear when comparing pre-pandemic load factors with load factors reflecting the impact from Covid-19. Load factors for European FSCs[1] fell 21.2 pp, reaching 63.4% in 2020 vs. 84.6% in 2019. LCCs in North America[2] reported load factors of 84.5% in 2019. However, in the aftermath of Covid-19, load factors decreased by 22.9 pp to 61.6% in 2020. FSCs in North America reported load factors of 59.2% in 2020 which are roughly 25 pp lower compared to 2019 (84.4%). Driven by airlines' huge dependence on fixed costs as well as decreasing passenger yields, break-even load factors of European and North American airline peers are now significantly higher.

Figure 3: *Load factor and break-even load factor (2019 vs. 2020)*

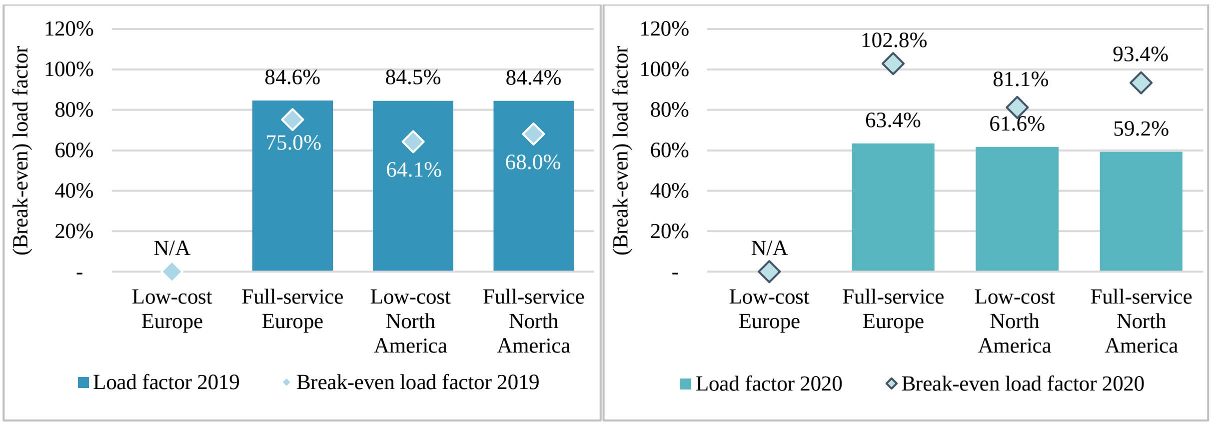


Figure 3 illustrates that, given the current cost structure and average ticket prices, each peer group is not able to operate profitable in 2020 as they cannot break even their load factors. In general, break-even load factors for FSCs are substantially higher. For example, the break-even load factor of FSCs in Europe exceeded 100% in 2020. This indicates that being profitable

[1] excluding Air France-KLM and SAS due to missing data; no data available for European low-cost carriers
[2] excluding Allegiant Travel Company due to missing data

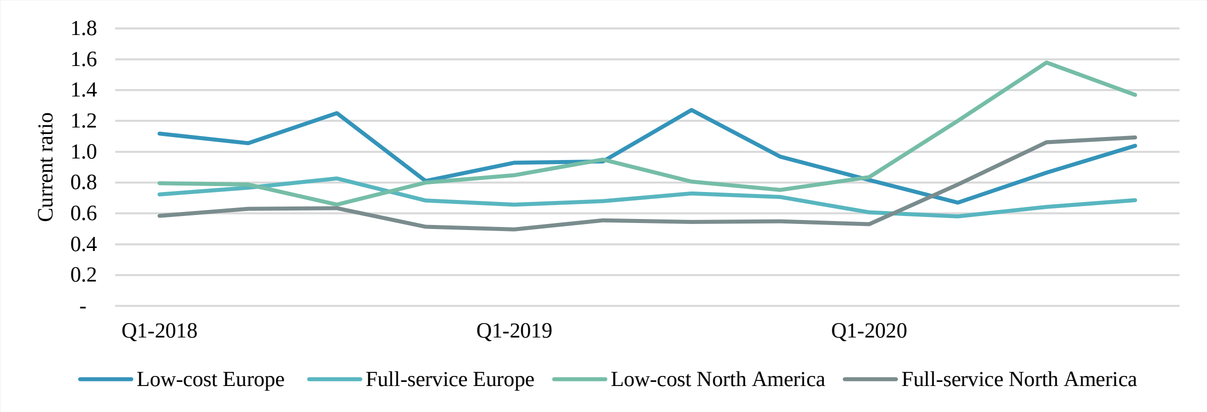
seems implausible unless FSCs in Europe consider different revenue streams such as onboard catering, baggage and legroom services as well as cargo (Fickling 2021). If airlines will not break even their costs, ticket prices are likely to increase (Gole, Dobrea, and Gombos 2021). However, considering an airline industry where demand is subdued and sluggish to rebound, increasing ticket prices are not an effective response to the crisis (IATA 2020e). Therefore, International Air Transport Association (IATA) already stated on 05 May 2020, that it "does not support mandating social distancing measures that would leave middle seats empty" (IATA 2020d). As a sustainable way to strengthen profitability, all airlines within our peer groups returned to current booking guidelines, being able to occupy the full capacity of their airplanes. However, airline profitability during the first half of 2021 was still behind pre-covid levels. EBITDA of all peers remained negative in Q1 2021. This was mainly driven by lower-than-expected recovery of air travel demand due to further travel restrictions implemented in early 2021 (IATA 2021g). A similar picture was observed in Q2 across all peer groups, except for LCCs in the North America which returned to positive EBITDA in Q2 2021. In line with this development, North America is expected to return to profitability in 2022 (Singh 2021).

(A4) Peer groups were able to prevent potential liquidity problems by quickly provided support

A stable liquidity situation is essentially to operate a business on a day-to-day basis and to overcome not foreseen challenges. The pandemic represents more a liquidity than a solvency crisis since airlines generated strong returns upfront and strengthened their balance sheets in advance (IATA 2020b). Nevertheless, the impact on long-term solvency is not clear yet. As analysed in *Section A3* above, Covid-19 had a substantial impact on the airline's profitability which heavily impacted the liquidity situation of the selected peer groups.

Liquidity management means keeping current assets and current liabilities balanced on a healthy level and is an important condition to improve companies' performance (Hiadlovský, Rybovičová, and Vinczeová 2016). The current ratio (CR) displays how much current assets the company owns compared to the total current liabilities (Barth and Landsman 2010).

***Figure** 4: Current ratio (Q1 2018 – Q3 2020)*



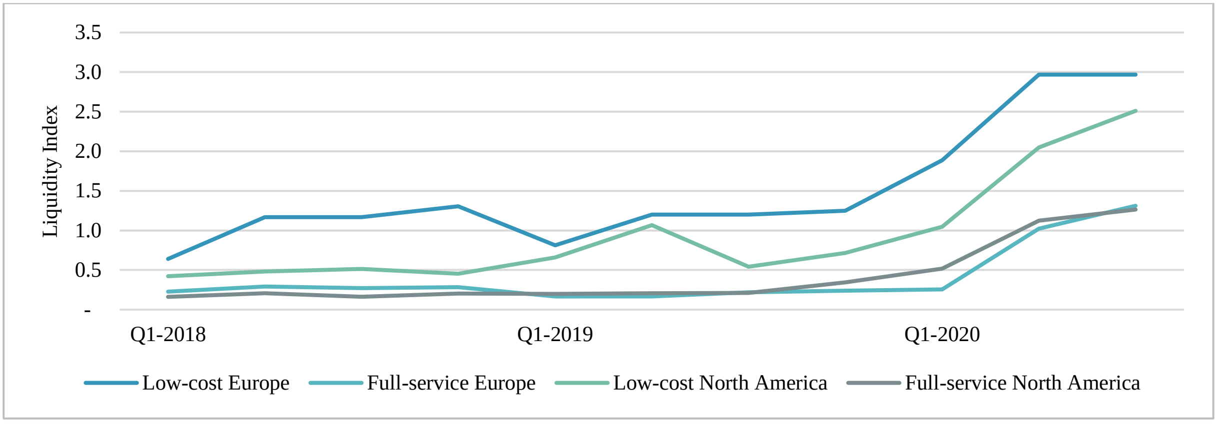
An analysis of the CR of the peer groups (*Figure 4*) shows that most carriers, except European LCCs, had a ratio below one before the crisis, which means companies could not pay their short-term obligations indicating a higher chance of a liquidity issue. FSCs show the worst values in North America and Europe[3] followed by North American[4] LCCs. European LCCs[5] display the most robust ratio. As a result of the profitability decrease through the pandemic, selected peer groups quickly anticipated liquidity problems. Their strong demand for quick and short-term liquidity in the beginning of 2020 was provided in particular by various governmental aid packages and banks (*Section B2*) (Albers and Rundshagen 2020). The quick availability of liquid funds has meant that the airlines have not experienced any acute liquidity problems as shown in *Figure 4*.

A further industry-specific consideration of crisis resilience in the context of liquidity is the analysis of the ratio of cash and cash equivalents to air traffic liabilities, hereafter defined as liquidity index. In case the liquidity index is lower than 1, a carrier does not have enough cash available to repay its customers in case it cancels all its flights or ceased its operations (e.g.

[3] excluding International Consolidated Airlines Group, S.A. for some quarters due to missing data
[4] excluding Frontier Group Holdings, Inc. for some quarters due to missing data
[5] excluding Wizz Air for some quarters due to missing data

insolvency) (Deloitte 2019). Air traffic liabilities represent tickets sold for future travel dates and can only be recognized as revenue when the related flight is made (Callahan, McHugh, and Smith 2004).

Figure 5: *Liquidity index (Q1 2018 – Q3 2020)*



By looking at the peer groups (*Figure 5*), one can observe that North American and European[6] FSCs had the lowest liquidity index values until the beginning of 2020, which indicates a high risk towards customers in case of failing operations. North American LCCs[7] ranged in the midfield. European LCCs[8] were able to maintain a liquidity index above 1 most of the time, indicating a stronger liquidity management. It is important to mention is that LCCs showed a significantly better liquidity index than the corresponding FSCs in the region. Nevertheless, with the beginning of the Covid-19 crisis in Q1 and Q2 2020 all four peer groups raised their median liquidity index above 1, thus significantly improving their situation. The increase of the liquidity ratio can be explained on the one hand by lower air traffic liabilities due to lower flight volumes and refunds and, on the other hand, by increased liquidity. European airlines were obliged by the European Commission to reimburse tickets in the case of cancellation at the beginning of Covid-19 but got the right to offer vouchers to customers (Suau-Sanchez, Voltes-Dorta, and Cugueró-Escofet 2020). Carriers in North America are obliged to provide refunds

[6] excluding International Consolidated Airlines Group and SAS AB due to missing data
[7] excluding Frontier Group Holdings, Inc. due to missing data
[8] excluding Ryanair and Wizz Air due to missing data

for cancelled flights as well. Also, the US government released the additional opportunity to offer travel vouchers (United States of America Department of Transportation 2020).

Figure 6: *Short-term liquidity (Q1 – Q3 2020)*

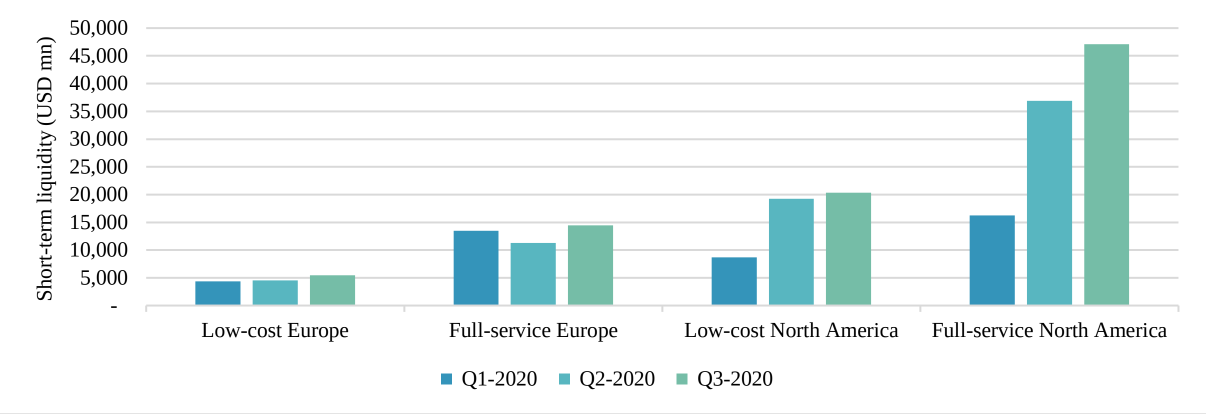


Figure 6 summarizes the impact of Covid-19 on the liquidity situation of the selected airline peer groups. All four peer groups improved their liquidity over time. Nevertheless, North American carriers received their liquidity support already in Q2 2020. This can be explained by earlier state support which was already recognized in Q2 results (Courtney 2020). More in-depth analyses of the change in liquidity are answered in *Section B1* and *Section B2.*

(A5) Increased leverage in all peers as a result of debt issuances with FSCs standing out; highly levered firms suffered the most in the crisis

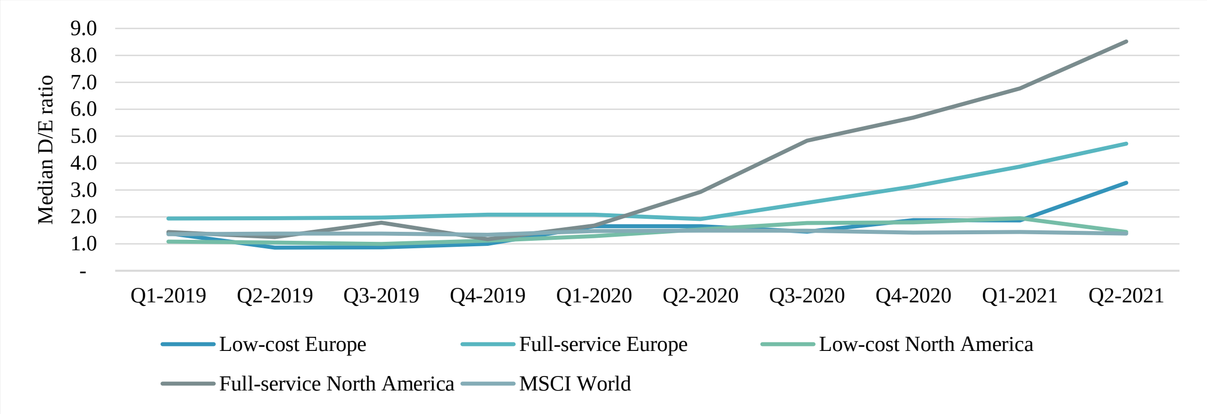
Maintaining a stable liquidity (analysed in *Section A4*) during the course of the pandemic affected leverage measured by the debt-to-equity (D/E) ratio. It represents the ability of shareholder equity to cover all outstanding debt in the event of business downturn. The calculation results from comparing total liabilities to total equity (Fernando 2021).

Applied to the peer group, a rise for all can be observed from Q1 2020 onwards. As displayed in *Figure 7*, the median D/E ratio for North American FSCs rose the strongest from 1.7 to 8.5, followed by European FSCs from 2.1 to 4.7 and European LCCs from 1.7 to 3.3, while North American LCCs[9] remained nearly the same.

[9] excluding Frontier Group Holdings due to missing data

(A) Which airlines were most affected by Covid-19?

Figure 7: *Median D/E ratio (Q1 2019 – Q2 2021)*

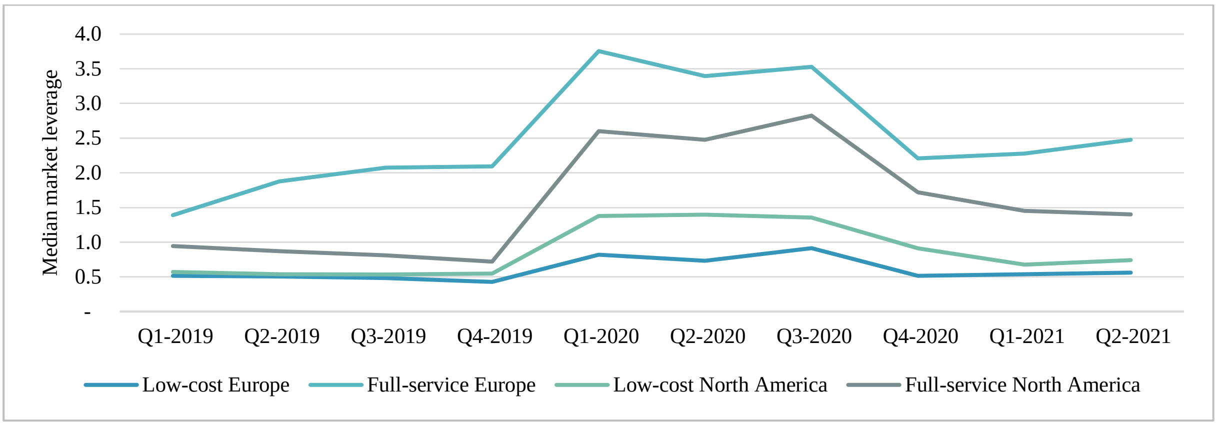


Still, the D/E ratios were above or in line with the benchmark MSCI World at nearly all times. Same applies when comparing the North American peer groups with the S&P500. In the case of Europe, the D/E ratios of FSCs were higher than the benchmark Euro STOXX Index, whereas LCCs fluctuated around the benchmark (*Appendix 3*). Airlines' leverage being higher than the market indicates that the industry is more impacted by the Covid-19 crisis compared to the market and therefore in need of additional funding to raise liquidity and maintain operations (Airports Council International 2021).

Even though leverage increased, the level of leverage was different for the peers even before the pandemic. A pattern could be found that higher levered companies suffered more in terms of market capitalisation. Peers who exhibited a D/E ratio below 1 in Q4 2019 lost 50.6% in market capitalization from Q4 2019 to Q1 2020. The respective figures for peers with a D/E ratio between 1 and 2 as well as above 2 amounted to -55.8% and -58.6%. In general, LCCs denoted lower leverage before the pandemic on average (1.5) compared to FSCs (2.5) which were less affected in terms of market capitalization. Based on these findings, increased leverage due to the pandemic seems to pose additional risk to airlines market capitalization.

Increased debt as well as dropping market capitalizations are an interesting basis to analyse market leverage in order to get a complementary understanding on how leverage developed during the Covid-19 crisis. Market leverage compares the total debt with the market value of the companies equity, while the D/E ratio previously mentioned compares it with its book value (Kenton 2020).

Figure 8: *Median market leverage (Q1 2019 – Q2 2021)*



As displayed in *Figure 8*, all peer groups follow the same pattern in terms of the median market leverage but are different in magnitude. With the start of the pandemic in Q1 2020, the market leverage spiked up due to falling stock prices resulting from closed borders and announced lockdowns. In Q2 2020, market leverage slightly decreased or remained unchanged as restrictions were lifted, but debt was taken to support liquidity shortages before the second wave of Covid-19 pushed market leverage upwards again in the third quarter. With vaccination efforts and opened borders, the stock prices were able to recover leading LCCs[10] to reach pre-pandemic levels with respect to the median market leverage, while the respective figures for FSCs declined, but stayed above pre-pandemic levels the quarter after (Dube, Nhamo, and Chikodzi 2021). In fact, FSCs had the biggest market leverages already before Covid-19, but also the largest increase. Those airlines needed to take on bigger amounts of debt and were not able to deliver their core offering intercontinental flights and, therefore, were hit harder on the stock market. Conversely, LCCs could continue to offer intra-continental and domestic flights at some degree and, hence, market leverage changed more mildly due to stock prices not falling as strongly (Budd, Ison, and Adrienne 2020).

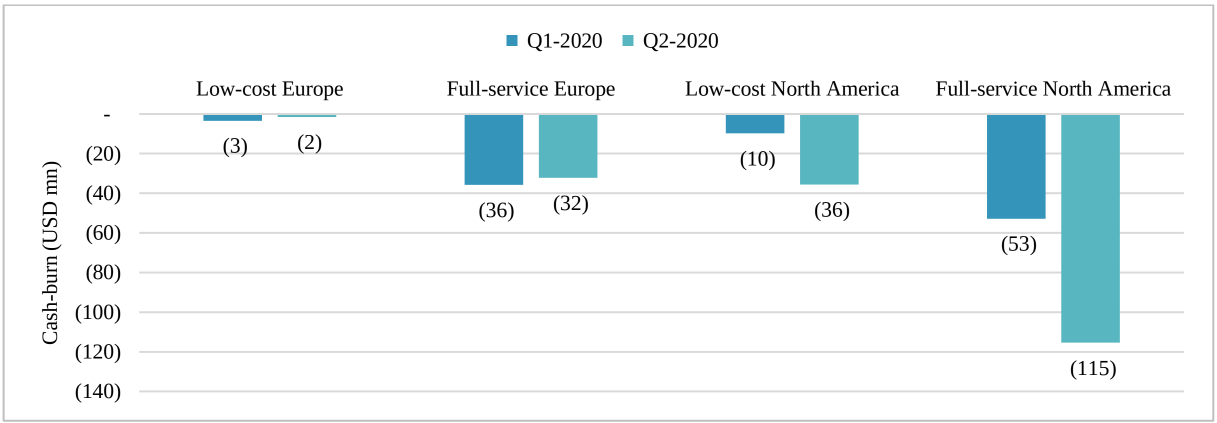
[10] excluding Frontier Group Holdings due to missing data

(A) Which airlines were most affected by Covid-19?

(A6) North American carriers experience highest cash burn at the beginning of the Covid-19 pandemic

The financial pressure that is put on airlines through Covid-19 is tremendous. Lufthansa for example, reported a monthly cash burn of USD 800 mn at the end of Q1 2020 (Miller and Hollinger 2020) and that their liquidity reserves were to be exhausted by the end of Q2 / beginning of Q3 2020 if operations continued as usual (Lufthansa 2020a). Carriers in North America also addressed cash burn issues. Southwest Airlines, for example, stated an expected cash burn of USD 30-35 mn per day in March 2020 (Bushey 2020). The cash burn rate became so important from Q2 2020 onwards that some airlines included the metric within their quarterly and annual reports. Nevertheless, the reporting is not subject to generally accepted accounting standards (GAAP or IFRS) and differs across airlines (Hersch 2021). This makes it difficult to compare respective cash burn rates directly. In order to obtain a universal view of the cash burn rate and be able to compare the peer groups, this report defined a standardized operational cash burn rate[11] based on the calculations of Lufthansa (Lufthansa 2020a).

Figure 9: *Daily cash burn (Q1 – Q2 2020)*



The results (*Figure 9*) show that all four peer groups are burning cash at the end of Q1 and Q2 2020. It can be recognized that North American carriers[12] had higher cash burn rates than their

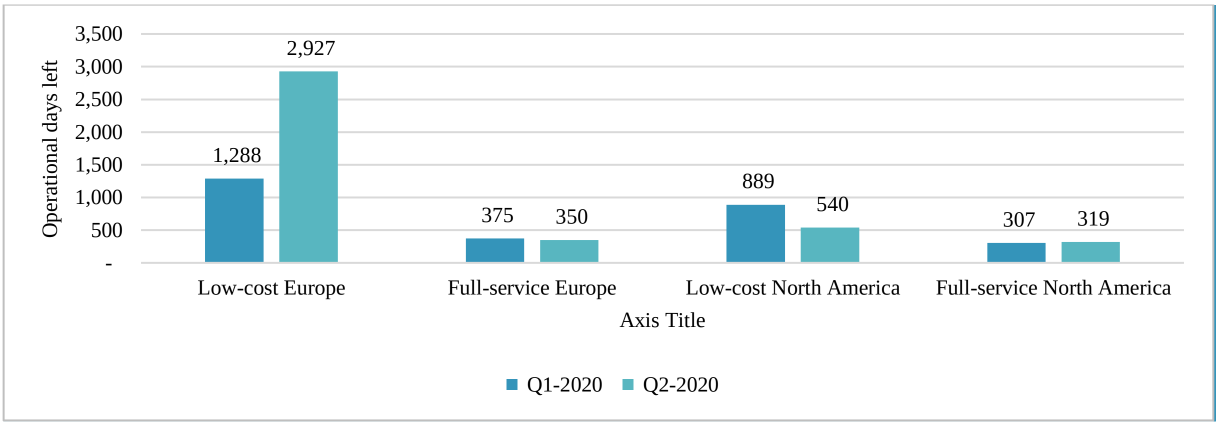
[11] EBITDA + CAPEX

[12] excluding Air Canada due to missing data

respective European[13] counterparts and that their cash burn rates have more than doubled from Q1 to Q2 2020.

The stronger increase can be explained by the fact that European carriers could reduce their crew costs faster than North American airlines (*Section B5).* The differences between FSCs and LCCs can be explained by the more cost-intensive business model of FSCs than LCCs, resulting in higher fixed cost rates of airlines (*Section A3)*. An additional explanation why FSCs experience higher cash burn rates is that airlines that have generated high revenues normally suffer extraordinary from high fixed costs. Combining the daily cash burn rates and current short-term liquidity situation to calculate how many days a company could continue operating offers a view of the precarious situation airline carriers face. The result *(Figure 10)* is that the situation is most difficult for FSCs. Both North American and European FSCs could, according to the calculations, operate for less than one year. Among LCCs, European LCCs dominate due to their low cash burn rate. In contrast, North American LCCs are still better positioned than corresponding FSCs with a calculated[14] operating lifetime of just under 1 1/2 years.

Figure 10: *Days operational left (Q1 – Q2 2020)*



[13] excluding International Airline Group, Wizz Air Holdings Plc and Jet2 plc due to missing data
[14] according to the cash burn rate and their current liquidity situation

(B) Which airlines have implemented the most effective measures in reaction to the crisis?

(A) Conclusion: FSCs were affected most by Covid-19 due to lacking profitability, greater liquidity issues and significant cash burn

To answer the question which airlines were affected most by Covid-19, this section assessed the impact of Covid-19 on airlines financial position which are summarized below.

A detailed revenue analysis provided evidence that LCCs in Europe experienced the greatest decline in revenues. However, LCCs in general were more flexible in terms of cost structure, allowing them to easily adjust costs which subsequently leads to faster recovery of profitability. Moreover, LCCs showed lower break-even load factors during Covid-19, providing evidence that LCCs are more profitable at lower capacity. Especially in times of Covid-19 when capacity has plummeted, this can be considered as one of the most important drivers for crisis-resistant airline management.

Furthermore, FSCs experienced greater liquidity issues during Covid-19. The liquidity index for FSCs was significantly lower compared to LCCs, indicating a higher risk for customers in case of failing operations. Moreover, leverage increased especially for FSCs which were consequently in need of additional funding to raise liquidity and maintain operations. A higher leverage for FSCs also showed, that FSCs experienced a greater decline in market capitalisation in contrast to LCCs. As a result, there was a stronger increase in market leverage of FSCs compared to LCCs as well.

Ultimately, cash burn for LCCs was substantially lower compared to FSCs in the respective regions. The main driver for this was a more flexible cost structure of LCCs. Considering profound cash burn rates for FSCs, FSCs are now fighting to survive in this fragile market environment. Consequently, FSCs were most affected by the outbreak of Covid-19.

(B) Which airlines have implemented the most effective measures in reaction to the crisis?

Coming from dropping revenues, lacking profitability and high cash burn potentially inducing bankruptcy and threatening the continuation of business, airlines were forced to take action in order to survive the crisis. To determine which airlines have implemented the most effective measures in reaction of the crisis, this part analyses debt and equity issuance (B1), governmental support (B2), leasing (B3) and cash management (B4) to increase liquidity as well as measures to reduce operational costs (B5).

(B1) FSCs and North American airlines raised most capital with debt being the overall favoured alternative

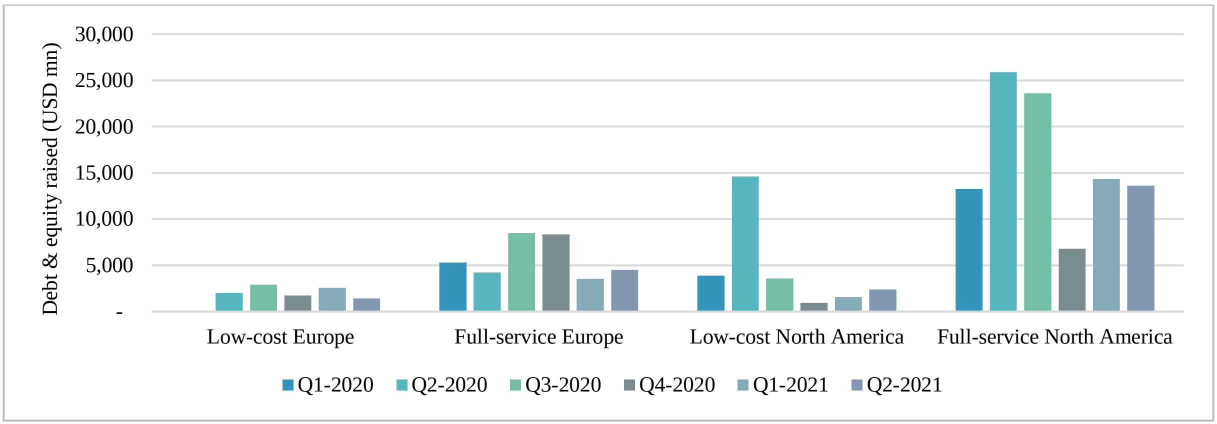
In general, the observations indicate that increasing leverage of North American FSCs as well as European FSCs and LCCs could result from either taking on additional debt or reducing equity. Overall, it seems that debt was the more favoured funding source to improve liquidity, especially for the European and the North American FSC peer groups, while the North American LCCs had the tendency to raise equity to generate cash in Q2 2021. In order to determine the kind, amount and time of capital raised, a closer look at the respective cash flow statement positions "Total debt issuance" and "Common stock issuance" were taken.

As analysed in *Section A2 and A3*, revenues and profitability started dropping in the end of Q1 2020 with airlines not being able to cover costs anymore and liquidity melting which reduced the days left to operate. Facing the dramatic situation, airlines were forced to raise funds to maintain operations and pay their obligations with Q2 and Q3 2020 being the most striking ones in terms of timing. The FSCs had the biggest capital needs with North American FSCs raising the most capital with USD 84.2 bn, followed by the European FSCs[15] with USD 29.1 bn from Q2 2020 until the end of Q2 2021. In turn, North American LCCs raised USD 23.1 bn in that period, while European LCCs[16] only needed to access USD 10.6 bn in line with their good liquidity situation before the pandemic as analysed in *Section A4.* In general, the North American market tend to have bigger capital needs than the European market which is recognized in higher equity funding as % of GDP (147% vs. 73%) and debt funding as % of GDP (114% vs. 82%) (Oliver Wymann 2016). The North American airlines gathered the

[15] excluding International Consolidated Airlines Group due to missing data for some quarters
[16] excluding WizzAir due to missing data

biggest share of funding in Q2 2020 (*Figure 11*) resulting from the quick response of the US government to support the economy with the CARES Act (United States Department of the Treasury 2021a), while European airlines raised it in Q3 2020 due to later received governmental support (Courtney 2020).

Figure 11: *Debt and equity raised by peer groups (Q1 2020 – Q2 2021)*



As suspected, debt issuance was the dominant source of funding for the peer group during the pandemic with shares ranging from 81.1% to 91.0% of total funding during the observation period from the start of Q2 2020 to the end of Q2 2021. It can be traced back mainly to airlines preferably seeking comparably cheap governmental funding and bailout programs consisting of inter alia capital injections, loans, tax deferrals and reductions of their tax liabilities (Suk and Kim 2021), where loans make up for the superior share (Scheelhaase et al. 2021). Geographically, European airlines have a higher share in equity funding with FSCs of 18.9% and LCCs of 18.6% of total funding compared to the North American players with FSCs of 9.0% and LCCs of 18.8% of total funding according to Capital IQ data. The major reason behind this are the capital increases and silent participations of German, French as well as Swedish and Danish governments to Lufthansa (EUR 2.8 bn), Air France-KLM (EUR 4 bn) and SAS (SEK 6 bn) in the FSC segment, respectively. In the European LCC segment, Ryanair raised EUR 400 mn, easyJet around GBP 400 mn and Icelandair around USD 167 mn, while Jet2 had gone through a capital increase of over GBP 420 mn. Compared to the huge amounts of funding raised, the capital increases of North American players were more insignificant. United Airlines issued USD 1 bn in new shares, whereas American Airlines raised an aggregate of USD 2.6 bn in the FSC segment. In the LCC segment, Southwest Airlines with a USD 2.3 bn and JetBlue with a USD 583 mn capital increase can be mentioned as examples.

Overall, the hypothesis that debt funding could be the predominant factor in increasing liquidity was confirmed. Additionally, low cash needs of European LCCs in comparison with the other peer groups due to the good liquidity situation of the former could be validated.

(B2) The role of governments as safe haven especially for FSCs and North American airlines by providing fast and sufficient support in order to survive the crisis

As airlines suffered due to falling revenues, lacking profitability and cash burn threatening liquidity, rating agencies downgraded several airlines among the peer group[17] (Fitch Ratings 2021). As a result, cost of borrowing rose in times where access to favourable financing conditions was necessary to survive the Covid-19 induced crisis. This is the reason why governmental funding and state aid gained such an important role for airlines in order to maintain a high degree of liquidity, while being able to finance the cash burn coming from low revenues paired with high fixed cost (Dube, Nhamo, and Chikodzi 2021).

There are different types of governmental support with this analysis focusing on grants, debt (loans and guarantees) and capital injections (hereinafter equity). In general, governmental support can be distinguished between cash inflow and cash outflow measures. On the one hand, cash inflow measures aim to support liquidity and/or keep solvency at a desired level and include loans, guarantees, warrants and equity. On the other hand, cash outflow target expense reduction in order to boost profitability. These type of support includes tax reduction, tax

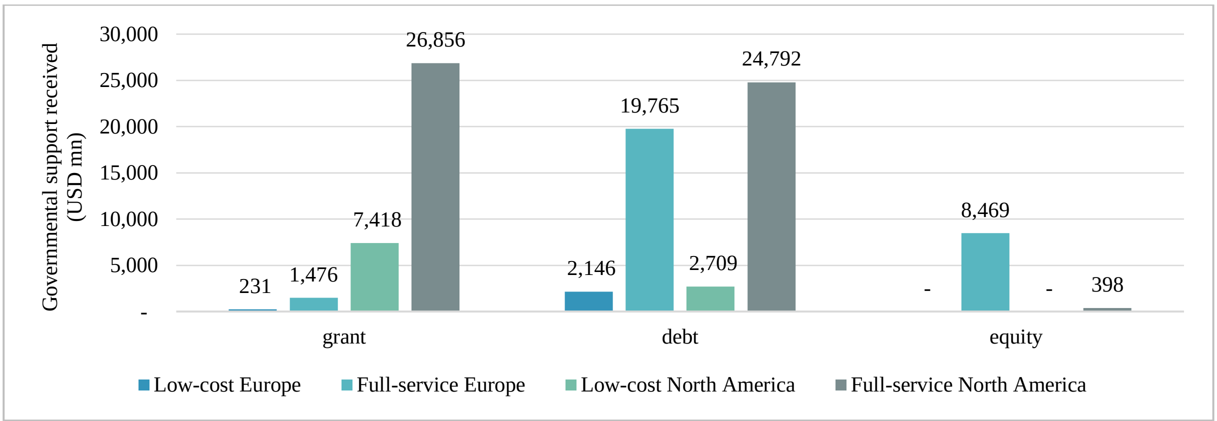
[17] including Lufthansa, IAG, SAS, Ryanair, EasyJet, Alaska Airlines, American Airlines, Delta, and Southwest Airlines

deferral, payroll support as well as suspension or delay of financial commitments like debt repayment, interest and leasing payments (OECD 2020a).

While governmental support in the North American peer groups is provided by the US and Canada through the Coronavirus Aid, Relief, and Economic Security (CARES) Act and Large Employer Emergency Financing Facility, respectively, the European peers in our analysis mainly received support from the national governments like the Federal Republic of Germany's Economic Stabilization Fund (ESF) and Covid Corporate Financing Facility (CCFF) from the UK Treasury instead of the EU as a central organ (*Appendix 4*).

The data analysed (*Figure 12*) suggests that FSCs and North American airlines received most governmental support, with North American FSCs getting roughly USD 52.1 bn, followed by its European peers with around USD 29.7 bn. In the LCC segment, North American players obtained slightly more than USD 10.1 bn while the European airlines brought up the rear with roughly USD 2.4 bn.

Figure 12: *Governmental support received (Q1 2020 – Q2 2021)*



FSCs may have received more government aid as LCCs due to the nature of FSCs being national flag carriers that governments were more willing to save for public image purposes or due to state-ownership. Sector-wide direct support for every airline in the market facilitated governmental support in the Northern American markets while state aid in the EU usually is prohibited or restricted by single market rules. However, barriers were reduced but still, governmental support was not going beyond economy-wide programs and was tied to strict conditions leading to lower amounts provided to airlines in Europe than in North America (OECD 2021).

In terms of types of support, debt, and debt related instruments (including guarantees) are predominant with a volume of around USD 49.4 bn among all peers, followed by roughly USD 36.0 bn of grants while equity with USD 8.9 bn plays a minor role considering governmental support. Deep diving into the peer groups, it can be observed that North American governmental support is grant- and debt-oriented, while European is debt- and equity-oriented (*Appendix 5*). Even though governments were interested in supporting the airline industry with debt and grants as transportation is essential for the public and reduction of it would lead to economic and societal damage, equity was used more selectively, because governments did not want to take ownership of airlines, but rather agree on state aid with repayment obligations. However, governments were more open to support former or current state-owned flag carriers like Lufthansa, SAS and Air France-KLM with capital injections (OECD 2021).

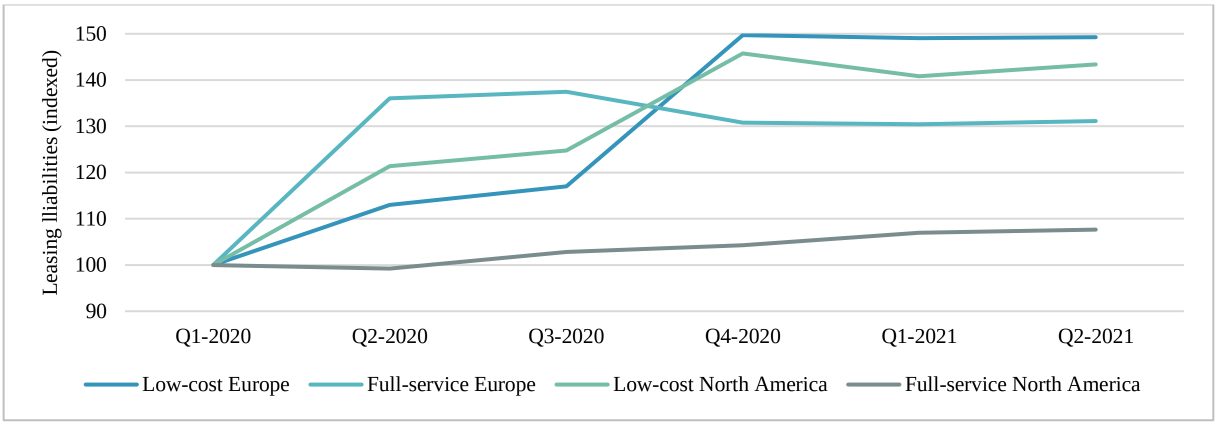
Overall, governmental support favoured debt as a support tool which creates a drawback as the debt needs to be serviced and repaid. The recovery of the industry is now additionally impacted by high leverage with airlines being pressured to raise capital from equity issuance or to generate free cash flow to repay debt. A quick recovery and improvement of passenger revenues will be crucial to contain cash burn resulting in positive cash flows that can be used for deleveraging. Still, bad operational performance and high debt service will restrict airlines from investments in fleet and product (IATA 2021e). Another striking factor posing risk onto airlines coming from high leverage is an increase in interest rates putting additional pressure on airlines (Krainer 1977).

(B) Which airlines have implemented the most effective measures in reaction to the crisis?

(B3) Sale and Leaseback transactions as complementary way to strengthen liquidity base and allow for more operational flexibility

Leasing demonstrates another alternative of financing coming with additional advantages. As can be seen in *Figure 13*, leasing liabilities grew for every peer group in the analysis in reaction to the pandemic with different rates from Q1 2020 to Q2 2021. While European LCCs[18] and FSCs[19] as well as North American LCCs[20] grew more strongly with rates of 49.2%, 31.1% and 43.4%, the effect for North American FSCs was more insignificant with 7.6% growth.

Figure 13: *Development of leasing liabilities (Q1 2020 – Q2 2021)*



Sale and Leaseback transactions (SLB) seem to be a tool in the crisis to generate cash inflow. SLB occurs, when airlines buy an airplane from manufacturers such as Airbus and Boeing and directly sell them to a leasing company (at a profit). Still, the airline will operate the plane as it leases the plane for a certain period. After the contract ends, the plane is returned to the leasing company and other planes can be leased. This model offers operational flexibility to airlines as it enables a younger fleet and constantly new airplanes with lower operational and maintenance costs ensuring higher profitability (Tiwari, Singh, and Kumar 2018). More important, SLB solves the airlines liquidity issues resulting from the crisis as the sale of airplanes generates cash inflows to the airlines strengthening the liquidity situation (Endrizalova et al. 2018).

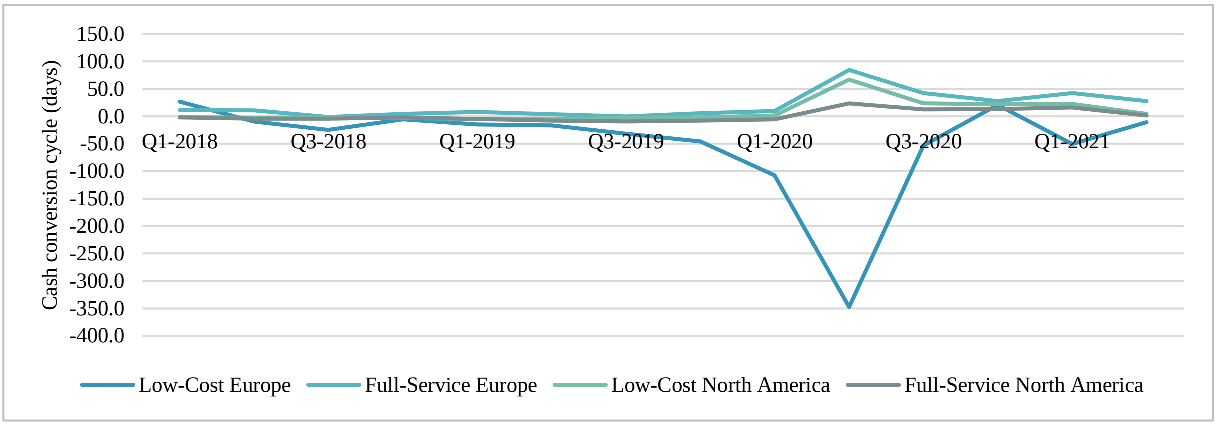
[18] excluding WizzAir due to missing data
[19] excluding International Consolidated Airlines Group due to missing data for some quarters
[20] excluding Frontier Group Holdings due to missing data for some quarters

For example, easyJet engaged in 33 SLB transactions in its fiscal year 2020 (ending September 2020) compared to 10 in the fiscal year before, while announcing additional 21 SLB transactions for the fourth quarter of 2020. In the case of Southwest Airlines 20 SLB transactions were made in 2020.

(B4) Only European LCCs were able to improve their internal cash management at the beginning of the pandemic

Liquidity management can be practiced not only by raising external funds but also through improved internal cash management. A metric to understand an airline's operational excellence is the cash conversion cycle (CCC). The Cash Conversion Cycle measures (in days) a company's time to generate money from services (Davies and Merin 2014). The higher the CCC, the more time a company needs to collect money. Consequently, the lower the CCC, the more efficient the company operates. The strong impact by the Covid-19 pandemic on revenues and costs of the airlines has resulted in a worsened CCC for FSCs in Europe, FSCs in North America and LCCs in North America (*Figure 14*).

Figure 14: *Cash conversion cycle (Q1 2018 – Q2 2021)*



Only European LCCs, especially Ryanair, improved their cash management. Their reviewed aircraft deliveries and changes in the contracted timing of aircraft payments led to higher payables, resulting in a tremendous improvement of their CCC (Ryanair 2020).

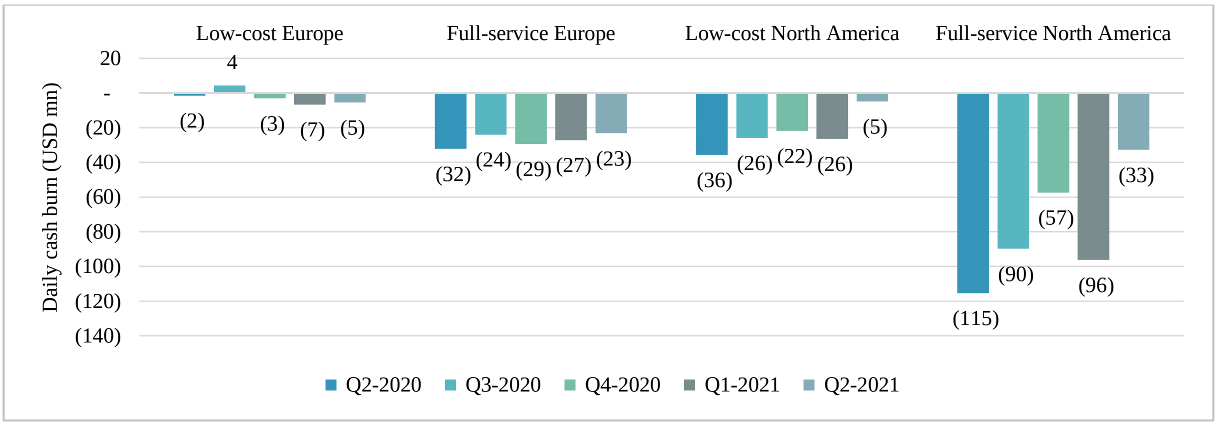
(B) Which airlines have implemented the most effective measures in reaction to the crisis?

(B5) Cash burn improvement across all peer groups due to cost savings and revenue recovery

The cash burn rate is another factor to improve the airline's current situation. This chapter deals with the cash burn development of the peer groups from Q2 2020 until Q2 2021 and gives insights into how airlines could improve their cash burn rate.

Looking at *Figure 15*, it can be observed that all peer groups except LCCs in Europe[21] (still have a shallow rate compared to other peers) were able to improve their cash burn rate from Q2 2020 until Q2 2021. This was achieved through cost savings, especially crew costs and CAPEX, and rising sales. It is to mention that North American carriers decreased their cash burn stronger than European carriers[22], mainly driven by a more substantial revenue recovery in the North American market. Nevertheless, all four peer groups are still burning cash at the end of Q2 2021.

Figure 15: *Daily cash burn (Q2 2020 – Q2 2021)*



Crew expenses are an essential driver to understand how airlines reacted to the pandemic. When looking at the development of crew expenses in relation to revenues *(Appendix 2)*, it can be identified that all four peer groups were able to reduce their crew expenses with the start of the pandemic during Q2 2020. It needs to be mentioned that European carriers were able to facilitate a stronger reduction in their crew costs with revenues (LCCs: 64% of revenues, FSCs: 80%) than their North American counterparts (LCCs: 156%, FSCs: 148%) which resulted in

[21] excluding Wizz Air Holdings Plc and easyJet plc due to missing data
[22] excluding International Consolidated Airlines Group and Air Canada due to missing data

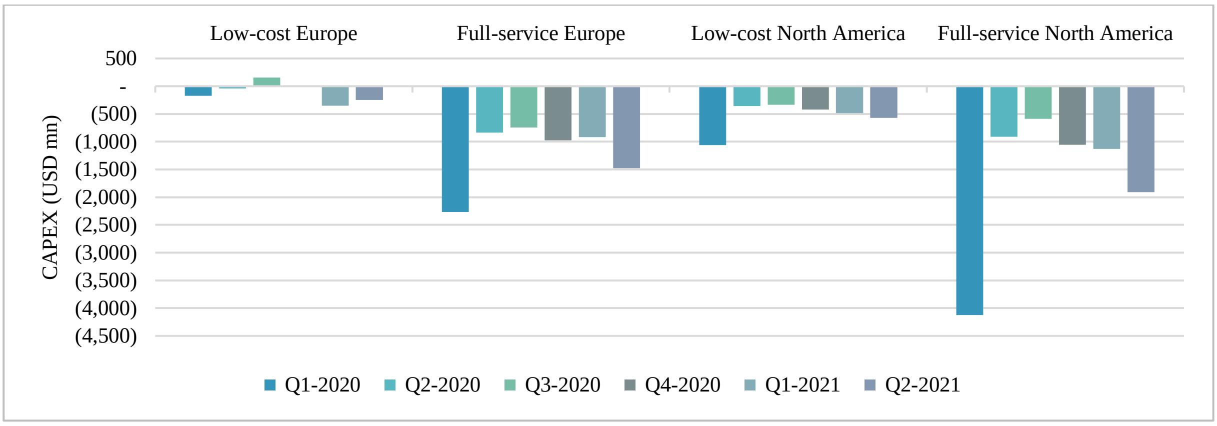
the latter showing higher crew costs than revenues. Lufthansa for example, reduced their crew costs by enabling short-time working and lower profit-share payment while agreeing with the labor union on not cutting jobs (Lufthansa 2020b). North American carriers received strong payroll support through various governmental programs and enabled voluntary separation programs for employees to cut costs (Southwest Airlines 2020). Such support programs had the conditions that involuntarily layoffs are not allowed, which is one explanation for the still high crew expenses (United States Department of the Treasury 2021a). Another reason is that those support programs in North America are mainly recognized as liquidity support than as cost reduction, which also explains the greater liquidity intake of firms in North America (*Section B1).* As can be seen in the further course of the graphs *(Appendix 2)*, airlines did not further adjust crew costs in absolute terms during 2020 and beginning of 2021 even though revenues slightly increased. The stagnating cost-cutting in crew costs can be explained by the fact that airlines were, in general, hoping for faster recovery, preserved their workforce to handle expected demand (IATA 2020a) and prevention of terminations through support programs. Nevertheless, European LCCs were able to reduce their crew costs during the pandemic strongly and were thus able to gain an advantage over the other peer groups. The business model functions in that their employees are typically self-employed, meaning that the company can flexibly adjust their crew size according to the flight demand (Brannigan et al. 2019). Nonetheless, once the states' layoff restrictions are lifted, PricewaterhouseCoopers (2020) expects a wave of layoffs to overhaul the organization in all regions. The key here will be to keep key functions running to ensure expected growth from the crisis.

CAPEX is another significant expense that has been adjusted by the airline companies with the Covid-19 pandemic. When looking at *Figure 16,* it can be identified that all four peer groups were able to reduce their CAPEX beginning of Q2 2020 tremendously. Airlines limited their CAPEX by cancelling projects and deferring aircraft deliveries during 2020 (IATA 2020f).

(B) Which airlines have implemented the most effective measures in reaction to the crisis?

Additionally, higher leasing intensity and SLB lead to lower CAPEX. Nevertheless, airlines started to respond to increased vaccination rates (Financial Times 2021) and a positive outlook for air travel by increasing their investment in deliveries of new, greener aircrafts *(Appendix 12)* and resumption of halted projects during Covid-19 pandemic.

Figure 16: *CAPEX (Q1 2020 – Q2 2021)*



The development can be seen in the absolute increase of CAPEX along the peers in Q1 and especially in Q2 2021. Due to the high regulations within the airline sector, a minimum level of CAPEX is required and limits the airline's ability to reduce their CAPEX (Deloitte 2019). When comparing the absolute CAPEX of the peer groups, FSCs have higher values than LCCs[23]. This can be explained by their differences in fleet size and respective investments *(Appendix 11).*

Airline companies could not exert a greater influence on other costs, such as fuel & oil, maintenance or landing fees, as these costs were heavily dependent on the flights operated and were therefore mainly variable costs. Despite their variable dependency, maintenance costs could be influenced more strongly by SLB and deferred maintenance. However, it should be mentioned here that they must keep a minimum level of maintenance for their fleet to ensure

[23] European LCC highly influenced due to missing quarterly data

compliance with the technical conditions at any time meaning that airlines can only reduce their total maintenance costs up to a certain point (De Florio 2016).

In summary, it was found that airlines are only to a limited extent able to adjust their cost structure so that they significantly improve their situation in the short to medium term. An improvement in the general Covid-19 situation and the associated revenue increases in Q3 and Q4 2020 *(Section A2)* were critical factors in reducing cash burn, especially for North America.

(B) Conclusion: LCCs implemented the most successful measures and are best positioned for the post-Covid environment; North America outperforms Europe

To answer the question which airlines have implemented the most effective measures in reaction of the crisis, this section assessed and interpreted different liquidity and cash burn parameters which are summarized below. Furthermore, an outlook for the industry is given.

Looking at debt and equity issuances as measures to counteract liquidity constraints, FSCs as well as North American players were able to raise the most funds. Diving deeper into governmental support, FSCs and North American peers benefitted the most from receiving the biggest funds. However, more remarkable is that North American airlines obtained a big share of governmental grants they do not need to repay in contrast to debt while equity played only a minor role. This indicates lower risk for North American peers compared to all others as the issuance of debt provides liquidity, but also additional pressure in repayment and service of interest payments. It forces airlines to generate positive free cash flows, take on equity for repayment and restricting themselves in engaging in investments especially in the current difficult market environment. In contrast, these risks are absent with grants, putting North American players at an advantage. Leasing as well as SLBs were complementary measures to increasing liquidity and offering additional flexibility where LCCs put in the biggest efforts. Finally, in contrast to external liquidity raising, European LCCs were the only ones to perform cash management effectively. Even though FSCs seemed to counteract liquidity constraints more effectively, it also should be critically considered that LCCs were less affected by the crisis in general and therefore, were not as desperately in need to take action like FSCs. Furthermore, the North American market extremely benefitted by the CARES Act giving direct support while governmental support in Europe is banned under normal circumstances and only exceptionally allowed on state-level. As a result, fundraising in these terms were not actively managed by airlines itself, but rather decided by the respective governmental authorities.

Furthermore, all four peer groups were able to reduce their cash burn by first reducing fixed costs, especially crew expenses and CAPEX, and second increasing revenues due to higher vaccination rates and lower restrictions. North American airlines in particular were able to drastically improve their initial situation. The flexible cost structure of European LCCs has led them to emerge as clear winners from the cash burn situation and the model has proven to have a promising future. The key for airlines will be to keep key functions running while cutting jobs to ensure expected growth from the crisis.

Both the liquidity and the cash burn measures have led to a significant improvement in the days operating left of all peer groups. Meaning how many days a company can maintain operations if no further measures are made. However, it must be emphasized that especially LCCs showed lower cash burn rates and higher operational days left (*Appendix 6*) compared to FSCs. Consequently, LCCs have implemented the most effective measures in reaction to the crisis.

Despite an improving market environment and a successful combating of Covid-19 so far, airline recovery remains uncertain and is especially dependent on the success of the global vaccination rollout as well as easing travel restrictions by the local governments. However, according to Willie Walsh, Director General of IATA (2021), “the recovery has definitely started in the second half (of 2021).” From a geographical perspective, North America is expected to recover faster than Europe as it will reach approx. 55% of the projected baseline revenues while Europe is forecast to achieve only 44% of the projected baseline revenues by the end of 2021. This development is caused by the fact that Europe's travel activities are heavily dependent on international markets. For example, almost 40% of European passengers in 2019 travelled outside the EU (CAPA 2021b). Therefore, domestic markets, which are recovering faster from Covid-19, are tendentially smaller in Europe than in North America (Bushey and Georgiadis 2021a). International markets still lack in recovery due to existing border control measures. Therefore, reaching pre-crisis levels on international markets require further loosening of travel restrictions in the future (IATA 2021i).

Driven by a fast recovery of the domestic market, LCCs are expected to emerge faster from Covid-19 than FSCs. Furthermore, especially in times of economic uncertainty, consumers are not willing to spend money for expensive long-distance tickets but rather prefer cheap short-haul flights (Amaro 2021). Aggressive cost-cutting measures of LCCs will enable them to further lower ticket prices in a new post-Covid environment while still breaking even despite lower capacities. A lower price environment will be challenging for FSCs as their high-cost business model will remain unprofitable when competing with LCCs.

WHICH AIRLINES PLACE THE GREATEST EMPHASIS ON SUSTAINABILITY?

To answer the second main question of this report which airlines emphasis the greatest on sustainability, the following chapter investigates two questions, which cover regulation and technology. First, it is examined which airlines in the selected peer group, meet the regulatory requirements best (*Section C*). Furthermore, how technology is impacting airline sustainability and which airlines prioritize it the most (*Section D*). Background information about climate change and its impact on the airline industry can be found in *Appendix 7*.

(C) Which airlines meet the regulatory requirements best?

To answer this question, the regulation of airlines and the environmental work of airlines is investigated. Hereby, the goals and initiatives of the global trade association IATA (C1) as well as international regulation from the UN organisation ICAO (C2) are reviewed. Afterwards, the differences in regulation between the US and the EU are outlined (C3). Furthermore, analyses are performed on CO_2-efficiency to measure the carbon footprint of the different peer groups (C4) and on total CO_2-output (C5). Finally, own offsetting and net-zero goals (C6) and third-party environmental scores are assessed (C7).

(C1) A path to net-zero based on four cornerstones

The IATA, the industry's own trade association of 290 airlines, including all FSC peers, and the LCC peers JetBlue and Icelandair Group, sets environmental goals for the industry and defines ways to reach them. In 2009, as the first industry association, the IATA has set sustainability goals to reach until the end of 2050. Firstly, fuel efficiency should improve by 1.5% annually on average until 2020. Secondly, carbon emissions should be stabilized as further growth has to be carbon-neutral from 2020 on. Thirdly, absolute emissions should be reduced by 50% in 2050 compared to 2005 (Corinne 2021). New goals and initiatives have been put into place recently by the IATA replacing the first long-term ones to ensure a more sustainable industry that keeps up to more strict regulations (IATA 2021j). Therefore, instead of trying to reduce absolute emissions by 50% compared to 2005 levels as set by IATA in 2009, a new resolution has been passed at the IATA Annual General Meeting on 04 October 2021 stating that they want to reach net-zero emissions by 2050 (IATA 2021b). This is an extremely ambitious goal, as the aviation industry had growing total CO_2 emissions until 2019 and only decreased their emissions dramatically in 2020 because of the Covid-19 related drop in air traffic (Kamel 2021). Until 2050 the industry expects over 10 bn passengers per year, which is nearly five times as much as in the Covid-19 impacted year of 2021. This would require the industry to abate 1.8 gigatons of carbon emissions in 2050 (IATA 2021j). With current airplane and fuel technology, it would be virtually impossible to reach the goal of net-zero emissions, therefore the IATA has presented four key elements that will contribute to their emissions reduction strategy. The IATA expects that to achieve this goal (I) 65% of the contribution has to come from Sustainable Aviation Fuels (SAF), (II) 19% from offsetting carbon capture and storage technology, (III) 13% from new aircraft technology, namely aircraft with electric or hydrogen propulsors and (IV) 3% from improved infrastructure and operational efficiency focusing on air traffic management (McCausland 2021e).

As SAF, hydrogen, and e-technologies are not widely available yet (analysed in *Section D)*, offsetting programs and carbon capture will be extremely important in the near future. Therefore, to contribute to the total CO_2 reduction in order to reach net-zero until 2050, airlines themselves offer offset programs to their customers as well as governmental and UN initiatives oblige airlines to compensate certain CO_2 emissions. CO_2 reductions in infrastructure and operations only account for 3% on the industry's path to net-zero in 2050 but given the huge amounts of CO_2 that is polluted and the timeframe of 30 years, it still has a major impact on the environment and is detrimental to the plan to reach net-zero (McCausland 2021c). To reach the goal, improvements must be made in different areas of the infrastructure and operations of the aviation sector including the improvement of aerodynamics and weights of airplanes, airport operations as well as air traffic management (ATM) optimization. The IATA itself has identified three ATM programs that can contribute a lot towards their goals and are projected to be implemented by 2030 namely the Global Air Navigation Plan (GANP) from ICAO, the EU Single European Sky ATM-System and the Next Gen ATM-System from the US (McCausland 2021c).

(C2) International regulation will raise costs especially for heavy polluters

The two most important globally binding initiatives by the UN organization ICAO to reach net-zero are first, the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) and second, the ICAO GANP for ATM. The ICAO CORSIA initiative was introduced in 2016 to offset global CO_2 emissions from international commercial flights and it was the first market-based offset method introduced by any industry. The aim was to stabilise net CO_2 emissions at 2019 levels from 2021 on and to be an alternative way to reduce net emissions until 2035 as SAFs and new technologies were not widely available yet (ICAO 2021a). To point out the importance of carbon offsetting in the short-term, it is expected that offsetting is reliable for 97% of all CO_2 reductions in 2025 and 93% of all reductions in 2030, but only 8% in 2050. As total CO_2 emissions in 2021 are down from 2019 levels due to Covid-19, airlines do not need to offset any emissions until they surpass them again. According to projections from the industry, the total RPK from aviation will not reach 2019 levels until 2025, indicating CO_2 emissions will have similar developments (Hersch 2021). Until the end of the first phase in 2027 every UN country can decide whether they want to enforce CORSIA on their airlines. As of September 2021, 107 countries accounting for 77% of the international aviation activity voluntarily joined CORSIA (Corinne 2021). From the start of the second phase in 2027, over 90% of the international aviation activity will join CORSIA excluding only small emitting countries who represent less than 0.5% of international aviation (ICAO 2021a). When enforced, airlines are required to buy certificates that are used to invest in climate protection programs, mostly in developing countries, or alternatively operate with CORSIA eligible SAFs on every emitted CO_2 that exceeds 2019 levels. Furthermore, participating airlines need to offset all exceeding emissions from the industry including those of non-participants. This component will be paid by every participant based on the share it has on the total CO_2 output of the industry, aiming to penalize airlines with a significant share and giving small market airlines time and resources to develop their business (Timperley 2019). Until the end of the second phase in 2035, 6% of global emissions from international aviation between 2015 and 2050 are projected to be offset through CORSIA. The fact that the quality of the offsets is not clearly regulated and that offsets could be double counted are criticisms arising about CORSIA (Timperley 2019). In order to address these issues, the aviation industry set criteria for the offsetting scheme. Firstly, offset of CO_2 emissions are permanent and additional to the common sustainability work.

Secondly, reductions in emissions must be quantified according to precise measurements, binding protocols, and auditing. This also includes rightful tracking to prevent double counting of offsets. Thirdly, offsets must be in accordance with national and international law and include risk management mechanisms for environmental and social risks (McCausland 2021b).

The second ICAO initiative to reduce CO_2 emissions is the GANP which aims to improve airport operations and ATM efficiency. The instruments that are used are Aviation System Block Upgrades and technology modernization projects to optimize airport operations, global interoperable systems and data, reach optimal capacity and increase flexibility of flights, and the efficiency of flight paths (ICAO 2021c). CO_2 emissions will be reduced by saving fuel due to more efficient operations. In 2025 emission savings are projected to be 1.6 to 3.0% after the first two blocks of GANP (McCausland 2021c). This is based on every ICAO member state implementing the recommended instruments. Overall, GANP includes four blocks of six years, each from 2013 to 2037, where several implementations should be made in the four different categories mentioned above (ICAO 2021c).

(C3) US airlines get favoured by regional environmental regulation

Next to international regulation, airlines have to comply with regional regulation where differences between the approach to environmental regulations between the US and EU can be observed.

The US has seen four years of the Trump administration, where climate protection and CO_2 reduction has not been prioritized, as President Trump terminated US participation in the Parisian climate agreement on the 04 November 2020 (McGrath 2020). His successor President Biden made a 180 degree change in US climate policy from the start of his legislative period on the 20 January 2021. He prioritized stopping climate change by first reagreeing to the Parisian climate agreement on the day of his inauguration and secondly presenting a plan with different measures to guide the US to reach net-zero emissions by 2050 (Cho 2021). The US plan includes separate initiatives to lead the aviation industry, one of the most severe polluters in the US with 3% of total greenhouse gas emissions, to net-zero greenhouse gas emissions.

Meanwhile, the EU has seen drastic changes in the political landscape in the last years as well as climate change became a major topic in the latest elections. This evolution was put to a paper by the European Commission on 11 December 2019 with the “European Green Deal”. This document set binding goals for the EU as a whole and therefore every member state by introducing many measures and investments in the coming years. The ultimate goal is to become climate neutral by 2050 and by 2030 the net greenhouse gas emissions must be reduced by at least 55% compared to 1990 levels (Harvey and Rankin 2020). These goals have also been put into the “European Climate Law” which entered into force on 29 July 2021. With this law, monitoring measures to track the progress within the EU are included and, if necessary, allow further actions to taken if adjustments must be made. The current state of progress in the reduction of net greenhouse gas emissions in the EU will be reviewed every five years (Gorzelak et al. 2021). In the US and EU, CO_2 reduction is projected to come from four sources, more efficient aircraft, more efficient ATM, broader availability of SAF, and the CORSIA offsetting scheme.

A primary focus of regulation from the EU and US for airlines is on SAF. Therefore, the Biden administration released an ambitious investment and production plan for SAF including USD 4.3 bn in investments in producers of SAF as well as a SAF tax credit to cut costs and scale domestic production of SAF. Expected productions are 3 bn gallons per year by 2030 and 35 bn gallons per year by 2050 to satisfy 100% of the US fuel demand, a major increase from 2019 levels of 4.5 mn gallons (The White House 2021). This usage of SAF instead of kerosine would cut carbon emissions from aviation by 20% in 2030. The government named a more ambitious target than the Airlines for America, a trade group of major US carriers, who set a target of 2 bn gallons SAF by 2030 in March 2021. But, Airlines for America agreed to the goal of

President Biden and forfeited their old one (Duncan 2021). In comparison, the EU has obliged fuel suppliers to supply all EU airports with more SAF, and airlines are required to refuel with SAF-blended fuel on every flight from an EU airport. Additionally, every gate and every outfield position on EU airports is obliged to provide electricity supply by 2025 and respectively 2030. This aims to lead to increasing use of SAF and e-fuels with levels going from 2% SAF and 0% e-fuels of the total fuel mix in 2025 to 28% e-fuels and 35% SAF in 2050 (European Commission 2021). Another topic arising from the new European Green Deal is the taxation of kerosine which airlines were exempted from until now. According to the proposed law by the EU Commission, taxation would not apply on SAF and would only be applied from 2023 on, starting at zero, with a gradual increase over a 10-year period (Abnett 2021).

Concerning Offsetting Schemes, the US is relying on the CORSIA offsetting scheme of the UN and on voluntary airline offsetting schemes. As of now, no other carbon pricing scheme will be enforced on the industry. Meanwhile, the EU has introduced its own emission trading scheme where emission certificates have been limited and tradeable since 2012. From 2021 on, 4.2% fewer allowances for intra-EU flights will be issued per year. By 2026, free allowances will not be handed out anymore and every extra-European flight must be offset in the CORSIA scheme. All those measurements will lead to higher costs for airlines and ultimately passengers. The European Commission projects an increase of costs of flying by around 8% by 2050, especially due to the increased use of SAF (Goulding Carroll 2021). Industry representatives have already criticized those new regulations, arguing that rather more emissions will occur (Abnett and Hepher 2021). They also fear that overlapping measures will lead to airlines paying twice for emissions, increasing costs even further (Caroll 2021). This leads to higher costs for airlines in the EU than the US as the EU charges USD 45 per tonne CO_2 while CORSIA only charges below USD 2 per tonne CO_2 (Dalunde 2021). Overall, US airlines will probably have a competitive advantage over EU airlines as they will be exposed to fewer costs regarding offsetting and will see more governmental investments and therefore fewer own investments in SAF.

Next to SAF and offsetting initiatives the US and EU both introduced initiatives to improve ATM and ground operations. The NextGen Initiative by the Federal Aviation Administration aims to improve ATM and ground operations in the US by replacing ground-based with more dynamic satellite-based technologies (McCausland 2021c). Benefits will come from access to and equity in the ATM for all airspace users, increased capacity, improved efficiency, environmental savings, increased flexibility, predictability, and safety. NextGen is separated in four phases of five years starting in 2010 and ending in 2030. In the first two segments from 2010 to 2020 foundational infrastructure measures were deployed, expanded, and improved. In the third and fourth segment from 2021 to 2030 NextGen will be realized and leveraged as concepts for safety, efficiency, predictability, and flexibility that require additional development to be deployed. Early implementations have saved 115 mn gallons of fuel and more than USD 7 bn from 2010 to 2019. Those cost savings can be divided in different measurements: 5% came from reduced accidents, 17% from fuel savings, 21% from other aircraft operating cost savings, and 57% from passenger travel time savings. By the early 2030s, the FAA projects a potential of USD 100 bn in savings for the industry thanks to NextGen (Federal Aviation Administration 2021). The corresponding EU initiative is called the Single European Sky aiming to reduce CO_2 emissions through an efficient ATM-System in a defragmented European airspace. Efficient and seamless air traffic would be generated through technological, safety, and operational improvements (Air Transportation Action Group 2021). There have already been initiatives by EU institutions in 2004, 2009, and 2013 to roll out the Single European Sky, but national authorities prevented this from happening in the past because of the sensibility of national airspace for security and defence policy reasons (Hütten 2021). Even though billions of dollars and 6-10% of emissions could be saved through the Single

European Sky, there is no clear track for its implementation as new propositions got turned down quickly by national governments (McCausland 2021c), (Langener and Schwenke 2011). Therefore, US airlines are at an advantage as they have a clear path where they can save emissions and costs without having to invest much themselves. Meanwhile, European airlines are exposed to EU countries, which prevent their initiative to launch.

(C4) LCCs outperform FSCs in CO_2 efficiency gains

The airline industry is a heavy polluter of CO_2 in the world as airlines are estimated to be responsible for 2.5% of all emissions in 2019 (Cropley 2021). In the last decade, however, airlines tried to be more climate friendly as they became more efficient on a CO_2 per RPK basis. The industry set themselves a goal to become 1.5% more efficient on a yearly basis between 2009 and 2020 which they even exceeded as efficiency improved by more than 2% (Stevens 2021). This is partly supported by the peer group data of the CO_2 efficiency on a yearly basis starting in 2016 until 2020[24]. The data showed that both European LCCs and North American LCCs managed to gain more than 1.5% efficiency between 2016 and 2019 with gains of 3.1% respectively 1.7% on average per year. Meanwhile, European FSCs and North American FSCs managed to become more efficient but could not meet the 1.5% goal as they only became more efficient by a reduction of 1.4% and 0.7% on average per year respectively *(Appendix 9).* In 2020, however, the efficiency could not hold up and got substantially worse through all peer groups, because there was a huge drop in passengers due to Covid-19. Consequently, while the European LCCs managed to limit their decrease in CO_2 efficiency to 10.8% in 2020, North American LCCs efficiency decreased more severely by 19.2%. Similar geographical differences could be observed from FSCs as European peers' efficiency decreased only by 19.2% while North American peers decreased by 41.2% (*Appendix 9)*. Efficiency will probably bounce back to pre-Covid-19 levels when passenger numbers increase, as those efficiency gains

[24] Emission data from Wizz Air Holdings, easyJet, Jet2, Allegiant Travel Company, Frontier Group Holdings and Spirit Airlines were not available

are mainly attributable to improved design and technology of airplane, larger aircrafts combined with an increased passenger load factor (Ritchie 2020).

(C5) Total CO_2 output – Covid-19 as a one-time effect or blueprint?

Overall, the efficiency gains of the past years would indicate that airlines are generally on a good track to reduce CO_2 emissions, but because the increase in number of passengers exceeded the effect of the efficiency, the airline industry polluted constantly more emissions. This led the peers to polluting more total CO_2 emissions every year between 2016 and 2019.[25] The greatest increase came from the North American FSCs (CAGR of 6.0%), followed by European LCCs (CAGR of 5.0%), European FSCs (CAGR of 3.8%) and North American LCCs (CAGR of 2.0%) (*Appendix 9*). In 2020, a contrary effect compared to the CO_2 efficiency has been observed, as emissions have decreased through all peer groups due to less traffic resulting from Covid-19. European FSCs had the most imminent decrease with 60.8% compared to 2019, followed by the North American FSCs with 53.6% and North American LCCs with 43.5%. European LCCs only decreased emissions by 0.7%, mainly because Ryanair's reporting year ends on the 31 March and therefore the Covid-19 effect was first seen in their 2021 report where their emissions dropped by 77.2% compared to 2020 *(Appendix 9).* These results are also in line with the global CO_2 emissions from commercial airlines. Another finding regarding total emissions is that North American peers pollute more than European peers both in FSCs and LCCs, as there are more passengers carried by North American than European peers (Finances Online 2020). Furthermore, FSCs are responsible for more emissions than LCCs both in North America and Europe. This is based on their business model, as on the one hand, 51.9% of all emissions from all flights starting from EU airports in 2020 were caused by flights of more than 4000 km, even though they only make up for 6.2% of all flights. On the other hand, from all flights starting from EU airports in 2020, 4.3% of all emissions came from flights with less than

[25] Emission data from Wizz Air Holdings, easyJet, Jet2, Allegiant Travel Company, Frontier Group Holdings and Spirit Airlines was not available

500 km, which account for 30.6% of all flights (EUROCONTROL 2021a). Overall, total emissions are directly related to the number of flights and the efficiency of aircrafts, therefore, in order to obtain a permanent low emission level, aircrafts either need to become emission free or flights need to be reduced massively.

(C6) FSCs try to reach ambitious net-zero goals through further offsetting schemes

As total emissions were increasing over the last years it is interesting to see whether airlines tried to offset some of their emissions independently of the regulatory offsetting schemes like CORSIA or the EU ETS. This can be assessed by analysing which peer group has initiatives to offset their emissions either by themselves, meaning they invest in offsetting projects, or has partner initiatives where passengers can access offsetting projects directly to offset their flights' emissions during the booking process. Both European FSCs and North American FSCs have two initiatives where airlines offset emissions themselves and four initiatives where passengers can offset their individual emissions. European LCCs follow with two offset initiatives for their own emissions and three initiatives for their customer's individual emissions. Only North American LCCs lay out as they only have two initiatives for their customers own individual emissions and otherwise rely on the governmental offsetting schemes[26]. Also noteworthy is the fact that three airlines of the peer group, two European FSCs[27] and one North American LCCs[28] are offsetting every emission coming from domestic flights *(Figure 17)*.

In this context, looking at whether the peers want to become carbon neutral in the future on their own terms, meaning only pollute as many emissions as they offset and whether they are more ambitious than their countries or the IATA which aim for 2050, is interesting. According to their own websites, four airlines want to become carbon neutral before 2050.[29] Overall, three

[26] Allegiant Travel Company, Frontier Group Holdings, and Spirit Airlines are the only airlines without an offsetting scheme from the peer group

[27] Air France from Air France-KLM and British Airways from International Consolidated Airlines Group

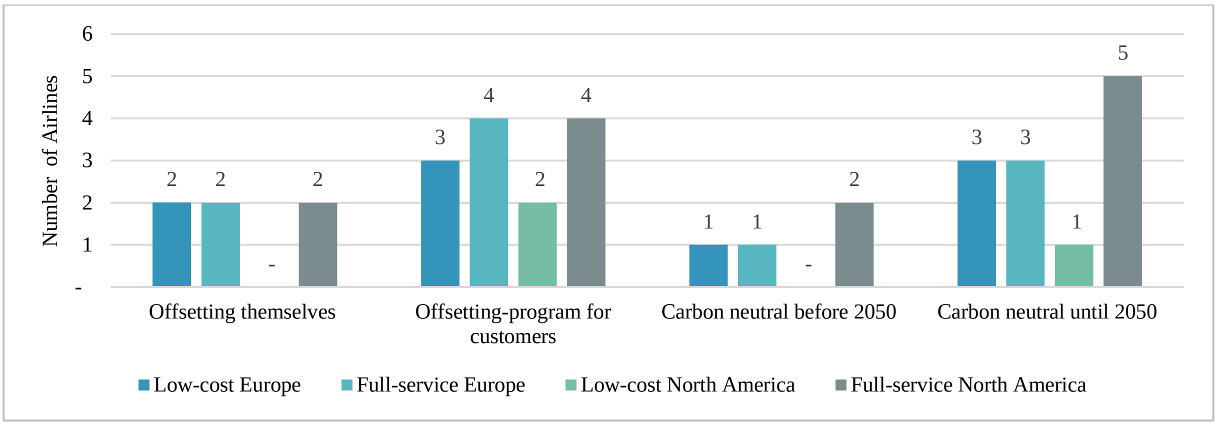
[28] JetBlue Airways Corporation

[29] easyJet in 2021, Delta Airlines in 2030, Alaska Air Group in 2040, and Finnair in 2045

(C) Which airlines meet the regulatory requirements best?

European FSCs and three LCCs want to be carbon neutral by 2050 at the latest as well as one North American LCC and all five North American FSCs (*Figure 17*).

Figure 17: *Overview of offsetting initiatives and carbon neutral goals*



This leads to the assumption that there is a significant gap between the ambitions and initiatives being made between LCCs in North America and all other peers who behave similarly in this regard. But for those ambitious airlines, the question arises of how realistic it is to reach them.

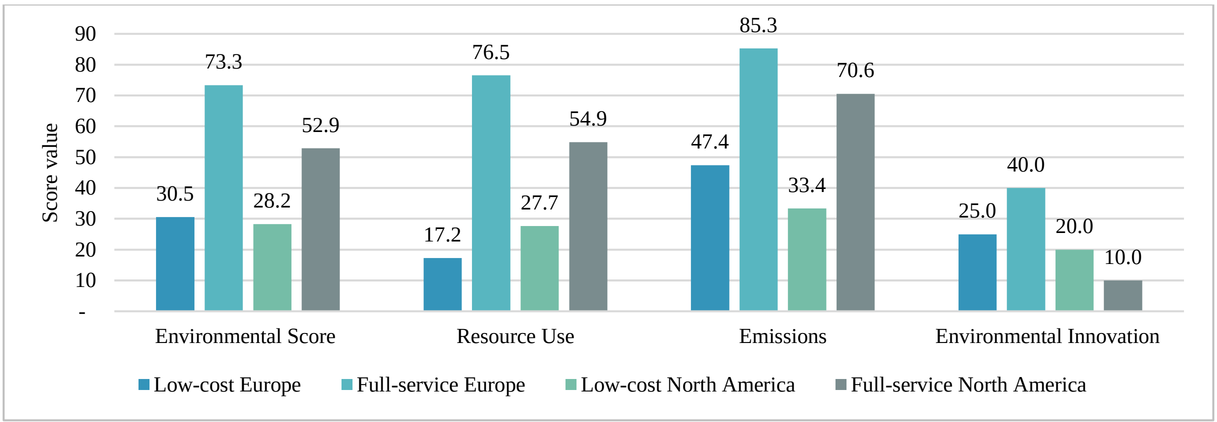
(C7) Refinitiv's environmental scores see European FSCs as the clear leader

As for this report, only the environmental evaluation of the companies is relevant and the other two other sections of ESG scores were disregarded. The environmental score itself has three categories; emissions, resource use, and innovation which are scored between 0 (worst) to 100 (best) *(Appendix 10).* Before assessing the Environmental scores from 2020 it is noteworthy that when looking at the last 10 years, a clear trend to more ESG reporting is detectable in the data of Refinitiv. Meanwhile, no trend on the Environmental scores of the peers is discernable as scores fluctuate over the years. For the different peer groups, LCCs both in North America and Europe had no or insufficient reporting in the last years as they received environmental scores later than FSC peers. Another finding is that Southwest Airlines is outperforming all LCC peers significantly and therefore is raising the average of LCCs, meanwhile FSCs are scoring more closely together over the years. Regarding the environmental score in 2020, European FSCs are outperforming all other peer groups significantly with an average score of

73.3, followed by North American FSCs at 52.9, European LCCs at 30.5 and North American LCCs at 28.2 *(Figure 18).* The geographical outperformance is supported by the fact that generally US companies report less on ESG than European (Holbrook 2021). As FSCs are historically larger firms based on revenue and market cap, the outperformance of FSCs in comparison to LCCs is reasonable as larger firms normally report more on ESG (Drempetic, Klein, and Zwergel 2020).

When accessing the peer group's sub-scores for emissions[30] and resource use in 2020, similar outcomes can be detected. European FSCs had the highest score on average in both cases, followed relatively closely by North American FSCs. European FSCs got scores above 75 in both categories while North American FSCs managed to surpass 50 in both categories. Meanwhile, European and North American LCCs dropped off significantly in both categories as they were rated below 50 in both and North American LCCs even dropped below 25 in resource use. In the last sub-score for innovations, all peers are below 50, with European FSCs ahead followed by European LCCs, North American LCCs and FSCs (*Figure 18).*

Figure 18: *Comparison of Refinitiv scores*



This low rating can be explained as airlines pollute CO_2 with every revenue and the fact that they rely on aircraft manufacturers which have not been able to make as much progress towards net-zero emissions as other industries (Cropley 2021).

[30] excluding Icelandair Group due to missing data

(C) Conclusion: No clear winner as airlines need to improve their environmental work

To answer the question which airlines meet the regulatory requirements best, this section assessed and interpreted the regulatory framework both globally, and regionally in the US and EU and afterwards assessed the environmental performance of the peer airlines. After the analyses a clear answer cannot be given on which airlines meet the regulatory requirements best. On the one hand European offsetting regulations are tougher, SAF investments are higher in the US, and ATM optimizations are being implemented in the US which indicates a more airline-friendly regulatory framework. But on the other hand, European FSCs are putting the most effort in their environmental work and European LCCs are outperforming North American LCCs. Consequently, this makes sense as European airlines must do more to meet the higher regulatory requirements, but it is tough to measure the extent to which European airlines have to put more effort compared to their North American peers. Furthermore, it is important to notice that FSCs tend to do a better job in reporting on ESG and engage in more environmental initiatives. Nevertheless, FSCs are larger entities that pollute more than LCCs and LCCs have become more efficient over the years. But the overall biggest finding is that airlines, no matter where they are or what business model they have, have major issues with becoming carbon neutral until 2050 with current technology. Therefore, the airline industry relies on aircraft manufacturers and SAF producers to provide them with the much-needed tools to meet the regulations until 2050. If this is not the case even stricter regulations for the airline industry will probably follow that will increase costs even further.

(D) How is technology impacting airlines sustainability and which airlines prioritise it the most?

After the work project has focused on regulations to make the aviation industry more environmentally friendly, the focus in this chapter lies on technologies. To answer the question of how technology is impacting airlines' sustainability and which airlines prioritise it the most, the following section contains a status quo analysis of technology (D1), an introduction of SAF

(D) How is technology impacting airlines sustainability and which airlines prioritise it the most?

(D2), what technologies are being researched to make the airline industry more sustainable (D3), an analysis of the peer groups fleet with efforts to fleet renewal (D4), as well a breakdown of which airlines use or invest the most in SAF (D5).

(D1) The engines of Pratt & Whitney and CFM International are crucial for airlines' sustainability in reducing emissions

This section focuses exclusively on propulsion technologies for commercial aircrafts since the IATA and governments, especially within North America and Europe, consider SAF and new propulsion technologies as the core for the reduction of CO_2 and make it an integral part of their plans to reach net-zero carbon emissions by 2050 (McCausland 2021e; 2021d; 2021a). Thus, the technological standard of propulsion technology determines the degree of success in achieving climate targets and minimising CO_2 emissions. Based on a specially conducted analysis, it was possible to prove that the fleets of the selected peer group consist of 46.0% aircraft from the European manufacturer Airbus and 50.0% from the American manufacturer Boeing (as of 31 March 2021). The remaining minority of 4.0% of the fleet was manufactured by the Canadian company Bombardier and the Brazilian manufacturer Embraer which is why the latest models from these manufactures are excluded from further investigation (*Appendix 11*). As of 31 March 2021, 88.4% of the aircraft in use by Airbus in the selected peer groups' fleets were the narrow-body aircraft models A320 and A321, which both belong to the "A320 family" (Airbus 2021b). For the American aircraft manufacturer Boeing, 70.9% of the aircraft in use by the peer group are of the B737 narrow-body aircraft model *(Appendix 11).* This status and the popularity of the competing models can also be confirmed by an analysis of Airbus' and Boeings' orders and deliveries from 2020 and 2021 (as of 31 October 2021). During this period, the percentage of Airbus A320 and A321 models ordered by peer group companies was 49.1% in 2020 and 97.2% in 2021, respectively. For Boeing, the percentage of orders for the B737max was as high as 100.0% in 2020 and 98.7% in 2021 (*Appendix 12*). Airbus "A320 family" models are available in the current version with the addition "new engine option" (neo), which differs significantly from the previous variant "current engine option" (ceo) not only in terms of the engine but also in respect of the wingtips, known as sharklets, and the interior technology and design of the cabin which is why the neo variant is of particular importance for Airbus competitive situation (Airbus 2021b; Hardiman 2020; 2021) (*Appendix 13*).

The engines for the neo aircrafts of the "A320 family" are manufactured and installed for Airbus customers either by the US company Pratt & Whitney or CFM International, a joint venture entitled to equal shares founded in 1974 between General Electric Aviation and the French company Safran Aircraft Engines (Airbus 2021a).

Background information of these models regarding technical and conceptual changes to highlight ecological advantages are described in *Appendix 14.* The entire configuration and functioning of a turbine will not be considered in detail further in this report. Pratt & Whitney distributes the PW1100G-JM engine for the Airbus A320neo models, which uses the geared turbofan technology compared to the previous models (Pratt & Whitney 2021). This technology is able to vary the speed of the turbines with a highly efficient gear system that allows these modules to operate at optimal speed and high efficiency. In addition, due to this gear system, this engine model delivers higher propulsive efficiency, more effective thermal efficiency (more information in *Appendix 15*), c.16% decrease in fuel consumption, c. 50% reduction in nitrogen oxide emissions, less maintenance costs and a c. 75% noise reduction in comparison to previous engine generations (Pratt & Whitney 2011; 2021; Sato, Imamura, and Fujimura 2014). Another engine alternative for Airbus and its customers is the LEAP-1A engine, which is produced and supplied by the joint venture CFM International (Airbus 2021a). The abbreviation LEAP stands for “Leading Edge Aviation Propulsion” and is a high-bypass turbofan engine which directly competes with the PW1100G-JM from Pratt & Whitney to power narrow-body or single-aisle aircraft. The "A" in the end of the abbreviation is a direct link to the customer (CFM International 2021). CFM International has maintained a close relation- and partnership with Airbus for decades. The previous engine model of the LEAP, the CFM56, was installed in the Airbus A340 (Georgilidakis 2021; Safran Group 2021a). Due to the processed materials and construction of the engine, the LEAP-1A has a 20% better thermal resistance, an improved fuel efficiency of up to 15% in fuel consumption and CO_2 emissions, reduction of c. 50% of nitrogen oxides emissions and lower noise exposure in comparison with the previous engine model CFM56 (Safran Group 2021b; CFM International 2021).

Compared with the PW1100G-JM, the LEAP-1A has minor differences in terms of construction, possible units of measurement and weight of the turbines. Thus, both turbines have slight advantages and disadvantages so that it cannot be said which manufacturer develops the better turbine. This result also sounds plausible since Airbus would otherwise not purchase supplies from both manufactures.

The Boeing 737max 10 is the largest aircraft in the B737max series and is in direct competition with the Airbus A321neo (Hardiman 2021). The current B737max generation is powered by the LEAP-1B engine from CFM International (CFM International 2021). The joint venture is exclusively supplying Boeing 737 generations since introduction of the Boeing 737 classic in 1984 and have thus maintained a close partnership since then (Georgilidakis 2021; CFM International 2021). CFM International supplies engines for the two largest aircraft manufacturers in the world which states the importance and strengths of CFM International in the aviation industry (Pfeifer 2021). The "B" in the abbreviation refers to "Boeing" (CFM International 2021). *Appendix 16* presents the LEAP-1B turbine on the one hand and also draws a direct comparison with the LEAP-1A turbine, which supplies the engines to Airbus. Like the LEAP-1A, the LEAP-1B is a high-bypass turbofan engine. Due to its construction, this engine achieves significant advantages over its predecessor, the CFM56. According to CFM International, the turbine can achieve lower noise level, a c.50% reduction in NOx emissions and a c.15% reduction in fuel consumption and CO_2 emissions (Safran Group 2021c; CFM International 2021).

Therefore, an assessment of which of the two turbines is better can therefore not be made since the LEAP-1A has conceptional advantages but is larger and heavier than the LEAP-1B. Nevertheless, the resulting propulsion efficiency advantage is almost equalized, and the engines are equal in terms of their performance and climate friendliness. Consequently, there are no significant differences or advantages for Boeing or Airbus, which are both supplied by CFM International.

(D2) SAF plays a crucial role for airlines sustainability over short- and long-term periods

According to IATA, SAF will be a significant driver for airlines sustainability (McCausland 2021d). The term SAF refers to sustainable, non-conventional aviation fuel (IATA 2021c; Riefer et al. 2020). Typically, biofuels are produced from biological resources such as animal waste, plant or algae material (Lehman 2021). Modern technology makes it possible to produce fuel by alternative, sustainable methods, which reduce the environmental impact. Compared to the conventional jet fuel, the physical and chemical specifications of SAF are almost similar which is why SAF entails a crucial advantage. SAF do not necessitate the adaption of current aircraft or engines, which is also a decisive economic factor for the airlines. Existing fleets do not have to be replaced promptly, and current orders do not have to be cancelled (IATA 2021c; Riefer et al. 2020). IATA can only recognize alternative fuels as SAF if they meet 3 essential criteria. The criteria include compliance with physical and regulatory standards, it must be produced sustainable, and finally, the raw materials must be an alternative to crude oil, meaning the resource or substance is not generated from traditional fossil resources. Such alternatives are for example cooking oil, agricultural leftovers or solid waste from homes or businesses (IATA 2021c; bp 2021). SAF have economic advantages for airlines as well as climate and social benefits, which can also have a huge impact on daily life (*Appendix 17*).

(D) How is technology impacting airlines sustainability and which airlines prioritise it the most?

According to IATA, SAF causes less carbon dioxide emissions in comparison to conventional jet fuel across its life cycle which would result in some cases up to 80% (IATA 2021c; McCausland 2021d; Lange 2021). In addition, SAF has, in comparison with traditional jet fuel, fine particulates reduction up to 90% and sulphur burdens by c. 100% (SkyNRG 2021). This represents a significant advantage as aircraft with current technology would fly much more climate-friendly and sustainable using SAF rather than conventional kerosene.

According to IATA, already c. 360,000 flights were made with SAF. In addition, already c. 100 mn liters of SAF were already used in 2021 with numbers expected to rise to c. 5 bn liters in 2025. Furthermore, the fact, that SAF worth of USD 13 bn were purchased in a forward purchase agreement underlines the status and importance of SAF for the industry participants (McCausland 2021d; Soone 2020). As of 09 October 2021, nine technical pathways of SAF already exist and are certified under the American Society for Testing and Materials (ASTM) (ICAO 2021b). Nevertheless, two of the nine pathways clearly stand out in terms of operational capability. The most common way for producing commercially available SAF is the HEFA approach, which stands for "hydroprocessed fatty acid esters and free fatty acid" and contains liquid biomasses such as plant- or used cooking oils which are transformed into green diesel by using hydrogen. These can then be separated to produce bio-based aviation fuel. The maximum blending ratio is 50%, which is also the maximum limit of the blend, prescribed by the industry (IATA 2021a; Soone 2020; ATAG 2021). The other approach is the Fischer-Tropsch synthesis, which use biomass such as forestry- and agricultural residues or grasses which is converted into synthetic gas and subsequently into bio-based jet fuel. As with the HEFA method, the maximum blending ratio is 50% (Soone 2020; ATAG 2021). There already exists a variant of Fischer-Tropsch called "A", in which alkylation of light aromatics to generate a hydrocarbon mixture that also contains aromatic compounds. The maximum mixture proportion is also 50% (Soone 2020).

(D) How is technology impacting airlines sustainability and which airlines prioritise it the most?

By 2025, up to 11 certified pathways are expected for SAF (McCausland 2021d). This further underlines the importance of SAF to the airline industry. However, to reach the goal of net-zero carbon by 2050, about 449 bn litres of SAF will be needed by 2050 (McCausland 2021d).

(D3) The use of hydrogen as synthetic fuel of the future is currently most promising

To answer the question of the impact of technology on sustainability, the focus is now on innovative approaches to propulsion technology. According to William Walsh, general director of IATA, Airbus and Boeing “do not do enough” to develop new technologies in order to reduce emissions (Bushey and Georgiadis 2021b). This accusation is addressed in the following as Airbus and Boeing are significantly involved in the status quo of propulsion technologies of the selected peer group companies.

The European aircraft manufacturer Airbus pursues two main innovative projects in propulsion technology for commercial aviation with hydrogen and electric flights (Airbus 2021d). Due to the Covid-19 pandemic, Airbus’ priorities regarding propulsion technology were shifted as financial support by the government became conditional. In exchange for help in the Covid-19 crisis, the French government wants Airbus to build, among other things, a regional- as well as a medium-haul aircraft that emits no CO_2 between 2030 and 2035 (Eiselin 2021). As a result, Airbus released a project, called “ZEROe”, with details of three hydrogen-powered concept aircrafts, which could be ready for service by 2035. The concept aircrafts are a conventional turbofan engines model, an turbo propeller model and a futuristic looking blended-wide body aircraft (Airbus 2021e; Hollinger 2021). All planes will be fuelled using hydrogen combustion through upgraded gas turbine engines (Airbus 2021e). According to Grazia Vittadini, Airbus’ chief technology officer, “Hydrogen is one of the technologies”, helping to reach zero-carbon emissions by 2050 (Hollinger 2021). Due to the strategic decision of Airbus to accelerate the research on hydrogen-based aircraft propulsion as well as the feasibility of implementation on passenger aircraft, the further focus is on hydrogen propulsion and neglects the electric-power approach. This course can be supported by the fact that Airbus cancelled its project in corporation with Rolls-Royce to design an electric-power aircraft model, the EFan-X, due to the pandemic (Woodhouse 2020).

While Airbus has already stated its aspirations to develop liquid hydrogen-powered aircraft by 2035, Boeing is not convinced. David Calhoun, Boeings' Chief Executive Officer (CEO), recently rejected the idea as a medium-term solution, adding that more SAF is "the only answer between now and 2050."(McGee 2021; Dunn 2021). This is due to Boeings' approach stating that it takes time to work out the technology and elements of hydrogen to target commercial use. The same applies to the electrically powered aircraft (Hollinger 2021).

According to Airbus, hydrogen has two primary uses in the aviation industry. First, hydrogen propulsion, where hydrogen can be burned in adapted gas turbine engines or transformed into electric energy to supplement the gas turbine in fuel cells. The combination of the two results is an extremely effective hybrid-electric propulsion system that is totally driven by hydrogen. Second, hydrogen can be utilized to generate e-fuels from renewable energy which belong to the group of synthetic fuels. Accordingly, hydrogen is produced using renewable power which is mixed with carbon dioxide to create fuel with net-zero greenhouse gas emissions (Airbus 2021c). In addition, hydrogen is a promising technology with three times the energy per unit mass of typical aviation fuel, which means that a hydrogen-powered aircraft would require considerably less fuel than a conventional aircraft for the same range (Airbus 2021c; Henderson 2021). Furthermore, hydrogen contains no carbon, which is why it produces no CO_2 emissions when created from renewable energy by electrolysis (Airbus 2021c; EUROCONTROL 2021b). Nevertheless, challenges and safety concerns of the implementation of hydrogen fuels start with its physics and chemistry which requires adjusting the tanks for carriage in aircraft (*Appendix 18*). Concerning Mr. Walsh's' criticism at the beginning of the chapter, it can be stated that he is only partly correct. Although the main focus of both manufactures is on SAF, Airbus is driving the hydrogen propulsion technology (although conditioned by French state aid). Nevertheless, it must be considered that companies are still suffering economically due to the Covid-19 pandemic. A final note is the targeted range and passenger capacity of Airbus' ZEROe models. While the propeller plane can carry a maximum of 100 passengers and should have a range of c. 1,800km, the other two models can carry a maximum of 200 passengers and cover c. 3,700km (Airbus 2021e). According to the Air Transport Group, c. 80% of the industries' carbon emissions are from flights longer than 1,500 km (Hollinger 2021), which raises doubts about long-term enforceability and impacts on airlines' sustainability and climate change.

(D4) North American LCCs have the youngest and greenest fleet among all peer groups and are most eager to add new aircraft to the fleets

A conducted analysis of the average fleet age of the peer group companies as of 01 December 2021 shows that the LCCs from North America have the youngest fleet with an average age of 10.04 years. Of particular note is the Frontier Group with an average fleet age of 4 years, the youngest of the 20 peer group airlines. With 12.32 years, FSCs in North America have the oldest fleet on average. In Europe, the figures are 11.34 years on average for FSCs and 11.52 years on average for LCCs, with Icelandair Group having a fleet age of 19.9 years on average, the oldest fleet of the entire peer group (*Appendix 19*). In order to be able to assess which airlines fly with the most modern engines, the entry into service of the engines for the commercial aviation industry must be considered. Airbus's "neo" variant was delivered to its first customer in January 2016 (Airbus 2016). On 22 May 2017, the first Boeing 737max 8 aircraft was delivered to customers with engines manufactured by CFM International (Safran Group 2017). Due to the fact that the new models were delivered to customers for the first time only 4.5 to almost 6 years ago, it can be assumed that at least some airlines have a large proportion of airlines in their fleets that are operated with old and more environmentally harmful engines than the current technology standard. The analysis presented below illustrates the percentage of Airbus and Boeing aircrafts in the selected peer groups that have Airbus aircraft age up to 6 years and Boeing aircraft age up to 4.5 years[31] to determine which peer groups are equipped most frequently with new, more climate-friendly engines. It becomes evident that the LCCs in the regional comparison have on average aircrafts with newer engines than the FSCs. The LCCs in North America have the fleets with the newest, sustainable, and most efficient engines with 39.5% on average. Again, Frontier Group Holdings has the highest value with 86.4% and thus has equipped a large part of the fleet with new engines, which is causal to the average fleet age of 4 years. It is also striking that the FSCs from North America have equipped their fleet with only 24.9% new aircraft and thus new engines. There are 3 airlines out of the 5 whose fleet consists of more than 80% old and more polluting aircraft models. United Airlines, which has one of the largest fleets in the selected peer group, only 10% of the fleet is under 6, or under 4.5 years old (*Appendix 19*).

LCCs in North America also prevail the other peer groups in terms of fleet renewal. The analyses carried out look at the orders of the peer group companies at Airbus and Boeing from 2020 and 2021 (as of 31 October 2021). The number of aircraft ordered in the period is taken in relation to the number of aircraft in the fleet of the respective peer group as of 31 March 2021. Accordingly, 17.6% of the total fleet size of LCCs in North America has been newly ordered. For the FSCs in North America, this figure was 15.5%. Compared to the European peers, it becomes obvious that the North American peer group companies renew more of their fleet in percentage terms. For the LCCs in Europe, the figure was 12.2%, while the FSCs in Europe, with 23 orders in 2020 and 2021, are renewing only 1.2% of their total fleet (*Appendix 19*).

(D5) Mainly FSCs are investing in the research of SAF

The following part highlights the efforts of peer group companies in terms of investing in the technology and benefitting from SAF which is of importance for airlines' sustainability.

[31] It is assumed that all aircraft younger than the specified period are equipped with new, more sustainable engines

(D) How is technology impacting airlines sustainability and which airlines prioritise it the most?

The North American FSC Delta Airlines made history when, after long test phases, the first commercial flight with 100% SAF was completed on 01 December 2021 (Rains 2021). The airlines' efforts to invest in SAF are intensifying, especially after these milestones in propulsion technology. In order to further increase SAFs influence for airlines sustainability, the World Economic Forum Clean Skies for tomorrow has proclaimed the goal that 10% of the fuel used in 2030 should be SAF (Otley 2021). Currently, the percentage of SAF used in commercial aviation is 0.1% (Ziady 2021). The members of the aviation alliance "OneWorld" which include some of the selected peer group companies, also pursue this goal. Therefore, the airlines and industry participants are free to decide how this goal can be achieved. The European LCC Ryanair for example opened the "Ryanair Sustainable Aviation Research Centre" together with Trinity College in Dublin on 29 April 2021, which conducts research into SAF with a donation from Ryanair of EUR 1.5 mn. In addition, Ryanair has set itself the goal of managing 12.5% of its flights with SAF by 2030 (Ryanair 2021). A high value compared to the 10% target set by the World Economic Forum. However, in an interview with CNBC, Ryanair CEO Michael O'Leary admits that it is "a very ambitious target, I'm not sure we'll get there" (Frangoul 2021). Lufthansa, on the other hand, which also shows strong efforts regarding SAF, tries to pursue a less optimistic target, in which 5% of the fuels used in 2030 will consist of SAF (Ahlgren 2021). To take a big step towards airline sustainability, Air Canada is investing USD 50 mn in SAF and carbon reduction. By 2030, the airline wants to reduce 20% of net greenhouse gases (Air Canada 2021). Further airlines, including mainly FSCs[32] of the selected peer groups, are taking the approach of using and promoting SAF to power their existing engines (Air Transport Action Group 2021). The investment and support of research facilities is therefore also essential for

[32] including Lufthansa, United Airlines, Delta Airlines, Southwest Airlines, JetBlue Airways, Air-France-KLM, Finnair, Alaska Airways, Air Canada, SAS and lastly the International Airline Group

future positioning, as airlines are already securing pre-emptive rights to SAF in order to secure commercial supply in the future.

(D) Conclusion: The impact of technology is significant for airlines sustainability; North American LCCs have short-term advantages while FSCs are winning long-term

To answer the question of how technology impacts airlines sustainability and which prioritize it most, this section focused exclusively on the propulsion technology and its impacts and further emphasized peer group efforts. The results are summarised below.

The impact of propulsion technology on airlines' sustainability is becoming more critical. First, current engines make it possible to reduce emissions and make flights more climate-friendly with the help of the construction and materials used while saving fuel costs due to the lower consumption. In the short term, the LCCs have advantages over the FSCs, especially in North America, because the trend in Europe and North America is towards narrow-body aircrafts, which LCCs have exclusively in their fleets. Secondly, the LCCs in North America have the youngest fleet on average and are currently making the most significant efforts to renew the fleet with the latest technology. Nevertheless, the IATA gives the future propulsion technology a 13% share in reaching the climate goals, since technologies such as hydrogen must be commercialized and able to carry a certain number of passengers on the one hand, and on the other hand must travel a certain distance to be competitive.

It is believed that the climate targets can be achieved to a large extent of up to 65% with the help of the SAF. This again underlines the importance of SAF as an influencing factor for airlines' sustainability since current engines can also fly with SAF. In the medium to long term, the percentage of SAF in the use of fuels will increase significantly, so many FSCs are currently making important strategic decisions. Cooperation with suppliers and investments in technology will make it easier to obtain SAF in the future. However, if the SAF can be produced in sufficient quantities and can therefore be purchased by all market participants without any problems, LCCs from North America will have a decisive advantage. Nevertheless, the analyses showed that a large part of the existing fleets is still operated with older aircraft models and thus less environmentally friendly engines. In addition, technologies, mainly hydrogen, are not fully developed and still require some time before potential implementation, which means that a particular effort needs to be made in terms of technology to achieve the specified climate targets. Consequently, further steps are required in addition to SAF to achieve net-zero carbon emissions by 2050. Therefore, the European and North American aviation industry is highly dependent on the development of SAF production and innovative technologies from aircraft manufactures which would significantly reduce the carbon dioxide emissions and further makes flying cheaper since kerosine taxations and offsetting CO_2 certificates are no longer required.

OVERALL CONCLUSION

The purpose of this work project was to investigate which airlines are best positioned to operate in a sustainable post-Covid environment. To do so, a sample of 20 airlines among four peer groups was analysed. The peer groups were constructed to cover the European and North American airline industry and further distinguish between LCCs and FSCs.

The first part of this work project analysed which airlines exhibit the greatest crisis-resistance in the context of the Covid-19 pandemic. In order to answer this question, the work project assessed the impact of Covid-19 from the following two dimensions. At first, it was examined which airlines were most affected by Covid-19. The results point out that particularly FSCs suffered most from the consequences of the outbreak of Covid-19 although LCCs were hit harder from a revenue perspective. LCCs benefited from a more flexible cost structure allowing them to reduce operational expenses which significantly contributes to the profitability. FCCs in turn showed higher break-even load factors and faced greater liquidity constraints and in turn, larger cash burn.

Overall conclusion

At second, the work project analysed which airlines have implemented the most effective measures in reaction to Covid-19. The results show that LCCs were able to implement the most effective measures. FSCs and North American peers counteracted liquidity shortages with capital raising due to the high cash needs of those players as well as the superior governmental support programs in the US. However, it should be considered that the different peers are coming from different circumstances and therefore, reacted differently to the crisis. As European LCCs were the less affected, there was not the same pressure to raise liquidity as for other peer groups which suffered greater from Covid-19. In contrast, LCCs were able to use leasing as a tool for higher operational flexibility and more liquidity as well as European LCCs exhibiting cash management adjustments. Considering the measures of each peer group taken in reaction to Covid-19, LCCs were able to reach lower levels of cash burn and consequently being left with higher operational days left.

To conclude to first part of the work project, LCCs exhibit the greatest crisis-resistance in the context of the Covid-19 pandemic due to the combination of being less affected by the pandemic as well as taking the most effective measures.

The second part of the work project investigated which airlines place the greatest emphasis on sustainability. In order to answer this question, the work project assessed the sustainability of the selected peer groups from the following two dimensions.

At first, it was investigated which airlines meet the regulatory requirements the best. The results show that regulations in North American are less strict as minor offsetting is required and more government investments in SAF are made. Furthermore, North American airlines save tons of CO_2 emissions and billions of dollars through their ATM system, meanwhile the European ATM initiative is blocked due to member states rejection. The assessment of the efforts of the peers to be more environmentally friendly, show that LCCs, especially Europeans, are becoming more CO_2 efficient and pollute less CO_2 in total. However, FSCs have more offsetting initiatives in place and have more ambitious goals. Lastly, European FSCs are best rated in third-party environmental scores. LCCs, especially North American, perform bad in their own efforts and third-party scores in comparison.

At second, it was investigated how technology is impacting airline sustainability and which airlines prioritise it the most. The results show that North American and European LCCs have on average younger aircrafts than the FSCs peers, this leads to the conclusion that LCCs have more environmentally friendly aircrafts that pollute less. FSCs on the other hand invest more in SAF, which will be one key element to reduce CO_2 in the near future. SAF also leads to less costs as offsetting certificates and kerosine taxation is not applied on SAF compared to kerosine.

To conclude the second part of this work project, the regulatory framework in North America facilitates respective peers in this region to become sustainable at minimal costs. Furthermore, LCCs, especially in North America, set the biggest emphasis on sustainability due to current propulsion technology advantages via younger and more sustainable aircraft fleets in the short term. However, the current propulsion technologies of the aircraft manufacturers are not sufficient to achieve defined climate targets. According to IATA, to achieve the climate targets, SAF in particularly will take an important position. Thus, FSCs may have an advantage over LCCs in the long-term as they already set the largest emphasis on research in SAF.

Overall, LCCs are best positioned to operate in a sustainable post-Covid environment. When evaluating these results from a critical perspective, one cannot neglect that the Covid-19 pandemic is characterised by a rapidly changing infection environment as new virus variants or mutants pose additional uncertainty on airlines. Especially the past has shown that the pandemic is not over yet, and new challenges have raised during the pandemic. Therefore, the results of the Covid-19 part are subject to a sound recovery of the Covid-19 pandemic. From a sustainability perspective, it must be considered that consumer behaviour represents a crucial and even essential contribution to achieving the climate targets. Thus, changing flight behaviour and the willingness to substantially contribute to climate change as an individual will impact the sustainability of airlines significantly. Nevertheless, airlines are facing now an important turning point in the middle of an environmental Covid-19 crisis. The next years are crucial as a structural change to the airline industry will reshape the European and North American market landscape. It is now the responsibility of airlines to overcome these challenges and position their business to compete or even survive in a fast-paced and sustainable post-Covid market environment.

APPENDIX 1: COVID-19 BACKGROUND

In December 2019, the World Health Organization (WHO) has observed a series of pneumonia cases in Wuhan, China (Carvalho, Krammer, and Iwasaki 2021). Constantly accelerated cases were attributed to the outbreak of a novel coronavirus, named SARS-CoV-2 (WHO 2020). Already three months later, roughly 80,000 cases have been identified in China as well as additional 10,500 infections were registered across 72 countries worldwide (Chinazzi et al. 2020). On 11 March, WHO officially declared the outbreak of Covid-19 a global pandemic (Carvalho, Krammer, and Iwasaki 2021).

Driven by an exponential spread of the virus, cases have skyrocket and reached record highs already months after the first infections have been confirmed. Since the beginning of Covid-19 in December 2019, over 239 mn global cases[33] have been confirmed and roughly 4.8 mn people have died as a consequence of Covid-19 (WHO 2021). Almost 20% of the cases can be traced back to the US, being the most severely affected country. Additionally, almost 740 k deaths have been registered in the US. In Europe, slightly more than 70 mn infections and 1.3 mn deaths have been registered (Statista 2021a).

Due to the continuously increasing number of confirmed cases, local health authorities have implemented lockdown measures and travel restrictions in order to prevent the virus from spreading (Hotle and Mumbower 2021). Particularly the US was one of the first countries to impose travel restrictions as former US president Donald Trump announced on 31 January 2020 that the country denies entry for people who have been to China within a 14-day period (Higgins-Dunn 2020). Following this action, first airlines cancelled routes to Mainland China in February (Josephs 2020). As flight suspensions further continued in the subsequent months, airline traffic significantly decreased. In May 2020, the total number of domestic and international flights was lower than it had ever been before (Sun et al. 2021).

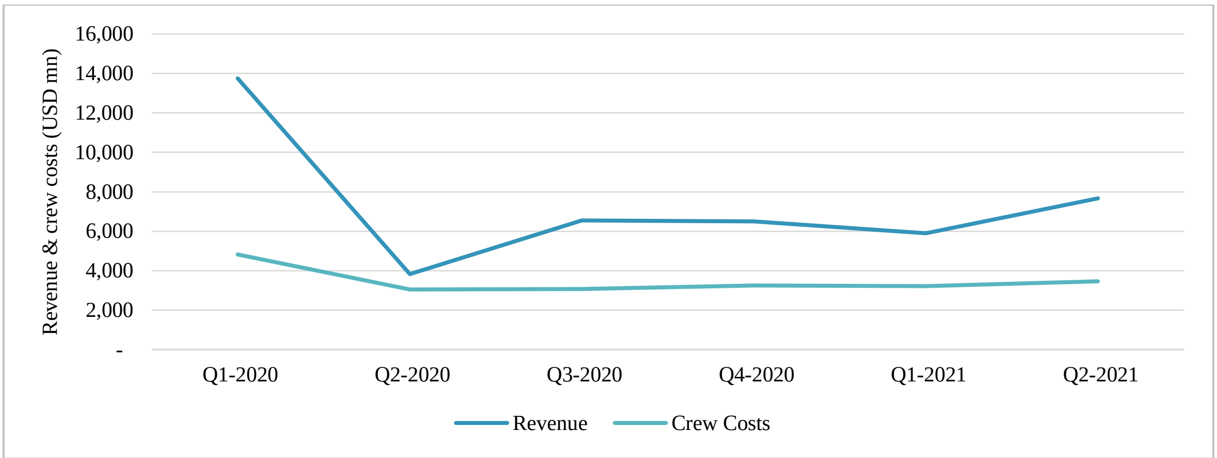
[33] As of 14 October 2021

As a principal consequence, the airline industry has been significantly influenced by confinement measures. In Europe, only 900,000 passengers have been carried in April 2020, dropping 96.9% compared to the previous year (eurostat 2021). For the same period, RPK fell by more than 98% and available seat kilometres (ASK) were down roughly 95%. The passenger load factor[34] decreased from 85.2% to 32.0% (IATA 2020c). Furthermore, at the end of 2020, more than half of the European airline fleet were grounded (Rodrigues et al. 2021). In the US, the total number of passengers carried fell sharply by 96% in April 2020, recording the largest year-on-year decrease since 1974 (Bureau of Transportation Statistics 2020). RPK declined by 96.6% and ASK fell 80.5%. The passenger load factor significantly collapsed by 69.9% ppts, reaching 15.0% in April 2020 (IATA 2020c).

As of today, the outbreak of Covid-19 has been undoubtedly the greatest challenge for airlines as 2020 was the worst year in the history of aviation (IATA 2021d). According to Airports Council International, global pre-pandemic levels will not be reached upon until the second half of 2023, considering a baseline scenario (Airports Council International 2021).

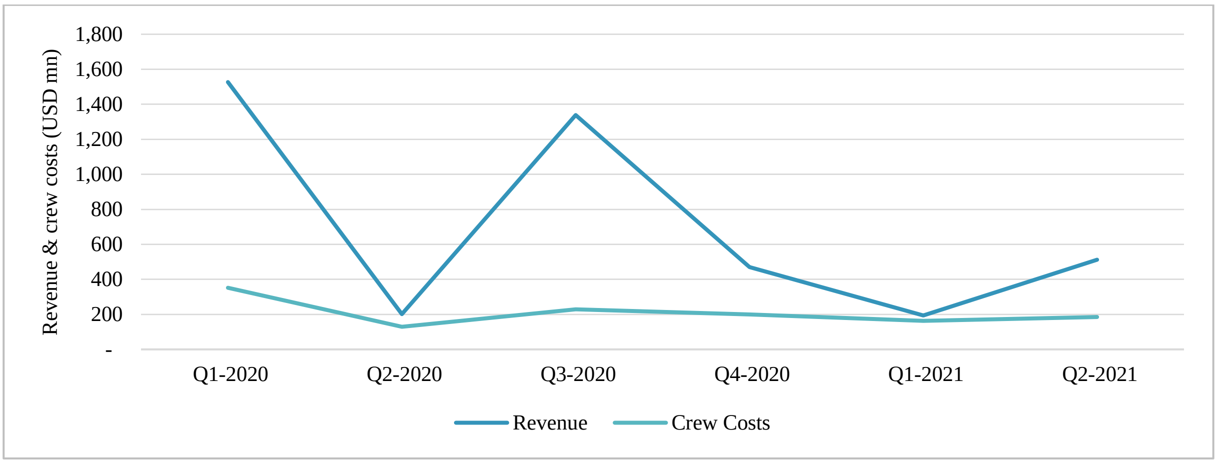
APPENDIX 2: CREW COSTS

Appendix Figure 1: *Revenue and crew costs Full-service (Q1 2020 – Q2 2021)*

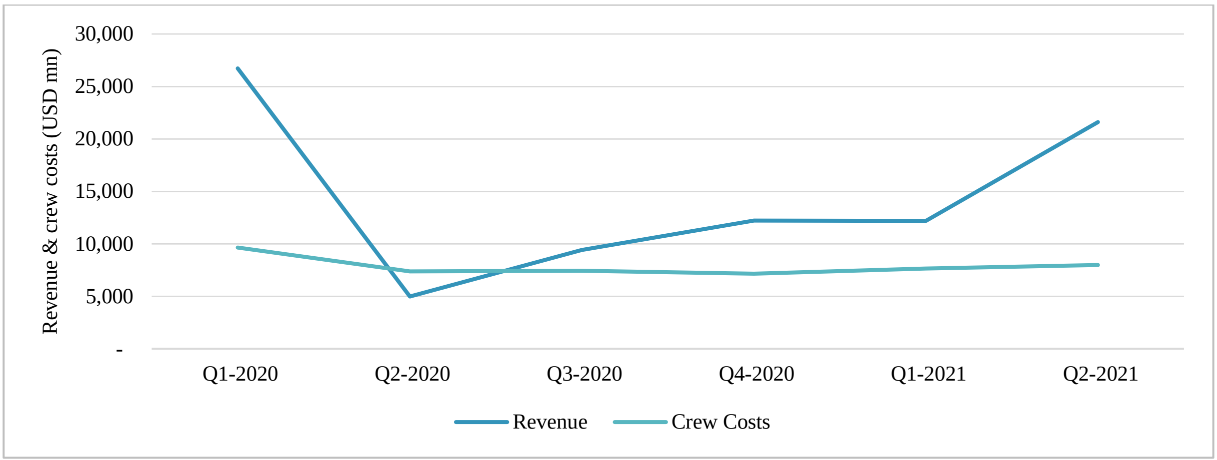


[34] Percentage of total available seating capacity that is occupied by passengers

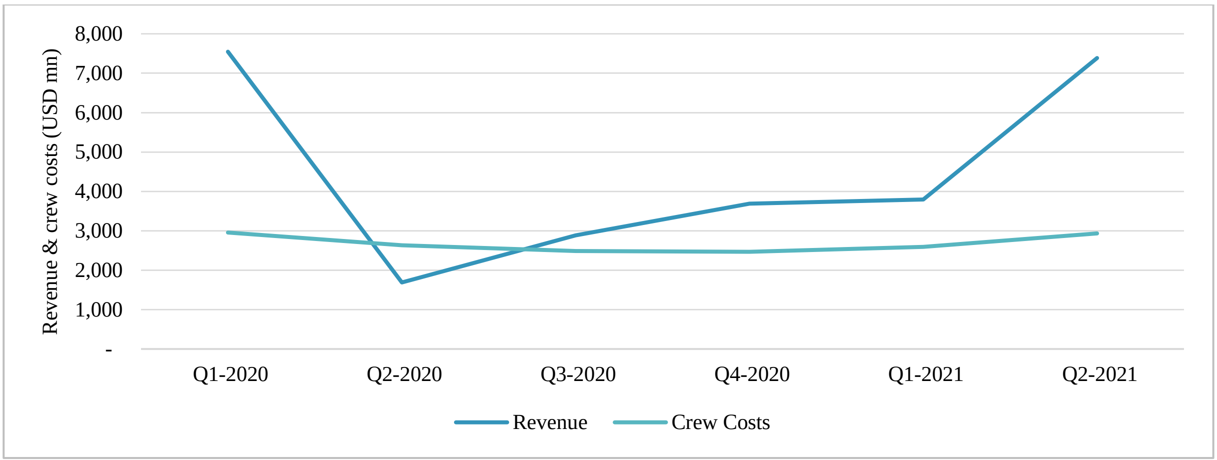
Appendix Figure 2: *Revenue and crew costs Low-cost Europe (Q1 2020 – Q2 2021)*



Appendix Figure 3: *Revenue and crew costs Full-service North America Q1 2020 – Q2 2021*

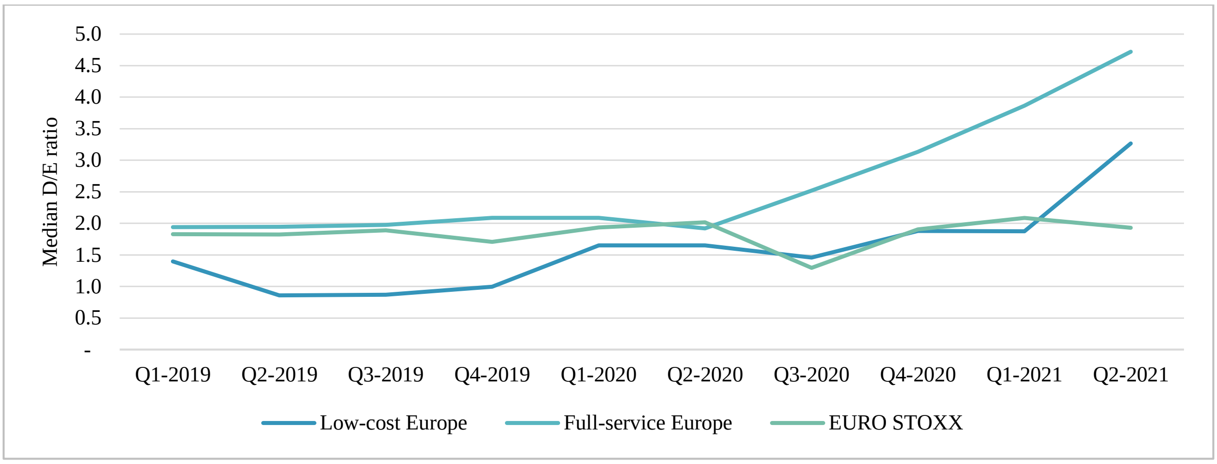


Appendix Figure 4: *Revenue and crew costs Low-cost North America Q1 2020 – Q2 2021*

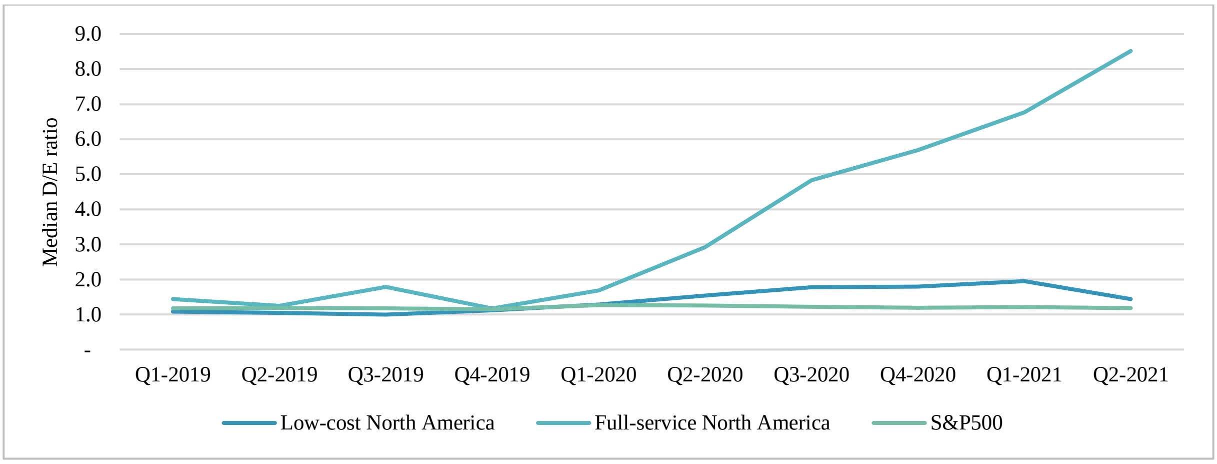


APPENDIX 3: LEVERAGE

Appendix Figure 5: *Median D/E ratio European peers (Q1 2019 to Q2 2021)*



Appendix Figure 6: *Median D/E ratio North American peers (Q1 2019 to Q2 2021)*



APPENDIX 4: CARES ACT AND ECONOMIC STABILISATION FUND

For a better understanding, the CARES Act and ESF are presented as examples in brief. The CARES Act is an instrument to provide economic assistance for American inhabitants, small businesses, and industries, was passed by congress on 25 March 2020 and entered into force two days later (United States Department of the Treasury 2021a). The support is provided either as loan or payroll support, where the latter is issued as a combination of grant and loan. Eligible for the Payroll Support Program (PSP) are air carriers, cargo air carriers, and certain contractors, that must use the support for maintaining payment of employee wages, salaries, and benefits. Air carriers are not allowed to layoff or furlough employees involuntarily, reduce wages and benefits, engage in share buybacks as well as paying dividends or making other capital distributions until 30 September 2021 (United States Department of the Treasury 2021c). After treasury paid out USD 25 bn to air carries in support under PSP1 from March 2020 onwards, an extension (PSP2) led to a support of USD 15 bn from December 2020 in line with Consolidated Appropriations Act and finally the PSP3 ensured a USD 14 bn aid from March 2021 (United States Department of the Treasury 2021b). The loan share of the payroll support payments has a 10 year maturity and favourable cash interest rate of one percent per year in the first five years which changes to the Secured Overnight Financing Rate increased by two percent per year in the last five years (United States Department of the Treasury 2021d).

The ESF serves to stabilize the German economy by strengthening capital base and counteract liquidity shortages with a total volume of EUR 600 bn. Instruments to achieve this goal are state-backed guarantees including credit lines and debt capital market instruments as well as recapitalization including silent participations and subordinated loans (Bundesministerium für Wirtschaft und Energie 2021a). Eligible are companies that meet two of three requirements following: a balance sheet total more than EUR 43 mn, a revenue higher than EUR 50 mn and more than 249 employees. Maturities for the debt is maximum 5 years and guarantees are maximum 90% of the total claim (Bundesministerium für Wirtschaft und Energie 2021c). Maturities for the silent participation is maximum 7 years (6 in case of publicly-listed companies) and maximum 6 years for subordinated loans (Bundesministerium für Wirtschaft und Energie 2021b).

APPENDIX 5: GOVERNMENTAL SUPPORT

Appendix Table 1: *Governmental support received (Low-cost Europe)*

Currency	Amount (mn)	Drawn down (mn)	in USD	Type	Provider
Ryanair Holdings					
GBP	600.0	600.0	742.9	Loan	Her Majesty's Treasury and Bank of England CCFF
EUR	84.0	84.0	98.6	Grant	EU
Wizz Air Holdings					
GBP	300.0	300.0	371.5	Loan	Her Majesty's Treasury and Bank of England CCFF
EUR	7.1	7.1	8.7	Grant	UK government
easyJet					
GBP	600.0	600.0	742.9	Loan	Her Majesty's Treasury and Bank of England CCFF
Jet2					
GBP	198.7	198.7	272.7	Loan	Her Majesty's Treasury and Bank of England CCFF
GBP	97.9	97.9	121.2	Grant	UK government
Icelandair Group					
USD	120.0			Guarantee	Icelandic government
USD	1.6	1.6	1.6	Grant	Icelandic government
USD	0.6	0.6	0.6	Grant	Icelandic government
USD	16.5	16.5	16.5	Loan	Icelandic government

Appendix Table 2: *Governmental support received (Full-service Europe)*

Currency	Amount (mn)	Drawn down (mn)	in USD	Type	Provider
International Consolidated Airlines Group, S.A.					
EUR	544.0	544.0	665.4	Grant	UK & Ireland government (CJRS & TWSS/EWSS)
EUR	214.0	214.0	235.2	Grant	Temporary Redundancy Plan (ERTE)
EUR	328.0	328.0	369.1	Loan	Her Majesty's Treasury and Bank of England CCFF
EUR	1010.0	1010.0	1136.6	Guarantee	Spainish Instituto de Crédito Oficial
EUR	150.0	150.0	183.5	Loan	Ireland Strategic Investment Fund (ISF)
EUR	2300.0	2300.0	2699.5	Guarantee	UK Export Finance
Deutsche Lufthansa AG					
EUR	300.0	300.0	337.6	Equity	Federal Republic of Germany's Economic Stabilisation Fund (ESF)
EUR	4700.0	1500.0	1688.0	Equity	Federal Republic of Germany's Economic Stabilisation Fund (ESF)
EUR	1000.0	1000.0	1125.4	Equity	Federal Republic of Germany's Economic Stabilisation Fund (ESF)
EUR	3000.0	1000.0	1125.4	Loan	Kreditantstalt für Wiederaufbau
CHF	1400.0	550.0	565.6	Guarantee	Swiss government
EUR	300.0	300.0	337.6	Loan	Austrian government
EUR	287.0	250.0	281.3	Loan	Belgian government
USD	345.0	345.0	345.0	Grant	CARES Act
USD	183.0	132.0	132.0	Loan	CARES Act
EUR	16.0	16.0	18.8	Grant	Italian government
Air France-KLM SA					
EUR	4000.0	4000.0	4501.5	Loan	French government
EUR	3000.0	3000.0	3376.1	Loan	French government
EUR	4000.0	4000.0	4694.8	Equity	French government
EUR	2400.0	2400.0	2700.9	Loan	Dutch government
EUR	1000.0	1000.0	1125.4	Loan	Dutch government
SAS AB (publ)					
SEK	788.0	788.0	81.8	Grant	Danish and Swedish government
SEK	598.0	598.0	62.1	Grant	Danish, Norwegian and Swedish government
SEK	650.0	650.0	67.5	Grant	Norwegian government
SEK	2000.0	2000.0	207.7	Equity	Danish and Swedish government
SEK	4000.0	4000.0	415.5	Equity	Danish and Swedish government
SEK	5000.0	5000.0	519.3	Loan	Danish and Swedish government
SEK	1000.0	1000.0	103.9	Loan	Danish government
Finnair Oyj					
EUR	400.0			Loan	Finnish government
EUR	540.0	540.0	607.7	Guarantee	Finnish government

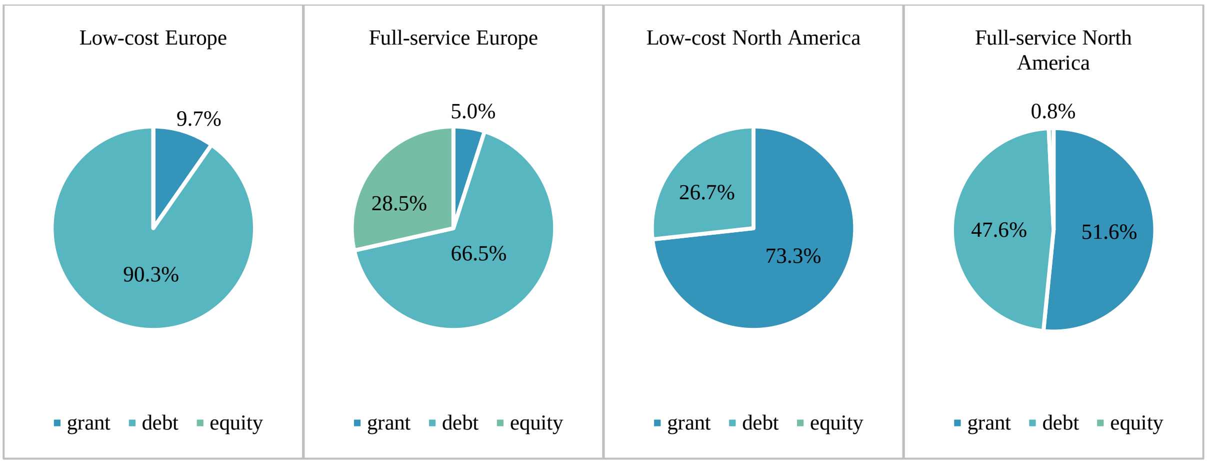
Appendix Table 3: *Governmental support received (Low-cost North America)*

Currency	Amount (mn)	Drawn down (mn)	in USD	Type	Provider
Southwest Airlines Co.					
USD	1327.0	1327.0	1327.0	Grant	PayrollSupportProgramme 3 (PSP3)
USD	526.0	526.0	526.0	Loan	PayrollSupportProgramme 3 (PSP3)
USD	1420.0	1420.0	1420.0	Grant	PayrollSupportProgramme 2 (PSP2)
USD	566.0	566.0	566.0	Loan	PayrollSupportProgramme 2 (PSP2)
USD	2378.0	2378.0	2378.0	Grant	PayrollSupportProgramme (PSP)
USD	976.0	976.0	976.0	Loan	PayrollSupportProgramme (PSP)
JetBlue Airways Corporation					
USD	1900.0	115.0	115.0	Loan	CARES Act
USD	19.0	19.0	19.0	Grant	PayrollSupportProgramme 3 (PSP3)
USD	8.0	8.0	8.0	Loan	PayrollSupportProgramme 3 (PSP3)
USD	206.0	206.0	206.0	Grant	PayrollSupportProgramme 2 (PSP2)
USD	46.0	46.0	46.0	Loan	PayrollSupportProgramme 2 (PSP2)
USD	685.0	685.0	685.0	Grant	PayrollSupportProgramme (PSP)
USD	251.0	251.0	251.0	Loan	PayrollSupportProgramme (PSP)
Allegiant Travel Company					
USD	49.2	49.2	49.2	Grant	PayrollSupportProgramme 3 (PSP3)
USD	104.0	104.0	104.0	Grant	PayrollSupportProgramme 2 (PSP2)
USD	2.0	2.0	2.0	Loan	PayrollSupportProgramme 2 (PSP2)
USD	154.2	154.2	154.2	Grant	PayrollSupportProgramme (PSP)
USD	24.5	24.5	24.5	Loan	PayrollSupportProgramme (PSP)
Frontier Group Holdings, Inc.					
USD	135.0	135.0	135.0	Grant	PayrollSupportProgramme 3 (PSP3)
USD	15.0	15.0	15.0	Loan	PayrollSupportProgramme 3 (PSP3)
USD	143.0	143.0	143.0	Grant	PayrollSupportProgramme 2 (PSP2)
USD	18.0	18.0	18.0	Loan	PayrollSupportProgramme 2 (PSP2)
USD	178.0	178.0	178.0	Grant	PayrollSupportProgramme (PSP)
USD	33.0	33.0	33.0	Loan	PayrollSupportProgramme (PSP)
Spirit Airlines, Inc.					
USD	168.5	168.5	168.5	Grant	PayrollSupportProgramme 3 (PSP3)
USD	29.4	29.4	29.4	Loan	PayrollSupportProgramme 3 (PSP3)
USD	184.2	184.2	184.2	Grant	PayrollSupportProgramme 2 (PSP2)
USD	25.3	25.3	25.3	Loan	PayrollSupportProgramme 2 (PSP2)
USD	267.2	267.2	267.2	Grant	PayrollSupportProgramme (PSP)
USD	73.3	73.3	73.3	Loan	PayrollSupportProgramme (PSP)

Appendix Table 4: *Governmental support received (Full-service North America)*

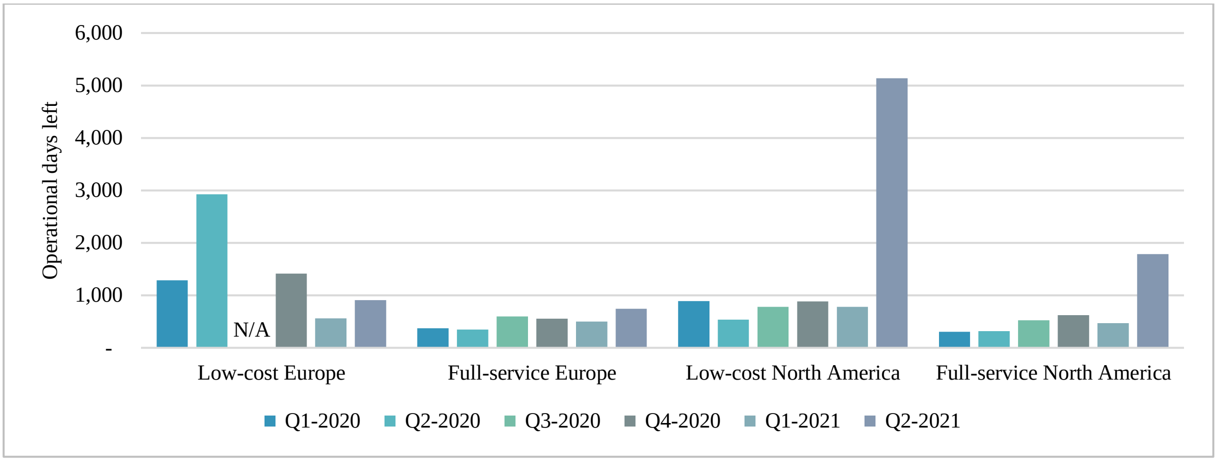
Currency	Amount (mn)	Drawn down (mn)	in USD	Type	Provider
Delta Air Lines, Inc.					
USD	2178.0	2178.0	2178.0	Grant	PayrollSupportProgramme 3 (PSP3)
USD	891.0	891.0	891.0	Loan	PayrollSupportProgramme 3 (PSP3)
USD	2333.0	2333.0	2333.0	Grant	PayrollSupportProgramme 2 (PSP2)
USD	957.0	957.0	957.0	Loan	PayrollSupportProgramme 2 (PSP2)
USD	3946.0	3946.0	3946.0	Grant	PayrollSupportProgramme (PSP)
USD	1648.0	1648.0	1648.0	Loan	PayrollSupportProgramme (PSP)
United Airlines Holdings, Inc.					
USD	520.0	520.0	520.0	Loan	CARES Act
USD	2000.0	2000.0	2000.0	Grant	PayrollSupportProgramme 3 (PSP3)
USD	810.0	810.0	810.0	Loan	PayrollSupportProgramme 3 (PSP3)
USD	2100.0	2100.0	2100.0	Grant	PayrollSupportProgramme 2 (PSP2)
USD	870.0	870.0	870.0	Loan	PayrollSupportProgramme 2 (PSP2)
USD	3600.0	3600.0	3600.0	Grant	PayrollSupportProgramme (PSP)
USD	1500.0	1500.0	1500.0	Loan	PayrollSupportProgramme (PSP)
American Airlines Group Inc.					
USD	7500.0	7500.0	7500.0	Loan	CARES Act
USD	2354.0	2354.0	2354.0	Grant	PayrollSupportProgramme 3 (PSP3)
USD	946.0	946.0	946.0	Loan	PayrollSupportProgramme 3 (PSP3)
USD	2500.0	2500.0	2500.0	Grant	PayrollSupportProgramme 2 (PSP2)
USD	1035.0	1035.0	1035.0	Loan	PayrollSupportProgramme 2 (PSP2)
USD	4200.0	4200.0	4200.0	Grant	PayrollSupportProgramme (PSP)
USD	1765.0	1765.0	1765.0	Loan	PayrollSupportProgramme (PSP)
Alaska Air Group, Inc.					
USD	431.0	431.0	431.0	Grant	PayrollSupportProgramme 3 (PSP3)
USD	147.0	147.0	147.0	Loan	PayrollSupportProgramme 3 (PSP3)
USD	457.0	457.0	457.0	Grant	PayrollSupportProgramme 2 (PSP2)
USD	160.0	160.0	160.0	Loan	PayrollSupportProgramme 2 (PSP2)
USD	757.0	757.0	757.0	Grant	PayrollSupportProgramme (PSP)
USD	293.0	293.0	293.0	Loan	PayrollSupportProgramme (PSP)
Air Canada					
CAD	500.0	500.0	398.4	Equity	Large Employer Emergency Financing Facility (LEEFF)
CAD	1500.0	1500.0	1195.1	Loan	Large Employer Emergency Financing Facility (LEEFF)
CAD	2475.0	2475.0	1971.8	Loan	Large Employer Emergency Financing Facility (LEEFF)
CAD	1404.0	858.0	683.6	Loan	Large Employer Emergency Financing Facility (LEEFF)

Appendix Figure 7: *Share of types of governmental support received by peers*



APPENDIX 6: OPERATIONAL DAYS LEFT

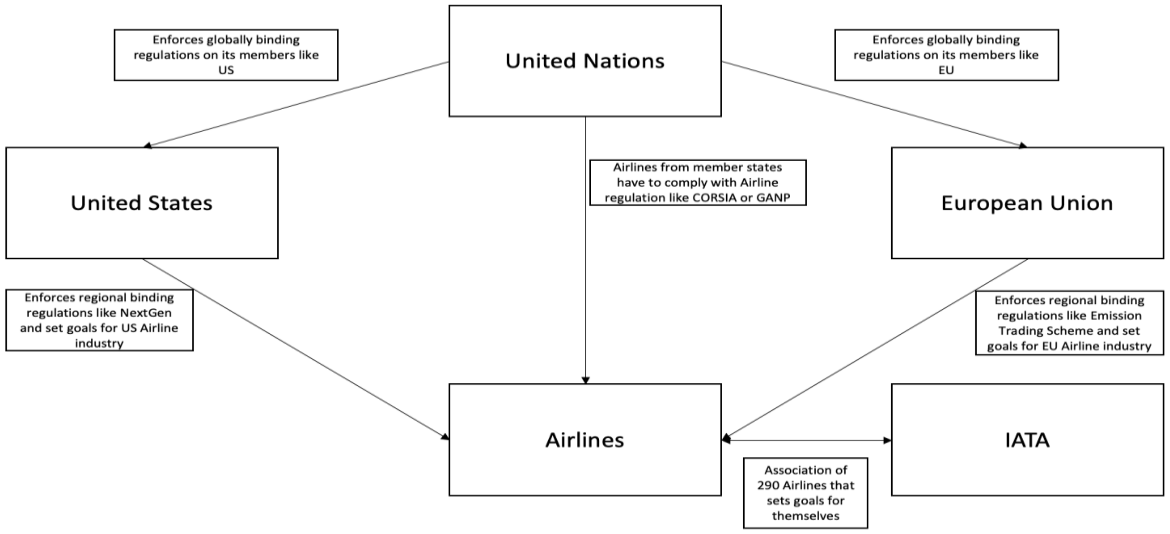
***Appendix Figure 8**: Operational days left (Q1 2020 – Q2 2021)*



APPENDIX 7: GLOBAL WARMING BACKGROUND

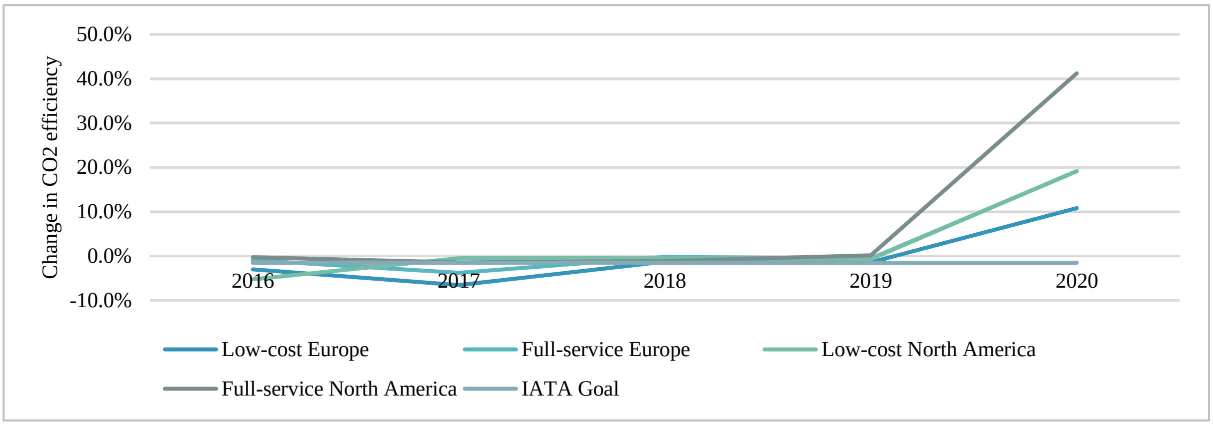
Next to Covid-19 the worlds' economy is facing another major challenge, the climate change. Already a major topic of research for many years the climate change has gotten more and more attention by industries and politics in the last years. The first-time global warming got the attention of scientists has been in the 1820s already, but it took until the end of the 19th century until the connection between global warming and carbon dioxide emissions has been discovered (Australian National University 2021). It was until 1988, the greenhouse effect theory was introduced, and the United Nations Environmental Programme and the World Meteorological Organization founded the Intergovernmental Panel on Climate Change (IPCC), after it was discovered that it has never been as warm as it has been in 1988 since 1880. Since then, the IPCC published many reports on the greenhouse effect theory and global warming (Enzler 2021). The first-time governments really acted on climate change has been with the Kyoto Protocol in 1997, where 191 participating countries agreed to reduce their human-caused greenhouse gas emissions by a minimum of 5% compared to 1990 in the time from 2008 to 2012. But several countries have not ratified the agreement, indicating there has not been a broad believe in the projected effects of global warming (Landeszentrale für politische Bildung Baden-Württemberg 2021). It took until 2015 to reach a new climate agreement with the Parisian Climate Agreement at the United Nations Climate Change Conference, where the participating countries committed themselves to limit global greenhouse gas emissions in order to stop the increase in global temperature this century at 2 degrees Celsius preferably even 1.5 degrees Celsius. This marks the foundation stone for a net-zero emission world (United Nations 2015). Based on current technologies and CO_2 emissions it is hard to imagine the airline industry in a world with net-zero emissions. As of 2019 the global airline industry emitted 905 mn tons of carbon dioxide emissions that accounts for 2.5% of all emissions worldwide (Cropley 2021). To set this number in perspective, the airline industry produces more emissions than all but five countries in the world, even more than industrial countries like Germany (Tiseo 2021). Global emissions from airlines increased steadily from 2004 until 2019 as more flights took place every year. Only because of less flights performed due to Covid-19 the airline industry managed to reduce its emissions to 495 mn tons in 2020, but total emissions will most likely increase in the coming years (Mazareanu 2021). Consequently, the airline industry, including aircraft manufacturers are facing challenging years. In order to achieve the defined climate targets, the research and development of new, sustainable fuels and technologies must be driven forward decisively, which will also make the road to net-zero emissions a costly undertaking for companies within the airline industry (Davis et al. 2018).

APPENDIX 8: INTERACTION BETWEEN THE PLAYERS IN THE REGULATION OF THE AIRLINE INDUSTRY

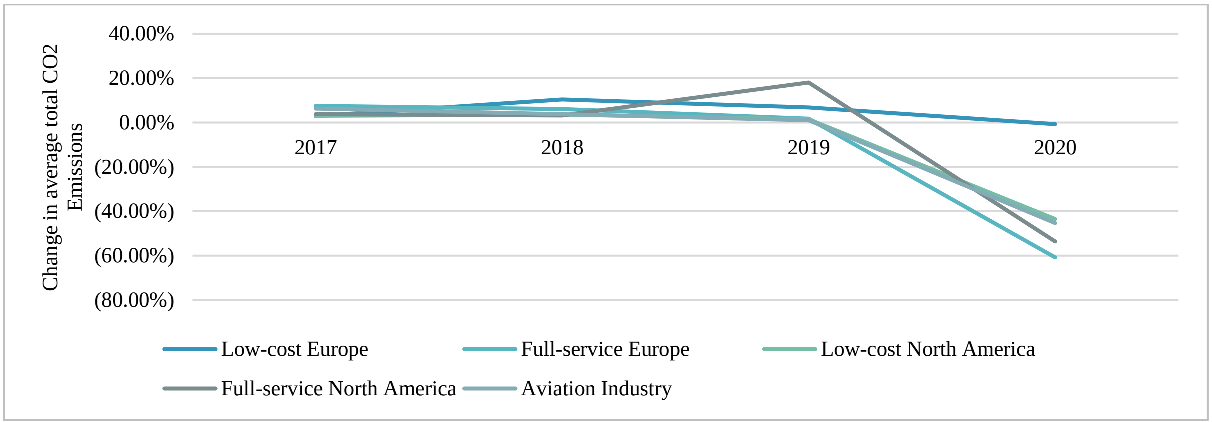


APPENDIX 9: CO_2 EMISSION ANALYSIS

***Appendix Figure 9:** Average change in CO_2 efficiency (2016 – 2020)*[35]



***Appendix Figure 10:** Change in average total CO_2 emissions (2017 – 2020)*



APPENDIX 10: REFINITIV SCORE

"Refinitiv", a well renowned company for financial data and risk assessment tools, gives companies from different industries ESG scores, combine that score from individual scores for environment, social and governance (Bloomberg 2021). According to Refinitiv scores from 0 to 25 indicate "poor relative performance and insufficient degree of transparency in reporting material data publicly", scores between 25 and 50 represent "satisfactory relative performance and moderate degree of transparency in reporting material data publicly", scores between 50 and 75 show "good relative performance and above average degree of transparency in reporting material data publicly", and scores between 75 and 100 indicate "excellent relative performance

[35] Emission data from Wizz Air Holdings, easyJet, Jet2, Allegiant Travel Company, Frontier Group Holdings and Spirit Airlines was not available

and high degree of transparency in reporting material data publicly”. Refinitiv bases the emission sub-score on four categories emissions, waste biodiversity and environmental management systems. The sub-score resource use is based on four categories, water, energy, sustainable packaging, and environmental supply chain by Refinitiv. The innovations sub-score is based on two categories, product innovation and green revenues, R&D, and CAPEX by Refinitiv.

APPENDIX 11: FLEET OF PEER GROUP

Appendix Table 5: *Fleet of total peer groups by aircraft manufacturer*

Airbus	Boeing	Others	Total
3,322	3,611	292	**7,225**
46%	50%	4%	**10%**

Appendix Table 6: *Total peer group fleet by aircraft models*

Airbus						Boeing					
A220 Family	A320 Family	A330 Family	A350 Family	A380	Total	B737 Family	B747 Family	B767	B777 Family	B787	Total
98	2,936	208	58	22	**3,322**	2,559	231	119	506	196	**3,611**
3.0%	88.4%	6.3%	1.7%	0.7%	**100.0%**	70.9%	6.4%	3.3%	14.0%	5.4%	**100.0%**

APPENDIX 12: FLEET GROUP ORDERS & DELIVERIES

Appendix Table 7: *Total peer group orders of aircrafts in 2020*

Airbus														
A220-100	A220-300	A319 ceo	A320ceo	A320neo	A321ceo	A321 neo	A330-200	A330-300	A330-800	A330-900	A350-900	A350-1000	A380	Total
-	-	47	-	33	-	22	-	-	-	-	10	-	-	112

Boeing										
B737max	B737-800A	B747-8F	B767-2C	B767-300F	B777-300ER	B777F	B787-8	B787-9	B787-10	Total
75	-	-	-	-	-	-	-	-	-	75

Appendix Table 8*: Total peer group orders of aircrafts in 2021*

Airbus														
A220-100	A220-300	A319ceo	A320ceo	A320neo	A321ceo	A321neo	A330-200	A330-300	A330-800	A330-900	A350-900	A350-1000	A380	Total
-	-	-	-	-	-	176	-	-	-	-	5	-	-	181

Boeing										
B737max	B737-800A	B747-8F	B767-2C	B767-300F	B777-300ER	B777F	B787-8	B787-9	B787-10	Total
455	-	-	-	-	-	1	-	5	-	461

APPENDIX 13: COMPARISON BETWEEN AIRBUS "CEO" AND "NEO" AIRCRAFT MODELS

The Airbus neo aircraft models have significant advantages over the previous aircraft generation. Besides engine advantages, the neo models record a 50% reduction in airframe noise, as well as a new cabin concept designed to offer passengers greater comfort, including the installation of High-efficiency Particulate Arrestors (HEPA) filters, which exchange and renew the air in the cabin every 2 to 3 minutes. According to Airbus, the so-called Electronic Instrument System (EIS) technology saved already up to 10 million tons of CO_2 by May 2021, which represents a decisive step forward in achieving climate targets and compliance with regulations (Airbus 2021b). The EIS technology, which is also known as "Electronic Flight Instrument System (EFIS)", is a system consisting of several displays in the cockpit of an aircraft on which flight and sensor data are presented. Pilots can quickly make economic and environmental decisions based on the provided information (Skybrary 2016).

APPENDIX 14: TECHNICAL DESCRIPTION OF THE PW1100G-JM- AND LEAP-1A ENGINE

The PW1100G-JM engine will not be produced exclusively by Pratt & Whitney, as important components will be supplied by Japanese companies IHI Aerospace, Japanese Aero Engines Corporation (JAEC), and MTU Aero Engines Holdings AG, among others (Sato, Imamura, and Fujimura 2014).

A conventional engine burns fuel in a compressor to provide energy to drive its turbine and work the fan. The fan creates bypass air running around the engine core which delivers most of the thrust for commercial aircrafts. The higher the bypass-ratio, the better. Conventional engines have bypass-ratios between 5:1 to 11:1, means for a bypass-ratio of 10:1 that 10kg of air passes through the bypass duct for every 1kg of air passing through the core (Bräunling 2015). Conventional engines runs its' fan and turbine at a same speed under direct-drive shaft (Pratt & Whitney 2011). In comparison to the conventional engines, the PW1100G-JM adopts a geared turbofan engine, which varies the speed of the turbines with a highly efficient gear system, that allows these modules to operate at optimal speed and high efficiency. The gear system is positioned between the fan and the low-pressure compressor, allowing low-pressure compressor and low-pressure turbine rotate faster than the fan, which enables top performance with fewer stages. Thus, the fan runs slower, consequently it can deliver more thrust from less work for an increased bypass-ratio of 12:1 (Pratt & Whitney 2011; 2021; Sato, Imamura, and Fujimura 2014).

The LEAP-1A engine, developed and produced by CFM International achieves, compared to its world-renowned predecessor, the CFM56, a bypass ratio of 11:1 and requires pounds of take-off thrust up to 35,000 (CFM International 2021). The LEAP-1A incorporates the latest technologies, such as 3D woven carbon fibres and ceramic components, which reduce the weight of the turbine by up to approximately 230kg. These ceramic components have a 20% better thermal resistance, which is why they are installed in the hottest part of the engine, the high-pressure turbine. In addition, ceramic components have the advantage of being lighter than metal based alloys and twice as strong (Safran Group 2021b; CFM International 2021). The LEAP-1A can have various size ratios depending on the aircraft model. For example, the turbine has dimensions of 3.328m in length, 2.533-2.543m in width and 2.362-2.368m in height. Depending on the configuration, the weight of the turbine thus varies between 2,990 - 3,253kg (EASA 2019b). Compared with the PW1100G-JM, the LEAP-1A has a small difference with respect to the bypass ratio. The PW1100G engine has a length of 3.401m and a dry weight of 2,858kg. This weight will increase when fuel injection is considered.

APPENDIX 15: PROPULSIVE- AND THERMAL EFFICIENCY

Propulsive efficiency means the efficiency with which the energy stored in an aircrafts' fuel is turned into kinetic energy, either to accelerate the aircraft (thrust) or to compensate for losses due to aerodynamic drag or gravity (Soares 2008). Thermal efficiency is the relation between the work done by an engine and the heating energy of the fuel it consumes, expressed in units of work or heat. In addition, an engine with better thermal efficiency generates less excess heat, which is transferred to the engines' cylinders, chambers, pistons, and cooling system. A high thermal efficiency also corresponds to low fuel consumption, i.e., less fuel is consumed to cover a given distance with a given power output. High thermal efficiency is therefore of practical importance and is one of the most widely used performance parameters of aircraft engines (FlightMechanic 2021; Soares 2008).

APPENDIX 16: TECHNICAL DESCRIPTION LEAP-1B ENGINE AND COMPARISON TO LEAP 1-A

The LEAP-1B engine achieves a bypass-ratio of 9:1 and requires pounds of take-off thrust up to 28,000 (CFM International 2021). Thus, the LEAP-1B has a lower bypass ratio compared to the LEAP-1A obtained from Airbus, which generally puts the LEAP-1B at a slight disadvantage. In terms of technology and materials used, the two engines are identical, but the dimensions and thus the weight of the LEAP-1A and LEAP-1B are different. The LEAP-1B turbine has a length of 3.147m, a maximum width of 2.421m and a maximum height of 2.256m. Thus, this engine model reaches a weight of 2,780kg (EASA 2019a). This means that the LEAP-1B is not only smaller in size than the LEAP-1A, but also has a lower weight of at least 210kg per engine, which is equivalent to 420kg for a single-aisle aircraft. Furthermore, the LEAP-1B requires less thrust to take off than the LEAP-1A, which gives a further advantage in terms of fuel consumption and emissions.

APPENDIX 17: ADVANTAGES OF SAF

The use of SAF results in several benefits to the airline industry, which is why this approach is being researched with great interest and vigor. First, SAF provides significant environmental benefits since its production results in less carbon dioxide emissions in comparison to conventional jet fuel across its life cycle (IATA 2021c; McCausland 2021d; Lange 2021). Moreover, because SAF includes less contaminants like Sulphur, it is possible to reduce

Sulphur dioxide and atmospheric pollution much further than todays' technology. In the case of SAF made from municipal waste, the environmental benefits come from both preventing the use of petroleum as well as the fact that the waste would instead be left to end up in landfills, generating no benefits and threatening greenhouse gases like methane, instead of being used to power a passenger airline, which would otherwise be fuelled by unsustainable, fossil-based fuel (IATA 2021c). Another benefit besides environmental advantages is the diversified supply. This advantage is due to the fact that conventional fuels are subject to fluctuating prices and the petroleum can consequently only be extracted in countries where natural reserves are located like in Venezuela and Saudi Arabia (IATA 2021c; Statista 2020; 2021b). The production of SAF is not dependent on locations or production sites, as waste, other vegetable or animal waste can be found in all regions of the world. Therefore, it is conceivable that even smaller production chains can be established locally, where SAF can be supplied to the airlines as well as to other industries where SAF is needed (IATA 2021c; Air Transport Action Group 2017). A further and last advantage, which is highlighted in this thesis, are economic and social benefits. The aforementioned advantage of SAFs' global and diversified production also has financial implications for airlines, as fuel costs are usually the highest operational cost item. Fluctuations in the price of kerosene, which powers conventional aircraft, complicate long-term budgeting plans. SAF can also improve the economy to regions of the world which have huge quantities of marginal or unprofitable land for food production but are ideal for cultivation SAF crops or have other sources of raw material, such as municipal waste. Several of these countries are developing nations that may substantially profit from a new industry sector, such as SAF manufacturing, without jeopardizing their capacity to produce food locally (IATA 2021c; Air Transport Action Group 2017). On a societal level, SAF might support employment creation while also encouraging better waste management practices, as garbage is a frequent environmental concern in developing nations. Implementing SAF might provide a mutually advantageous solution for waste processing while also lowering carbon dioxide emissions in aviation industry (IATA 2021c; Air Transport Action Group 2017).

APPENDIX 18: CHALLENGES OF IMPLEMENTING HYDROGEN FUELS AND SAFETY RISKS

The challenges of implementing Hydrogen fuels are beginning with physics and chemistry. Hydrogen has a lower energy density since it is a gas which has typical atmospheric temperature and pressure. Therefore, the hydrogen has to change the state of aggregation into a liquid by cooling the gas to greatly low temperatures of -253 degrees Celsius in order to store liquid hydrogen in adequate quantities (Henderson 2021). This requires special cryogenic tanks in which hydrogen can be transported and stored using complex cooling systems. Therefore Airbus intends to set up research facilities in Nantes and Bremen to build such cryogenic tanks starting in 2023 (Eiselin 2021). Another disadvantage that comes along with the cryogenic tanks and the condition of hydrogen is that the energy density of liquid hydrogen is only c. 1/4 of that of conventional aviation fuel. Therefore, the size of the cryogenic tanks have to be 4 times bigger than for current tanks (Henderson 2021; Eiselin 2021; Hollinger 2021). As a result, either less space remains for transport of passenger or cargo, which results in a reduction of revenues, or the fuselages of hydrogen aircraft would have to be designed to be correspondingly larger (Henderson 2021). This means that placing the tanks in the wings (as is the case with current kerosene tanks) is only possible to a limited extent, resulting in the debate where to place the fuel tanks. Other questions are possible safety concerns or whether liquid hydrogen can be produced at scale and at a competitive price without generating high emissions during production. Also, a completely new infrastructure must be installed at airports that can manage the transport and storage of liquid hydrogen. Glenn Llewellyn, Vice President Zero Emission Aircraft at Airbus, also sees this as an essential point in the possible failure of hydrogen as a fuel if the infrastructure cannot be guaranteed or cannot be guaranteed sufficiently (EUROCONTROL 2021b).

APPENDIX 19: PEER GROUP FLEET ANALYSIS

Appendix Table 9: *Peer Group Fleet Age Analysis*

Low-cost Europe	Average Age	Full-service Europe	Average Age	Low-cost North America	Average Age	Full-service North America	Average Age
Ryanair Holdings Group	9.2	Deutsche Lufthansa	12.4	Southwest Airlines	12.8	Delta Airlines	14.2
Wizz Air Holdings	5.2	Air France-KLM	12.4	JetBlue Airways	11.6	United Airlines Holdings	16.5
EasyJet	8.6	International Consolidated Airlines Group	11.3	Allegiant Travel Company	14.9	American Airlines Group	11.8
Jet2	14.7	SAS	8.6	Frontier Group Holdings	4.0	Alaska Air Group	9.4
Icelandair Group	19.9	Finnair	12.0	Spirit Airlines	6.9	Air Canada	9.7
Average	**11.5**		**11.3**		**10.0**		**12.3**

Appendix Table 10: *Overview of peer group fleet*

Low-cost Europe	# Airbus	Fleet age < 6 y	Fleet age > 6 y	# Boeing	Fleet age < 4.5 y	Fleet age > 4.5 y	% new engines
Ryanair Holdings Group	29	-	29	451	121	330	25.2%
Wizz Air Holdings	147	101	46	-	-	-	68.7%
EasyJet	311	105	206	-	-	-	33.8%
Jet2	3	-	3	91	18	73	19.1%
Icelandair Group	-	-	-	36	9	-	25.0%
Average	**98**	**41.2**	**56.8**	**115.6**	**29.6**	**80.6**	**34.4%**
Full-service Europe	**# Airbus**	**Fleet age < 6 y**	**Fleet age > 6 y**	**# Boeing**	**Fleet age < 4.5 y**	**Fleet age > 4.5 y**	**% new engines**
Deutsche Lufthansa	515	117	398	61	15	46	22.9%
Air France-KLM	144	20	124	268	34	234	13.1%
International Consolidated Airline	432	140	292	91	15	76	29.6%
SAS	84	56	28	19	-	19	54.4%
Finnair	59	22	37	-	-	-	37.3%
Average	**246.8**	**71**	**175.8**	**87.8**	**12.8**	**75.0**	**31.5%**
Low-cost North America	**# Airbus**	**Fleet age < 6 y**	**Fleet age > 6 y**	**# Boeing**	**Fleet age < 4.5 y**	**Fleet age > 4.5 y**	**% new engines**
Southwest Airlines	-	-	-	736	121	615	16.4%
JetBlue Airways	222	68	154	-	-	-	30.6%
Allegiant Travel Company	118	13	105	-	-	-	11.0%
Frontier Group Holdings	110	95	15	-	-	-	86.4%
Spirit Airlines	170	90	80	-	-	-	52.9%
Average	**124**	**53.2**	**70.8**	**147.2**	**24.2**	**123.0**	**39.5%**
Full-service North America	**# Airbus**	**Fleet age < 6 y**	**Fleet age > 6 y**	**# Boeing**	**Fleet age < 4.5 y**	**Fleet age > 4.5 y**	**% new engines**
Delta Airlines	364	217	147	475	75	400	34.8%
United Airlines Holdings	194	-	194	662	86	576	10.0%
American Airlines Group	442	90	352	458	64	394	17.1%
Alaska Air Group	53	16	37	174	29	145	19.8%
Air Canada	74	26	48	93	45	48	42.5%
Average	**225.4**	**69.8**	**155.6**	**372.4**	**59.8**	**312.6**	**24.9%**

Appendix Table 11: *Peer group fleet renewal*

	Low-cost Europe	Full-service Europe	Low-cost North America	Full-service North America
New orders 2020 & 2021	126	23	240	440
Percentage of fleet renewal	12.2%	1.2%	17.6%	15.5%

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EUROPEAN AIRLINE CONSOLIDATION

ACQUISITION STRATEGY FOR A POTENTIAL TAKEOVER OF JET2 BY EASYJET

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ABSTRACT

The group part of the airline industry report investigates which airlines are best positioned to operate in a sustainable post-Covid market environment. The results show that low-cost carriers are likely to emerge as the leading business model in the future. The individual part of the airline industry report investigates whether consolidation represents a potential way for easyJet to return to profitability and strengthen its strategic position in a post-pandemic market environment. Analysing a proposed takeover of Jet2 by easyJet provides evidence that easyJet could substantially increase its financial and strategic position on the European airline market after Covid-19.

Keywords: Strategy, airline industry, Covid-19, sustainability, mergers & acquisitions, consolidation, easyJet, Jet2.

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INTRODUCTION

Accelerated by the unexpected outbreak of Covid-19, 2020 has been recorded as the worst year in aviation history (IATA 2021b). Especially in Europe, airlines are facing financial hurdles as profitability has plummeted and reached record lows (Statista 2021c). In addition, recovery in Europe is stubbornly slow, and pre-pandemic levels are assumed not to be reached before 2024 (Eurocontrol 2021). Unsurprisingly, given the uncertainty of achieving normal market conditions combined with a fragile financial position, European airlines are fighting to survive in this precarious situation. As a principal consequence, airlines are seeking alternative ways to inorganically recover from the repercussions of the Covid-19 crisis (Bouwer, Krishnan, and Saxon 2020). For example, Wizz Air has shown public interest in taking over easyJet as a consequence of the global pandemic in September 2021 (Georgiadis and Ralph 2021). This takeover approach drew attention to European airline consolidation as a possible way to recover faster from the financial drawbacks caused by Covid-19 (Georgiadis 2021). Although easyJet was hit hard by Covid-19 and further has to deal with increasing competition from Ryanair and Wizz Air, the company rejected Wizz Air's takeover approach and commented that it will seek for growth opportunities through M&A in the role of a potential buyer (Jasper 2021).

The following work project analyses a potential consolidation process in the European airline industry based on an acquisition strategy for a proposed takeover of Jet2 by easyJet. To this end, the work project answers the question whether consolidation can be a potential way for easyJet to return to profitability and further strengthen its strategic position in a post-pandemic market environment. In this sense, *Chapter 1* briefly describes the impact of Covid-19 on European airlines. By highlighting precedent transactions and analyzing the overall market structure, *Chapter 2* subsequently details the European M&A landscape in the aviation sector. *Chapter 3* presents an acquisition strategy for a proposed takeover of Jet2 by easyJet. Lastly, *Chapter 4* provides a brief conclusion and critical assessment of the findings.

CHAPTER 1: MACROECONOMIC REVIEW

The European airline industry has been one of the most affected industries by Covid-19 (Airports Council International 2021). At the end of 2020, more than half of the European airline fleet was grounded (Rodrigues et al. 2021). Subsequently, flight traffic in Europe has significantly plunged as the number of commercial flights decreased by 57% on average. As a principal consequence of a lower number of flights and travel restrictions imposed by local health authorities, the number of passengers carried substantially fell to 277 mn in 2020. This development presents a decline of more than 73% compared to the previous year (eurostat 2021). Unsurprisingly, the financial performance of European airlines was strongly impacted by this fragile market environment. European airlines have experienced severe net losses of EUR 22.2 bn in 2020 (Rodrigues et al. 2021, 19). Furthermore, operating margins of -30.4% in Europe were amongst the most negative compared to other regions (IATA 2021a). Supinely, airlines are struggling to survive in this environment given the uncertainty of reaching post-Covid-19 levels. Since the beginning of Covid-19, 30 airlines filed for bankruptcy in 2020 (CAPA 2021a). According to Airports Council International, recovery in Europe will be lower than in other regions due to Europe's massive dependence on international markets, which tendentially recover slower than domestic markets (Bushey and Georgiadis 2021). By the end of 2021, European airlines are expected to generate only 44% of the predicted baseline revenues, which would result in revenue losses of around USD 49 bn (Airports Council International 2021). Furthermore, operating performance in Europe is forecast to be the weakest across regions (IATA 2021c).

CHAPTER 2: EUROPEAN AIRLINE M&A MARKET

2.1. Precedent transactions

The European airline industry faced a wave of consolidation after the market was deregulated and liberalized in 1997 (Bilotkach, Fageda, and Flores-Fillol 2013). A liberal market structure allowed airlines to grow much faster by seeking inorganic growth (Merkert and Morrell 2012).

Appendix 1 provides an overview of the most relevant transactions in the European airline industry since 2000, which will be further discussed in the following.

Starting in 2004, Air France and KLM decided to combine both entities in a USD 827 mn merger (Milner 2003). The strategic rationale behind this merger was to extend their network while simultaneously benefitting from synergies (Merkert and Morrell 2012). The combined entity became the largest airline by revenues in 2004. Furthermore, synergies in operating income between EUR 385-495 mn in the fifth year and an additional EUR 600 mn in the consecutive years were realized (Gudmundsson 2018).

Only one year later, airlines continued to seek growth opportunities through mergers and acquisitions as Lufthansa acquired Swiss International Airlines for USD 396 mn in May 2005 (Done 2008). In the subsequent period between 2007 and 2010, M&A activity remained stable with several acquisitions such as Air Berlin / LTU Group Holding (USD 454 mn), easyJet / GB Airways (USD 212 mn), and Lufthansa / Austrian Airlines (USD 293 mn) (Reuters 2006; Done 2007; European Commission 2009).

In January 2011, International Consolidated Airline Group (IAG) emerged as a result of a USD 3.2 bn merger between British Airways and Iberia (CAPA 2011). Followed by this merger, IAG continuously expanded its network through additional acquisitions such as British Midland Airways, Vueling, Aer Lingus, and Nikki (Parker, Wembridge, and Sakoui 2011; IAG 2012; Boland 2015; Wissenbach and Nasralla 2017). Despite several acquisitions by IAG, consolidation in Europe slowed down in the subsequent years. Consequently, the European airline market has seen no significant changes in its competitive structure (CAPA 2018).

2.2. European airline consolidation

The airline industry is currently facing one of the most challenging market conditions as a consequence of the outbreak of Covid-19 (Bouwer, Saxon, and Wittkamp 2021, 19). Industry leaders and the European governments are responsible for building a strong and sustainable landscape in order to emerge stronger from Covid-19. In this sense, consolidation represents an attractive opportunity to strengthen airlines' fundamental position and return to profitability (Zaccaria 2021).

In the aftermath of the Covid-19 crisis, European airlines are likely to face market conditions similar to North America (Georgiadis 2021), where consolidation already started in 1977 with the deregulation of the American aviation market (Bilotkach, Fageda, and Flores-Fillol 2013). Comparing the European airline industry with North America, the European market landscape significantly differs from North America. Although Europe has large conglomerates such as Lufthansa Group, IAG or, Air France-KLM, *Appendix 2* shows that leading industry players are substantially smaller than their North American counterparts in terms of fleet size (Zaccaria 2021). This can be explained by the lagging consolidation progress for European airlines mentioned in *Chapter 2.1*. Unsurprisingly, the European airline industry is still fragmented while North America is dominated by larger airline groups (Maul, Spear, and Usman 2018). For example, 135 airlines operate in Europe while America only has 59. Additionally, 70% of the total North American airline market is controlled by the five largest airlines. In contrast, the top five European airlines together constitute only a 35% market share of the European aviation market (The Economist 2019).

Consolidation in the US has shown that airlines managed to improve their fundamental position significantly, as the profitability of North American airlines sustainably recovered after a wave of consolidations. Although North American airlines only account for c. 22% of the global revenue passenger kilometers (RPK) in 2019, over 65% of the industry net profits were earned by North American airlines (Zaccaria 2021).

A fragmented market landscape in Europe provides ideal conditions to drive European airline consolidation in the upcoming years. However, consolidation in Europe is highly regulated by politics. Especially mergers or acquisitions of larger airlines are subject to several restrictions

(Canelas and Ramos 2016). For example, non-EU investors are prohibited from owning more than 49% of airlines that operate in the EU. Therefore, consolidation in Europe will face mergers and acquisitions of local European players without the intervention of carriers outside of Europe (Zaccaria 2021).

In September 2021, Wizz Air has shown public interest in taking over easyJet as a consequence of the global pandemic (Georgiadis and Ralph 2021). Although easyJet has rejected the offer, this takeover approach by Wizz Air has increased the awareness for inorganic growth opportunities in a post-pandemic market environment and can thus be an important starting point for European airline consolidation (Georgiadis 2021). According to Boston Consulting Group, European airlines will enter a period of consolidation and concentration within the next five years (Wade et al. 2020).

CHAPTER 3: ACQUISITION STRATEGY FOR POTENTIAL TAKEOVER OF JET2

3.1. Deal assumptions

The following chapter will provide a detailed acquisition strategy for a potential takeover of Jet2, a British airline and package holiday provider, by easyJet. For the purpose of this work, it is assumed that easyJet provides a sufficient financing approach that is reasonable for the acquisition of Jet2. Additionally, given the fact that Jet2 is a public listed company with a market capitalization of GBP 2.0 bn (Bloomberg 2021b), the transaction is dependent on strict merger control procedures and further regulatory screenings. However, precedent transactions of the same size have not faced any regulatory hurdles. Therefore, it is expected that a potential transaction between easyJet and Jet2 complies with regulatory aspects in all regards. From an ownership perspective, Jet2 has a free float of 70.4% mainly owned by institutional investors (Bloomberg 2021a). As a high level of institutional ownership is positively related to large M&A deals (Andriosopoulos and Yang 2015), it is expected that Jet2 shareholders are in favour of reaching an agreement between Jet2 and easyJet.

3.2. Company Profiles

3.2.1. easyJet (Buyer)

Founded in 1995, easyJet is the second-largest airline by passengers flown in the UK and employs c. 14,000 people. The company offers leisure bookings, business flight-only trips, and easyJet holidays packages. Its services are mainly distributed through the company's online platform, mobile applications, call centers, global distribution systems, and application program interfaces (Yahoo Finance 2021).

easyJet's airline operations fly to more than 154 destinations via 981 routes. The airline furthermore comprises a fleet of 342 aircrafts. In FY20, easyJet carried 48.0 mn passengers and, load factor was as high as 87.2%. From a financial perspective, easyJet generated revenues of GBP 3,009 mn (easyJet 2020).

easyJet holidays was established in 2019, representing a separate operating segment to the company's airline operations. It offers package holidays to easyJet's leisure customers and cooperates with hotels, destination management companies, and tourism boards. As of today, easyJet holidays is relatively small compared to the company's airline business since it has been recently established. Hence, this segment does not account for a significant part of the company's overall financial performance. However, a key pillar in easyJet's strategic direction is to drive growth of its holiday package business and strengthen its position in the market (easyJet 2020).

3.2.2. Jet2 (Target)

Founded in 1983, Jet2 is a UK-based leisure travel group and employs c. 9,100 people. The company offers scheduled holiday flights, holiday packages as well as other leisure travel services and operates through its main segments Jet2.com and Jet2holidays (Jet2 2021).

Jet2.com is the third-largest airline by passengers flown in the UK (Statista 2021d). The low-cost carrier flies to more than 70 destinations via 453 routes. Moreover, the airline comprises a fleet of 90 aircrafts. In FY21, Jet2.com carried 1.3 mn passengers, and load factor was as high as 66.0%. From a financial perspective, Jet2.com generated passenger revenues of GBP 53.7 mn, accounting for 14% of the group's total revenues (Jet2 2021).

Jet2holidays is the leading tour operator in the UK, offering package holidays in the Mediterranean region. Since Jet2holidays was launched in 2007, it has served more than 15 mn customers. In FY21, Jet2holidays served 370 k package holiday customers. From a financial perspective, Jet2holidays generated revenues of GBP 53.7 mn, accounting for 64% of the group's total revenues. In addition to Jet2's main segments, the company further offers other leisure travel services through Jet2Villas, Jet2CityBreaks, Indulgent Escapes, and Vibe (Jet2 2021).

3.3. Strategic rationale

3.3.1. Airline operations

Most airline mergers and acquisitions follow a strategic direction to benefit from a broader and deeper airline network by expanding or strengthening its geographical presence (Smyth and Pearce 2006). Especially from a geographical perspective, easyJet and Jet2 are complementary in their markets. Both companies target a well-diversified footprint across Europe with a strong geographical presence in the Mediterranean region. Considering this similarity in both airline networks, Jet2 can be considered as a good fit to strengthen easyJet's market position in its existing markets. This is of crucial importance as competition in the European low-cost environment significantly increases (Pitfield 2008). Airlines such as Ryanair and Wizz Air are on the rise and continuously increasing their market presence (CAPA 2021b). Between 2014 and 2019, Ryanair and Wizz Air increased their number of passengers carried by 64% and 188%, respectively. easyJet's passenger growth in comparison was 49% and 15 pp lower compared to Ryanair (Statista 2021a; 2021b; 2021c). Additionally, Ryanair and Wizz Air seem to be benefiting from the Covid-19 crisis, with share prices already well above their pre-Covid levels (Bloomberg 2021c). Considering a potential acquisition of Jet2 by easyJet, the combined entity is expected to reach c. 108 mn passengers by 2024, which subsequently increases competitive pressure on Ryanair and Wizz Air. Hence, Jet2 can significantly contribute to future growth on easyJet's core markets and strengthen easyJet's strategic position due to increased market power.

3.3.2. Package holidays business

Apart from easyJet's airline operations, the company's package holidays business represents an important role in easyJet's corporate strategy. easyJet recently introduced a sustainability concept for its package holidays business, indicating a clear strategic direction in the future. One of the core pillars of this strategy is to create better holiday choices in the long term (easyJet 2021). easyJet positioned its package holidays business to be an important driver for future growth, which helps to differentiate its business model from traditional low-cost carriers (easyJet 2020). However, scaling easyJet's package holidays business from an organic perspective seems impossible, given uncertain market conditions and lagging growth opportunities due to the Covid-19 crisis. Hence, Jet2 as the leading provider of package holidays in the UK represents an attractive opportunity to contribute to easyJet's ambitious holiday packaging strategy. By acquiring Jet2, easyJet would significantly benefit from Jet2's well-diversified travel portfolio. The company has over 4,600 hotels in its portfolio which would substantially increase easyJet's product offerings (Jet2 2021). A broader and deeper set of services offered to easyJet's customers would lead to higher customer attractiveness. Moreover, Jet2 can be seen as a good fit given the company's high customer loyalty. This is of crucial importance as easyJet holidays targets its airline passengers to book package holidays directly when choosing to fly with easyJet. In 2020, Jet2holidays customers accounted for more than 58% of Jet2's flown passengers. By combining easyJet's large customer base with a well-diversified product portfolio of Jet2, easyJet could create a strong growth potential driven by airline passengers becoming also package holidays customers.

The UK package holidays business is expected to recover faster from Covid-19. Hence, this segment presents an important role on easyJet's way to recover faster from Covid-19 as competitors do not operate in this segment. From a strategic perspective, the package holidays business of Jet2 can be integrated into easyJet's organisation, benefiting from a fast recovery and diversified product offering. Apart from that, the package holidays business could be structured to create a new independent company through a potential spin-off. By obtaining a fair market price for the holiday package business, those funds would equivalently provide appropriate financial cushioning to recover faster from the Covid-19 crisis.

3.4. Financial rationale

3.4.1. Financial benchmarking

The European airline industry will face a competitive market structure after airlines recover from Covid-19 (Rodrigues et al. 2021, 19). Especially airlines such as Ryanair and Wizz Air impose strong competitive pressure on easyJet. Analyzing the post-Covid airline industry from a financial perspective, easyJet's fundamental performance in 2024 is expected to lag behind its competitors. However, benchmarking the company's potential acquisition of Jet2 against major European airlines shows that a combined entity can provide a financial tailwind and strengthen easyJet's financial position, which subsequently increases competition. The results of the benchmarking are illustrated in *Appendix 6-8*.

From a revenue perspective, the new entity can notably increase its revenues by more than 60% up to GBP 13,023 mn in 2024. This strong increase in additional revenue is mainly fueled by Jet2's holiday packaging business as it tends to recover faster from Covid-19, as mentioned previously. Consequently, easyJet's well-diversified product offering of airline operations and package holidays creates attractive revenue potential and constitutes a unique strategic advantage compared to its competitors. This would enable easyJet to replace Ryanair as Europe's largest low-cost carrier in 2024 by revenues and substantially increase the company's market power.

From a profitability perspective, a potential acquisition of Jet2 would contribute to easyJet's profitability. Jet2's variable cost structure allows easyJet to flexibly adjust operating costs which subsequently drives profitability. Hence, easyJet's EBITDA margin can increase by 0.8 pp, reaching 15.4% in 2024. However, benchmarking this profitability level shows that easyJet only takes fourth place after Wizz Air (32.8%), Ryanair (25.3%), and IAG (20.6%). Nonetheless, a sound net income margin of 6.4%, which is well above the peer median (5.9%), provides attractive conditions to create shareholder value in the long term.

3.4.2. Synergy realization

When companies merge, their resources are pooled to accelerate the value of the combined entity. This additional value is derived from synergies, which in turn can be differentiated between revenue and cost synergies (Lenartowicz, Mason, and Foster 2013).

Cost synergies are defined as the reduction in operating costs as a result of merging two businesses (Engert and Rosiello 2010). Most of the cost synergies for airlines are captured by redundancies of processes as the combined entity would benefit from lower labor costs and a joint infrastructure (Schosser and Wittmer 2015). Moreover, combining the operations of easyJet and Jet2 would result in lower landing fees and ground operations as a consequence of greater bargaining power of the new entity (Hansson, Neilson, and Belin 2021). In addition, the company can benefit from standardizing its fleet, which consequently leads to lower maintenance and training expenses. Simultaneously, optimizing the network and flight schedule can result in increased aircraft utilization, generating economies of scale and minimizing variable operating costs. Furthermore, this allows easyJet to eliminate inefficient hubs and routes (Schosser and Wittmer 2015). Especially cost synergies present an attractive opportunity to drive cost reduction and consequently return to profitability in a post-pandemic environment as airlines currently are facing significant cost pressure (Hansson, Neilson, and Belin 2021).

Revenue synergies are defined as the enhancement of revenue growth as a result of merging two businesses (Engert and Rosiello 2010). The combined entity allows easyJet to enter new markets while simultaneously strengthening its competitive position in existing markets as additional 453 Jet2 routes will be integrated into easyJet's European network. As a result, the combined entity can benefit from a larger network which leads to higher customer attractiveness and ultimately to increased revenues (Rajasekar and Fouts 2009). Moreover, Jet2's package holidays platform further increases the combined network as Jet2 currently operates as the leading provider of package holidays in the UK *(Chapter 3.2.2)*. Apart from that, harmonized pricing and increased market power would result in higher margins for the combined entity (Götsch and Albers 2005). Thus, revenue synergies can strengthen airline profitability in the future, although realizing those synergies is in tendency more difficult (Christofferson, McNish, and Sias 2004).

Although synergies can be seen as beneficial, a larger combined entity is more difficult to manage from a strategic perspective. However, as outlined in *Chapter 2.2*, European airlines are much smaller than their US counterparts and hence still well below an "optimal scale".

CHAPTER 4: CONCLUSION

The purpose of this work project was to investigate whether consolidation can be a potential way for easyJet to return to profitability and further strengthen its strategic position in a post-pandemic market environment. *Chapter 1* pointed out that the European airline industry is one of the most affected industries by Covid-19 and recovery will tend to take longer compared to other regions. *Chapter 2* subsequently detailed that the European airline industry has experienced a first wave of consolidation after the market was deregulated. However, in the past few years, M&A activity has come to a halt leading to a fragmented market structure.

Hence, the European airline market provides ideal conditions for future consolidation. Finally, an acquisition strategy for a potential takeover of Jet2 by easyJet presented in *Chapter 3* established that consolidation provides strategic and financial tailwind for easyJet to recover faster from Covid-19 and strengthen its market position in a post-pandemic industry landscape. From a strategic perspective, easyJet can enter new markets or extend its geographical presence on existing core markets to further increase competition. Moreover, the easyJet / Jet 2 case showed that new business areas such as the package holidays business present attractive opportunities to diversify easyJet's product portfolio and subsequently make its operations "crisis-proof". However, and most important, consolidation contributes to easyJet's fundamental situation and ultimately improves profitability. Besides that, especially cost synergies allow easyJet to cut costs in spite of a huge dependence on fixed costs.

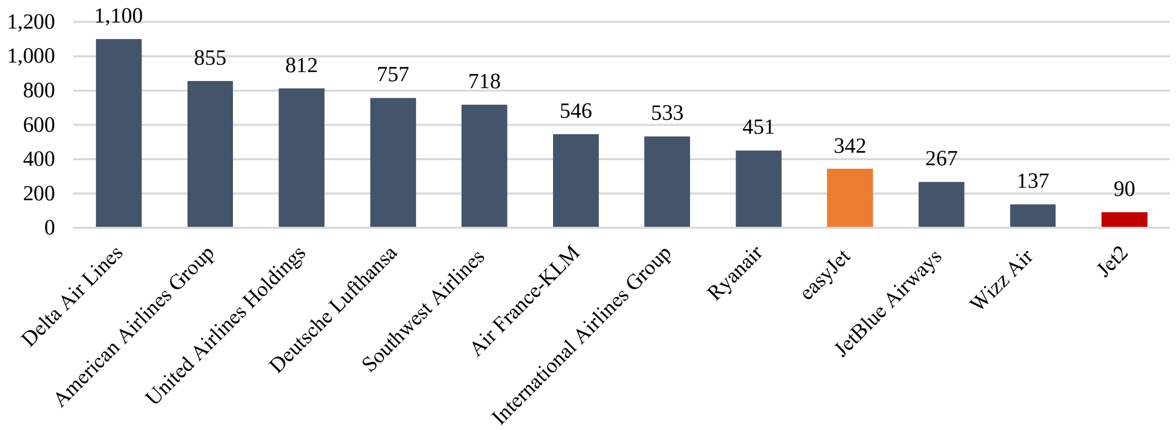
A potential takeover of Jet2 by easyJet can be the starting point for the next wave of airline consolidation. This could potentially reshape the European airline industry and help easyJet to become more successful from both a financial and strategic perspective. However, it has to be critically questioned if the acquisition complies with regulatory requirements. Although it is expected that such takeovers do not impose regulatory difficulties, the completion of the takeover remains subject to an individual assessment of regulatory screenings. Additionally, significant improvements in easyJet's financial performance are dependent on realising attractive synergies. However, capturing both cost and revenue synergies in the future will be subjected to a successful post-merger integration. Furthermore, the takeover approach of easyJet by Wizz Air has shown that easyJet represents an attractive target, especially for European low-cost carriers. Although the company is trying to operate as a potential buyer on the market, it is not excluded that easyJet can be acquired by one of its competitors in the future. Nevertheless, it is now the responsibility of easyJet to seek inorganic growth opportunities such as Jet2 and kick off a post-pandemic success story.

APPENDIX

Appendix 1: Completed precedent transactions in Europe (in USD mn; 2000-2021)

Date	Stake sought	Buyer	Country	Target	Country	Deal value
Aug-2002	100%	easyJet	United Kingdom	GoFly	United Kingdom	545
Apr-2003	100%	Ryanair	Ireland	Buzz	Netherlands	22
Jun-2004	100%	Air France	France	KLM	Netherlands	827
Jun-2005	99%	Deutsche Lufthansa	Germany	Swiss International Air Lines	Switzerland	396
Jun-2009	45%	Deutsche Lufthansa	Germany	SN Brussels	Belgium	73
Mar-2017	100%	Air Berlin	United Kingdom	LTU Group Holding	Germany	454
Jan-2008	100%	easyJet	United Kingdom	GB Airways	United Kingdom	212
Feb-2010	58%	Deutsche Lufthansa	Germany	Austrian Airlines	Austria	293
Jan-2011	100%	British Airways	Iberia	Spain	Spain	3,187
Apr-2012	100%	IAG	Spain	British Midland Airways	United Kingdom	277
Aug-2013	54%	IAG	Spain	Vueling	Spain	191
Sep-2015	100%	IAG	Spain	Aer Lingus	Ireland	1,495
Dec-2017	100%	IAG	Spain	Nikki	Austrian	20
Feb-2019	14%	Kingdom of the Neterlands	Netherlands	Air France-KLM	France	846

Appendix 2: Fleet size (# aircrafts) of leading US and European airlines (latest available data)



Appendix 3: Projected easyJet stand-alone income statement (2016-2030E)

in GBP mn / 30 September	2016	2017	2018	2019	2020	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
Passenger Revenues	4,587.0	4,061.0	4,688.0	5,009.0	2,303.0	1,087.2	3,930.2	5,502.3	6,644.0	7,117.1	7,550.5	7,932.6	8,252.3	8,542.3	8,820.6
Ancillary Revenues	82.0	986.0	1,210.0	1,376.0	706.0	239.2	1,179.1	1,375.6	1,461.7	1,565.8	1,661.2	1,745.2	1,815.6	1,879.4	1,940.6
Total revenues	**4,669.0**	**5,047.0**	**5,898.0**	**6,385.0**	**3,009.0**	**1,326.4**	**5,109.3**	**6,877.9**	**8,105.8**	**8,682.9**	**9,211.7**	**9,677.8**	**10,067.8**	**10,421.7**	**10,761.2**
Fuel	(1,114.0)	(1,062.0)	(1,184.0)	(1,416.0)	(721.0)	(376.0)	(996.5)	(1,295.5)	(1,360.2)	(1,428.3)	(1,499.7)	(1,574.6)	(1,653.4)	(1,736.0)	(1,822.9)
Ground operations	(1,267.0)	(1,465.0)	(1,649.0)	(1,845.0)	(938.0)	(464.2)	(1,532.8)	(2,407.3)	(2,837.0)	(3,039.0)	(3,224.1)	(3,387.2)	(3,523.7)	(3,647.6)	(3,766.4)
Navigation	(336.0)	(381.0)	(400.0)	(409.0)	(206.0)	(119.4)	(306.6)	(478.4)	(563.8)	(604.0)	(640.8)	(673.2)	(700.3)	(724.9)	(748.5)
Crew costs	(542.0)	(645.0)	(761.0)	(859.0)	(629.0)	(464.2)	(664.2)	(894.1)	(1,053.8)	(1,128.8)	(1,197.5)	(1,258.1)	(1,308.8)	(1,354.8)	(1,399.0)
Maintenance	(237.0)	(274.0)	(335.0)	(302.0)	(278.0)	(132.6)	(255.5)	(343.9)	(405.3)	(434.1)	(460.6)	(483.9)	(503.4)	(521.1)	(538.1)
Selling & marketing	(107.0)	(122.0)	(143.0)	(157.0)	(107.0)	(66.3)	(153.3)	(180.9)	(213.2)	(228.3)	(242.2)	(254.5)	(264.8)	(274.1)	(283.0)
Other operating income / (expenses)	(296.0)	(389.0)	(590.0)	(427.0)	(488.0)	(331.6)	(357.7)	(412.7)	(486.3)	(521.0)	(552.7)	(580.7)	(604.1)	(625.3)	(645.7)
Operating expenses	(3,899.0)	(4,338.0)	(5,062.0)	(5,415.0)	(3,367.0)	(1,954.5)	(4,266.5)	(6,012.7)	(6,919.6)	(7,383.5)	(7,817.6)	(8,212.2)	(8,558.5)	(8,883.8)	(9,203.5)
EBITDAR	**770.0**	**709.0**	**836.0**	**970.0**	**(358.0)**	**(628.1)**	**842.8**	**865.2**	**1,186.2**	**1,299.4**	**1,394.1**	**1,465.6**	**1,509.4**	**1,537.9**	**1,557.7**
Rent	(103.0)	(110.0)	(162.0)	(5.0)	(1.0)	-	-	-	-	-	-	-	-	-	-
EBITDA	**667.0**	**599.0**	**674.0**	**965.0**	**(359.0)**	**(628.1)**	**842.8**	**865.2**	**1,186.2**	**1,299.4**	**1,394.1**	**1,465.6**	**1,509.4**	**1,537.9**	**1,557.7**
Depreciation	(157.0)	(181.0)	(199.0)	(484.0)	(485.0)	(265.3)	(408.7)	(412.7)	(551.5)	(590.8)	(626.8)	(658.5)	(685.0)	(709.1)	(732.2)
Amortisation	(12.0)	(14.0)	(15.0)	(15.0)	(18.0)	(13.3)	(16.6)	(22.3)	(26.3)	(28.2)	(29.9)	(31.4)	(32.7)	(33.8)	(34.9)
Depreciation & amortisation	(169.0)	(195.0)	(214.0)	(499.0)	(503.0)	(278.5)	(425.3)	(435.0)	(577.8)	(619.0)	(656.7)	(689.9)	(717.7)	(742.9)	(767.1)
Impairment	-	-	-	-	(37.0)	-	-	-	-	-	-	-	-	-	-
EBIT	**498.0**	**404.0**	**460.0**	**466.0**	**(899.0)**	**(906.6)**	**417.5**	**430.2**	**608.3**	**680.5**	**737.5**	**775.7**	**791.7**	**794.9**	**790.6**
Interest expenses	(13.0)	(29.0)	(30.0)	(60.0)	(491.0)	(124.6)	(134.2)	(137.9)	(129.4)	(123.1)	(118.2)	(115.3)	(111.5)	(108.0)	(103.2)
Interest income	10.0	10.0	15.0	24.0	117.0	35.2	30.2	44.3	50.1	49.9	41.9	43.3	39.7	34.4	36.5
Net interest	(3.0)	(19.0)	(15.0)	(36.0)	(374.0)	(89.4)	(104.0)	(93.6)	(79.3)	(73.2)	(76.3)	(72.0)	(71.8)	(73.6)	(66.7)
Profit / (loss) before taxes	**495.0**	**385.0**	**445.0**	**430.0**	**(1,273.0)**	**(996.0)**	**313.5**	**336.6**	**529.0**	**607.3**	**661.2**	**703.7**	**719.9**	**721.3**	**723.9**
Taxes	(68.0)	(80.0)	(87.0)	(81.0)	194.0	**175.6**	**(55.3)**	**(59.3)**	**(93.3)**	**(107.1)**	**(116.6)**	**(124.1)**	**(126.9)**	**(127.2)**	**(127.6)**
Profit / (loss) after taxes	**427.0**	**305.0**	**358.0**	**349.0**	**(1,079.0)**	**(820.4)**	**258.2**	**277.3**	**435.8**	**500.2**	**544.6**	**579.6**	**593.0**	**594.2**	**596.3**

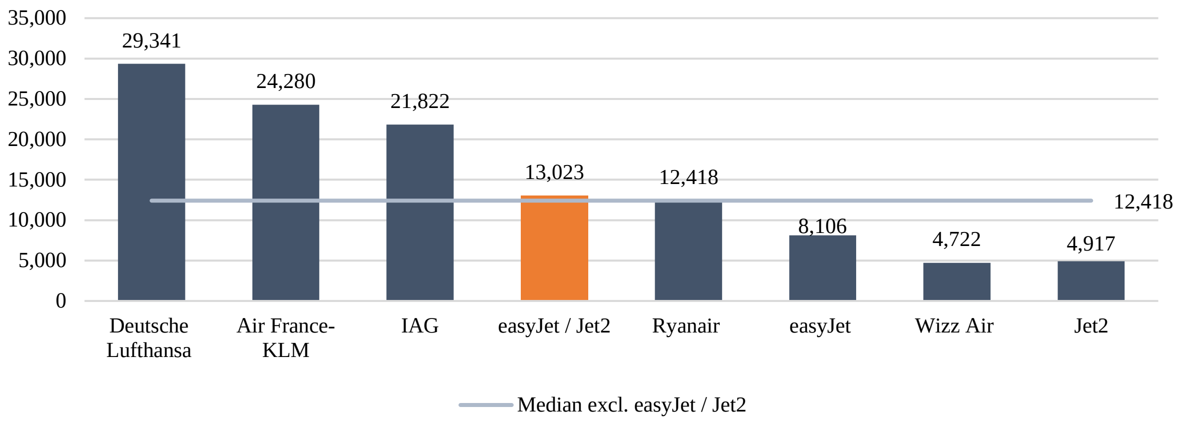
Appendix 4: Projected Jet2 stand-alone income statement (2017-2031E)

in GBP mn / 31 March	2017	2018	2019	2020	2021	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E	2031E
Passenger Revenues	-	403.9	530.8	604.1	53.7	154.9	429.0	597.5	706.4	800.3	890.3	972.0	1,041.2	1,093.9	1,138.0
Non-ticket revenue	-	233.8	308.6	364.3	38.4	106.2	318.7	414.4	497.2	547.0	590.7	626.2	651.2	664.2	670.9
Package holidays	-	1,585.5	2,118.4	2,591.6	252.8	910.4	2,846.2	3,320.3	3,652.3	3,944.5	4,181.2	4,348.4	4,435.4	4,479.8	4,502.2
Other leisure travel	-	-	6.6	24.7	50.5	53.0	55.7	58.5	61.4	64.5	67.7	71.1	74.6	78.3	82.3
Distribution & logistics		168.6	178.7	-	-	-	-	-	-	-	-	-	-	-	-
Total revenues	**1,729.3**	**2,391.8**	**3,143.1**	**3,584.7**	**395.4**	**1,224.5**	**3,649.6**	**4,390.6**	**4,917.3**	**5,356.3**	**5,729.9**	**6,017.7**	**6,202.4**	**6,316.2**	**6,393.3**
Accommodation costs	(512.9)	(837.7)	(1,102.9)	(1,340.0)	(113.0)	(353.1)	(1,021.9)	(1,229.4)	(1,327.7)	(1,544.6)	(1,652.4)	(1,735.4)	(1,788.7)	(1,821.5)	(1,843.7)
Fuel	(203.4)	(222.3)	(305.8)	(359.1)	(79.9)	(211.7)	(275.3)	(289.0)	(303.5)	(318.6)	(334.6)	(351.3)	(368.9)	(387.3)	(406.7)
Navigation	(141.2)	(219.4)	(279.4)	(329.5)	(34.3)	(98.0)	(292.0)	(351.2)	(393.4)	(428.5)	(458.4)	(481.4)	(496.2)	(505.3)	(511.5)
Maintenance	(63.1)	(77.7)	(109.8)	(100.2)	(25.7)	(48.2)	(143.7)	(172.9)	(193.6)	(210.9)	(225.6)	(236.9)	(244.2)	(248.7)	(251.7)
Crew costs	(257.2)	(336.8)	(439.9)	(444.7)	(224.2)	(274.4)	(817.9)	(984.0)	(1,102.0)	(1,200.4)	(1,284.2)	(1,348.7)	(1,390.1)	(1,415.6)	(1,432.8)
Agent commission	(37.5)	(48.1)	(59.8)	(81.4)	(9.0)	(26.0)	(77.6)	(93.3)	(104.5)	(113.9)	(121.8)	(127.9)	(131.9)	(134.3)	(135.9)
In-flight cost of sales	(25.1)	(35.4)	(46.5)	(57.4)	(8.2)	(24.5)	(58.4)	(61.5)	(59.0)	(53.6)	(45.8)	(36.1)	(24.8)	(12.6)	(6.4)
Subcontractor charges	(44.2)	(40.3)	(42.4)	-	-	-	-	-	-	-	-	-	-	-	-
Other operating income / (expenses)	(200.0)	(268.8)	(345.8)	(343.1)	(73.5)	(151.8)	(452.3)	(544.1)	(609.4)	(663.8)	(710.1)	(745.8)	(768.7)	(782.8)	(792.3)
Operating expenses	(1,484.6)	(2,086.5)	(2,732.3)	(3,055.4)	(567.8)	(1,187.8)	(3,139.0)	(3,725.4)	(4,093.1)	(4,534.3)	(4,832.9)	(5,063.5)	(5,213.3)	(5,308.0)	(5,381.0)
EBITDAR	**244.7**	**305.3**	**410.8**	**529.3**	**(172.4)**	**36.8**	**510.6**	**665.2**	**824.2**	**821.9**	**897.0**	**954.2**	**989.1**	**1,008.2**	**1,012.3**
Rent	(54.7)	(63.1)	(75.9)	(31.8)	-	-	-	-	-	-	-	-	-	-	-
EBITDA	**190.0**	**242.2**	**334.9**	**497.5**	**(172.4)**	**36.8**	**510.6**	**665.2**	**824.2**	**821.9**	**897.0**	**954.2**	**989.1**	**1,008.2**	**1,012.3**
Depreciation	(87.0)	(111.6)	(131.5)	(134.2)	(115.2)	(49.0)	(146.0)	(175.6)	(196.7)	(214.3)	(229.2)	(240.7)	(248.1)	(252.6)	(255.7)
Amortisation	-	-	-	(70.3)	(48.5)	(24.5)	(73.0)	(87.8)	(98.3)	(107.1)	(114.6)	(120.4)	(124.0)	(126.3)	(127.9)
Depreciation & amortisation	(87.0)	(111.6)	(131.5)	(204.5)	(163.7)	(73.5)	(219.0)	(263.4)	(295.0)	(321.4)	(343.8)	(361.1)	(372.1)	(379.0)	(383.6)
Hedging ineffectiveness	-	-	-	(108.4)	-	-	-	-	-	-	-	-	-	-	-
EBIT	**103.0**	**130.6**	**203.4**	**184.6**	**(336.1)**	**(36.7)**	**291.6**	**401.7**	**529.1**	**500.5**	**553.2**	**593.1**	**617.0**	**629.2**	**628.7**
Interest expenses	(5.1)	(21.1)	(36.3)	(44.0)	(40.5)	(42.2)	(44.5)	(39.5)	(34.2)	(33.1)	(35.8)	(36.2)	(39.1)	(38.1)	(36.1)
Interest income	3.1	4.8	10.7	14.5	2.0	2.9	7.0	9.1	7.6	5.4	6.9	7.2	8.7	7.5	6.1
Net interest	(2.0)	(16.3)	(25.6)	(29.5)	(38.5)	(39.3)	(37.5)	(30.4)	(26.6)	(27.7)	(28.9)	(29.0)	(30.4)	(30.6)	(30.0)
Net FX revaluation gains / (losses)	(10.9)	20.0	(2.6)	(8.1)	3.9	0.5	2.7	(0.7)	(0.3)	1.2	0.7	0.7	0.3	0.5	0.7
Profit on disposal of PPE	-	0.3	2.3	0.7	0.8	0.8	1.0	1.1	0.9	0.9	0.9	1.0	1.0	0.9	0.9
Other non-operating income / (expenses)	(10.9)	20.3	(0.3)	(7.4)	4.7	1.3	3.7	0.4	0.5	2.1	1.6	1.7	1.3	1.4	1.6
Profit / (loss) before taxes	**90.1**	**134.6**	**177.5**	**147.7**	**(369.9)**	**(76.0)**	**254.1**	**371.3**	**502.5**	**472.8**	**524.3**	**564.1**	**586.6**	**598.6**	**598.7**
Taxes	(13.4)	(23.9)	(31.9)	(36.1)	70.4	-	(49.8)	(74.2)	(102.4)	(92.5)	(103.1)	(111.9)	(116.6)	(118.9)	(118.3)
Income from discontinued operations	-	-	-	4.4	28.3	-	-	-	-	-	-	-	-	-	-
Profit / (loss) after taxes	**76.7**	**110.7**	**145.6**	**116.0**	**(271.2)**	**(76.0)**	**204.3**	**297.2**	**400.2**	**380.4**	**421.2**	**452.2**	**469.9**	**479.7**	**480.4**

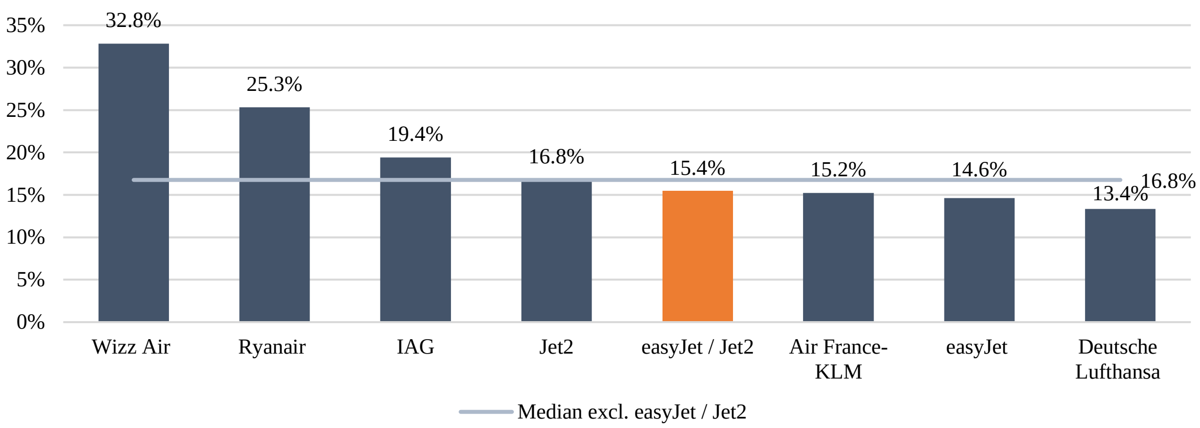
Appendix 5: Projected combined income statement (2016-2030E)

in GBP mn / 30 September	**2021E**	**2022E**	**2023E**	**2024E**	**2025E**	**2026E**	**2027E**	**2028E**	**2029E**	**2030E**
Passenger Revenues	1,242.1	4,359.3	6,099.8	7,350.4	7,917.4	8,440.8	8,904.6	9,293.5	9,636.2	9,958.6
Non-ticket revenue	345.4	1,497.8	1,789.9	1,959.0	2,112.8	2,251.9	2,371.4	2,466.8	2,543.6	2,611.5
Package holidays	910.4	2,846.2	3,320.3	3,652.3	3,944.5	4,181.2	4,348.4	4,435.4	4,479.8	4,502.2
Other leisure travel	53.0	55.7	58.5	61.4	64.5	67.7	71.1	74.6	78.3	82.3
Total revenues	**2,550.9**	**8,758.9**	**11,268.5**	**13,023.1**	**14,039.2**	**14,941.6**	**15,695.5**	**16,270.3**	**16,737.9**	**17,154.5**
Accommodation costs	(353.1)	(1,021.9)	(1,229.4)	(1,327.7)	(1,544.6)	(1,652.4)	(1,735.4)	(1,788.7)	(1,821.5)	(1,843.7)
Fuel	(587.8)	(1,271.8)	(1,584.5)	(1,663.7)	(1,746.9)	(1,834.2)	(1,926.0)	(2,022.2)	(2,123.4)	(2,229.5)
Ground operations	(464.2)	(1,532.8)	(2,407.3)	(2,837.0)	(3,039.0)	(3,224.1)	(3,387.2)	(3,523.7)	(3,647.6)	(3,766.4)
Navigation	(217.3)	(598.5)	(829.7)	(957.2)	(1,032.5)	(1,099.1)	(1,154.6)	(1,196.5)	(1,230.2)	(1,260.0)
Maintenance	(180.9)	(399.2)	(516.8)	(598.9)	(645.0)	(686.2)	(720.8)	(747.6)	(769.8)	(789.8)
Crew costs	(738.7)	(1,482.1)	(1,878.1)	(2,155.8)	(2,329.2)	(2,481.7)	(2,606.8)	(2,698.9)	(2,770.4)	(2,831.8)
Selling & marketing	(66.3)	(153.3)	(180.9)	(213.2)	(228.3)	(242.2)	(254.5)	(264.8)	(274.1)	(283.0)
Agent commission	(26.0)	(77.6)	(93.3)	(104.5)	(113.9)	(121.8)	(127.9)	(131.9)	(134.3)	(135.9)
In-flight cost of sales	(24.5)	(58.4)	(61.5)	(59.0)	(53.6)	(45.8)	(36.1)	(24.8)	(12.6)	(6.4)
Other operating income / (expenses)	(483.4)	(810.0)	(956.8)	(1,095.8)	(1,184.8)	(1,262.8)	(1,326.4)	(1,372.7)	(1,408.1)	(1,438.0)
Operating expenses	(3,142.2)	(7,405.5)	(9,738.1)	(11,012.8)	(11,917.8)	(12,650.4)	(13,275.7)	(13,771.8)	(14,191.9)	(14,584.5)
EBITDAR	**(591.3)**	**1,353.4**	**1,530.3**	**2,010.3**	**2,121.4**	**2,291.2**	**2,419.8**	**2,498.5**	**2,546.1**	**2,570.0**
Depreciation	(314.3)	(554.7)	(588.3)	(748.2)	(805.1)	(856.0)	(899.2)	(933.1)	(961.8)	(988.0)
Amortisation	(37.8)	(89.6)	(110.1)	(124.6)	(135.3)	(144.5)	(151.7)	(156.7)	(160.1)	(162.8)
Depreciation & amortisation	(352.0)	(644.3)	(698.4)	(872.9)	(940.4)	(1,000.5)	(1,051.0)	(1,089.8)	(1,121.9)	(1,150.7)
EBIT	**(943.3)**	**709.1**	**831.9**	**1,137.5**	**1,181.0**	**1,290.7**	**1,368.8**	**1,408.6**	**1,424.2**	**1,419.2**
Interest expenses	(166.8)	(178.7)	(177.4)	(163.6)	(156.2)	(154.0)	(151.5)	(150.6)	(146.1)	(139.3)
Interest income	38.1	37.2	53.4	57.7	55.3	48.8	50.5	48.4	41.9	42.6
Net interest	(128.7)	(141.5)	(124.0)	(105.9)	(100.9)	(105.2)	(101.0)	(102.2)	(104.2)	(96.7)
Net FX revaluation gains / (losses)	0.5	2.7	(0.7)	(0.3)	1.2	0.7	0.7	0.3	0.5	0.7
Profit on disposal of PPE	0.8	1.0	1.1	0.9	0.9	0.9	1.0	1.0	0.9	0.9
Other non-operating income / (expenses)	1.3	3.7	0.4	0.5	2.1	1.6	1.7	1.3	1.4	1.6
Profit / (loss) before taxes	**(1,072.0)**	**567.6**	**707.9**	**1,031.6**	**1,080.1**	**1,185.5**	**1,267.8**	**1,306.4**	**1,320.0**	**1,322.5**
Taxes	**203.7**	**(107.8)**	**(134.5)**	**(196.0)**	**(205.2)**	**(225.2)**	**(240.9)**	**(248.2)**	**(250.8)**	**(251.3)**
Profit / (loss) after taxes	**(868.3)**	**459.8**	**573.4**	**835.6**	**874.9**	**960.2**	**1,026.9**	**1,058.2**	**1,069.2**	**1,071.3**

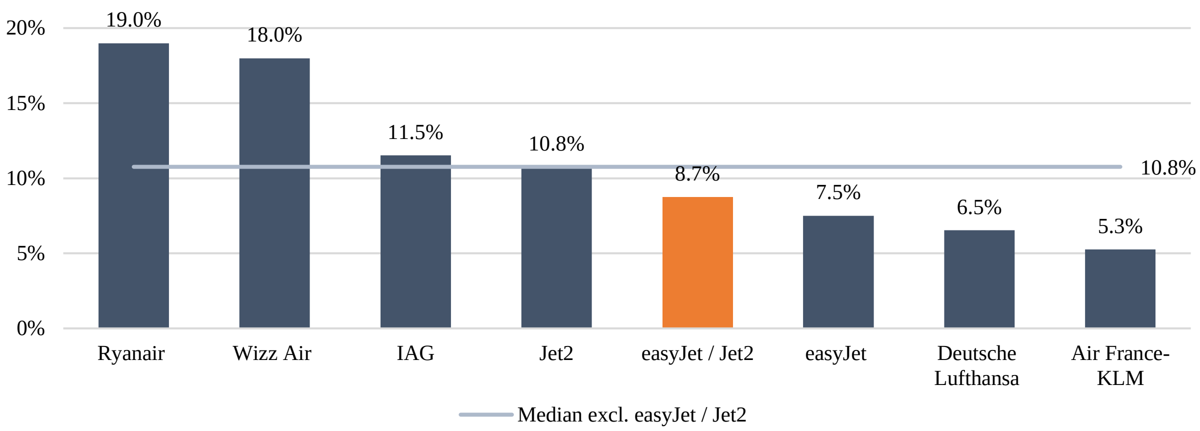
Appendix 6: European airline benchmarking: Revenues (in GBP mn; 2024E)



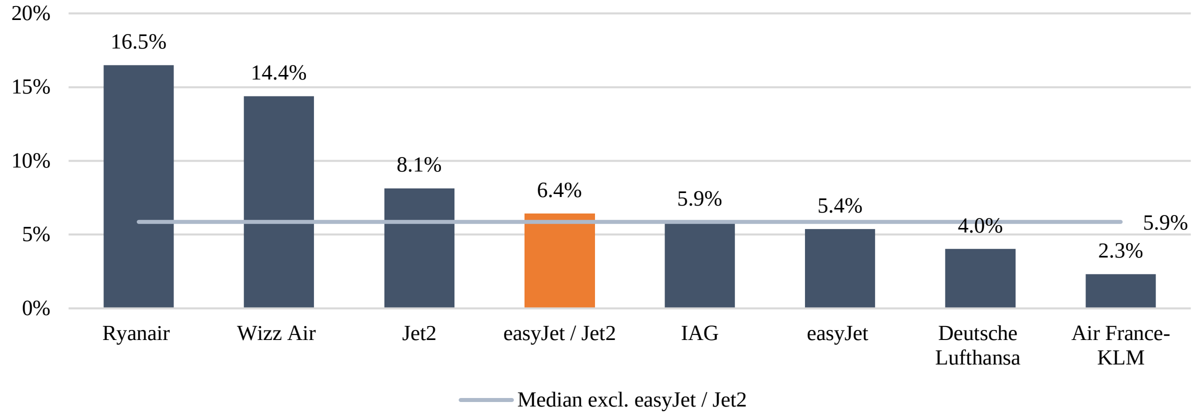
Appendix 7: European airline benchmarking: EBITDA margin (2024E)



Appendix 8: European airline benchmarking: EBIT margin (2024E)



Appendix 9: European airline benchmarking: Net income margin (2024E)



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